2.5 Socioeconomics

The existing socioeconomic characteristics of the region associated with Fermi 3 are established in this section under five subheadings: 1) Demography, 2) Community Characteristics, 3) Historic Properties, 4) Environmental Justice, and 5) Noise. These sections provide a discussion of the baseline socioeconomic characteristics within a 50-mi radius of the Fermi 3 site. In addition, socioeconomic characteristics are also described for the 10-mi radius and the 3-mi low population zone (LPZ). Data are provided in sufficient detail to support conclusions made in subsequent impact sections regarding the socioeconomic impacts of Fermi 3 construction and operation. The submitted information meets 10 CFR 100.10 and 10 CFR 50.34(a)(1) and serves as a basis for assessing radiological impacts of the station operation and assessment of socioeconomic factors and impacts.

2.5.1 Demography

The demographics of the Fermi 3 project area are described in this subsection. In most instances, the population statistics are taken from the 2000 U.S. Census data contained in the LandView® 6 software[1]. This software is a flexible tool capable of identifying economic and demographic information for selected areas that can be defined as concentric circles lying at various distances from a given geographic location. The most commonly used geographic area in this section is the *region*, defined as the area encompassed by a 50 mile radius from the center of the Fermi 3 power block. The region includes all or a portion of the 16 counties in Michigan and Ohio and 3 counties in Ontario, Canada listed in Table 2.5-1[2]. These areas are also shown in Figure 2.5-1, where a 50 mile circle from Fermi 3 is also drawn.

Figure 2.5-2 indicates the segment population of the area within the 10-mi radius for Fermi 3. On this map and in all sectional maps developed for this section, the location of the Fermi 3 power block is located at the center of the drawing, and concentric circles are drawn around the center at distances of 1, 2, 3, 4, 5, and 10 miles. The circles are divided into 22.5 degree segments with each segment centered on one of the 16 cardinal compass points (e.g. north, north northeast, etc.). Within each area defined by the concentric circles and radial lines, the resident population for 2000 is listed, according to LandView® 6.

The 10-mile resident population statistics are also listed in Table 2.5-2. The population within 10 miles of Fermi 3 was 89,198 in 2000. The largest population segment lies west southwest of the site in the City of Monroe. The largest population areas, according to LandView® 6, and their

1. LandView® 6 software is the result of a collaborative effort among the U.S. Environmental Protection Agency (EPA), the U.S. Census Bureau, the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS) to provide the public readily accessible published federal spatial and demographic data. It is composed of two software programs: the LandView® 6 database manager and the MARPLOT® map viewer. These two programs work in tandem to create a computer mapping system that displays individual map layers and the associated demographic and spatial data.

2. Generally, Canadian provinces are equivalent to U.S. states, Canadian divisions (many divisions make up a province) are equivalent to U.S. counties, and Canadian subdivisions (many subdivisions make up a division) are equivalent to U.S. tracts (many tracts make up a county).

relative locations and distances to Fermi 3 are shown in Table 2.5-3. Within 10 miles of Fermi 3, the City of Monroe has the largest population (32,339).

Figure 2.5-3 indicates the segment population for the area between 10 and 50 miles of Fermi 3. Within each area defined by the concentric circles and radial lines, the resident population for 2000 (United States) and for 2001[3] (Canada) is listed. The resident population statistics are also listed in Table 2.5-4 where it is seen that the total regional population was 5.38 million in 2000. The data indicate that the largest regional population segments lie in the Detroit metropolitan area to the north and northeast, and in the Toledo metropolitan area to the southwest of Fermi 3.

The segment population was derived from LandView® 6 using Census Block Points, which represent a small population for a limited but unspecified area around the block point, and are the most accurate method of determining segment population. Figure 2.5-4 shows all the Census Block Points for Monroe County and the demographic information that each block point represents. To develop the population for each segment, the following methodology was used:

- For the 0 to 1 mile distance from the plant, the population was not divided into directional segments. Rather, the population for all Census Block Points lying within the 1 mile radius was summed consistent with Figure 2.5-1 in NUREG 1555.
- For other distances beyond the 1 mile radius, Census Block Point populations were allocated entirely to the segments in which they were reported in LandView® 6 (see Figure 2.5-5).

For the segments in Canada, ArcGIS[4] software was used to find the percentage of each segment lying within a Canadian subdivision; this percentage was then multiplied by the population in each subdivision.

In summary, the population distribution tables and figures indicate that the Fermi site is located in a relatively sparsely populated area, and that there are major population centers to the north (Detroit) and southwest (Toledo) within the 50-mile plant radius. Within a 10 mile radius, the largest population center is associated with the City of Monroe, west-southwest of the site.

2.5.1.1 **Transient Populations**

Transient populations include those populations that do not reside permanently in an area, but are there instead on a temporary basis. There are a large number of categories that can potentially be considered as part of the transient population. Such categories include employees at businesses located outside the workers' area of residence, hotel and motel guests, and patrons of sporting

3. The United States conducts a census every 10 years on the decade. Canada conducts a census every 5 years and on the year following a decade or half decade, therefore all Canada population figures are for the year 2001. Whenever, population figures are given it is assumed that they are in the year 2000 for the United States and in 2001 for Canada, unless otherwise stated. Since the two censuses are only one year apart, whenever U.S. and Canadian populations are combined, population figures will be considered to represent the year 2000.

4. ArcGIS Desktop is a mapping and data analysis software that allows the user to discover patterns, relationships, and trends in data, and to map and integrate data, perform advanced analysis, model and automate operational processes, and display results on professional-quality maps. ArcGIS Desktop is published by ESRI.

events and recreational facilities. There are also special facilities for which populations can be counted as transient, including schools, hospitals and nursing homes, and correctional facilities.

When viewing transient population figures, it should be noted that it is not possible to determine how many persons in some categories (e.g. the workforce at an employer, guests in a hotel, etc.) reside within or outside the study area, meaning that the category can lead to double counting, especially in larger geographic areas. Therefore, the sum of the resident and transient populations tends to overstate the total area population. Nevertheless, transient population estimates can be useful and are provided below for the 0 to 10 mile and 10 to 50 mile radii from Fermi 3.

2.5.1.1.1 **Transient Population, 0 to 10 Miles**

An estimate of the total transient population for the 10 mile radius of the plant (referred to as the Emergency Planning Zone (EPZ) in COLA Part 5) is provided in COLA Part 5 with the "Fermi Nuclear Power Plant Development of Evacuation Time Estimates" (ETE) (Reference 2.5-1). The ETE reports two transient group populations:

- the transient population (persons who live outside of the 10 mile boundary but enter this radius for a specific reason, and then leave the radius; e.g. include campers or recreational facility users), and
- commuter-employees (persons who live outside the 10 mile radius yet commute to work within the radius)

The ETE transient information is organized by the distance and compass direction from the Fermi site. Based on the resident population developed above and the total transient population from the ETE, the total 10-mile radius population (permanent plus transient total) is estimated at 106,736 in Table 2.5-5 and the transient population of 17,538 comprises approximately 16.4 percent of this figure.

Based on the resident population developed above and the total transient population from the Evacuation Time Estimate, the total population in the 10 mile radius (resident, transient, and special facilities population) is estimated at 136,633. The total transient population is estimated to comprise approximately 34.7 percent of the total 2000 population in the 0 to 10-mile radius concentric circles.

Figure 2.5-6 is a map of the resident plus transient population distribution in the 10-mile Fermi 3 radius, divided into directional segments. The figure confirms that, in the 10-mile radius, the segment having the largest population is the City of Monroe, west-southwest of the site. Table 2.5-5 also lists the total resident and transient population estimates as well as the population densities for concentric circles within the 10-mile radius of Fermi 3.

2.5.1.1.2 **Transient Population, 10 to 50 Miles**

The estimated total transient population in 2000 for the Fermi 0 to 50 mile radii is shown in Table 2.5-6 as 200,656. The table also shows the total resident and transient population and the population density for the 0 to 50 mile concentric circles. Approximately 3.6 percent of the total population in the 0 to 50 mile concentric circle is estimated to be transient.

Figure 2.5-7 is a map of the resident and transient population distribution in the 50 mile Fermi 3 region by segment. The estimated total transient population for each Michigan or Ohio segment within each concentric circle is calculated by combining estimates of the following, as explained further below:

- 2000 U.S. Census commuter information for each county (Reference 2.5-2)
- 2000 U.S. Census information from LandView® 6 on the number of Recreational, Seasonal, and Occasional housing units in the 50 mile region (Reference 2.5-3)
- Special facilities transient population data

The 2000 U.S. Census reports commuter inflow and outflow information for each county. Table 2.5-7 lists the commuter inflow and outflow data for counties within 50 miles of the Fermi site. Once this commuter information was compiled, ArcGIS software (Reference 2.5-4) was used to find the percentage of each county lying within a segment. Multiplying this percentage by the commuter net flow for each county produces an estimate of the net commuter transient population for each concentric circle segment for the 10 to 50 mile radii.

The LandView® 6 software is used to estimate the transient population associated with the use of recreational, seasonal, or occasional housing units as follows. LandView® 6 is used to determine the number of houses in each segment based on Census Block Point data. For each segment, the number of housing units is then multiplied by the percentage of total housing units in the generally corresponding Census Block Group classified as “for recreational, seasonal, or occasional use.” The result is an estimate of the number of houses in each segment that are vacant. Next, and to translate this into a population estimate, the number of units for recreational, seasonal, or occasional use for each segment is multiplied by the county’s average household size to arrive at the maximum population in recreational, seasonal, or occasional housing units in each segment. Finally, because these units are only occupied part of the year, it is arbitrarily assumed that three quarters of the housing units would only be occupied for three months (one quarter) of the year. Thus, by multiplying the maximum population in recreational, seasonal, or occasional housing units by 0.1875 (0.75 * 0.25) an estimate of the equivalent transient housing population for recreational, seasonal, or occasional use for each segment is derived.

Table 2.5-8 lists special facilities transient population information for several categories (correctional facilities, college dormitories, nursing homes, hospitals, religious group quarters, and other non household living situations) for each county within 50 miles of Fermi 3. ArcGIS software was used to find the percentage of each county lying within a segment. Multiplying this percentage by the transient population for each county produces an estimate of transient population for each concentric circle segment for these several categories.

The transient population for segments in Canada is assumed to be equal to the same percentage as the transient population percentage in the United States. This methodology is deemed appropriate because the transient population makes up a small percentage of the total population, 3.6 percent for the U.S. region within 50 miles of Fermi 3, and the percentage of resident Canadian population to the whole regional resident population is 8.7 percent.

2.5.1.2 Projected Total Population

Assessing the potential socioeconomic impact of Fermi 3 requires a population projection. Population projections for the segments within 10 miles of Fermi 3 for 2020 (the assumed first year of operation) and for each subsequent decade for four decades through the year 2060 are based upon the average annual growth rate in United States county census population from 1990 through 2005 (Table 2.5-9) for the regional counties, applied to the 2000 resident and transient population estimate for each segment. ArcGIS software is used to find the percentage of each segment lying within an area. A weighted average growth rate for each segment is calculated by summing up the product of the county growth rate and the segment tract area percentage associated with each county. Figure 2.5-8 shows a graphical representation of this methodology. The transient population was estimated to grow at the same rate as the resident population because schools, employment, and a number of other transient categories are generally linked to resident population. The resulting population projection is shown in Table 2.5-10.

The population projections for the 10 to 50 mile segments from Fermi 3 for 2020 (the projected first year of operation) and for each subsequent decade for four decades through the year 2060 (the projected end of the initial license period plus 10 years) are based upon the average annual growth rate in United States county census population from 1990 through 2005 (Table 2.5-9) and the average annual growth rate in Canadian census subdivision population from 1996 through 2006 (Table 2.5-11), applied to the 2000 (US) and 2001 (Canada), resident and transient population estimate for each segment. The resulting population projections for the 10 to 50 mile segments are shown in Table 2.5-12.

2.5.1.3 LPZ, 10 Mile Radius, and Regional Characteristics

The age and gender distributions in 2000 for the regional counties around Fermi 3 are listed in Table 2.5-13. The table indicates more females than males in the region and that the 35 to 44 age group is the largest age grouping for the more than 5 million people in the regional counties. Table 2.5-14 provides similar information for the Canadian population in the region. Note that to derive the detailed age estimates for the U.S. counties, the methodology requires a change from the previous population estimates made from LandView® 6. Previous population estimates in this section were based on census information organized and reported according to Census Block Points that, in the LandView® 6 software, allows a relatively precise estimate of population within 50 miles (or other distance) from Fermi 3. However, age distribution is not available at the Census Block Point level in LandView® 6, and a larger census reporting area called the Census Block Group (CBG) must be used, as this reporting area does include age distribution data. According to the LandView® 6 supporting documentation, the average CBG contains about 39 Census Block Points. The consequence of using this CBG estimating approach is that the block groups do not exactly coincide with the 50 mile (or other distances) radius from Fermi 3. Instead, and as shown in Figure 2.5-9, some of the CBGs near the 50 mile radius extend beyond the 50 mile circle. This has the effect, in the instance of the 50 mile radius, of increasing the resident population from 5,378,266 using the Census Block Point method, to 5,570,309. Likewise, at the 10 mile radius, the CBG estimating approach produces a population of 100,931 rather than the 89,198 estimate under the more precise Census Block Point method. Figure 2.5-10 indicates the CBGs lying wholly or partly within the 10 mile radius. Figure 2.5-11 indicates the CBGs in the low population zone (LPZ).

Racial and ethnic population characteristics for the LPZ, defined as the area within 3 miles of Fermi 3, the 10 mile radius, and the region are listed in Table 2.5-15 for U.S. counties, and in Table 2.5-16 for Canadian populations in the region. To derive the data in the tables, the CBG estimating approach was again used, meaning that CBGs wholly or partly within the selected areas were included in the estimates.

Racial and ethnic population characteristics for the LPZ, defined as the area within 3 miles of Fermi 3, the 10 mile radius, and the region are listed in Table 2.5-15 for U.S. counties, and in Table 2.5-16 for Canadian populations in the region. To derive the data in the tables, the CBG estimating approach was again used, meaning that CBGs wholly or partly within the selected areas were included in the estimates.

Data indicate that for the U.S. counties in the region, the 3.5 million Caucasians comprise 70 percent of the overall population (5.1 million) followed by the 1.1 million African-Americans who account for 22 percent of the regional population. In the LPZ and 10 mile radius, Caucasian populations comprise 94 percent and 93 percent of the total population, respectively. Similarly, some 89 percent of the Canadian population in the region is Caucasian.

Income distribution information by household for the LPZ, 10 mile radius, and the region is listed in Table 2.5-17[5]. As indicated in the table, the largest category in each geographic area is the $50,000 to $74,999 grouping. The median household income for households in the LPZ was $58,325 in 2000, and was $51,807 for the 10 mile radius and $47,852 in the region. Table 2.5-18 lists additional income information for the regional counties, Michigan, Ohio, and the U.S. Both Michigan (12.5 percent) and Ohio (11.7 percent) have poverty rates below the national average of 12.7 percent. Monroe County, Michigan, where Fermi 3 is located, has a poverty rate of only 8.7 percent. Table 2.5-19 provides similar income data for the Canadian population, arranged by subdivision within the Province of Ontario.

2.5.1.4 Jurisdictional Population Estimates

Recent population data is available for the counties and municipalities in the selected region from the U.S. Census Bureau. Data for the counties in the region plus selected municipalities is provided in Table 2.5-19-A. From 2000 through 2008, the counties in the region experienced a slight decrease in population, with the cities of Detroit and Toledo also experiencing a decrease in population.

2.5.2 **Community Characteristics**

This subsection describes the community characteristics in the vicinity of the Fermi site. For many of the community characteristics discussed, the emphasis is on Monroe County and Frenchtown Township, although some statistics are also presented for Wayne County, Lucas County and the

5. The corresponding information for the Canadian divisions is not available from the Canadian Census.

two surrounding metropolitan areas of Toledo and Detroit in those categories that could incur a noticeable impact due to Fermi 3 construction or operation. Limited data is also presented for the portion of Canada within the 50-mile Fermi region and the limited amount of data is appropriate due to the expected lack of significant impact on Canadian community facilities and services from the Fermi 3 project.

This overall focus is appropriate because the largest potential for increased demand for community facilities and services, relative to the existing level of services, will be in Monroe County and Frenchtown Township, where Fermi 3 is located. While the large Detroit and Toledo population centers are likely to be home to many of the Fermi 3 construction and operational workforce, these workers will be widely dispersed and many will be commuting to the site from existing residences, thereby avoiding significant new demands for community facilities and services in these areas. Community characteristics in Lucas County and Wayne County that are discussed include those that could be realistically impacted and include the area economic base (Subsection 2.5.2.1), demographics (Subsection 2.5.2.3), social structure (Subsection 2.5.2.4), housing (Subsection 2.5.2.5), education (Subsection 2.5.2.6), police service (Subsection 2.5.2.9.2), fire protection (Subsection 2.5.2.9.3), hospital and ambulance service (Subsection 2.5.2.9.4), highways (Subsection 2.5.2.10.1), airports, ports, and railways (Subsection 2.5.2.10.2), and distinctive characteristics (Subsection 2.5.2.11). Descriptive areas limited to Monroe County and Frenchtown Township include political structure (Subsection 2.5.2.2.1), tax base (Subsection 2.5.2.2.2), recreational facilities (Subsection 2.5.2.7), land use planning and zoning (Subsection 2.5.2.8), water and sewer services (Subsection 2.5.2.9.1), and public transportation services (Subsection 2.5.2.10.2). This focus is consistent with the emphasis of NUREG-1555's discussion of the "relevant region."[6] Subsection 2.5.2 is confined to describing the region's baseline characteristics; while in Section 4.4 and Section 5.8, the respective impacts from Fermi 3 construction and operation are evaluated.

2.5.2.1 Area Economic Base

The region's economic base owes its historical development to manufacturing and, in particular, to the automotive industry. Dating back to the turn of the 20th century and to Henry Ford's early production facilities in Detroit, the regional economy benefited greatly from the assembly line production method and the subsequent emergence of dozens of automobile companies in the first half of the century. During World War II, many regional factories were used to produce armaments for the military and following the war, the region reached new economic heights. As with many manufacturing sectors, however, the regional industrial base began to encounter a sharp downturn during the 1970s as foreign competition ushered in a period of significant structural shift in employment. As seen in the statistics below, the structural shift in regional employment continues to be a significant issue, though there has also been employment growth in some service industries in the recent past.

6. The relevant region as defined by NUREG-1555, Section 2.5.2, is as follows, "The relevant region is limited to that area necessary to include social and economic base for (1) the county in which the proposed plant would located and (2) those specific portions of surrounding counties and urbanized areas from which the construction/operations workforce would principally be drawn, or that would receive stresses to community services by a change in residence of construction/operation workers."

Labor force and employment statistics in 2000 and 2006 are presented in Table 2.5-20 for the Michigan and Ohio counties located within the 50-mile region, the Detroit and Toledo areas, and the region as a whole. The Detroit data is based on the Combined Statistical Area (CSA) shown in Figure 2.5-12 that includes the Michigan counties of Monroe, Wayne, Oakland, Genesee, Lapeer, St. Clair, Livingston, Macomb, and Washtenaw. For Toledo, data is for the Metropolitan Statistical Area (MSA) which is shown in Figure 2.5-13 and includes the Ohio counties of Wood, Fulton, Ottawa, and Lucas.

Table 2.5-20 indicates that the 2000 labor force in Monroe County numbered 77,194 and there were 74,756 people employed. The 2000 unemployment rate for the county was 3.2 percent. Just to the north, Wayne County had a 2000 labor force of 952,300 of which 911,069 were employed; this yielded an unemployment rate of 4.3 percent in 2000. To the South, Lucas County had a 2000 labor force of 227,304 with 217,049 people employed; therefore the unemployment rate for Lucas County was 4.5 percent. The entire region had a labor force of 3,091,011 in 2000, of which 2,977,479 were employed, resulting in an unemployment rate of 3.7 percent. The Detroit CSA accounted for 2,700,947 of the regional labor force in 2000 and had a 5.8 percent unemployment rate. The Toledo MSA had a 2000 labor force of 317,744 in 2000 and the unemployment rate was 4.7 percent.

From 2000 to 2006, the Monroe County employment level decreased by 1.1 percent, Wayne County's employment decreased by 10.1 percent, Lucas County's employment decreased by 2.4 percent, and total employment in the 50-mile region decreased by 6.5 percent. The 2006 unemployment rates for Monroe and Wayne counties were 6.5 percent and 8.4 percent, respectively. For the region as a whole, the 2006 unemployment rate was 6.8 percent. As shown in Table 2.5-20, the Detroit CSA had an unemployment rate of 10.1 percent in 2006 and the Toledo MSA unemployment rate in the same year was 8.2 percent.

Table 2.5-21 lists 2000 and 2006 employment by industry for Monroe County, Wayne County, Lucas County, the Detroit CSA, and the Toledo MSA. Also listed is the industry employment for the 50-mile region in 2000. Data in Table 2.5-21 indicate that the manufacturing industry in the region encountered significant employment losses between 2000 and 2006. In Monroe County, manufacturing employment decreased from 18,120 to 14,587 but this was eclipsed by the manufacturing job loss of 40,973 in Wayne County and 107,853 manufacturing jobs lost in the entire Detroit CSA. In the Toledo MSA, manufacturing jobs decreased only slightly during the 2000 through 2006 period while in Lucas County 5,771 manufacturing jobs were lost.

The largest growth for the region occurred in the educational, health and social services industry, and all four of the county and statistical areas listed in Table 2.5-21 realized an increase in employment in this industry sector during the 2000 through 2006 period. Other industries experiencing growth in Monroe County include retail trade, the finance, insurance, and real estate industry, and the arts, entertainment, recreation, and food services industry.

The three Canadian counties that lie within the 50-mile radius of Fermi 3 are Essex, Chatham-Kent, and Lambton. The combined 2001 employment data for these Canadian counties listed by major industry is presented in Table 2.5-22. As with the U.S. portion of the Fermi region, employment in the Canadian counties was concentrated in manufacturing and construction (94,290). Other large industries include health and education (45,195), and the trade industries (43,595).

The largest employers in Monroe County are listed in Table 2.5-23. According to the Monroe County Finance Department, the top three employers in Monroe County in 2006 were Automotive Components Holdings, formerly named Visteon Corporation, (approximately 2,000 employees), Detroit Edison Corporation (approximately 1500 employees) and Mercy Memorial Hospital (approximately 1,300 employees). Employment data for 1998 is also listed in the table and reveals a trend toward increased concentration of total county employment among the largest firms. According to the Monroe County Development Corporation, Automotive Components Holding is scheduled to scale down operations in 2008 through a workforce reduction of at least 1,000.

Table 2.5-24 and Table 2.5-25 show the largest employers for Wayne County and Lucas County, respectively. In Wayne County, the largest employer in 2007 was Ford Motor Company with 42,309 employees; down from the 57,659 people employed in 1998. Ford Motor Company was followed by Detroit Public Schools (17,329 employees) and the City of Detroit (13,593 employees). In Lucas County, the three largest employers in 2006 were ProMedica Health Systems (11,265 employees), Mercy Health Partners (6,723 employees), and the University of Toledo (4,987 employees).

Table 2.5-26 lists the industry employment projections for Michigan and the Detroit MSA in 2014, as made by the Michigan Department of Labor and Economic Growth. In making its projections, the department includes Monroe County as part of the Detroit MSA, along with the counties of Wayne, Lapeer, Macomb, Oakland, and St. Clair (note that this list differs from the counties in the Detroit CSA). According to the Michigan Department of Labor and Economic Growth, employment between 2004 and 2014 will increase by 6.9 percent overall in the Detroit MSA, although manufacturing employment will decline by 11.4 percent and the durable goods manufacturing sector is projected to decrease by 13.4 percent. The overall growth will be driven by the service industries, with professional and business services (18.9 percent), educational and health services (11.2 percent), and the leisure and hospitality industry (10.6 percent) projected to experience the largest growth rates. At the state level, the overall growth from 2004 through 2014 is projected to be 7.9 percent.

Table 2.5-27 shows the 2014 industry employment projections for the Toledo MSA. It is projected that by 2014, there will be an employment decrease of 4,230 in the goods producing sector with manufacturing to experience a decrease of 5,030 jobs. However, service producing industries will experience an employment increase of nearly 26,990 jobs within the Toledo MSA. Table 2.5-28 provides additional employment information for Monroe County by listing recent and expected changes in employment.

The most detailed view of the regional workforce in relation to the needs of the Fermi 3 project during construction and operation is seen when comparing the key occupational requirements of the project (in Sections 4.8 and 5.8) with the available labor force for these occupations.

Concerning the available heavy construction industry craft workers in the region, Table 2.5-28(A) lists the key craft and the location of the primary and supporting union halls that will provide key craft workers to the project. Also listed is the number of craft workers at the identified union halls in 2009, and the direct journeyman wages by craft. At the state level, Table 2.5-28(B) lists the 2006 and projected 2016 labor force at the state level for Michigan and Ohio for several craft occupations that will be required on the Fermi 3 project.

Staffing requirements during the Fermi 3 operational phase will consist of multiple occupational classifications. The 2004 study prepared for the Department of Energy (DOE) titled: "Study of Construction Technologies and Schedules, O&M Staffing and Cost, Decommissioning Costs and Funding Requirements for Advanced Reactor Designs (Volume 1)", called the DOE staffing study herein, lists more than 200 staffing job categories required for the operation of a nuclear power plant, organized into several departments. The functional departments are listed below, and some of the key job categories for each department are also identified:

- Management – includes director positions over O&M and safety, plus various corporate services such as financial support.
- Operations – includes manager of operations positions and support, shift licensed and non-licensed operators, shift supervisors, operations engineers, refueling operators, clerks and administrative support.
- Engineering – includes the engineering manager and administrative support, systems engineers, reactor engineers, component engineers, civil and mechanical engineers, and records clerks.
- Maintenance – includes the maintenance manager and administrative support, electricians and electrical supervisors, mechanics and supervisors, I&C technicians, outage scheduling personnel, outage inspectors, and maintenance procurement workers.
- Outage and Planning – includes the outage and planning manager and administrative support, the nuclear scheduling supervisor, electrical schedulers and planners, mechanical schedulers and planners, I&C schedulers and planners, unit outage coordinator, and turbine maintenance specialists.
- Major Modification and Site Support – includes the nuclear support services manager and administrative support, the construction engineering supervisor, construction engineers, quality inspectors, electrical construction specialists and supervisors, civil/mechanical construction specialists and supervisors, project controls specialists and supervisors, labor support and supervisors, and construction equipment management.
- Organizational Effectiveness – includes the licensing supervisor and engineers, nuclear safety supervisor, and corrective action coordinators.
- Radiation Protection – includes radiation protection manager and administrative support, health physicist technicians and supervisors, radwaste technicians and supervisor, and chemistry technicians and supervisor.
- Training – includes the nuclear training manager and administrative support, operations initial training supervisor and staff, operations continuing training supervisor and staff, and maintenance/rad protection training supervisor and staff.

- Security – includes the protection services manager and administrative support, security supervisors, security officers, safety and loss prevention personnel, and the site emergency planning personnel.
- Supply Chain Management – includes the supply chain manager and administrative support, the warehouse supervisor and storekeepers, receiving and inspection workers, and emergent sourcing specialists.
- Telecommunications – includes the IT manager, business analysts, local area network field services workers, and telecommunications services.

Data at the state level for several occupations that closely correspond with many of the job categories in the DOE staffing study is shown in Table 2.5-28(C). This table indicates the historic and projected labor force and wage data for key occupations in Michigan and Ohio that would include many of the Fermi 3 occupational jobs.

In addition, Table 2.5-28(C) indicates the average hourly wages for each occupation by state. The average hourly rate in 2008 varied widely by occupation, ranging from a low of $12.21 ($2008) per hour for security guards to $47.98 ($2008) per hour for general and operations managers. Additional employment considerations pertaining to the impacts of Fermi 3 during construction and operation will be discussed in Chapter 4 and Chapter 5, respectively.

2.5.2.2 Area Political Structure and Taxation

The Fermi site is located within the Frenchtown Charter Township in Monroe County. This section discusses the relationship between counties, townships, villages, and cities in Michigan, and provides recent tax information for Monroe County and Frenchtown Township. The main focus of the subsection is Frenchtown Township and Monroe County due to the fact that it is these areas that will be primarily impacted and will receive the majority of the tax benefits generated by Fermi 3.

2.5.2.2.1 Political Structure

In Michigan, counties have always been the basic unit of local government and possible configurations include the county commission form, the county controller form and the county executive form. Historically, townships are the oldest subunit area within counties and their roots extend back to the Northwest Ordinance of 1785, which called for surveys that divided the land into six-mile squares (Reference 2.5-7). These areas were organized into political units in Michigan under the Township Act of 1827, which created the position of the township supervisor who also sat on the county board of supervisors. This arrangement was confirmed and the role of township government was further refined in the 1850 Michigan Constitution, when the township offices of supervisor, clerk, highway commissioner, constables, a highway overseer, and justices of the peace were created. Townships were also designated as a corporate body with the right to sue or to be sued in the 1850 Constitution. As opposed to cities and villages, townships and counties do not have home rule powers, meaning that they only have those powers and authority expressly provided or inferred by state law (Reference 2.5-7).

Today, Michigan townships are designated either as general law townships or as charter townships. The charter township is afforded additional discretions not available to the general law township, and charter townships are generally immune from annexation by a neighboring city. General Law townships have no ability to levy an income tax and have stricter limits than charter townships with regard to property taxes that can be levied without voter approval.

By 2000, there were 1242 townships in Michigan, and 127 had adopted the charter township form of government through a vote of the county board or through a citizen vote (Reference 2.5-7). Many townships offer complete public facilities and services including water and wastewater supply and treatment, police and fire protection, and parks and recreational services. Most township revenues are derived from the state, collected from user fees, or generated from interest on investments. Frenchtown Township is a charter township governed by a seven member board. As will be subsequently discussed, the township provides multiple public facilities and services, including fire protection, water, zoning, and parks and recreation (Reference 2.5-8).

Historically, as the state population continued to grow during the 1800s, villages and small cities naturally began to arise. To accommodate the need for local government in such communities, the Michigan Constitution of 1850 called for the state legislature to allow for the incorporation of cities and villages. Between 1850 and 1895, there were 89 cities and 297 villages incorporated in the state. The primary difference between a village and city in Michigan is that cities tend to be larger, and villages remain within the township, meaning that those within the village continue to pay township taxes and have a voice in township governance. Conversely, the formation of a city removes the area from the township government, though city residents continue to pay county taxes and have a voice in county government (Reference 2.5-7).

In addition to the aforementioned classifications, Michigan law allows for the formation of special-purpose districts and authorities if there is a need for services that do not match-up with existing governmental boundaries. Examples can include police and fire services, joint agencies for electric power, parks and recreational authorities, and transportation authorities (Reference 2.5-7).

In general, local government is financed through a number of tax sources, and this revenue is allocated to various account funds. The largest of these funds is usually the general fund that typically generates revenues through ad-valorem property taxes. These taxes generally apply to all non-government and non-church property. The basic unit of taxation is the mill, which is one-tenth of a cent, or 1/1000 of a dollar. In Michigan, the mill levy is applied to 50 percent of the assessed value when determining property taxes (Reference 2.5-7).

Another primary source of local funding in Michigan is the state revenue sharing program in which the state distributes sales taxes collected to cities, counties, villages, and townships. As of 2002, state revenue sharing was determined by the constitutional requirement of 15 percent of the 4 percent gross collections of the state sales tax, and a statutory requirement that 21.3 percent of the 4 percent gross collections of the state sales tax be distributed to local governments (Reference 2.5-7).

Monroe County is divided into nine distinct geographic districts, each of which elects a representative to the Monroe County Board of Commissioners for a two-year term (Reference 2.5-9). Once the Board is elected, a Chairman and Vice Chairman are selected, as is a County Administrator who acts as the Chief Operating officer and is responsible for administrative compliance with Board polices, state laws, and the fiscal integrity of the county (Reference 2.5-10). The Monroe County Board of Commissioners maintains four standing committees:

- Finance Committee. This committee consists of all Board members and is concerned with budgets, expenditures, auditing and economic development.
- Personal Services/Human Resources Committee. This committee is comprised of four members appointed by the Chairman with responsibilities ranging from the health department to housing.
- Physical Resources Committee. This committee consists of four members appointed by the Chairman with duties consisting of management over procurement, roads, drainage, parks and recreation, 911 dispatch, and historic sites.
- Judiciary, Law Enforcement and Public Safety Committee. This committee consists of four members appointed by the Chairman, and oversees the local courts, sheriff, emergency medical services, and emergency management. (Reference 2.5-10)

2.5.2.2.2 **Taxation**

Tax information for Monroe County from 2001 through 2005 is provided in Table 2.5-29, which lists the property tax rate per $1000 (also known as a mil or mil rate) of taxable value in several categories of taxes and for overlapping locations within the county. The school district category had the highest property tax rate in the county, and these taxes averaged 26.80 per $1000 of taxable property in 2005. By way of comparison, the township average rate in 2005 was 2.72 mils, and the total county direct rate was 5.41 mils.

Table 2.5-30 details the value of taxable property within Monroe County by land type, classified by residential, agricultural, commercial, industrial, developmental, and personal property. As of 2005, the total assessed value in the county was $6.9 billion of which $4.1 billion was residential and $1.0 billion was industrial. The total true cash value of property was $13.9 billion.

Table 2.5-31 lists the leading property tax payers in Monroe County in 2006 and 1997. The entity with the highest assessed property value in 2006 was Detroit Edison which had a taxable assessed value of $822,719,335 or 12.6 percent of the total county taxable assessed value (this is down from the 1997 assessed value of $1,178,001,644 when the figure was 31.4 percent of the Monroe County total). There was significantly less taxable assessed value of the second ranked entity, Automotive Components Holding, which had a taxable assessed value of $104,799,157 and accounted for 1.6 percent of the county total and that, as previously mentioned, will undergo a significant downsizing in 2008. Table 2.5-32 and Table 2.5-33 list the largest tax payers for Wayne County and Lucas County, respectively.

Table 2.5-70 shows the Fermi 2 property taxes, nuclear fuel property tax, and the total Fermi 2 property taxes paid from 2002 to 2007. As seen in Table 2.5-70, over the past 5 years, Fermi 2 has paid $142,243,792 in total property taxes. Also, during this same time period the taxes paid by Fermi 2 per year has decreased by approximately $10 million, i.e. Fermi 2 paid $29,506,399 in total property taxes in 2002 and paid $19,057,947 in total property taxes in 2007 (this decline in taxes paid concurs with the declining assessed value of Fermi 2 shown in Table 2.5-31). Table 2.5-71 shows the 2007 millage rate composition for the Frenchtown Charter Township. Fermi 2 is in the Jefferson Resort School District and in 2007 paid a millage rate of approximately 46.7 mils. Of this total, approximately 6.7 mils went to the Frenchtown Township, 13.2 mils went to Monroe County (including the Monroe Intermediate School District, Monroe Community College, Monroe County Library), 25.0 mils went to the school district (of which 6 mils went to the state), and the remaining 2.8 mills went to the Resort Authority.

Taxable property and the resulting property tax revenues are a major source of the total township revenue. According to Table 2.5-34, property tax revenues accounted for 55 percent of the total Frenchtown Township revenue in 2001, and ranged from 38 percent to 70 percent of the total township revenues in the 1989 through 2001 period. Table 2.5-35 lists the value of taxable property by category in Frenchtown Township as reported in the 2002 township Master Plan. The table indicates that in 2002, the leading category in taxable value was the industrial classification, which accounted for 62 percent of the property value and includes real property values for the utility category (Reference 2.5-11). The residential category accounted for 31 percent of the taxable value of property in Frenchtown Township in 2002.

The Frenchtown Master Plan contains a significant discussion about the tax benefits of the Fermi plant. Key text is provided below:

> Around 1980, Frenchtown Township became the site of Detroit Edison's Enrico Fermi power generation facility located on the shore of Lake Erie. As a result, total SEV [State Equalized Value] of property in the Township increased by 500 percent between 1980 and 1988. In 1989, the Fermi plant (building and land alone) represented fully 74 percent of the property tax base in the Township. While this represented a windfall for the Township, it is in fact a temporary condition… [B]eginning around the year 2000, the taxable value of the Fermi plant began to decline and will continue to decline in coming years. By 2002, the Fermi plant represented only 49 percent of the property tax base in the Township (Reference 2.5-11).

The Master Plan then discusses the trend of residential property accounting for an increasing percent of the overall township property tax base (from 10 percent in 1988 to 27 percent in 2002) and notes that "residential land uses cost more in terms of the services that the local community must deliver than the tax revenue they typically generate." Although the overall residential property value in the township is increasing, as indicated by the rate of increase in residential value exceeding the rate of increase in the number of residential units, the Master Plan makes the following conclusion regarding overall Township funding sources:

> The trends would suggest that it will be important in the future to continue efforts to bring sufficient industrial, office and or commercial development to the Township to partially offset the decline in taxable value occurring at the Fermi Plant. Failure to do so may create a future dilemma between higher tax rates and lower levels of Township services. (Reference 2.5-11)

In addition to property tax benefits accruing to the local community, Table 2.5-72 indicates that significant sales tax revenues are associated with the operation of Fermi 2. The Applicant has estimated that sales tax revenues arising from Fermi 2 operation and maintenance (O&M) and capital expenditures for the years 2002 through 2007 averaged approximately $1.154 million per year in direct sales taxes (those taxes generated by Fermi 2 direct expenditures). These tax revenues were realized by Michigan and Ohio, each of which has a 6 percent sales tax rate.

Also shown in Table 2.5-72 are the estimated indirect sales tax benefits associated with Fermi 2. The Applicant estimates that, between 2002 and 2007, an annual average of $4.44 million in indirect sales tax revenues were generated in Michigan and Ohio.

Table 2.5-36 lists the per capita taxes paid in Michigan and Ohio and ranks the state data relative to other states. Michigan ranks high in terms of per capita corporate income taxes at 9th and tobacco products taxes at 2nd. The per capita taxes in Michigan rank toward the bottom in terms of individual income tax at 32nd and motor fuel taxes at 43rd, while total per capita taxes rank 25th in the nation. Ohio ranks 21st in the nation in total per capita taxes while ranking 8th in individual income taxes and 22nd in corporate income taxes.

Table 2.5-37 displays Michigan's general property tax collection broken down by jurisdiction for the years 2004 and 2005, while Table 2.5-38 lists the taxes and fees collected by the state of Michigan from 2001 to 2006.

2.5.2.3 **Demographics**

Detailed demographic information for the Fermi region and segments at various distances from Fermi 3 are provided in Subsection 2.5.1. This section will present additional discussion related to the demographics of Monroe, Wayne, and Lucas Counties, plus selected cities within these counties as these communities will be the areas primarily impacted by Fermi 3. Section 4.4 and Section 5.8 provide onsite labor information for the construction and operation periods.

With its location between two MSAs, Monroe County is influenced to the north by Detroit and to the south by Toledo; yet the community has retained its character as a relatively rural area, as approximately 75 percent of the county is cropland, with small and medium sized villages and cities distributed throughout the county (Reference 2.5-12). As seen in Figure 2.5-14, population centers within the 10-mile radius include Woodland Beach (2.9 miles away to the west-southwest of the Fermi site and having a population of 2179); Carleton (9.4 miles northwest and a population of 2,561); Detroit Beach (4.0 miles west-southwest and a population of 2,289); Flat Rock (9.5 miles north and a population of 8,488); Gibraltar (9.5 miles north-northeast and a population of 4,264); Rockwood (7.6 miles north and a population of 4,726); and Stony Point (1.3 miles south-southwest and a population of 1,175). The City of Monroe (5.5 miles away at the closest point to the southwest) is the largest city in Monroe County and the largest city lying within the 10-mile radius. As of 2000, the City of Monroe had a population of 32,229. This population figure included 10,293 people in the labor force, of which 9,938 were employed and 355 were unemployed (an unemployment rate of 2.1 percent) (Reference 2.5-13).

According to the U.S. Census Bureau, the total 2006 resident population of Monroe County was approximately 155,000, equating to 281 people per square mile (an increase of 16 people per square mile from the year 2000). By comparison, the state of Michigan had a population density of 177.7 people per square mile in 2006, a slight increase from the 175 persons per square mile in 2000 (Reference 2.5-14).

In sharp contrast, Wayne County to the north had a 2006 population of 1.97 million and is the most populous county within Michigan and the 11th most populous county in the United States (Reference 2.5-15). The land area is 623 square miles (3,165 people per square mile) and the county is made up of 43 civil divisions. The City of Detroit, the Wayne County seat, is the largest governmental division within the county having a 2006 population of approximately 871,000 (Reference 2.5-16 and Reference 2.5-17). The City of Detroit's land area is 139 square miles (6,267 people per square mile), which accounts for 22 percent of the total land area of Wayne County, and the city includes approximately 50 percent of the county's total population. Detroit is also the largest city in Michigan and the 10th largest city in the United States (Reference 2.5-18).

To the south of Monroe County lies Lucas County, Ohio and is comprised of 340 square miles of land. In 2000, Lucas County had a population density of 1338 people per square mile of land compared to 277 people per square mile for Ohio as a whole (Reference 2.5-19). The largest city in Lucas County is Toledo, which had a 2000 population of approximately 309,000. Toledo's land area is 81 square miles giving it a population density of 3,890 people per square mile (Reference 2.5-20).

2.5.2.4 **Social Structure**

Monroe County is a moderately populated county located between Detroit and Toledo. While Monroe County residents live in a semi-rural area, the City of Monroe and other smaller cities offer local access for the procurement of basic goods, services, and recreational opportunities. For specialized goods and services, the population is able to commute to Detroit or Toledo. Detroit and Toledo also provide regional employment opportunities in a wide range of industries and specialties. Census data indicate, for example, that while 51.1 percent of Monroe County residents are employed in the county, 18.4 percent commute to Lucas County (Ohio) and 17.7 percent of local workers commute to Wayne County (Table 2.5-55).

As the county's second largest employer, Detroit Edison, and the Fermi plant in particular, helps keep the number of local residents working in Monroe County relatively high. The anticipated additions of Fermi 3 will further contribute to regional employment diversity and add to the importance of Detroit Edison as an employer in Monroe County.

2.5.2.5 **Housing**

Key housing information is presented in Table 2.5-39 for the 50-mile regional counties, the Canadian districts, and the states of Michigan and Ohio. Monroe County had 56,471 housing units in 2000, of which 53,772 were occupied. The heavily populated Wayne County, just to the north, had 826,145 housing units in 2000; 768,440 of these were occupied. To the south, Lucas County had 196,259 housing units in 2000 with 182,847 of those being occupied. The total number of housing units in the entire 50-mile region was 2,436,635 in 2000; 2,288,055 of these were occupied and there were 148,580 vacant housing units. These vacant houses, plus other housing options, will be more than adequate to support the influx of construction and operational workers; these issues are further discussed in Section 4.4 and Section 5.8, respectively. The state of Michigan had a total of 4,234,279 housing units and Ohio had 4,783,051 housing units in 2000. There were 233,550 housing units in the Canadian area of the 50-mile region.

Table 2.5-40 lists occupancy tenure data for the housing located in the U.S. portion of the 50-mile region. As seen in the table, according to U.S. Census data, approximately 45 percent of the population had moved into their homes in the previous 5 years, and this high percentage is partially a function of the economic downturn in the region that has caused many households to relocate.

Changes in the Monroe, Wayne, and Lucas County housing characteristics from 2000 through 2006 are shown in Table 2.5-41, along with renter and owner cost data. Between 2000 and 2006, the number of units in Monroe County increased by 12 percent, much higher than the 2 percent increase in Wayne County and the 3 percent increase in Lucas County, although the number of units in Monroe County remains far below those in Wayne and Lucas counties. Between 2000 and 2006, the number of vacant units in Monroe County increased from 2,699 units to 4,685, but this 74 percent increase is mild compared to the 115 percent increase in Wayne County. During the same time period there was a 71 percent increase in vacancies within Lucas County. Wayne County had 124,280 vacant housing units in 2006, while Lucas County had 22,938. Housing unit renter costs were comparable between the three counties in 2000 and 2006, with the 2006 monthly cost of a rental home of $695 in Monroe County, $719 in Wayne County, and $594 in Lucas County. Wayne and Monroe County had average monthly mortgage costs of slightly more than $1,350 in 2006 while Lucas County's costs were slightly below these at $1,215.

Table 2.5-42 indicates the adequacy of housing structures in the regional counties in 2000 as well as the totals for Michigan and Ohio. In general, it can be concluded that the housing stock in Monroe County had a lower incidence of inadequacy than the average for Michigan, and was comparable to the average for Ohio. Wayne County, on the other hand, had a significantly higher percentage of housing units lacking plumbing and complete kitchen facilities than either state, as well as a higher percentage of units without telephone service, and a higher percentage of overcrowded units. Lucas County was comparable to Monroe County in the percent of houses lacking plumbing, kitchen, and telephones facilities as well as the sharing the same percentage of housing units with greater than one occupant per room.

More recent housing data is available for the counties in the selected region from the U.S. Census Bureau's American Community Survey. Data for all Michigan counties is provided in Table 2.5-42-A for the year 2007. Data for the Ohio counties is also provided in the table and is either for 2007 or for the period 2005-2007, as not all Ohio region counties were surveyed in 2007.

Table 2.5-42-B includes projections of the number of occupied housing units for the southeast Michigan region. The forecast is made by the Southeast Michigan Council of Governments (SEMCOG) and is from the April, 2008 document 2035 Forecast for Southeast Michigan.

Table 2.5-42-C lists information on the number of manufactured housing or mobile homes in Monroe County as of 2006. Mobile homes, especially those in mobile home parks, will be a primary housing option for workers during the construction of Fermi 3 due to the availability of this type of housing and the affordability of this option (prices for mobile homes in 2006 in Monroe County were generally between $40,000 and $100,000).[7] Available mobile homes together with vacant houses and other lodging alternatives will be options for construction workers relocating to the area temporarily. As of 2006, Monroe County had 29 mobile home parks and 7,451 licensed sites in these parks. There was a 17.2 percent vacancy rate of the sites surveyed in 2006, up from 14.3 percent in 2004.[8] When applied to the 7,451 licensed mobile home sites, the estimated number of vacant mobile home sites in 2006 was 1,282.

Table 2.5-42-D lists the total number of manufactured home parks and sites for Southeast Michigan in 2000 and 2006. In 2006, there were 74,521 manufactured housing sites in 285 mobile home parks in Southeast Michigan. The number of sites in 2006 represents a 6.5 percent increase compared to the number of sites in 2000.

Table 2.5-42-E lists the building permit activity for Southeast Michigan from 1989 through 2008, including the number of new building permits issued, the number of demolitions, and the net change in housing. As shown in the table, there has been a dramatic decrease in the number of building permits for new housing in 2007 and 2008, and this is attributed to the national economic downturn as well as the worsening regional economy. In 2008, there was a net decrease of housing units, and this was the first time in the 20-year period that there has been a net decrease in regional housing units.

Table 2.5-42-F lists short term accommodations within 50 miles of Monroe City. As seen in the table there are over 375 accommodation establishments including, hotels and motels, bed and breakfast, cabins and cottages, condos, historic inns, and campgrounds.

Section 4.4 provides further discussion on workers requiring temporary and permanent housing during construction phase, while Section 5.8 discusses workers need for permanent and temporary housing during the operation phase.

2.5.2.6 **Educational System**

The Monroe County educational system includes nine public school districts, two charter schools, fifteen parochial and private schools, and the schools in the Monroe County Intermediate School

7. *2006 Annual Building Activities Report*, Monroe County Planning Department, p. 42.
8. *2006 Annual Building Activities Report*, Monroe County Planning Department, p. 43.

District (ISD). Key statistics for the school districts and charter schools are provided in Table 2.5-43 (Table 2.5-44 and Table 2.5-45 show the districts, and the number of students and schools per district for Wayne County and Lucas County, respectively). As shown in the Table 2.5-43, there are 55 schools among the districts and academies listed for Monroe County. The total enrollment in these schools was 25,963 in 2005-2006 and there were 1435.1 full time equivalent teachers. The resulting average student/teacher ratio was 18.1, although the ratio in the various districts ranged from a low of 10.4 to a high of 19.6. The student/teacher can be used as a capacity indicator but ratio reflects the teachers' workload and indicates the availability of teachers to the students; therefore the lower the ratio the higher the availability of services a teacher may offer a student. Monroe County's 18.1 student/teacher ratio is a little above the 2005-2006 national average of 15.7 and Michigan's 17.4 (Reference 2.5-134). But even though Monroe County's student/teacher ratio is a little higher than the state and national average local school officials from Monroe ISD, Monroe Public Schools, and Jefferson Public School foresaw no problems stemming from capacity related issues. When asked if there respective districts foresaw any capacity issues they responded that at this time there is constant or declining enrollment and that there is capacity for future growth.

The school districts and charter schools listed in Table 2.5-43 benefit from the activities of the Monroe County ISD that, among its other duties, acts as a regional agency connecting local school districts with the Michigan Department of Education to provide various services that individual school districts may not be able to afford independently. Special services include communications and information support services, a comprehensive health program, curriculum consultation, special education services, diagnostic support, and early childhood special education support among other services (Reference 2.5-21).

Table 2.5-46 presents revenue and expenditure data for the school districts and charter schools in Monroe County in the 2004-2005 school year. The Monroe Public School District had the largest budget, with revenues of $60.4 million, followed by the Monroe ISD, with revenue of $42.8 million. Table 2.5-47 compares median expenditures per student in Michigan, Ohio, and the U.S. Data indicate that the median expenditure per pupil in the U.S. was $9,392 in 2004-2005 compared to $9,103 in Michigan and $8,687 in Ohio.

The demographic breakdown of the school population within Monroe County is as follows: nursery school and preschool: 1,545 students; kindergarten: 2,260 students; elementary school (grades 1-8): 16,168 students; high school (grades 9-12): 9,365 students; and college or graduate school: 8,258. For grades 1 through 8, 13.2 percent of the students are enrolled in private schools versus the state average of 11.2 percent. Students in grades 9 through 12 have a private enrollment rate of 8.5 percent compared to 8.7 percent at the state level (Reference 2.5-22).

The largest public school districts within the region are the Detroit City School District and the Toledo City School District. To the north of Monroe County, the Detroit City School District has a total of 235 schools spanning pre-kindergarten to twelfth grade. The student population for the district is 133,255 with 7187.2 full-time equivalent (FTE) classroom teachers giving the district a student/teacher ratio of 18.5. To the south, the Toledo City School district has 58 schools covering grades pre-kindergarten to twelfth. The district educates a total of 30,423 students with 1852.1 FTE classroom teachers equating to a 16.4 student teacher ratio.

In addition to the high schools and elementary schools, there are a number of colleges within Monroe County. These include: Monroe County Community College (Monroe), Monroe County Community College-Whitman Center (Temperance), Siena Heights College (Division of Monroe Community College), Eastern Michigan University (Monroe), and Spring Arbor University. The largest of which, Monroe County Community College was established in 1964 goal with the objective of providing a high quality preparatory education for those planning to attend a 4 year university, as well as offering occupational programs. The current enrollment at this college is 4433 students, with 85.6 percent of the student being residents of Monroe County (Reference 2.5-23).

Other major colleges in the region include: Wayne State University (Detroit), University of Detroit-Mercy (Detroit), University of Michigan (Ann Arbor), University of Michigan-Dearborn, and Eastern Michigan University (Ypsilanti) (Reference 2.5-24), and the University of Toledo and Bowling Green State University in Ohio. The largest of these is the University of Michigan, which had an enrollment on its Ann Arbor campus of 40,025 in the fall of 2006, followed by Wayne State University with an enrollment of 33,137 in the fall of 2005 (Reference 2.5-25 and Reference 2.5-26).

In Monroe County, there are 103,857 individuals aged 25 and over. In 2006, there were 2,770 people with less than 9^{th} grade education, 10,451 with a 9^{th} to 12^{th} grade education but no diploma, 39,147 high school graduates (including equivalency), 25,997 with some college but no degree, 9,278 with an Associate’s degree, 11,715 with a Bachelors degree and 4,499 people with graduate or professional degrees (Reference 2.5-22).

2.5.2.7 Public and Private Recreational Facilities

Recreational facilities and programs in Monroe County are administered by a ten member Parks and Recreation Commission, who are appointed by the County Board of Commissioners. The Parks and Recreation Commission develop a 5-Year Recreation Plan for the county, with the most recent plan drafted in January 2008. The mission statement of the Commission, as stated in the Recreation Plan, is to:

> …plan, acquire, develop, and maintain, in cooperation with all interested individuals and groups, a responsive, efficient, and creative natural resource based park and recreation system available to all citizens, composed of a variety of services, park areas and special facilities that contribute to the well-being of the individual, the family, and the social and economic health of the Monroe County community. (Reference 2.5-12)

The Commission works closely with the Monroe County Planning Department and the Purchasing and Property Maintenance Division, with the relationship between these groups and the county Board of Commissioners illustrated in Figure 2.5-15.

Monroe County has a well-developed system of recreational facilities and programs. The recreational facilities in the county are listed in Table 2.5-48, where additional information on location, type of facility, and size is provided. Within Monroe County, there are five park classifications. These classifications and the amount of acreage devoted to these classifications include: 1) county parks (221 acres), 2) state owned parks (7413 acres), 3/4) city and township parks (821.5 acres), and 5) neighborhood and subdivision parks (233.6 acres) (Reference 2.5-12).

In addition, Monroe County has nine campgrounds occupying 1593.7 acres, a total of thirty-seven marinas with 3946 boat slips, ten public access sites occupying 1410.5 acres, fifteen shooting ranges and sportsmen's clubs, twenty-five golf courses/driving ranges, and eleven miscellaneous recreational facilities (Reference 2.5-12).

Table 2.5-49 lists recreational and lodging facilities within the 10-mile radius, and Figure 2.5-16 depicts several recreational facilities within the vicinity of Fermi, including wildlife conservation areas that provide hiking, fishing, and other recreation opportunities. The closest areas to Fermi 3 that are used for recreation are along the Lake Erie shore and are associated with the resort communities at Stony Point Beach, about 2 miles south, and Estral Beach, 2 miles northeast. Swimming and some boating activity occurs in these areas (Reference 2.5-27). The Detroit River International Wildlife Refuge (DRIWR) extends along the shore of Lake Erie from the River Raisin to the south of the Fermi site to southern Detroit north of the Fermi site. The area encompasses 656 acres of the Fermi site as part of the refuge, that part of which is not open to the public (Reference 2.5-28).

In addition to the areas described above, the following areas in the Fermi 3 vicinity are available for recreation (note that the utilization of these facilities is not tracked):

- Swan Creek: 0.52 mile north of the Fermi site (just north of the Fermi property boundary)
- Pointe Mouillee State Game Area: 3.1 miles northeast
- William C. Sterling State Park: 4.8 miles south-southwest
- Captain Norman Heck Park: 5.5 miles southwest
- Raisin River Golf Club: 5.4 miles southwest
- Lake Erie Metropark (Wayne County): 6.6 miles north-northeast
- Monroe Multi-Sport Complex: approximately 7 miles southwest in Monroe

2.5.2.8 **Local Land Use Planning and Zoning**

The Monroe County Planning Department & Commission (Planning Commission) is responsible for a wide range of county functions, including land use planning, zoning, specialized research, interface with state and federal agencies, and economic development. The Planning Commission consists of 11 members appointed to three year terms by the County Board of Commissioners.

One of the key agencies that interface with the Planning Commission is the Southeast Michigan Council of Governments (SEMCOG). This regional agency aims to solve regional government problems, increase governmental efficiency, promote economic development, improve the region's water quality and transportation system, perform statistical analyses, and to generally help members improve the quality of life of the region's residents. SEMCOG receives funding from federal and state grants, contracts and membership fees. There are 155 current members of SEMCOG including Monroe, Livingston, Macomb, Oakland, St. Clair, and Washtenaw Counties (Reference 2.5-29 and Reference 2.5-30).

In its zoning function, the Planning Commission is mandated to review all township zoning applications (Reference 2.5-31). Official cases are given to the Planning Commission for review after a Township Planning Commission reviews the case and before the final decision is made by the Township Board. The County Planning Commission's recommendations on a zoning case are provided to the townships, which make the final ruling through the Township Board. In 2004, the Planning Commission provided recommendations on 68 zoning-related cases. The zoning cases reviewed are shown in Table 2.5-50, which indicates that changes in zoning ordinance texts constituted 26 of the total cases, followed by 18 reviews involving single family residences and 11 cases involving commercial zoning issues. From 2000 through 2004, the average percent of cases each year that the County Planning Commission agreed with the Township Planning Commission recommendation was 82.6 percent (non-weighted average), and the final Township Board decision agreed with the County Planning Commission recommendation an average of 85.6 percent of the time (Reference 2.5-31).

While much of Monroe County is zoned for rural land use and 75 percent of the land area is devoted to crop production, there are a number of areas zoned for industrial and utility use (Reference 2.5-12). Frenchtown Township also includes significant parcels of land zoned for industrial and utility use, and the 2002 zoning in effect for the township can be seen in Figure 2.5-17. This figure indicates that the Fermi site in the extreme eastern part of the township and bordering on Lake Erie has a designated land use of utility as is a corridor extending from the Fermi site to I-75 and following the highway for much of its route through the township.

Table 2.5-51 indicates the acreage devoted to various land uses in Monroe and Wayne Counties, and in Frenchtown Township in 1990 and 2000. In Monroe County, the largest classification was agricultural (more than 62 percent of the acreage in 2000), though the category declined by 7 percent from 1990. This was followed by residential land use (14.8 percent), woodlands and wetlands (11 percent), non residential (5.7 percent), and grassland and shrub (3.4 percent). Industrial and commercial/office land uses, while each comprising less than 1 percent of the overall acreage in 2000, nevertheless grew at respective rates of 41 percent and 32 percent between 1990 and 2000 in Monroe County. In Frenchtown Township, agricultural land use accounted for 51 percent of total acreage in 2000, followed by residential land use (19 percent), woodland and wetland land use (9.4 percent of all acreage), and transportation and utility uses (4.5 percent).

Figure 2.5-18 indicates the future land use plans for Frenchtown Township as presented in the most recent (2002) Master Plan. As seen in the figure, the Fermi site land use is expected to remain classified as utility. South of the site, the land is anticipated to remain a low and medium density residential area. The Fermi site is expected to be surrounded primarily by agricultural lands, open areas and woodlands to the west and north, with the possibility of a waterfront opportunity area northwest of the site. Regarding this possibility, the Master Plan states:

> The Master Plan recommends that the Township continue to search for new lake front recreation opportunities. Township acquisition of lakefront property is one alternative. As noted later, a more feasible approach might be to allow private mixed use development along the waterfront, where such development would maximize exposure, access, and orientation to the lake. Two areas where this type of mixed use development would be

feasible are designated on the Future Land Use Map: in the far northeast corner of the Township, and south of Point Aux Peaux and Brest Roads (Reference 2.5-11).

The Master Plan also anticipates pursing development and allocating significant parcels to industrial use, primarily the land area in the northern two-thirds of the township just east of I 75. Related to utility land use, the Master Plan states "The Future Land Use Map acknowledges the continued presence of the Enrico Fermi Energy Center by designating the entire complex as "utilities." (Reference 2.5-11)

2.5.2.9 Social Services and Public Facilities

2.5.2.9.1 Water and Sewer Services

The Frenchtown Township Water Treatment Plant, constructed in 1994, draws water from Lake Erie at a joint intake facility at Pointe Aux Peaux Road; this intake facility is shared with the City of Monroe. The plant is operated by Frenchtown Township and recently expanded the capacity from 4 million gallons per day (mgd) to 8 mgd. The current capacity is expected to be sufficient for at least the next 20 years. Table 2.5-52 indicates that the average daily demand was 2.10 mgd in 2001, and the maximum day demand in 2001 was 3.73 mgd, below the all time high of 3.88 mgd in 1998 (Reference 2.5-11).

The 2002 Master Plan indicated that the water distribution system in the township included more than 70 miles of water transmission main and two 500,000 gallon elevated storage tanks. Areas served by the township water supply plant and transmission mains in 2002 are indicated in Figure 2.5-19.

Sewer service in Frenchtown Township is provided by the City of Monroe. Waste water is collected and sent to the City's treatment plant located on the Raisin River on the east side of the city. Figure 2.5-20 illustrates the areas within Frenchtown Township served at the time the Master Plan was prepared. The treatment capacity at the plant is 24 mgd in dry weather conditions and 30 mgd during storm conditions, although flows of more than 50 mgd have been documented during major storm events, indicating that the collection system is not water tight and is subject to overload during storm events (Reference 2.5-11). According to the 2002 Master Plan, a sanitary sewer capacity analysis was underway for the township, and the study would include recommendations to allow for continued growth.

2.5.2.9.2 Police Service

Police Service in Monroe County is provided by the Monroe County Sherriff's Office, the City of Monroe, and the Michigan State Police. The Sheriff's Office includes 80 officers, 30 of whom serve various villages, cities and townships that have contracted for additional police services. These officers are under the direction of a commander who supervises the lieutenants in command of the three district offices, and the five sergeants who serve as shift supervisors for the 24-7 operation (Reference 2.5-32). The Monroe County Sheriff's Office also has a number of specialty divisions consisting of an Administrative Division, a Detective Bureau, a Marine Unit, a Special Response Team, a Youth Services Team, and a Traffic Services Division that enforces traffic laws on secondary roadways in Monroe County (Reference 2.5-33). At this time, according to officials of the Monroe County Sheriff's office, there are no plans for expansion. Rather, they are trying to maintain status quo. They indicated that due to the fact that Monroe County recently tightened finances and that the sheriff's department currently receives the largest portion of the budget for law enforcement, there would be no new hirings.

To facilitate rapid response, the Sheriff's Office has three district offices that serve specific portions of the county. District One services Frenchtown, plus the townships of Ash, Berlin, Monroe, and Raisinville. An additional District One substation exists in Monroe Township at the Inmate Dormitory, on East Dunbar Road, east of LaPlaisance Road. The district is staffed by 20 Deputy Sheriffs who are assisted by detectives from the Monroe office (Reference 2.5-34). According to the 2002 Frenchtown Township Master Plan, the Monroe County Sheriff's Office also provides patrol services through contractual arrangements with Frenchtown Township (Reference 2.5-11). Four officers are specifically assigned to Frenchtown Township as contract officers, along with a lieutenant and a detective. The southern portion of the Township is also served by officers assigned to the Monroe Township substation.

District Two of the Monroe County Sheriff's Office is headquartered behind the Bedford Township Hall and encompasses Lasalle, Ida, Whiteford, Bedford and Erie Townships. Current staffing at this District consists of 12 uniformed officers and 2 detectives (Reference 2.5-35).

District Three is headquartered in the Dundee Township Hall with substations in the City of Petersburg and in the Village Offices in Dundee. Deputies assigned to these offices provide police services on a contract basis to the City of Petersburg and the Village of Dundee. The district is comprised of Dundee, Summerfield, Milan, London, and Exeter Townships (Reference 2.5-36).

Primary roadways in Monroe County are served by officers in the Second District of the Michigan Highway Patrol. This district includes six counties that also encompass Detroit and areas north. The Second District has a local office in Monroe; Monroe Post #28 (Reference 2.5-37).

Monroe County has two existing jails. One is located on Second Street in the City of Monroe and is linked to the courthouse via a skywalk. The jail was built in 1981 and was originally designed to hold 127 inmates. Subsequent renovations increased the capacity to 183 inmates. Nevertheless, overcrowding became an issue and in 1999, Monroe County purchased 155 acres of land on East Dunbar Road and began the construction of two 80 man dormitory style-housing units plus an administrative support unit. The administrative support unit was constructed to support a prisoner population of 400 and includes medical, classroom, training, maintenance, administration and public areas (Reference 2.5-38).

The City of Monroe also maintains a police force, which dates to 1837. Currently, the city police department has a staff of 48 officers plus 10 civilian support personnel, who maintain records, enforce parking regulations, operate computers and manage patrol vehicles. The department provides uniform road patrol, consisting of officers assigned to one of three main shifts and providing 24-hour police coverage. Other units include the Multi-Jurisdictional Drug Task Force, School Resource Officers, Traffic & Safety, the Detective Bureau, Court Officers, Juvenile Officers, the K-9 Unit, and Motorcycle Units. The city police department is located in the same building as the Monroe County Sheriff's Department (Reference 2.5-39)

To the north, the Wayne County Sheriff's Department has more than 1,300 officers making it the second largest law enforcement agency in Michigan (Reference 2.5-40). The Wayne County Sheriff's Department also operates a 2,600 inmate capacity jail, as well as services in the areas of fugitive apprehension, internet investigations, border enforcement, child rescue, drug and prostitution enforcement, and other services. The City of Detroit Police Department consists of a total of 4,154 full time sworn personnel (Reference 2.5-41). The Lucas County Sheriff's Office has 515 employees including correction officers, deputy sheriff and clerks, 9-1-1 operators, dispatchers, medical staff and clerical staff. (Reference 2.5-42)

2.5.2.9.3 **Fire Protection**

Fire protection in Monroe County is provided through 17 fire departments organized at the township and city level; in total, there are 22 fire stations located in the county. Table 2.5-53 lists and describes these fire stations and Figure 2.5-21 shows the fire districts within the county. In total, there are 447 firefighters within Monroe County including 240 volunteer firefighters, 144 paid per call firefighters, and 63 career firefighters. Most of the fire departments are manned by volunteer staff; however, the Monroe City Departments are classified as having career firefighters, and the Frenchtown Township Fire Department employs mostly career firefighters. The Frenchtown Township fire districts on Figure 2.5-21 are District 32-1 and District 32-2. District 41 is the City of Monroe.

The Frenchtown Township Fire Department has a total of four fire stations and 22 career firefighters. There are also 17 paid per call firefighters and one non-firefighting employee. Figure 2.5-22 indicates the location of the four stations in the township, one of which is adjacent to and southeast of Fermi 3. This is township Fire Station No. 4 is listed in the 2002 Master Plan as being more than 25 years old. Stations 1 and 2 are staffed by full time professional firefighters, while Stations 3 and 4 are staffed by part time, paid per call firefighters (Reference 2.5-11). Officials from Frenchtown Township Fire Department indicated that there are no plans for expansion at this time.

The nearby City of Monroe Fire Department has three stations and 41 career firefighters. An engine company is deployed at each station, and two of the stations also house ambulances (Reference 2.5-43).

To help the firefighters in the county, the Monroe County Fire Association Inc. was created to further develop skill sets such as firefighting and rescue work and represents all the firefighters within Monroe County. The association educates by gathering and dispensing information to members and also promoting legislation for the betterment of all departments. The twenty-five member fire departments and six non-fire department members represent every fire department within the county, as well as Washtenaw County, Wayne County and Washington Township in Ohio (Reference 2.5-44).

There are numerous fire departments to the north and south of Monroe County. To the north, Wayne County has a total of 45 fire departments, the largest of which is the City of Detroit Fire Department. The firefighting division of the Detroit Fire Department has approximately 1141 firefighters located at 45 stations around the city. To the south, Lucas County has 16 fire departments, the largest of which is the Toledo Fire Department with 521 firefighters and 37 non-firefighting employees. The Toledo Fire Department has an average minimum daily staffing of 103 Firefighters and Officers housed at 17 stations within the city.

2.5.2.9.4 **Community Emergency Planning**

The emergency planning for Monroe County is conducted by the Emergency Management Division. The division is responsible for planning and coordination of large-scale emergency and disaster events that include the following categories:

- Natural
- Technological
- National Security
- Nuclear

In addition to the aforementioned planning and coordination efforts the Emergency Management Division also provides the following services to the county:

- Maintenance of an emergency operations center that can be activated 24 hours a day, 7 days a week
- Maintenance of a database that allows for the procurement of needed resources in emergency
- Public education programs to educate the community about emergency situations
- Provide emergency information to the public in times of emergency
- Coordinates volunteer organizations
- Maintains and operates a county-wide early warning siren system; comprised of 105 outdoor sirens (Reference 2.5-45)

2.5.2.9.5 **Hospital and Ambulance Service**

Hospital service to Monroe County is provided by Mercy Memorial Hospital in the City of Monroe. The address is 718 North Macomb Street, Monroe which is just off Highway 125. The hospital has 136 full-time physicians and 185 full-time equivalent registered nurses. There are 235 licensed beds in the hospital. The average daily patient census for Mercy Memorial Hospital for the time period of December 2007 thru February 2008 was 114 patients. This equates to an average of 48.5 percent capacity utilization. If Monroe County’s average annual growth rate in total population of 0.94 percent is applied to the average daily patient census, the 2020 average daily census would be approximately 128 patients and the hospital would be operating at a 54.5 percent capacity utilization level. The emergency room is staffed 24-hours a day, seven days a week through the

Schumacher Group, which is under contract with the hospital. The physicians manning the emergency room are approved by the local physicians and the hospital's Board of Commissioners.

Mercy Hospital offers a wide range of services including cardiac rehabilitation, pulmonary rehabilitation, family-centered birthing place, occupational health services, sleep disorder center, pastoral care, pain management, rape crisis center, health information management, nutrition and diabetes education, outpatient surgical center, hospice care, comprehensive mental health, 24-hour emergency care, rehabilitation services, home respiratory care, home health care, nursing center, lab locations, and a forensic nurse examiner.

In addition to Mercy Memorial Hospital, there are fifteen other hospitals/healthcare facilities in Wayne County excluding Detroit, sixteen within Detroit, and an additional twelve in Toledo. A list of regional hospitals and their addresses is provided in Table 2.5-54. The largest of these regional facilities is the Detroit Medical Center, which has more 2000 licensed beds and over 3,000 affiliated physicians and is the biggest non-governmental employer in the City of Detroit. The nearest burn unit in the region is St. Vincent's Hospital in Toledo, but most burn patients from Monroe County are usually sent to the University of Michigan Hospital.

The Monroe County Health Department also provides multiple health-related services to the community. Located at 2353 South Custer Road in Monroe, the Health Department's mission is to protect the public's health through health promotion, disease prevention, and linking people to personal health services (Reference 2.5-46).

Ambulance service and 9-1-1 emergency response for most county residents (except for the City of Monroe which is served by the City of Monroe Fire Department) is provided by Monroe Community Ambulance (MCA), which has ambulances stationed around the clock at strategic locations in the county, such as at selected fire stations, to provide timely response to medical emergencies. Paramedic emergency ambulances are staffed with experienced paramedics and outfitted with advanced lifesaving equipment. MCA also has a program called MCA Plus in which county residents can pay a tax deductible membership fee and avoid paying a user fee or deductible payment should medically necessary ambulance service be required within the county or to the out-of-county service area that includes six other counties and 2,500 square miles (Reference 2.5-47).

2.5.2.10 **Transportation System**

2.5.2.10.1 **Highways**

There is a highly developed transportation network in the 50-mile Fermi region, with the network laid out in a predominantly north-south direction that connects Detroit with areas to the south. The roadway network in Monroe County is illustrated in Figure 2.5-23. The major route that passes through the Frenchtown Township is Interstate 75, which is the major transportation link between Detroit and Toledo, and extends southward to its termination in southern Florida. Interstate 275 also splits from I-75 in Monroe County, heading toward the western portion of Detroit in Wayne County. Two other major highways within Frenchtown Township and Monroe County include U.S.

24 (also called North Telegraph Road due west of the Fermi site) and M-125 which merges into U.S. 24 due west of the Fermi site (Reference 2.5-11).

Monroe County had 1882 miles of roads and 345 bridges in 2006 (Reference 2.5-48). The transportation network within Frenchtown Township was comprised of 190 miles of roads with 27 bridges (Reference 2.5-49). The well-developed transportation network provides several commuting alternatives to the site from within Monroe County and beyond.

From the north, the primary route to the Fermi site would likely be the southbound I-75 exit at the Newport Road/Swan Creek Road, then proceeding southeast to the site via Swan Creek Road, followed by heading south on North Dixie Highway, and finally taking Fermi Drive southeast into the site. Traffic heading south on I-275 could also use this route after exiting to north-bound I-75 and taking Swan Creek Road. For traffic traveling to the site on I-75 from the south, the primary route would be to take the North Dixie Highway exit near the City of Monroe, and then travel northeast to Fermi Drive. These roads near the Fermi site can also be accessed from U.S. 24, and M-125.

In terms of comparing traffic levels on North Dixie Highway with the estimated capaCity of the highway, the *Highway Capacity Manual* (HCM) issued by the Transportation Research Board is widely used to estimate highway capacity. While the capacity level of a two-lane rural highway is difficult to estimate (as it depends on multiple factors such as directional flow, vehicle mix, lighting conditions, physical dimensions of the highway, weather, posted speed limit, and other factors), a reasonable maximum capacity of 2800 passenger car equivalents per hour can be assumed under ideal conditions. (Reference 2.5-135) If this figure is reduced to 1000 per hour to account for the fact that ideal conditions are seldom present on any road and the conditions on North Dixie Highway, this would imply a maximum daily volume of approximately 24,000 for North Dixie Highway, meaning that on a 24-hour basis, there remains ample excess capacity. Although, this measure can be misleading because it does not capture short-term problems that could be present during peak traffic flow periods.

Figure 2.5-24 lists 24-hour traffic counts for the roadway network in Frenchtown Township and near the Fermi site with the highest traffic counts on North Dixie Highway occurring near the City of Monroe. Figure 2.5-25 shows the 24-hour traffic counts near the Fermi site with the two-way 24-hour traffic count on North Dixie Highway near Fermi Drive at 5,580 vehicles.

Table 2.5-55 includes data reflecting the commuter populations of Frenchtown Township and Monroe County. Specifically, the table indicates the commuting origin and destination of community residents, and the origin of those working within Frenchtown Township and Monroe County. In 2000, there were 7,413 people working within Frenchtown Township. Of this figure 1838 workers originated from within the township, followed by 1520 who originated from the City of Monroe, and 779 workers who originated from Monroe Township. Regarding the destination of the 9,518 Frenchtown Township resident workers, 2,276 workers commuted to the City of Monroe, 1,838 workers stayed within Frenchtown Township, and 635 workers commuted to Monroe Township.

In 2000, there were a total of 48,526 people working within Monroe County; 35,202 workers were Monroe County residents; followed by 4,456 workers originating from Lucas County, Ohio; and

4,111 workers originating from Wayne County. The destinations of the 68,835 employed residents within Monroe County are as follows: 35,202 worked within Monroe County, 12,654 workers commuted to Lucas County Ohio, and 12,161 workers commuted to Wayne County.

Table 2.5-56 denotes the number and methods of those who commuted to work in Frenchtown Township and Monroe County in 2000. In Frenchtown Township, 8,381 workers drove alone, 826 workers carpooled, and 110 people walked to work. In Monroe County, 60,671 workers drove alone, 5627 workers carpooled, and 704 people walked to work.

There are multiple road and bridge development projects outlined in the Michigan Department of Transportation 5-year plan from 2008-2012; Table 2.5-57 lists each project and the first year of construction. In addition, Table 2.5-58 lists proposed transportation projects within Monroe County. Not included on this list is the recent I-75 reconstruction as it enters Wayne County. Also Dixie Highway was undergoing repavement construction work just north of Fermi in August 2007.

Section 4.4 and Section 5.8 address the number of daily commuting workers during operation and construction, respectively.

2.5.2.10.2 **Public Transportation, Airports, Ports, and Railways**

In addition to private commuting, Monroe County has a public bus transportation system; the Lake Erie Transit (LET). LET has 68 employees, 28 vehicles and provided transportation for 384,768 passengers in the fiscal year 2006 (Reference 2.5-50). Within Monroe County the LET has eight distinct routes which transports passengers to most of Monroe's popular destinations, and for the Townships of Bedford and Frenchtown LET offers a Dial-a-ride service. This service provides curbside pick-up to customers and takes them to their destination within the respective township or to another one of LET's fixed route lines (Reference 2.5-51).

The region contains a number of airports, the largest of which is the Detroit Metropolitan Wayne County Airport (DTW) located 19 miles north-northwest of the Fermi site. DTW occupies 6700 acres and has six runways ranging from 12,000 to 8000 feet and 150 passenger gates. In 2006, DTW had a passenger volume of 36 million passengers which ranked as 10^{th} largest in the United States and the 19^{th} largest in the world. DTW contributes to an estimated $7.6 billion per year economic impact within the Detroit area (Reference 2.5-52).

Another commuter airport in the region is Coleman A. Young International Airport, formerly known as Detroit City Airport, located north-northeast of the Fermi site. Coleman A. Young is a two runway airport with a 53,000 square foot passenger terminal and an average daily operation of 225 commercial corporate and private flights (Reference 2.5-53). To the south is Toledo Express Airport, which has four runways, 96 aircraft based on the field and serves more than half a million passengers annually. The Toledo Express Airport recently began a 4-year $22 million renovation project (Reference 2.5-54 through Reference 2.5-56).

In addition to these major passenger airports, the Willow Run Airport is located twenty-four miles to the northwest of the Fermi site. Willow Run is one of the nation's largest airports for handling cargo air freight. Willow Run consists of five runways that handle more that 400 million pounds of cargo annually. Table 2.5-59 lists additional smaller airports that serve Monroe County (Reference 2.5-57).

There is a significant amount of barge traffic on Lake Erie near the project site, most of which is in transit to or from the Port of Monroe, the Port of Detroit, or the Port of Toledo, all of which are a part of the Great Lakes St. Lawrence Seaway System. Since 1959, the St. Lawrence Seaway has provided a link between the world and the Midwest. The Seaway System is 2,000 miles long and is responsible for annual commerce exceeding 200 million net tons. In addition, over thirty million people rely on this system either for recreation or commerce.

Table 2.5-60 provides data for the ports of Monroe, Detroit, and Toledo. The Port of Monroe is the closet to the Fermi site, located approximately 7 miles to the southeast. In 2003, it handled just over a million tons of cargo, of which more than 80 percent was coal. The Port of Monroe is serviced by two railroads, has immediate access to Interstate 75, and is within five miles of a regional airport. The Port of Detroit, as of 2001, handled an overall annual tonnage of just under seventeen million, and the Port of Toledo in 2003 handled just under ten million tons of cargo.

The Canadian National Railway (CN), the CSX Transportation (CSX), and the Norfolk Southern Railway (NS) all run through Frenchtown Township in a southwest to northeast direction. The CSX runs parallel to Telegraph Road (US-24) while NS and the CN railways run in a narrow corridor just east of I-75 (Reference 2.5-11 and Reference 2.5-58).

2.5.2.11 **Distinctive Characteristics**

The Fermi 50-mile region is distinguished by a rich history that pre-dates the U.S. Constitution. One of the highlights of this history is that the region helped lead the nation's industrial economic boom in the 20th century. As the transportation network advanced over the past several decades, Monroe County has become increasingly integrated with the larger metropolitan areas to the north and south, yet has been able to largely retain a rural atmosphere. This section briefly describes some of the regional history and distinctive characteristics of the region.

The history of Monroe County is linked to French missionaries who first came to Monroe County as early as 1634, though a trading post and fort were not established in the county until 1778. The first settlement in the county was called Frenchtown and consisted of one hundred French families who came to the area from Detroit and Canada. Frenchtown has the distinction as the site of one of bloodiest battles of the War of 1812. Following the war, Monroe County was established in July 1817 and named in anticipation of President James Monroe's visit to the Michigan territory (Reference 2.5-59).

Today, tourism in Monroe County remains linked to this history as can be seen in the various museums and historical sites that attract tourists each year. One of the more popular museums is Monroe County Historical Museum. It displays early Monroe history, artifacts of General George Armstrong Custer, Indian lore, and other region specific cultural relics. Other Museums include: Old Mill Museum, Monroe County Labor Museum, and Martha Baker Country Store Museum (Reference 2.5-60). There are also a number of historic sites in the area. Some of the more famous ones include the Navarre Anderson Trading Post, Michigan's oldest residence and considered the best example of French colonial architecture in the state. The River Raisin Battlefield Visitor Center, a remembrance to the largest battle fought in the War of 1812. The Custer Home purchased by General Custer and his brother are also tourist attractions (Reference 2.5-61). In addition to the aforementioned museums and sites, Table 2.5-61 provides a list of local tourist and recreational attractions in Monroe County.

The history of Detroit is also storied. In 1701 a French Officer named Antoine de la Mothe founded a settlement called Fort Detroit, but during the French and Indian War (1760), British troops gained control and changed the name to Detroit. The United States eventually took control of Detroit in 1796 under the Jay Treaty, and most of the settlement subsequently burned down in 1805. During the rebuilding, Detroit became the capital of Michigan; and continued in this role until 1847. Also during this period, Detroit became a key stop on the Underground Railroad.

Detroit has many significant architectural buildings, with a number of them on the National Register of Historic Places. Among the most noteworthy is the Ford Motor Company's River Rouge Complex, for a time the largest single manufacturing complex in the United States, with peak employment of about 120,000 during World War II. During the first half of the 20th century the automobile plant achieved a milestone in self-sufficiency and vertical integration, featuring a continuous work flow from iron ore and other raw materials to finished automobiles. The complex included dock facilities, blast furnaces, open-hearth steel mills, foundries, a rolling mill, metal stamping facilities, an engine plant, a glass manufacturing building, a tire plant, and its own power house supplying steam and electricity (Reference 2.5-62). Detroit also has numerous neighborhoods and historic districts that are listed on the National Register of Historic Places, including Lafayette Park which is part of the Mies van der Rohe residential district and Indian Village. Adding to this culturally rich heritage are the many history, science, and art museums located in the Detroit area. A few examples include: The Henry Ford and Motown Historical Museum (history), the New Detroit Science Center and Motor Cities National Heritage Area (science), and the Detroit Institute of Arts and Museum of Contemporary Art Detroit (art) (Reference 2.5-63).

Detroit is the largest city in the state of Michigan and the Wayne County seat. It is also a major port city on the Detroit River and Lake Erie. At its peak, Detroit was the 4th largest city in the United States, but has been declining in rank since the 1960's. Detroit, sometimes nicknamed the Motor City, is known as the world's automotive center and houses the "Big Three" automobile companies[9] (General Motors, Ford, and Chrysler). The city also became well known in the 1960s as a source of popular music, largely through the rise of Motown Records; hence, the city is also nicknamed Motown.

Detroit has four border crossings into Canada. The Ambassador Bridge and the Detroit-Windsor Tunnel provide motor vehicle thoroughfares, the Michigan Central Railway Tunnel provides railroad access and Detroit-Windsor Truck Ferry, located near the Windsor Salt Mine and Zug Island, provides water transport of heavy vehicles.

9. The automotive industry accounts directly or indirectly for 1 out of every 10 jobs in the United States. http://www.autoalliance.org/index.cfm?objectid=2EB2CCD2-1D09-317F-BB2409EF20317559

Toledo was once a part of Monroe County but following the very brief 1835 Toledo War was allocated to Ohio as part of the brokered settlement that awarded the Upper Peninsula to Michigan. Today, Toledo is known as the Glass City because of its long history of innovation in all aspects of the glass industry: windows, bottles, windshields, construction materials, and glass art, of which the Toledo Museum of Art has a large collection. Also, the first all glass building was constructed in Toledo in 1936, this was the building for the Owens-Illinois Glass Company. Toledo has also been known as the “Auto Parts Capital of the World.” The Jeep vehicle has been manufactured in Toledo since 1941, and the Big Three all have factories in metropolitan Toledo.

The general decline in the nation’s manufacturing sector, especially in the auto industry, has significantly impacted the employment base of Detroit and, to a lesser degree, Toledo. Both metropolitan areas have fought to revitalize their cities and to bring in new industry that would create employment opportunities. Perhaps the most visible example of this effort was the development of the Renaissance Center, located in downtown Detroit, which has helped the city become a major tourist attraction and convention city. The city hosted Super Bowl XL in 2006.

The region also benefits from a number of large and respected institutes of higher education. These include the University of Michigan and Wayne State University in Michigan, and the University of Toledo and Bowling Green State University in Ohio.

2.5.3 **Historic Properties**

In support of the Fermi 3 project, surveys of cultural resources (above-ground and archaeological) were conducted to identify historic resources in and near the Fermi 3 project area and to assess possible Fermi 3 impacts to these resources. Additionally, preliminary investigations were conducted along the transmission line route from the Fermi 3 project area to the Milan substation in Washtenaw County to identify previously recorded historic resources. The cultural resources investigations for the Fermi 3 project have been carried out pursuant to Section 106 of the National Historic Preservation Act (NHPA), as amended (P.L. 89-665, October 15, 1966; 16 U.S.C. 470) and its implementing regulations (36 CFR 800), which require federal agencies to take into account their activities on historic resources that may be impacted as a result of project activities. The work reported herein conforms to the requirements of the NHPA, as well as the guidance contained in NUREG-1555, and the requirements of the Michigan State Historic Preservation Office (SHPO). The members of the archaeological and above-ground resources teams meet or exceed the qualifications set out in the Secretary of the Interior’s Qualification Standards. The work conducted for the project and the work products conform to the Secretary of the Interior’s Standards and Guidelines and the standards established by the Michigan SHPO.

2.5.3.1 **Prior Cultural Resources Surveys**

Site and Vicinity

Prior to the field survey, no formal cultural resources investigations had been conducted in the Fermi 3 area or in the vicinity. A search of records maintained at the Office of the State Archaeologist (OSA), the State of Michigan Archives, and the Monroe County Museum revealed only one report on the archaeological resources in the Fermi 3 area, i.e., a letter from the director of the University of Michigan Museum of Anthropology, documenting his visit to the site shortly after construction of Fermi 2. No excavations were undertaken during this visit and no archaeological finds were noted. The archaeological site files maintained at the OSA record four sites within a 2-mile radius of the Fermi site. These sites are summarized in Table 2.5-62. One site is located within the Fermi 3 project area, a “Native American” site of unknown age and function and described in the site files as a “lithic scatter on beach.” None of the sites within the Fermi 3 area has been field verified, nor has any been assessed for National Register of Historic Places (NRHP) eligibility.

The National Archeological Data Base (NADB), maintained by the National Park Service Archeology Program, lists 72 titles of reports of archaeological resources in Monroe County; only one of which contains information about the resources within the Fermi 3 project area (NADB record 5538). This is the report of an unverified prehistoric site recorded in the Holmquist Atlas maintained at Wayne State University. The National Register Information System (NRIS) online data base contains two National Register-listed archaeological sites in Monroe County, the North Maumee Bay Archeological District and the River Raisin Battlefield Site, neither of which is within 2 miles of the Fermi 3 project area.

The files maintained at the Michigan SHPO record 22 above-ground resources within a 10 mile radius of Fermi 3 that are listed on the National Register of Historic Places or have been determined eligible for listing in the NRHP. These sites are summarized in Table 2.5-63.

Only one systematic survey has been conducted for above-ground resources within a 10 mile radius of the Fermi 3 vicinity, the 1973 Monroe County Building Survey, which exists as a collection of photographs and data cards maintained at the Monroe County Historical Museum. No accompanying report was located, and the goal of the survey is unknown, although it appears, from review of the photographs and data cards, that the primary focus of the survey was to document resources within the City of Monroe. For resources located within 10 miles of Fermi 3, the records in the 1973 survey report duplicate the information on file at the Michigan SHPO office (Reference 2.5-120).

A search of the information housed at the Monroe County Historical Museum and the Monroe County Library System’s Ellis Reference and Information Center did not reveal any other previously recorded NRHP-listed or NRHP-eligible above-ground resources within a 10-mile radius of Fermi 3.

Transmission Corridors

The portion of the transmission line route from the Fermi 3 project area north to the Sumpter-Post Road junction (near Haggerty and Arkona Roads) will utilize an existing transmission line route. Therefore, the preliminary survey of historic resources was limited to the new transmission line route from the Sumpter-Post Road junction in Wayne County to the Milan substation in Washtenaw County. A search of the files at the OSA revealed 77 previously recorded archaeological sites within 1.5 miles of the proposed transmission lines from the Fermi 3 project area to the Milan substation. A summary of these sites is contained in Table 2.5-64. Fifteen reports on file at the OSA contain information regarding investigations conducted in the area of the proposed transmission line route. Of these 15 reports, six are reports of amateur surveys or collections. The remaining nine reports detail contract surveys conducted for municipal projects (e.g., wetland mitigation, proposed landfill and wastewater treatment facilities). The most recent of these surveys was conducted in 2002 on a 65-acre parcel in Wayne County. The other surveys were conducted primarily during the early 1980s and the early 1990s. All surveys conducted in the proposed transmission line route or in the near vicinity identified either prehistoric or historic archaeological sites.

Six archaeological sites are crossed by the new transmission route from the Sumpter-Post Road junction to the Milan substation. All six occur in Wayne County. Five of the sites are prehistoric and one is historic. All have been determined not eligible for listing in the NRHP.

The files maintained at the Michigan SHPO record no NRHP-listed or NRHP-eligible above-ground resources within 1.5 miles of the new transmission route from the Sumpter-Post Road junction to the Milan substation.

The only systematic survey of above-ground resources known for the transmission line area is the 1973 Monroe County Building Survey referenced above. This survey shows no resources in the vicinity of the transmission line route (Reference 2.5-120).

2.5.3.2 **Current Cultural Resources Survey**

Site and Vicinity

Geographically, the project area is comprised of portions of Berlin Township in the northern section of the area and Frenchtown Township in the southern section. A broad expanse of agricultural fields defines large portions of the area, particularly in those areas at some distance from the Lake Erie shore. In recent years, a number of the once open fields have become the site of newly erected houses and subdivisions. Remnants of historic communities like Oldport and Brest are evident, although the dominating presence in the area remains the beachfront resort communities. These communities have their roots in the late nineteenth century, but were greatly expanded during the first decades of the twentieth century. A description of the ecology of the site area is provided in Subsection 2.4.1 and Subsection 2.4.2.

Transmission Corridor

The transmission line route travels through Monroe, Wayne, and Washtenaw counties (Figure 2.2-3). The portion of the new transmission route from the Sumpter-Post Road junction to the Milan substation, which is the subject of the preliminary survey, is sited east-west through Wayne and Washtenaw counties. Land use along the corridor is characterized primarily by low-density residential development and heavily wooded undeveloped property. Agricultural property is prominent in the study area. Few obviously commercial properties were identified in the study area, and industrial properties were not encountered. An extensive landfill is situated at the far east end of the study area. A description of the ecology of the transmission corridor is provided in Subsection 2.4.1.9 and Subsection 2.4.2.9.

2.5.3.2.1 **Area of Potential Effect Delineation**

The area of potential effect (APE) is defined as "…the geographic area within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist" (36 CFR 800.16(d)). In consultation with the SHPO, two APEs were delineated, one for archaeological resources and one for above-ground resources. Overall, the APE for archaeological resources is limited to construction-impacted ground within the Fermi site. To reduce the likelihood of additional archeological surveys as more detailed construction plans are developed, the APE covers a broader expanse of the Fermi site than the current construction impact areas described in Chapter 4 for non-cultural resource impacts. At the outset of the archaeological fieldwork, the archaeological APE included a series of interconnected roadway grades (60 acres), a stone quarry (48 acres), two spoil disposal zones (11 acres and 12 acres), and two previously affected Fermi site locations comprised of a 37-acre tract and a 172-acre tract. Additions to the Fermi site redesign consisted of a 53-acre "EF2 Parking Warehouse, etc" tract on the northwest margin of the site, a 24-acre construction laydown area and a 5.5-acre meteorological (MET) tower, both located at the southern margin of the site. In addition, the APE includes a tentative access road corridor from the MET tower site to Pointe Aux Peaux Road. Acreage values include areas that are based on an initial proposed site layout. The projected impact areas shown in Figure 2.5-27 encompass the current postulated APE. The current archaeological APE encompasses approximately 551 acres (Figure 2.5-27).

At the determination of the Michigan SHPO, the APE for above-ground resources was reduced from the 10-mile radius set out in NUREG-1555 to an area encompassing the Fermi site and the communities of Estral Beach, Stony Point, and Woodland Beach, with boundaries as follows:

> Beginning at the approximate intersection of Masserant Road with the Lake Erie shoreline, due southwest to the approximate intersection of Sandy Creek Road with the Lake Erie shoreline; north to North Dixie Highway; due northeast along North Dixie Highway to Port Sunlight Road; south on Port Sunlight Road to Masserant Road; east on Masserant Road to the point of beginning (Figure 2.5-28).

For the new transmission lines, the preliminary survey of APE for both archaeological resources and above-ground resources measured 1.5 miles on either side of an assumed 300 feet wide corridor centerline. The transmission line route from the Fermi 3 project area north to the Sumpter-Post Road junction will utilize an existing transmission line route. Therefore, the APE for both archaeological and above-ground resources included only the undeveloped portion of the new transmission line route from the Sumpter-Post Road junction in Wayne County to the existing Milan substation in Washtenaw County.

2.5.3.2.2 **Prefield Research and Field Methods**

Prior to the cultural resources survey, documents housed at the SHPO, OSA, Monroe County Historical Museum, and Monroe County Library System Ellis Reference and Information Center were consulted to obtain information pertaining to historic land use and the existence of known historic sites in the Fermi 3 area and along the new transmission line route to the Milan substation.

The initial Phase I archaeological survey began in November 2007 and was completed in April 2008. Survey of the Construction laydown area and a portion of the MET tower site and tentative access road was conducted on October 20, 2009. A desk-top analysis was conducted in 2010 for those portions of the MET tower site and tentative access road corridor that were not subjected to field survey in 2009 and the new 345 kV transmission corridor. This desk-top analysis indicated that no further field surveys of these area were required. The methods employed in these studies entailed a combination of pedestrian surface inspections and shovel testing. Walk-over surface examinations were limited to areas exhibiting surface visibility of greater than 50 percent. Both surface inspection and shovel testing were carried out along 50-foot transects, with shovel tests spaced as 50-foot intervals. This approach was modified where access was hampered by saturated soils or flooding. Wet and flooded areas were commonly encountered throughout the undeveloped portions of the property; therefore, opportunistic shovel testing at drier elevations was routinely carried out. Similarly, the extensive made lands and spoil deposits comprising much of the property were avoided when they could be recognized and confirmed through field verification. Shovel test soils were screened through ¼- inch metal hardware cloth and trowel sorted. Each unit was backfilled upon the completion of field examination. Shovel test excavations were restricted to a maximum depth of 1 foot below the existing ground surface.

The above-ground resources survey began in December 2007 and was completed in April 2008. Architectural historians photographed and mapped resources within the APE that were at least 50 years old and "…possess a degree of integrity above the norm for the area…" Resources were photographed showing the façade and one other elevation in the same image. Where this was not possible, resources were photographed to obtain the view that would best allow for assessment of age and integrity. For complexes containing more than one building, such as farmsteads, streetscape views of the overall property were obtained to illustrate the buildings' relationship to each other. The location of each resource was plotted on a USGS quadrangle map, and photographic details (e.g., photograph number, date, and direction of view) were recorded on standard photography logs.

The field view for the transmission route preliminary survey took place on June 18 2008. During the field view, the transmission line route was evaluated for the existence of potentially significant above-ground resources. At that time, the transmission line study area was also visually inspected from existing roadways for evidence of obvious disturbance and the existence of landforms that are known to contain archaeological sites (e.g., sandy hummocks).

2.5.3.3 **Consultation**

In preliminary SHPO consultation, the OSA noted that the project area, especially the Lake Erie shoreline, is sensitive for archaeological resources, and the area had not been systematically examined. Based on the archaeological sensitivity of the Fermi site and the lack of prior systematic surveys in the area, the OSA required an archaeological survey of the project area. The SHPO further identified a preliminary APE for above-ground resources. Subsequent consultation resulted in a modified APE and scope of work as detailed in the preceding subsection. A report has been provided to the SHPO regarding the above ground resources of the site and vicinity.

Inquiries were made with Native American tribal agencies having historical ties to the Fermi site geographic area. These consultations did not result in any concerns regarding the further development of the Fermi site.

2.5.3.4 **Archaeological Site Results**

The archaeological survey resulted in the identification of seven archaeological sites (4 prehistoric, 2 historic, 1 multi-component [prehistoric/historic]) within the Fermi site and vicinity. All are located within the archaeological APE. However, only two sites are located within the Fermi 3 site, the five other sites are located outside of Detroit Edison-owned property. None of these sites is recommended eligible for listing in the NRHP.

Preliminary investigations of the transmission line route from the Sumpter-Post Road junction to the Milan substation, owned by ITC*Transmission*, indicate a moderate to high potential for encountering archaeological resources. It is unclear, however, whether any sites would be eligible for listing on the NRHP.

2.5.3.4.1 **Prehistoric Sites**

Four sites represent isolated findspots consisting of chert debitage found on the surface. The context in which the artifacts were found had been compromised by continued plowing. These artifacts are indicative of the presence of prehistoric peoples in the area at some time in prehistory; however, little other data can be gathered from these sites. None of these prehistoric sites is recommended eligible for listing on the NRHP.

2.5.3.4.2 **Historic Sites**

Two historic sites located within the Fermi property represent likely farmstead sites dating to the early to mid-twentieth century. One site is a historic farmstead site dating to the ca. 1930s-1960s. The site was identified by the presence of four poured concrete and concrete block foundations and one brick (house) foundation. Bottle glass and historic ceramic sherds were scattered throughout the site. A farmstead at the approximate location of the site is shown on aerial photographs of the site dating to 1949 and 1957. A 1961 aerial photograph shows the site; however, it cannot be determined from this aerial if the site contains structures or merely foundations. This late-dating farmstead is unlikely to provide information about the historic settlement and use of the area; therefore, this site is not recommended eligible for listing in the NRHP. The second site is a scatter of temporally non-diagnostic historic debris and three marked pet burials near the location of the new meteorological tower. Aerials dating to 1949, 1957 and 1961 show farmsteads along Point Aux Peaux Road in the vicinity of the site. It is likely that the site is associated with one of there farmsteads; however, this site is unlikely to provide significant information about the historic settlement of the area and it is not recommended eligible for listing in the NRHP. Detroit Edison has conducted an investigation into the archeological resources which could be impacted as a result of the construction of the Fermi 3 discharge line. There are no known archeological resources within the planned path of the discharge line. There is considered to be a moderate to high sensitivity for unidentified maritime resources. (Reference 2.5-138)

2.5.3.4.3 Multi-Component Sites

One multi-component site was found during the archaeological survey. It was identified through the discovery of a single piece of chert debitage located on the surface and a scatter of historic bottle glass and ceramic sherds. Neither the prehistoric nor the historic component is likely to provide significant information about this site or the people who occupied it; therefore, this site is not recommended eligible for listing on the NRHP.

2.5.3.5 Above-ground Resources Results

Eighty-three above-ground sites within the above-ground APE were recorded. One four-building district and 19 individual sites are recommended as eligible for listing on the NRHP. One previously determined NRHP-eligible above-ground resource, a residence, is situated within the Fermi 3 APE, but it is not located in the Fermi 3 project area. The house was determined eligible for listing on the NRHP by the Michigan SHPO in 1995. The above-ground resources APE contains no other above-ground resources listed on or determined eligible for listing on the NRHP.

The current above-ground resources survey resulted in the identification of one four-building district and 19 individual properties that are recommended eligible for listing on the NRHP. A detailed description of these buildings has been provided to the SHPO. Although these resources are located within above-ground resources APE, none is located within the Fermi 3 site. The only resource of possible note within the Fermi site is the Enrico Fermi Atomic Power Plant, Unit 1 (Fermi 1). Fermi 1 was not evaluated as part of this cultural resources survey. An assessment is in progress to determine Fermi 1 NRHP eligibility.

2.5.3.6 Site National Register Eligibility

The archaeological APE contains no archaeological resources listed in or determined to be eligible for listing in the NRHP. One prehistoric archaeological site is located within the archaeological APE. This site was identified on the basis of archival material and has not been field verified, nor has it been assessed by the SHPO for NRHP eligibility. No NRHP-eligible archaeological sites have been identified as a result of the archaeological survey.

The Fermi 3 site contains no above-ground resources that are listed in the NRHP or that have been determined eligible for listing in the NRHP. The Fermi 1 site which requires demolition as part of the Fermi 3 project plan meets the NRHP eligibility requirements. Fermi 1's history has been documented in detail (Reference 2.5-139) and has been submitted to the Michigan SHPO as part of its consideration for nomination to the NRHP. If nominated, mitigation plans will be developed and implemented prior to its demolition.

2.5.4 Environmental Justice

The Environmental Justice analysis presented in this subsection has its impetus in Executive Order 12898, “Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations,” which was issued on February 11, 1994. The order was designed to focus the attention of Federal agencies on the human health and environmental conditions in minority and low-income communities. This Executive Order has been adopted in the nuclear regulations through NRR Office Letter No. 906, Revision 2, “Procedural Guidance for Preparing Environmental Assessments and Considering Environmental Issues,” September 21, 1999. Through this letter, environmental justice reviews involve identifying off-site environmental impacts, their geographic locations, minority and low-income populations that may be affected, the significance of such effects and whether they are disproportionately high and adverse compared to the population at large within the geographic area, and if so, what mitigative measures are available, and which will be implemented.

This approach is consistent with the EPA objectives concerning environmental justice which include “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (Reference 2.5-121).

2.5.4.1 **Methodology**

This subsection provides an indication of the minority and low-income populations within a 50 mile radius surrounding Fermi 3. The characteristics of the population within the 50 mile region were determined through the use of the LandView® 6 software (see Subsection 2.5.1 and Subsection 2.5.2 for more information on this software). The analysis evaluates data at the state, county, and Census Block Group (CBG) level.

Table 2.5-65 summarizes county and state minority and low-income population data at the CBG level. According to the table, there were a total of 4596 CBGs within the 50-mile region. The impacts on minority and low-income populations from construction and operation will be further addressed in Section 4.4 and Section 5.8, respectively.

In addition to the CBG analysis of minority and low-income populations, the environmental justice methodology involved contacting local officials and citizens likely to have knowledge of any subsistence living activities on or near the site. Such activities could include subsistence fishing, subsistence farming activities, or the culturally significant use of the acreage to be used for Fermi 3. As described below, all indications are that no subsistence activities are occurring on or near the site.

2.5.4.1.1 **Minority Populations**

For purposes of making an environmental justice determination, the NRC defines a “minority” racial population as “American Indian or Alaskan Native; Asian: Native Hawaiian or Pacific Islander; or Black races, or Hispanic ethnicity.” A “minority population” is defined to exist if the percentage of minorities within an environmental impact area (or CBGs) exceeds the percentage of minorities in the state in which the impact area or CBGs are located 1) by 20 percentage points or more, or 2) if the percentage of minorities in the impact area or CBGs is 50 percent or greater (Reference 2.5-122).

Using the two aforementioned guidelines and comparing the data to the state minority percentage of 21.45 in Michigan and 15.99 percent in Ohio shown in Table 2.5-66, Table 2.5-65 lists the number of minority CBGs by state and within the 50-mile region. Figure 2.5-29 depicts the minority counties in the 50-mile region, and Figure 2.5-30 depicts the minority CBGs within the 50-mile region. Only Wayne County (52.89 percent minority) qualifies as a minority regional county, and 1438 CBGs within the 50-mile region qualified as minority CBGs.

2.5.4.1.2 **Low-Income Populations**

The U.S. Census Bureau determines the number of low-income families in a given area by comparing the actual income of a family against the low-income threshold established for the corresponding family category, which includes the variables of family size, the number of children, and the age of the householder (Reference 2.5-123). For purposes of evaluating environmental justice impacts, a low-income population is defined to exist in an area if 1) the percentage of households within an environmental impact area or CBG living below the poverty level exceeds the percentage of low-income households within the state by 20 percentage points, or 2) the percentage of low-income households in the impact area or CBG is 50 percent or greater (Reference 2.5-122).

There were no counties that qualified as low-income within the 50 mile region. As presented in Table 2.5-65 and Figure 2.5-31, there were 572 low-income CBGs within the 50 mile region.

2.5.4.2 **Analysis**

The following subsections provide the results of Environmental Justice review for the Fermi 3 region. Related construction and operational impacts are described in Subsection 4.4.3 and Subsection 5.8.3, respectively.

2.5.4.2.1 **Minority Populations**

Of the 1438 CBGs (or 31.29 percent of the total CBGs within the region) that qualify as minority within the 50-mile region, only one CBG lies within Monroe County, meaning that 125 of 126 CBGs in the county are not of concern from a minority environmental justice perspective. The single CBG that qualifies as minority in Monroe County is located approximately 8 miles to the southwest of the Fermi site in the City of Monroe. No CBGs lying partly or wholly in Frenchtown Township are minority.

The majority of the regional CBGs classified as minority lie to the north and south of the Fermi site in Wayne County and Lucas County, respectively. There are 1,124 minority CBGs in Wayne County, most of which are in the City of Detroit, and 113 minority CBGs in Lucas County, most of which are located in Toledo.

There is only one Native American population residence within the 50-mile region. The population is located on Walpole Island, approximately 50 miles to northeast of the site. The island is inhabited by the Chippewa, Potawatomi, and Ottawa peoples; in 2001 the population was 1843. (Reference 2.5-124)

2.5.4.2.2 Low-Income Populations

As indicated in Table 2.5-67, 10.5 percent of the Michigan population is low-income (or living in poverty), and 10.6 percent of the Ohio population is low-income. Under the adopted criteria, no counties within a 50-mile region qualify as low-income population areas, but 572 CBGs (or 12.45 percent of the CBGs shown on Table 2.5-65) qualify as low-income. Figure 2.5-31 indicates that only one CBG out of 126 within Monroe County qualifies as low-income, and this CGB lies approximately 8 miles southeast of the Fermi site. The majority of low-income CBGs lie to the north and south in Wayne County and Lucas County, respectively. Specifically, there were 428 low-income CBGs in Wayne County (most of which are located in Detroit), and 71 low-income CBGs in Lucas County (most of which are located in Toledo).

2.5.4.2.3 Migrant Labor

Migrant labor or migrant workers are defined by the U.S. Department of Agriculture (USDA) as “a farm worker whose employment required travel that prevented the migrant worker from returning to his/her permanent place of residence the same day.” (Reference 2.5-125) Table 2.5-68 lists 2002 regional statistics for farms with hired labor and for farms with hired migrant labor. In 2002, Monroe County had 35 farms with migrant labor out of 268 farms with hired labor, resulting in 13.1 percent of the farms within the county hiring migrant labor. To the north, Wayne County had 5 farms with migrant labor out of 52 farms with hired labor, equating to 9.6 percent of the farms in the county employing migrant labor. The figures for Monroe and Wayne County are close to the Michigan state average of 11.5 percent of farms employing migrant labor. To the south, Lucas County had 24 farms employing migrant labor out of 136 farms in the county with hired labor in 2002. This ratio equates to 17.7 percent of Lucas County farms employing migrant labor which is substantially above the Ohio state average of 3.1 percent.

2.5.4.2.4 Subsistence Uses

Subsistence refers to the use of natural resources as food for consumption and for ceremonial and traditional cultural purposes, usually by low income or minority populations. Specific examples of subsistence uses include gathering plants for direct consumption (rather than produced for sale from farming operations), for use as medicine, or in ritual practices. Fishing or hunting activities associated with direct consumption (rather than for sport), associated with use in ceremonies are other examples.

Determining the presence of subsistence use can be difficult, as data at the county or CBG level is aggregated and not usually structured to identify such uses on or near the site, where any impacts arising from the construction or operation of Fermi 3 would arise. Frequently, the best means of investigating the presence of subsistence use is through dialogue with the local population who are most likely to know of such activity. This may include county officials as well as land owners in the immediate vicinity who would have knowledge of subsistence activity.

For the Fermi 3 analysis, contact was made with the Monroe County Sheriff and the Superintendent of the Monroe County Intermediate School District. In addition, two local church officials and a local land owner who has farmed more than 200 acres approximately 2 miles from the site for more than

30 years were contacted about subsistence uses. Through discussions with each of these individuals, no populations involved in subsistence use activities (as described above) were identified on or near the site. This is consistent with the controlled access to the Fermi site, and the use of the adjacent land either for farmland or for residences.

2.5.5 Noise

This section provides a description of the existing acoustical environment around the Fermi site. The existing acoustical environment was determined by an ambient sound level survey conducted on November 26-28, 2007, with Fermi 2 in operation. The survey was conducted in accordance with applicable standards, including ANSI S12.9 (Reference 2.5-128), ANSI S12.18 (Reference 2.5-129), and ANSI S1.13 (Reference 2.5-130). In order to effectively quantify and qualify the existing daily sound levels, the ambient survey included both continuous monitoring and short-term measurements. This section provides information regarding the existing acoustical environment for subsequent discussion in Chapter 3, Chapter 4, and Chapter 5.

A description of the Fermi site and vicinity is included in Subsection 2.2.1. Figure 2.5-32 shows the Fermi site and the seven noise monitoring locations (NMLs) identified during the survey. The NMLs were chosen based on the location of the nearest noise-sensitive receptors (i.e., the nearest residences) within 5 miles of the Fermi site.

The weather conditions during the survey were generally conducive to the measurement of sound levels. The temperature range was between 18 and 39°F and relative humidity range was between 45 and 100 percent. (With regards to relative humidity, even at times when the air was saturated there was no precipitation during the survey.) Skies were generally overcast and winds were generally calm, with the exception of a brief period of relatively high average wind speed between 10:00 a.m. and 3:00 p.m. on November 27, 2007 (discussed in more detail below). Since the survey was conducted during the late fall, many of the surrounding deciduous trees had shed their leaves.

The noises observed during the survey were typical for suburban areas and are summarized in Table 2.5-69. Observed noise sources generally included distant and local traffic noise, birds, dogs barking, some intermittent gunshot noise from the Fermi firing range, and the Fermi cooling towers. The Fermi cooling towers were faintly audible at five of the seven NMLs during the survey, as shown in Table 2.5-69.

Continuous noise monitoring was conducted at NMLs 1-3 for 24 hours between 3:00 a.m. on November 27 through 3:00 a.m. on November 28, 2008, to capture typical ambient daytime and nighttime sound level trends. In addition to the continuous monitoring, manned, short-term noise measurements were conducted at NMLs 1-7. These short-term measurements helped to qualify the surrounding noise sources and to provide an indication of the spectral content of the existing acoustical environment. The measurement period was 10 minutes in length in order to capture sound levels representative of each location during different time periods throughout the day.

Measurements at each NML included L_{90} and L_{eq} sound level metrics. The L_{90} is the 90-percentile exceeded sound level; i.e., the sound level that was exceeded for 90 percent of the measurement period. The L_{90} is referred to as the residual sound level; it provides a measure of the background sound level without the influence of loud, transient noise sources (Reference 2.5-128). The L_{dn} is the day-night average sound level over a 24-hour period and is derived using the hourly equivalent continuous sound levels ($L_{eq,1h}$) measured over a 24-hour period. The derivation of L_{dn} includes applying a 10 dB penalty to the nine nighttime hours between 10:00 p.m. and 7:00 a.m. (Reference 2.5-131). Figure 2.5-33 shows the hourly L_{eq} sound levels at NMLs 1-3 for the 24-hour measurement period, along with the associated L_{dn} for each receptor. Figure 2.5-34 shows the hourly L_{90} sound levels at NMLs 1-3 for the 24-hour measurement period. In general, the highest sound levels were experienced during the late morning / early afternoon hours between 10 a.m. and 2 p.m., which is typical for suburban areas due to, e.g., increases in highway and local traffic flow. The lowest sound levels were experienced during the late night / early morning hours between approximately 11:00 p.m. and 3:00 a.m., when noise in suburban areas from major sources (such as highways) reaches a minimum. There was also a period of high average wind speed between 10 a.m. and 3 p.m. on November 27, 2007, which contributed to the sound levels shown in Figure 2.5-33 and Figure 2.5-34.

Section 5.3.4 of NUREG-1555 states that “(n)oise levels are acceptable if the day-night average sound level outside a residence is less than 65 decibels.” This requirement is consistent with U.S. Department of Housing and Urban Development (HUD) guidelines in 24 CFR 51.101(8), *Exterior noise goals,* for outdoor sound levels (Reference 2.5-132). There are no state or county noise regulations for Michigan or Monroe County, respectively. The Frenchtown Township Charter Township Zoning Ordinance provides noise regulations for uses established in Commercial and Manufacturing Districts (Reference 2.5-133). However, as stated in Section 2.2, the Fermi site is located within a Public Service District. Therefore, the Frenchtown Township noise regulations are not applicable to the Fermi site. Nonetheless, the Frenchtown Township noise regulations for Manufacturing uses are consistent with both the NUREG-1555 and HUD guidelines for outdoor sound levels (i.e., $L_{dn} \leq 65$ dBA).

Table 2.5-69 provides the location of each NML; the lowest L_{90} sound level measured during the survey for each location; the L_{dn} sound level measured over the 24-hour survey period for NML-1, NML-2, and NML-3; and the noise sources that were generally observed during the survey at each NML. All seven NMLs represent the nearest noise-sensitive receptors (i.e., the nearest residences) to the Fermi facility. The approximate distance from each NML to Fermi 2 equipment is provided in Table 2.5-69. The NML-6 sound level can be considered to be representative of the nighttime background sound level typically experienced by residences nearest to the existing transmission lines leading away from the Fermi site and includes noise contributions from the existing transmission lines.

It should be noted that a period of high average wind speed was observed between approximately 10 a.m. and 3 p.m. on November 27, 2007. The average wind speed during this period was high enough to have affected sound level measurements, which will have affected the measured L_{dn} sound level, particularly at NML-1 and NML-2. It is estimated that the L_{dn} sound level for a 24-hour period with lower winds during the 10 a.m. to the 3 p.m. period could be approximately 3-7 dB lower than the L_{dn} sound level indicated for NML-1 and NML-2 in Table 2.5-69 and Figure 2.5-33.

Nonetheless, even including the period of higher average wind speed, the measured existing L_{dn} sound levels for NML-1, NML-2, and NML-3 are below 65 dBA.

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Table 2.5-1 U.S. and Canadian Counties within a 50-Mile Radius of Fermi 3

Michigan Counties	Ohio Counties	Ontario CA Counties
Jackson	Erie	Essex
Lenawee	Fulton	Chatham-Kent
Livingston	Henry	Lambton
Macomb	Lucas	
Monroe*	Ottawa	
Oakland	Sandusky	
Washtenaw	Seneca	
Wayne	Wood	

* Location of Fermi 3

Table 2.5-2 Resident Population Distribution by Segment, 1 to 10 Miles from the Fermi Site (2000)

Cardinal Compass Direction	Mile Range					
	0-1[1]	1-2	2-3	3-4	4-5	5-10
NORTH	121	83	397	218	188	12,715
N-NE		124	46	26	71	7,212
NE		282	204	0	0	0
E-NE		0	0	0	0	0
EAST		0	0	0	0	0
E-SE		0	0	0	0	0
SE		0	0	0	0	0
S-SE		0	0	0	0	0
SOUTH		1,154	0	0	0	0
S-SW		259	0	0	0	0
SW		280	0	106	162	1,609
W-SW		115	1,279	2,426	1,341	35,180
WEST		185	213	219	518	4,863
W-NW		28	0	70	263	5,066
NW		195	392	203	776	5,521
N-NW		205	199	240	191	4,253
Total Population Per Segment	121	2,910	2,730	3,508	3,510	76,419
Total Population: All Segments	89,198					

Note:
1. Per NUREG-1555, Figure 2.5-1, Census Block Points were summed within the 1-mile radius, rather than divided into directional segments.

Table 2.5-3 Largest Population Areas within 10 Miles of the Fermi Site (2000)

Populated Place	Population	Distance from Fermi 3 (Mi)
Stony Point	1,775	1.3
Woodland Beach	2,179	2.9
Detroit Beach	2,289	4.0
Monroe	32,339	5.5
Rockwood	4,726	7.6
Carleton	2,562	9.4
Flat Rock	8,488	9.5
Gibraltar	4,264	9.5

Table 2.5-4 Resident Population Distribution by Segment, 0 to 50 Miles from the Fermi Site (2000)

Cardinal Compass Direction	Mile Range				
	0-10[1]	10-20	20-30	30-40	40-50
NORTH	89,198	121,416	453,510	571,939	365,114
N-NE		107,027	354,880	725,303	453,907
NE		15,533	123,981	36,136	5,371
E-NE		10,242	17,807	22,751	19,742
EAST		2,220	4,917	11,590	2,351
E-SE		-	-	256	-
SE		-	67	8,110	43,157
S-SE		-	1,540	17,199	28,286
SOUTH		-	7,621	14,145	27,723
S-SW		3,547	112,020	36,023	40,991
SW		12,453	265,684	111,951	28,032
W-SW		8,945	10,475	10,573	8,240
WEST		6,730	8,705	37,023	30,762
W-NW		5,732	20,446	19,167	16,759
NW		17,938	122,093	138,391	67,173
N-NW		24,388	221,758	179,240	149,989
Total Population Per Segment	89,198	336,170	1,725,503	1,939,797	1,287,597
Total Population: All Segments			5,378,266		

Note:
1. Per NUREG-1555, Figure 2.5-2, Census Block Points were summed within the 1-mile radius, rather than divided into directional segments.

Table 2.5-5 Resident and Transient Population and Density by 0 to 10-Mile Concentric Circles from Fermi 3 (2000)

Concentric Circle	Population Resident	Population Transient	Population Total	Area (Sq Mi)	Population Density (Persons/Sq Mi)
0 – 1 Mile	121	449	570	3.1	181
1 – 2 Mile	2,910	14	2,924	9.4	310
2 – 3 Mile	2,730	30	2,760	15.7	176
3 – 4 Mile	3,508	226	3,734	22.0	170
4 – 5 Mile	3,510	2,153	5,663	28.3	200
5 - 10 Mile	76,419	14,666	91,085	235.6	387
0 - 10 Mile	89,198	17,538	106,736	314.2	340
Michigan overall			9,938,444	56,804	175

Note:
Column totals may not equal the sum of the components due to rounding

Table 2.5-6 Resident and Transient Population and Density by 0 to 50-Mile Concentric Circles from Fermi 3 (2000)

	Population			Area	Population Density
Concentric Circle	Resident	Transient	Total	(Sq Mi)	(Persons/Sq Mi)
0 - 10 Mile	89,198	17,538	106,736	314	340
10 - 20 Mile	336,170	10,906	347,076	942	368
20 - 30 Mile	1,725,503	44,433	1,769,936	1,571	1127
30 - 40 Mile	1,939,797	70,601	2,010,398	2,199	914
40 - 50 Mile	1,287,597	57,178	1,344,775	2,827	476
0 - 50 Mile	5,378,266	200,656	5,578,922	7,854	710
Michigan overall			9,938,444	56,804	175
Ohio overall			11,353,140	40,948	277

Note:
Column totals may not equal the sum of the components due to rounding

Table 2.5-7 Commuter Information for the Fermi 3 Region (2000)

County	Inflow	Outflow	Net flow
Jackson Co, MI	9,899	16,929	-7,030
Lenawee Co, MI	6,160	14,759	-8,599
Livingston Co, MI	20,093	45,884	-25,791
Macomb Co, MI	116,045	158,944	-42,899
Monroe Co, MI	12,886	33,633	-20,747
Oakland Co, MI	287,517	174,731	112,786
St, Clair Co, MI	8,203	28,113	-19,910
Washtenaw Co, MI	69,192	39,361	29,831
Wayne Co, MI	226,899	208,906	17,993
Erie Co, OH	9,680	9,366	314
Fulton Co, OH	8,676	8,124	552
Henry Co, OH	3,151	5,977	-2,826
Lucas Co, OH	49,919	32,211	17,708
Ottawa Co, OH	4,175	8,510	-4,335
Sandusky Co, OH	7,452	9,335	-1,883
Seneca Co, OH	5,388	10,504	-5,116
Wood Co, OH	26,509	27,099	-590
Totals	871,844	832,386	39,458

Table 2.5-8 Special Facilities Transient Population Data for the Regional Counties (2000)

	Number of People Living in:					
County	State Prisons/ Local Jails[1]	College Dormitories[2]	Nursing Homes	Hospitals or Wards[3]	Religious Group Quarters[4]	Other non-house hold living situations[5]
Jackson Co, MI	7,327	761	1,139	153	253	405
Lenawee Co, MI	2,597	1,005	543	299	602	131
Livingston Co, MI	423	3	212	119	330	178
Macomb Co, MI	2,513		3,935	502	167	1,177
Monroe Co, MI	300		507	73	301	329
Oakland Co, MI	2,571	1,837	4,327	1,753	1,483	1,773
St. Clair Co, MI	274		605	152	448	174
Washtenaw Co, MI	3,318	14,898	1,244	1,194	222	453
Wayne Co, MI	7,783	1,254	10,061	4,661	1,493	6,726
Erie Co, OH	108		1,443	37	223	175
Fulton Co, OH	5		372	17	27	13
Henry Co, OH	180		294	31		74
Lucas Co, OH	591	2,505	3,663	628	414	871
Ottawa Co, OH	72		382	137	32	2
Sandusky Co, OH	99		621	101	69	105
Seneca Co, OH	8	751	369	195	311	19
Wood Co, OH	232	6,377	777	87	88	144
Total:	28,401	29,391	30,494	10,139	6,463	12,749

Notes:
1. Includes local jails (including police lockups), halfway houses, state prisons, juvenile institutions (including short-term care, detention or diagnostic centers), other correctional institutions, federal prisons, and military disciplinary barracks
2. Includes college quarters off campus
3. Includes homes for the mentally/physically handicapped/ill, hospitals/wards and hospices for chronically ill, orthopedic wards, institutions for the deaf or blind, patients who have no usual home elsewhere
4. Includes workers' dormitories, agriculture workers' dormitories on farms, other group homes
5. Includes other noninstitutional group quarters, job corps and vocational training facilities

Source: Reference 2.5-5

Table 2.5-9 United States Population and Average Annual Growth Rates

	Historical and Estimated Population			Average Annual Growth Rate		
U.S. Division	**1990**	**2000**	**1-Jul-05**	'90-'00	00-'05	'90-'05
Michigan	9,295,297	9,938,444	10,100,833	0.67%	0.32%	0.56%
Jackson Co, MI	149,756	158,422	163,432	0.56%	0.62%	0.58%
Lenawee Co, MI	91,476	98,890	101,778	0.78%	0.58%	0.71%
Livingston Co, MI	115,645	156,951	181,404	3.10%	2.94%	3.05%
Macomb Co, MI	717,400	788,149	828,950	0.94%	1.01%	0.97%
Monroe Co, MI	133,600	145,945	153,772	0.89%	1.05%	0.94%
Oakland Co, MI	1,083,592	1,194,156	1,213,669	0.98%	0.32%	0.76%
St. Clair Co, MI	145,607	164,235	171,079	1.21%	0.82%	1.08%
Washtenaw Co, MI	282,937	322,895	342,124	1.33%	1.16%	1.27%
Wayne Co, MI	2,111,687	2,061,162	1,990,932	-0.24%	-0.69%	-0.39%
Ohio	10,847,115	11,353,140	11,470,685	0.46%	0.21%	0.37%
Erie Co, OH	76,779	79,551	78,374	0.36%	-0.30%	0.14%
Fulton Co, OH	38,498	42,084	42,888	0.89%	0.38%	0.72%
Henry Co, OH	29,108	29,210	29,431	0.03%	0.15%	0.07%
Lucas Co, OH	462,361	455,054	447,410	-0.16%	-0.34%	-0.22%
Ottawa Co, OH	40,029	40,985	41,430	0.24%	0.22%	0.23%
Sandusky Co, OH	61,963	61,792	61,279	-0.03%	-0.17%	-0.07%
Seneca Co, OH	59,733	58,683	57,373	-0.18%	-0.45%	-0.27%
Wood Co, OH	113,269	121,065	123,889	0.67%	0.46%	0.60%
All Regional Counties	5,713,440	5,979,229	6,029,214	0.46%	0.17%	0.36%

Table 2.5-10 1 to 10 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 1 of 5)

		Population in Mile Range					
	Year	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**Total**
	Year	Population in the 0-1 Mile Range					
	2000	570					
	2008	1163					
	2020	1153					
	2030	1144					
	2040	1133					
	2050	1122					
	2060	1109					
North	2000	83	397	218	188	14,146	15,032
	2008	89	427	234	202	14,505	15,457
	2020	100	478	262	226	15,061	16,127
	2030	109	525	288	249	15,541	16,712
	2040	120	577	317	273	16,036	17,323
	2050	132	634	348	300	16,547	17,961
	2060	145	696	382	329	17,074	18,626
N-NE	2000	124	46	26	2,071	9,912	12,179
	2008	133	49	28	2,232	9,834	12,276
	2020	149	55	31	2,498	9,718	12,451
	2030	164	60	34	2,743	9,623	12,624
	2040	180	66	37	3,013	9,529	12,825
	2050	198	73	41	3,309	9,436	13,057
	2060	217	80	45	3,634	9,343	13,319

Table 2.5-10 1 to 10 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 2 of 5)

		Population in Mile Range					
	Year	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**Total**
NE	2000	282	204	0	0	0	486
	2008	303	219	0	0	0	522
	2020	340	246	0	0	0	586
	2030	373	270	0	0	0	643
	2040	410	296	0	0	0	706
	2050	450	325	0	0	0	775
	2060	494	358	0	0	0	852
E-NE	2000	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2020	0	0	0	0	0	0
	2030	0	0	0	0	0	0
	2040	0	0	0	0	0	0
	2050	0	0	0	0	0	0
	2060	0	0	0	0	0	0
East	2000	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2020	0	0	0	0	0	0
	2030	0	0	0	0	0	0
	2040	0	0	0	0	0	0
	2050	0	0	0	0	0	0
	2060	0	0	0	0	0	0
E-SE	2000	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2020	0	0	0	0	0	0
	2030	0	0	0	0	0	0
	2040	0	0	0	0	0	0
	2050	0	0	0	0	0	0
	2060	0	0	0	0	0	0

Table 2.5-10 1 to 10 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 3 of 5)

		Population in Mile Range					
	Year	1-2	2-3	3-4	4-5	5-10	Total
SE	2000	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2020	0	0	0	0	0	0
	2030	0	0	0	0	0	0
	2040	0	0	0	0	0	0
	2050	0	0	0	0	0	0
	2060	0	0	0	0	0	0
S-SE	2000	0	0	0	0	0	0
	2008	0	0	0	0	0	0
	2020	0	0	0	0	0	0
	2030	0	0	0	0	0	0
	2040	0	0	0	0	0	0
	2050	0	0	0	0	0	0
	2060	0	0	0	0	0	0
South	2000	1,154	0	0	0	0	1,154
	2008	1,243	0	0	0	0	1,243
	2020	1,391	0	0	0	0	1,391
	2030	1,528	0	0	0	0	1,528
	2040	1,679	0	0	0	0	1,679
	2050	1,844	0	0	0	0	1,844
	2060	2,025	0	0	0	0	2,025
S-SW	2000	259	0	0	0	0	259
	2008	279	0	0	0	0	279
	2020	312	0	0	0	0	312
	2030	343	0	0	0	0	343
	2040	376	0	0	0	0	376
	2050	413	0	0	0	0	413
	2060	454	0	0	0	0	454

Table 2.5-10 1 to 10 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 4 of 5)

		Population in Mile Range					
	Year	1-2	2-3	3-4	4-5	5-10	Total
SW	2000	280	0	106	162	8,526	9,074
	2008	301	0	114	174	9,190	9,779
	2020	337	0	127	195	10,284	10,943
	2030	370	0	140	214	11,295	12,019
	2040	407	0	154	235	12,405	13,201
	2050	447	0	169	258	13,624	14,498
	2060	491	0	186	284	14,963	15,924
W-SW	2000	115	1,309	2,426	1,458	38,357	43,665
	2008	123	1,410	2,614	1,571	41,344	47,062
	2020	138	1,578	2,926	1,758	46,267	52,667
	2030	152	1,734	3,213	1,931	50,814	57,844
	2040	167	1,904	3,529	2,121	55,808	63,529
	2050	183	2,091	3,876	2,329	61,293	69,772
	2060	201	2,297	4,257	2,558	67,317	76,630
West	2000	185	213	219	554	5,003	6,174
	2008	199	229	236	597	5,392	6,653
	2020	223	256	264	668	6,034	7,445
	2030	245	282	290	733	6,627	8,177
	2040	269	309	318	806	7,279	8,981
	2050	295	340	349	885	7,994	9,863
	2060	324	373	384	972	8,780	10,833
W-NW	2000	28	0	70	263	5,066	5,427
	2008	30	0	75	283	5,460	5,848
	2020	33	0	84	317	6,110	6,544
	2030	37	0	92	348	6,711	7,188
	2040	40	0	101	382	7,370	7,893
	2050	44	0	111	420	8,095	8,670
	2060	49	0	122	461	8,890	9,522

Table 2.5-10 1 to 10 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 5 of 5)

		Population in Mile Range					
	Year	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**Total**
NW	2000	195	392	379	776	5,802	7,544
	2008	210	422	408	836	6,253	8,129
	2020	235	472	457	936	6,998	9,098
	2030	258	519	502	1,028	7,686	9,993
	2040	283	570	551	1,129	8,441	10,974
	2050	311	626	605	1,240	9,271	12,053
	2060	342	687	665	1,361	10,182	13,237
N-NW	2000	219	199	290	191	4,273	5,172
	2008	236	214	312	205	4,450	5,417
	2020	264	240	349	230	4,731	5,814
	2030	290	263	384	253	4,978	6,168
	2040	318	289	421	277	5,239	6,544
	2050	349	317	463	305	5,513	6,947
	2060	384	349	508	335	5,801	7,377

Table 2.5-11 Canadian Population and Average Annual Growth Rates

	Historical Population			Average Annual Growth Rate		
Canadian Subdivision	**1996**	**2001**	**2006**	**'96-'01**	**'01-'06**	**'96-'06**
Ontario	10,753,573	11,410,046	12,160,282	1.19%	1.28%	1.24%
Amherstburg	19,273	20,339	21,748	1.08%	1.35%	1.22%
Chatham-Kent	109,350	107,341	108,177	-0.37%	0.16%	-0.11%
Essex	19,437	20,085	20,032	0.66%	-0.05%	0.30%
Kingsville	18,409	19,619	20,908	1.28%	1.28%	1.28%
Lakeshore	26,127	28,746	33,245	1.93%	2.95%	2.44%
LaSalle	20,556	25,285	27,652	4.23%	1.81%	3.01%
Leamington	25,389	27,138	28,833	1.34%	1.22%	1.28%
Pelee	283	256	287	-1.99%	2.31%	0.14%
Tecumseh	23,151	25,105	24,224	1.63%	-0.71%	0.45%
Walpole Island 46	1,525	1,843	1,878	3.86%	0.38%	2.10%
Windsor	197,694	208,402	216,473	1.06%	0.76%	0.91%
All Subdivisions	461,194	484,159	503,457	0.98%	0.78%	0.88%

Table 2.5-12 10 to 50 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 1 of 4)

Cardinal Compass Direction	Year	Mile Range 10-20	20-30	30-40	40-50	Total
North	2000	126,286	461,805	589,430	391,250	1,568,771
	2008	122,381	447,527	608,376	415,635	1,593,919
	2020	116,750	426,934	637,944	455,093	1,636,721
	2030	112,255	410,499	663,679	490,821	1,677,254
	2040	107,934	394,696	690,452	529,354	1,722,436
	2050	103,779	379,502	718,305	570,912	1,772,498
	2060	99,784	364,893	747,281	615,732	1,827,690
N-NE	2000	110,927	363,265	731,939	446,579	1,652,710
	2008	112,409	372,223	739,588	481,669	1,705,889
	2020	114,670	386,077	751,213	539,541	1,791,501
	2030	116,589	398,015	761,040	593,044	1,868,688
	2040	118,540	410,323	770,996	651,854	1,951,713
	2050	120,523	423,010	781,081	716,495	2,041,109
	2060	122,540	436,091	791,299	787,547	2,137,477
NE	2000	16,227	128,415	37,448	5,553	187,643
	2008	17,859	140,785	44,592	6,614	209,850
	2020	20,620	161,611	57,944	8,598	248,773
	2030	23,245	181,300	72,077	10,699	287,321
	2040	26,204	203,388	89,658	13,312	332,562
	2050	29,539	228,167	111,527	16,565	385,798
	2060	33,299	255,965	138,730	20,612	448,606
E-NE	2000	10,608	18,443	23,564	20,448	73,063
	2008	11,176	19,782	27,221	22,628	80,807
	2020	12,088	21,976	33,798	26,343	94,205
	2030	12,904	23,989	40,477	29,901	107,271
	2040	13,775	26,187	48,476	33,939	122,377
	2050	14,705	28,586	58,056	38,523	139,870
	2060	15,698	31,204	69,529	43,725	160,156

Table 2.5-12 10 to 50 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 2 of 4)

Cardinal Compass Direction	Year	Mile Range 10-20	20-30	30-40	40-50	Total
East	2000	2,299	5,092	12,004	2,435	21,830
	2008	2,354	5,485	13,290	2,592	23,721
	2020	2,441	6,134	15,482	2,847	26,904
	2030	2,516	6,734	17,582	3,078	29,910
	2040	2,593	7,392	19,967	3,329	33,281
	2050	2,672	8,114	22,676	3,599	37,061
	2060	2,754	8,907	25,753	3,892	41,306
E-SE	2000	0	0	265	0	265
	2008	0	0	267	0	267
	2020	0	0	272	0	272
	2030	0	0	276	0	276
	2040	0	0	280	0	280
	2050	0	0	284	0	284
	2060	0	0	288	0	288
SE	2000	0	100	9,884	43,966	53,950
	2008	0	101	10,055	44,528	54,684
	2020	0	104	10,317	45,386	55,807
	2030	0	107	10,542	46,113	56,762
	2040	0	109	10,770	46,852	57,731
	2050	0	112	11,004	47,602	58,718
	2060	0	114	11,243	48,365	59,722
S-SE	2000	0	1,467	16,677	28,597	46,741
	2008	0	1,494	16,883	28,585	46,962
	2020	0	1,535	17,197	28,568	47,300
	2030	0	1,571	17,463	28,553	47,587
	2040	0	1,607	17,733	28,539	47,879
	2050	0	1,645	18,007	28,524	48,176
	2060	0	1,683	18,286	28,510	48,479

Table 2.5-12 10 to 50 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 3 of 4)

Cardinal Compass Direction	Year	Mile Range				
		10-20	20-30	30-40	40-50	Total
South	2000	166	8,116	13,136	27,293	48,711
	2008	163	8,202	13,193	27,091	48,649
	2020	158	8,333	13,279	26,793	48,563
	2030	155	8,444	13,351	26,546	48,496
	2040	152	8,556	13,424	26,302	48,434
	2050	148	8,670	13,497	26,060	48,375
	2060	145	8,785	13,570	25,820	48,320
S-SW	2000	3,789	115,973	37,284	42,979	200,025
	2008	3,812	117,045	38,847	45,018	204,722
	2020	3,847	118,673	41,316	48,259	212,095
	2030	3,877	120,047	43,494	51,138	218,556
	2040	3,907	121,436	45,786	54,188	225,317
	2050	3,937	122,842	48,198	57,421	232,398
	2060	3,967	124,264	50,738	60,846	239,815
SW	2000	10,965	270,798	121,157	33,280	436,200
	2008	11,788	272,133	120,372	34,105	438,398
	2020	13,141	274,148	119,205	35,383	441,877
	2030	14,387	275,838	118,241	36,484	444,950
	2040	15,750	277,539	117,285	37,619	448,193
	2050	17,243	279,251	116,337	38,790	451,621
	2060	18,877	280,973	115,396	39,997	455,243
W-SW	2000	6,896	7,699	12,189	8,175	34,959
	2008	7,433	8,264	12,725	8,657	37,079
	2020	8,318	9,190	13,575	9,434	40,517
	2030	9,135	10,040	14,327	10,135	43,637
	2040	10,033	10,970	15,120	10,888	47,011
	2050	11,019	11,985	15,957	11,696	50,657
	2060	12,102	13,095	16,840	12,565	54,602

Table 2.5-12 10 to 50 Mile Resident and Transient Population Projections (2000, 2008, 2020, 2030, 2040, 2050, and 2060) (Sheet 4 of 4)

Cardinal Compass Direction	Year	Mile Range 10-20	20-30	30-40	40-50	Total
West	2000	4,676	6,513	36,417	30,483	78,089
	2008	5,040	6,968	38,549	32,267	82,824
	2020	5,640	7,711	41,985	35,141	90,477
	2030	6,194	8,390	45,081	37,731	97,396
	2040	6,803	9,129	48,405	40,511	104,848
	2050	7,472	9,933	51,974	43,497	112,876
	2060	8,206	10,808	55,807	46,702	121,523
W-NW	2000	4,181	23,120	27,245	26,576	81,122
	2008	4,515	25,232	29,915	29,019	88,681
	2020	5,067	28,768	34,420	33,112	101,367
	2030	5,578	32,090	38,688	36,960	113,316
	2040	6,141	35,796	43,485	41,256	126,678
	2050	6,760	39,930	48,877	46,051	141,618
	2060	7,442	44,541	54,937	51,403	158,323
NW	2000	21,003	129,325	148,411	72,477	371,216
	2008	21,223	141,425	164,240	84,721	411,609
	2020	21,558	161,731	191,205	107,075	481,569
	2030	21,842	180,863	217,028	130,146	549,879
	2040	22,129	202,258	246,338	158,189	628,914
	2050	22,420	226,184	279,607	192,275	720,486
	2060	22,715	252,941	317,370	233,704	826,730
N-NW	2000	29,054	229,806	193,348	164,684	616,892
	2008	28,216	225,322	203,502	185,988	643,028
	2020	27,004	218,761	219,742	223,223	688,730
	2030	26,034	213,440	234,261	259,885	733,620
	2040	25,099	208,248	249,739	302,570	785,656
	2050	24,198	203,182	266,240	352,265	845,885
	2060	23,329	198,239	283,831	410,122	915,521

Table 2.5-13 United States Age and Gender Distribution Surrounding Fermi 3 (2000)

Population Parameter	Low Population Zone[1]	10 Mile Radius	Region[2]
Gender			
Male	4,879	49,745	2,467,388
Female	4,679	51,186	2,618,762
Age			
Less than 5 years	594	7,118	347,933
5-9 years	699	7,672	385,901
10-14 years	829	7,781	374,869
15-19 years	858	7,254	348,222
20-24 years	554	6,281	326,312
25-34 years	1249	13,860	739,901
35-44 years	1,660	16,582	816,740
45-54 years	1506	14,738	698,877
55-59 years	467	4,903	240,281
60-64 years	328	3,663	182,136
65-74 years	455	5,996	324,723
75-84 years	260	3,765	228,474
85 years and up	99	1,318	71,781
Total	9,558	100,931	5,086,150

Methodology: CBG estimating approach

Notes:
1. Low population zone (LPZ) is defined as the area located within a 3-mile radius of Fermi 3
2. Region is defined as the area located within a 50-mile radius from Fermi 3

Source: Reference 2.5-3

Table 2.5-14 Canadian Age and Gender Distribution Surrounding Fermi 3, 50-Mile Radius (2001)

Population Parameter	Region[1]
Gender	
Male	237,530
Female	244,775
Age	
0-4 years	29,770
5-14 years	66,905
15-19 years	33,580
20-24 years	31,850
25-44 years	145,455
45-54 years	66,350
55-64 years	44,240
65-74 years	34,785
75-84 years	22,570
85 years and over	6,810
Total	482,315

Notes:
1. Region is defined as the area located within a 50-mile radius from Fermi 3

Source: Reference 2.5-3

Table 2.5-15 United States Racial and Ethnic Distribution Surrounding the Fermi Site (2000)

	Low Population Zone[1]	10 Mile Radius	Region[2]
Ethnicity			
African American	120	2,096	1137912
Asian	8	583	126707
Caucasian	8,991	94,199	3547397
Hawaiian	3	13	1247
Hispanic	281	2,318	163480
Native American	44	365	16387
Some Other Race	111	1,357	93020
Total	9,558	100,931	5,086,150

Methodology: CBG estimating approach

Notes:
1. Low population zone (LPZ) is defined as the area located within a 3-mile radius of Fermi 3
2. Region is defined as the area located within a 50-mile radius from the planned Fermi 3

Source: Reference 2.5-3

Table 2.5-16 Canadian Racial and Ethnic Distribution Surrounding Fermi 3, 50-mi Radius (2001)

Ethnicity	Region[1]
Caucasian	423,940
Aboriginal	6,165
Chinese	6,205
South Asian	6,960
Black	10,870
Filipino	3,165
Latin American	2,825
Southeast Asian	3,295
Arab	8,800
West Asian	1,180
Korean	605
Japanese	310
Visible minority; n.i.e	1,500
Multiple visible minorities	490
Total	476,310

Methodology: Canadian Subdivisions

Notes:
1. Region is defined as the area located within a 50-mile radius from Fermi 3

Source: Reference 2.5-3

Table 2.5-17 United States Household Income Distribution Surrounding Fermi 3 (2000)

Income Category	Households in the LPZ[1]	Households in the 10 Mile Radius	Households in the Region[2]
Less than $10,000	151	2,774	172,233
$10,000 to $14,999	111	1,875	107,276
$15,000 to $24,999	333	4,061	226,515
$25,000 to $34,999	400	4,192	229,373
$35,000 to $49,999	550	6,204	302,877
$50,000 to $74,999	671	8,521	395,535
$75,000 to $99,999	517	5,327	237,507
$100,000 to $149,999	357	3807	193,007
$150,000 to $199,999	124	786	50,281
$200,000 or More	64	533	48,531
Median Household Income	$58,325	$51,807	$47,852

* Methodology: CBG estimation approach

Notes:
1. Low population zone (LPZ) is defined as the area located within a 3-mile radius of Fermi 3
2. Region is defined as the area located within a 50-mile radius from the planned Fermi 3

Source: Reference 2.5-3

Table 2.5-18 United States County and State Median Household Income Data

	Households	Persons per household	Median Household Income	Per capita money income	Persons below poverty, percent
	2000	2000	2004	1999	2004
County					
Jackson County, MI	58,168	2.55	$43,559	$20,171	12.70%
Lenawee County, MI	35,930	2.61	$47,944	$20,186	9.20%
Livingston County, MI	55,384	2.80	$71,683	$28,069	5.10%
Macomb County, MI	309,203	2.52	$58,784	$24,446	8.20%
Monroe County, MI	53,772	2.69	$53,838	$22,458	8.70%
Oakland County, MI	471,115	2.51	$64,293	$32,534	7.80%
St. Clair County, MI	62,072	2.62	$48,095	$21,582	10.20%
Washtenaw County, MI	125,327	2.41	$55,437	$27,173	11.10%
Wayne County, MI	768,440	2.64	$38,743	$20,058	18.80%
Erie County, OH	31,727	2.45	$44,515	$21,530	9.60%
Fulton County, OH	15,480	2.69	$47,958	$18,999	7.10%
Henry County, OH	10,935	2.62	$45,573	$18,667	7.30%
Lucas County, OH	182,847	2.44	$40,277	$20,518	14.70%
Ottawa County, OH	16,474	2.45	$46,849	$21,973	7.50%
Sandusky County, OH	23,717	2.56	$42,793	$19,239	8.90%
Seneca County, OH	22,292	2.56	$39,620	$17,027	9.80%
Wood County, OH	45,172	2.51	$46,191	$21,284	8.00%
U.S.	105,480,101	2.59	$44,334	$21,587	12.70%
Michigan	3,785,661	2.56	$44,409	$22,168	12.50%
Ohio	4,445,773	2.49	$43,371	$21,003	11.70%

Source: Reference 2.5-6

Table 2.5-19 Canadian Census Division Median Household Income Data (2001)

	Households	Persons per household	Median household Income	Per capita money income	Persons below poverty, percent
Subdivision					
Amherstburg	7,230	2.81	$65,594	$23,317.01	NA
Chatham-Kent	41,950	2.56	$46,517	$18,179.34	NA
Essex	7,420	2.71	$57,364	$21,191.98	NA
Kingsville	6,805	2.88	$61,191	$21,224.57	NA
Lakeshore	9,895	2.91	$72,228	$24,862.45	NA
LaSalle	8,380	3.02	$81,022	$26,852.46	NA
Leamington	9,260	2.93	$48,467	$16,537.86	NA
Pelee	NA	NA	NA	NA	NA
Tecumseh	8,385	2.99	$80,991	$27,050.77	NA
Walpole	NA	NA	NA	NA	NA
Windsor	83,825	2.49	$46,949	$18,884.18	NA
Province					
Ontario	4,219,410	2.70	$53,626	$19,830.78	NA

Source: Reference 2.5-3

Table 2.5-19-A Population Data for the Fermi 3 Region Counties and Selected Cities

	2000	2001	2002	2003	2004	2005	2006	2007	2008
Michigan	9,938,444	10,004,341	10,037,303	10,065,881	10,090,280	10,093,266	10,083,878	10,049,790	10,003,422
Monroe	145,945	147,631	148,566	149,649	151,041	152,242	153,150	153,331	152,949
Monroe City	22,076	21,769	21,589	21,573	21,604	21,599	21,616	21,488	21,374
Wayne	2,061,162	2,058,087	2,052,396	2,044,832	2,035,701	2,024,183	2,009,204	1,981,654	1,949,929
City of Detroit	951,270	935,637	927,802	926,035	923,352	920,675	918,849	916,936	912,062
Oakland	1,194,156	1,201,330	1,200,284	1,203,036	1,205,936	1,205,877	1,204,666	1,202,287	1,202,174
Livingston	156,951	163,333	168,102	171,644	175,739	179,427	182,075	182,655	182,575
Macomb	788,149	800,000	807,173	813,733	820,633	825,228	828,282	829,364	830,663
Washtenaw	322,895	329,239	333,636	337,093	340,725	344,025	346,185	347,969	347,376
Jackson	158,422	159,761	160,802	161,839	161,790	162,573	162,867	162,706	160,180
Lenawee	98,890	99,586	100,185	100,491	100,945	100,983	101,313	101,345	100,801
St. Clair	164,235	165,824	166,721	168,359	169,548	169,525	170,187	169,840	168,894
Ohio	11,353,140	11,391,298	11,410,582	11,430,306	11,445,095	11,450,954	11,458,390	11,477,641	11,485,910
Lucas	455,054	454,392	453,244	452,015	449,044	446,458	443,908	442,408	440,456
City of Toledo	313,619	311,848	309,684	307,750	304,112	301,144	297,618	295,614	293,201
Fulton	42,084	42,152	42,205	42,254	42,576	42,633	45,512	42,482	42,485
Ottawa	40,985	40,972	40,915	41,127	41,302	41,294	41,200	41,069	40,823
Henry	29,210	29,135	29,236	29,143	29,160	29,185	29,210	28,902	28,841
Sandusky	61,792	61,675	61,684	61,398	61,431	61,233	61,110	60,927	60,637
Seneca	58,683	58,314	57,943	57,755	57,532	57,246	56,860	56,688	56,461
Erie	79,551	79,228	78,643	78,472	78,365	77,786	77,423	77,162	77,062
Wood	121,065	121,891	121,951	122,358	123,569	123,975	124,127	124,811	125,340
Total, Region Counties	5,979,229	6,012,550	6,023,686	6,035,198	6,045,037	6,043,873	6,034,279	6,005,600	5,967,646

Source: U.S. Census Bureau, Population Estimates, 2008 Estimates of Incorporated Places and Minor Civil Divisions, All States, incorporated places only. Available at http://www.census.gov/popest/cities/cities.html

Table 2.5-20 Regional Employment Data (2000 and 2006)

		2000				2006				2000-2006 Percent Change in Employment
		Labor Force	Employ-ment	Unemploy-ment	Unemploy-ment Rate, Percent	Labor Force	Employ-ment	Unemploy-ment	Unemploy-ment Rate, Percent	
Michigan Counties	Monroe	77,194	74,756	2,438	3.2	79,051	73,936	5,115	6.5	-1.1
	Wayne	952,300	911,069	41,231	4.3	894,058	818,844	75,214	8.4	-10.1
	Jackson	79,088	76,396	2,692	3.4	78,785	73,160	5,625	7.1	-4.2
	Lenawee	51,699	49,769	1,930	3.7	50,586	46,897	3,689	7.3	-5.8
	Livingston	89,687	87,314	2,373	2.6	94,228	89,214	5,014	5.3	2.2
	Macomb	433,912	418,171	15,741	3.6	421,446	391,252	30,194	7.2	-6.4
	Oakland	675,896	656,461	19,435	2.9	630,690	594,361	36,329	5.8	-9.5
	Washtenaw	185,202	180,898	4,304	2.3	191,462	182,667	8,795	4.6	1.0
Ohio Counties	Lucas	227,304	217,049	10,255	4.5	226,172	211,883	14,289	6.3	-2.4
	Fulton	22,695	21,786	909	4.0	23,387	21,998	1,389	5.9	1.0
	Henry	15,272	14,618	654	4.3	16,173	15,197	976	6.0	4.0
	Erie	42,168	40,380	1,788	4.2	42,663	40,145	2,518	5.9	-0.6
	Ottawa	21,404	20,320	1,084	5.1	21,944	20,412	1,532	7.0	0.5
	Sandusky	32,819	31,453	1,366	4.2	33,427	31,508	1,919	5.7	0.2
	Seneca	30,954	29,629	1,325	4.3	31,431	29,769	1,662	5.3	0.5
	Wood	66,346	64,027	2,319	3.5	68,447	64,857	3,590	5.2	1.3
Region		3,091,011	2,977,479	113,532	3.7	2,988,136	2,783,519	204,617	6.8	-6.5
Detroit CSA		2,700,947	2,544,486	156,461	5.8	2,714,017	2,439,109	274,908	10.1	-4.1
Toledo MSA		317,744	302,749	14,995	4.7	344,837	316,706	28,131	8.2	4.6

Source: Reference 2.5-72 through Reference 2.5-74

Table 2.5-21 Area Employment by Industry (2000 and 2006) (Sheet 1 of 2)

	Monroe County		Wayne County		Lucas County		Detroit CSA		Toledo MSA		Region
Industry	**2000**	**2006**	**2000**	**2006**	**2000**	**2006**	**2000**	**2006**	**2000**	**2006**	**2000**
Agriculture, forestry, fishing and hunting, and mining	894	788	1,044	965	866	440	6,405	6,965	918	2,581	12,409
Construction	5,370	5,299	39,296	34,634	12,230	12,028	152,923	133,451	14,787	18,614	156,170
Manufacturing	18,120	14,587	185,856	144,883	38,774	33,003	571,992	464,139	54,833	54,404	634,663
Wholesale trade	2,307	2,402	26,904	24,153	8,411	6,791	85,105	78,589	12,491	9,444	94,005
Retail trade	8,430	8,811	90,905	84,515	25,977	24,467	293,743	277,391	35,712	37,328	321,218
Transportation and warehousing, and utilities	5,112	5,388	54,387	46,478	11,599	12,552	108,062	103,280	19,029	19,821	130,039
Information	973	1,188	21,231	19,086	4,079	4,058	66,888	56,068	5,855	5,788	65,196
Finance and insurance, and real estate and rental and leasing	2,669	4,224	50,591	53,936	10,258	11,421	143,764	157,182	16,252	15,016	157,808
Professional, scientific, and management, and administrative and waste management services	4,012	5,093	77,890	74,914	19,036	16,845	247,998	255,136	24,961	25,169	267,823
Educational services, and health care, and social assistance	12,891	16,499	158,342	164,573	46,342	51,115	470,184	519,322	61,939	76,213	542,599
Arts, entertainment, and recreation, and accommodation, and food services	4,894	6,620	68,026	72,197	17,110	17,714	203,540	208,121	33,343	29,063	204,648
Other services, except public administration	3,054	3,726	42,366	37,643	10,226	8,652	115,713	106,692	13,087	13,246	125,170

Table 2.5-21 Area Employment by Industry (2000 and 2006) (Sheet 2 of 2)

	Monroe County		Wayne County		Lucas County		Detroit CSA		Toledo MSA		Region
Industry	**2000**	**2006**	**2000**	**2006**	**2000**	**2006**	**2000**	**2006**	**2000**	**2006**	**2000**
Public administration	1,618	2,937	34,272	26,042	7,111	6,666	78,169	72,773	9,542	10,019	91,589

Source: Reference 2.5-64 through Reference 2.5-74

Table 2.5-22 Employment by Industry for Canadian Counties in the 50-mi Region (2001)

Industry	Employment
Agriculture and other resource-based industries	18,740
Manufacturing and construction industries	94,290
Wholesale and retail trade	43,595
Finance and real estate	11,385
Health and education	45,195
Business services	39,345
Other services	58,580

Includes the Canadian counties of Essex, Chatham-Kent, and Lambton that lie within the 50-mile radius of Fermi 3.

Source: Reference 2.5-75 through Reference 2.5-77

Table 2.5-23 Monroe County Principal Employers (2006 and 1998)

Employer	Employees, 2006	Percent of Total County Employment	Employees, 1998	Percent of Total County Employment
Automotive Components Holdings (Formerly Visteon Corporation)	2,000	3.39	1,400	2.58
Detroit Edison Corp.	1,500	2.55	1,480	2.72
Mercy Memorial Hospital	1,300	2.21	811	1.49
Meijer Inc.	1,025	1.74	900	1.66
Monroe Public Schools	1,000	1.70	803	1.48
Monroe County	741	1.26	786	1.45
Bedford Public Schools	725	1.23	515	0.95
Cabela's	650	1.10	-	0.00
MacSteel (Formerly North Star Steel)	500	0.85	-	0.00
Monroe Auto Equipment	500	0.85	500	0.92
Guardian Industries Corp.	500	0.85	500	0.92
La-Z-Boy Inc	500	0.85	500	0.92
Totals	10,941	18.57	8,195	15.08

Source: Reference 2.5-78

Table 2.5-24 Charter County of Wayne, Michigan Principal Employers (2007 and 1998)

	2007		1998	
Employer	**Employees**	**Percentage of Total County Employment**	**Employees**	**Percentage of Total County Employment**
Ford Motor Company	42,309	5.23	57,659	6.33
Detroit Public Schools	17,329	2.14	17,286	1.90
City of Detroit	13,593	1.68	17,302	1.90
Henry Ford Health System	11,475	1.42	9,872	1.08
Detroit Medical Center	10,190	1.26	13,967	1.90
U.S. Postal Service	9,396	1.16		
Chrysler LLC *	9,000	1.11	15,834	1.53
General Motors Corporation	7,843	0.97	11,067	1.22
Oakwood Healthcare Inc.	7,510	0.93	6,653	1.74
U.S. Government	7,417	0.92	14,140	0.73
St. John Health System	-		7,136	0.78
Total	136062	16.83	170,916	6.00
Total Wayne County Employment	808,380		910,396	

Source: Reference 2.5-79

Table 2.5-25 Lucas County Principal Employers (2007 and 1997)

Top 2006 Private & Public Employers			Top 1997 Private & Public Employers		
Employer	**Number of Employees**	**Percentage of Total Employment**	**Employer**	**Number of Employees**	**Percentage of Total Employment**
ProMedica Health Systems	11,265	5.31%	Mercy Health Partners	6,680	3.06%
Mercy Health Partners	6,723	3.17%	Daimler-Chrysler/Toledo Jeep	5,400	2.47%
University of Toledo	4,987	2.35%	Toledo Public Schools	5,319	2.44%
Toledo Public Schools	4,554	2.15%	University of Toledo	5,245	2.40%
Lucas County	4,168	1.96%	General Motors/Power Train	4,600	2.11%
Daimler-Chrysler/Toledo Jeep	3,548	1.67%	Seaway Foodtown	4,548	2.08%
Kroger	3,503	1.65%	Toledo Hospital	4,506	2.06%
U.T. Health Science Campus	3,300	1.56%	Lucas County	4,300	1.97%
City of Toledo	2,979	1.40%	Medical University of Ohio	3,442	1.58%
State of Ohio	2,487	1.17%	City ·of Toledo	3,017	1.38%
General Motors/Power Train	2,112	1.00%	Andersons	2,962	1.36%
United Parcel Service	2,108	0.99%	Kroger	2,667	1.22%
Andersons	1,766	0.83%	Meijers	2,000	0.92%
HCR Manor Care	1,745	0.82%	State of Ohio	1,990	0.91%
Meijers	1,721	0.81%	United Parcel Service	1,946	0.89%
Top ten total employed	56,966	26.85%	Top Ten Total Employed	58,622	26.85%
Total Employed in Lucas County	212164		Total Employed in Lucas County	218331	

Source: Reference 2.5-80

Table 2.5-26 Detroit MSA and Michigan Industry Employment Forecasts (2004 – 2014) (Sheet 1 of 2)

		Detroit MSA				Michigan			
		Employment		Change		Employment		Change	
		2004	2014	Level	Percent	2004	2014	Level	Percent
Total Wage and Salary Employment		2,026,680	2,166,530	139,850	6.9	4,394,360	4,743,180	348,820	7.9
Natural Resources and Mining		1,190	1,160	-30	-2.0	8,160	7,900	-260	-3.1
Construction		82,610	89,020	6,410	7.7	191,540	208,620	17,080	8.9
Manufacturing		295,640	262,070	-33,570	-11.4	697,290	653,070	-44,220	-6.3
	Durable Goods	250,990	217,310	-33,680	-13.4	547,950	503,050	-44900	-8.2
	Nondurable Goods	44,650	44,750	100	0.2	149,340	150,010	670	0.5

Table 2.5-26 Detroit MSA and Michigan Industry Employment Forecasts (2004 – 2014) (Sheet 2 of 2)

		Detroit MSA				Michigan			
		Employment		Change		Employment		Change	
		2004	2014	Level	Percent	2004	2014	Level	Percent
Service Industries		1,647,240	1,814,290	167,050	10.1	3,497,370	3,873,590	376,220	10.8
	Wholesale Trade	92,900	100,500	7,600	8.2	170,600	185,060	14460	8.5
	Retail Trade	223,150	231,810	8,660	3.9	513,680	539,340	25660	5.0
	Transportation, Warehousing and Utilities	82,490	86,640	4,150	5	153,680	162,160	8480	5.5
	Information	36,560	38,050	1,490	4.1	68,560	71,030	2470	3.6
	Finance and Insurance	85,100	88,800	3,700	4.3	161,320	172,080	10760	6.7
	Real Estate and Rental Leasing	30,610	32,570	1,960	6.4	56,110	60,180	4070	7.3
	Professional and Business Services	362,210	430,630	68,420	18.9	584,700	700,550	115850	19.8
	Educational and health Services	381,780	424,720	42,940	11.2	950,610	1,070,320	119,710	12.6
	Leisure and Hospitality	182,010	201,380	19,370	10.6	402,020	451,130	49110	12.2
	Other Services	74,620	80,680	6,060	8.1	178,000	195,840	17840	10.0
	Government	95,810	98,540	2,730	2.8	258,100	265,900	7800	3.0

MSA COMPOSITION: Lapeer, Macomb, Monroe, Oakland, St. Clair, and Wayne Counties

Source: Reference 2.5-81 and Reference 2.5-82

Table 2.5-27 Toledo MSA Industry Employment Projections Report (2004-2014) (Sheet 1 of 2)

Industry	2004 Annual Employment	2014 Projected Employment	Change in Employment 2004-2014	Percent Change 2004-2014
Goods-Producing	71,000	66,770	-4,230	-6.0
Natural Resources and Mining	4,000	3,760	-240	-6.0
Construction	15,150	16,190	1,040	6.9
Manufacturing	51,850	46,820	-5,030	-9.7
Service-Providing	255,640	282,630	26,990	10.6
Trade, Transportation and Utilities	64,360	68,120	3,760	5.8
Wholesale Trade	13,390	14,100	710	5.3
Retail Trade	37,540	40,220	2,680	7.1
Transportation and Warehousing	11,760	12,220	460	3.9
Utilities	1,670	1,580	-90	-5.4
Information	4,560	4,860	300	6.6
Financial Activities	13,050	13,890	840	6.4
Finance and Insurance	8,640	9,110	470	5.4
Real Estate and Rental and Leasing	4,410	4,780	370	8.4
Professional and Business Services	33,950	39,020	5,070	14.9
Professional, Scientific & Technical Services	11,130	12,910	1,780	16.0
Management of Companies and Enterprises	3,250	3,310	60	1.8
Administrative and Waste Services	19,570	22,800	3,230	16.5
Education and Health Services	47,370	55,870	8,500	17.9
Educational Services	4,310	4,460	150	3.5
Health Care & Social Assistance	43,060	51,410	8,350	19.4

Table 2.5-27 Toledo MSA Industry Employment Projections Report (2004-2014) (Sheet 2 of 2)

Industry	2004 Annual Employment	2014 Projected Employment	Change in Employment 2004-2014	Percent Change 2004-2014
Leisure and Hospitality	32,620	36,440	3,820	11.7
Arts, Entertainment & Recreation	4,880	5,550	670	13.7
Accommodation and Food Services	27,740	30,890	3,150	11.4
Other Services	15,150	16,580	1,430	9.4
Government	44,580	47,850	3,270	7.3
Federal Government	2,570	2,510	-60	-2.3
State Government	11,650	12,160	510	4.4
Local Government	30,360	33,180	2,820	9.3
Self-Employed, Private Household and Unpaid Family Workers	19,580	21,720	2,140	10.9

MSA COMPOSITION: Fulton, Lucas, Ottawa and Wood Counties

Source: Reference 2.5-83

Table 2.5-28 Recent and Projected Major Employment Changes within Monroe County

Employer	City	Job Change	Source	Notice Date	Effective Date	Comment
Splash Universe	Dundee	200	Monroe News	11/9/2006	1/22/2007	25,000 square foot water park, $25 million investment
Backyard Storage Solutions	Monroe	130	Monroe News	11/6/2006	1/15/2007	Site of vacant Lear Corporation Plant, 1000 Ternes Dr, $5 million investment, consolidating from Warren and Detroit
Ciena Healthcare of Southfield	Frenchtown	100	Monroe News	11/2/2006	12/1/2007	New 120 bed skilled care facility 1971 N. Monroe Street on 11.2 acres
Ford Motor Company	Monroe	-1200	Monroe News	8/25/2007	12/30/2008	Closing Automotive Component Holdings (ACH), 3200 E. Elm Ave, 48162

Table 2.5-28(A) Regional Union Construction Labor Force and Wage by Major Craft Occupation

Primary Coverage Unions	Location	Area Total Journeymen	Area Total Apprentices	Base Journeyman Wages ($2008)
Iron Worker #55	Toledo	661	72	28.00
Boiler Makers #85	Toledo	256	144	33.43
Electrician #8	Toledo	1,520	194	34.00
Operating Eng. #324	Michigan (State wide)	4,500	77	32.75
Brick Layer-Allied	SEM*	1,550	138	29.00
Pipefitter/Plumber #671	Monroe	335	21	32.32
Cement Mason #886	SEM*	400	24	28.00
Sheet Metal Worker #33	SEM*	400	50	29.00
Carpenters	SEM*	4,391	338	30.16
Laborers #959SEM*	1,091	63	26.28	
Insulators #45	Toledo	110	57	29.37
Other Union Hall Locations				
Iron Workers #25	Detroit	2,500	200	29.00
Boiler Makers #169	Detroit	444	146	32.89
Electrician #58	Detroit	4,024	275	35.85
Pipefitter/Plumbers #636	Detroit	1,650	140	36.25
Insulators #25	Detroit	195	35	30.77

*SEM- Southeast Michigan
**Detroit Edison personnel collected this information from local union leaders in Sept. 2009

Table 2.5-28(B) Michigan and Ohio Construction Labor Force

	Michigan 2006 (Actual)	Michigan 2016 (Projected)	Ohio 2006 (Actual)	Ohio 2016 (Projected)
Iron Workers	1,770	1,850	3,590	3,800
Boilermakers	520	580	590	670
Electricians/Instrument Fitters	24,000	30,190	30,400	
Operating Engineers	9,090	9,680	12,080	12,950
Pipefitters	15,060	15,760	18,120	19,110
Cement Masons	4,140	4,940	6,610	7,340
Sheetmetal Workers	4,960	5,190	5,770	5,750
Carpenters	31,710	33,710	41,220	44,930
Laborers	27,240	29,330	32,330	35,270
Insulators	960	1,040	1,720	1,830
Millwrights	5,500	5,520	5,410	4,550
Painters	8,580	9,090	12,620	13,970
Teamsters/Truckers	87,510	96,620	116,930	126,530

Sources: Reference 2.5-136 and Reference 2.5-137

Table 2.5-28(C) Michigan and Ohio Nuclear Operations Labor Force and Wages

Occupation	Michigan 2006 Actual	Michigan 2016 Projected	Michigan Average Hourly Wage 2008	Ohio 2006 Actual	Ohio 2016 Projected	Ohio Average Hourly Wage 2008
General and Operations Managers	36,460	35,450	$47.98	56,770	54,430	$49.06
Accountants and Auditors	34,290	38,230	$30.79	49,080	54,050	$29.55
Computer Software Engineers Applications and Systems Software	19,420	24,400	$38.63	23,770	31,760	$39.76
Network and Computer System Administrators	7,850	9,270	$30.96	12,020	14,510	$31.18
Chemical Engineers	1,050	1,160	$38.92	1,530	1,570	$41.15
Civil Engineers	6,190	6,870	$33.58	5990	6460	$34.20
Electrical Engineers	6,370	6,790	$37.04	4,440	4,500	$34.93
Mechanical Engineers	24,730	25,970	$38.13	11,350	10,630	$33.25
Nuclear Technicians	90	90	$35.27	400	400	$28.04
Security Guards	25,360	27,600	$12.21	31,390	33,680	$11.99
Office & Administration Support Occupations	699,660	723,590	$15.71	917,670	943,850	$15.11
Nuclear Power Reactor Operators	NA	NA	$33.31	150	160	$31.24
Power Distributors and Dispatches	490	470	$32.19	160	140	$26.27
Power Plant Operators	1,640	1,680	$27.13	1,260	1,220	$28.22
Stationary Engineers and Boiler Operators	1,310	1,320	$26.20	2,080	1,970	$24.07

Sources: Reference 2.5-136 and Reference 2.5-137

Table 2.5-29 Monroe County Direct and Overlapping Property Rates (2001-2005) (Rate per $1,000 of Taxable Value)

	Tax Levy Year				
	2001	**2002**	**2003**	**2004**	**2005**
County Direct Rates	4.84	4.83	4.79	4.81	4.80
Jail Bond	0.16	0.16	0.10	0.11	0.11
Senior Citizen	0.49	0.49	0.48	0.49	0.50
Total Direct Rate	5.49	5.49	5.39	5.40	5.41
Overlapping Rates					
Cities:					
Luna Pier	13.12	12.76	10.07	11.11	11.80
Milan	18.96	19.21	18.83	18.82	18.71
Monroe	15.32	15.33	15.34	15.46	15.80
Petersburg	23.94	21.38	21.57	20.34	20.71
Township (average)	2.64	2.87	2.91	2.91	2.72
School Districts (average)	27.51	27.41	25.99	26.97	26.80
Intermediate School Districts (average)	4.38	4.72	4.69	4.92	4.89
Community College	2.20	2.19	2.18	2.19	2.18
Library	0.82	0.82	0.81	1.00	1.00

Source: Reference 2.5-78

Table 2.5-30 Monroe County Assessed and Estimated True Cash Value of Taxable Property (2001-2005)

Tax Year	Residential Property	Agricultural Property	Commercial Property	Industrial Property	Developmental Property
2001	$3,066,123,121	$293,630,302	$519,720,689	$1,163,041,197	$11,622,138
2002	$3,343,306,250	$316,306,273	$588,621,309	$1,127,474,795	$12,978,813
2003	$3,591,071,882	$342,155,453	$638,975,155	$1,113,076,146	$16,428,886
2004	$3,868,050,728	$373,425,880	$695,883,009	$1,081,071,159	$24,187,555
2005	$4,171,394,039	$437,947,734	$731,115,107	$1,042,462,771	$45,988,525

Tax Year	Personal Property	Total Assessed Value	Total Direct Tax Rate	Estimated True Cash Value
2001	$471,793,096	$5,525,930,543	5.4843	$11,112,871,803
2002	$488,638,679	$5,877,326,118	5.4768	$11,823,516,893
2003	$464,976,294	$6,166,683,816	5.3773	$12,412,251,677
2004	$475,914,907	$6,518,532,638	5.4046	$13,110,642,494
2005	$489,137,589	$6,918,045,765	5.4052	$13,926,131,767

Note:
Residential, commercial and industrial values are calculated without tax-exempt values.

Source: Reference 2.5-78

Table 2.5-31 Monroe County's Largest Property Tax Payers

Taxpayer	2006 Tax Levy			1997 Tax Levy		
	Taxable Assessed Value	Rank	Percent of County Total	Taxable Assessed Value	Rank	Percent of County Total
Detroit Edison	$822,719,335	1	12.62	$1,178,001,644	1	31.36
Automotive Components Holding (formerly Visteon)	$104,799,157	2	1.61	$100,559,120	2	2.68
Consumers Power Co.	$75,254,259	3	1.15	$73,019,791	3	1.94
Macsteel Monroe (formerly North Star)	$29,832,080	4	0.46	$24,721,540	4	0.66
Goodwill Co. (Meijer)	$23,780,814	5	0.36	$17,705,690	8	0.47
Holam Inc. (Holcim)	$23,088,046	6	0.35	$23,470,696	5	0.62
International Transmission Co.	$22,524,233	7	0.35	-	-	-
Cabela's	$18,305,544	8	0.28	-	-	-
Frenchtown Square	$18,253,393	9	0.28	$14,910,450	9	0.40
Aquila (formerly Michigan Gas Utilities)	$17,129,162	10	0.26	-	-	-
Utilicorp				$19,239,648	6	0.51
TWB/Worthington Steel				$18,532,700	7	0.49
Tenneco				$11,118,300	10	0.30
Totals	$1,155,686,023		17.73	$1,481,279,579		39.44

Source: Reference 2.5-78

Table 2.5-32 Charter County of Wayne Principal Property Taxpayers (Fiscal Year 2007)

Firm	Total Assessment ($)	Percentage of State Equalized Value
Ford Motor Company	1,560,809,660	2.42
DTE Energy	1,009,871,003	1.57
Daimler Chrysler Corp.	425,214,864	0.66
General Motors Corp.	298,624,472	0.46
United States Steel	213,766,632	0.33
MGM Grand Detroit LLC	164,692,964	0.26
Marathon Oil/ Ashland Petroleum LLC	157,376,388	0.24
Auto Alliance Int'l Inc.	136,153,300	0.21
Severstal Steel Company	114,684,000	0.18
ATT Mobility LLC (f/n/a Cingular)	88,934,491	0.14
Total	4,170,127,774	6.48
Total State Equalized Value (S.E.V.)	64,401,640,723	

Source: Reference 2.5-79

Table 2.5-33 Lucas County Top Ten Private Sector Principal Tax Payers, December 31, 2006 (Amount's in 000's)

Firm	2006 Assessed Real Estate Values ($)	2006 Assessed Personal Property Values ($)	2006 Assessed Property Values ($)	2006 Percent Firms Assessed Value to Total 2006 Assessed Property Value
Sunoco Inc. R&M.	4,467	58,128	62,595	0.60
Westfield Shopping Town	53,092	226	53,318	0.55
General Motors Hydra-Matic	8,684	42,553	51,237	0.53
BP America	3,455	41,800	45,255	0.46
Daimler Chrysler	22,329	20,758	43,087	0.45
D-Serf Co.	31,935	2800	34,735	0.36
the Andersons	12,704	13,148	25,852	0.27
Johns Manville	3,628	16,876	20,504	0.21
Meijer Stores	14,006	5,959	19,965	0.20
AERC	19,097		19,097	0.20
Totals	173,397	202,248	375,645	3.83

Source: Reference 2.5-80

Table 2.5-34 Frenchtown Township Total Revenue and Property Tax Comparison

Year	Total Township Revenue ($)	Property Tax Revenue ($) (Real & Personal)	Percentage of Revenue Represented by Property Tax
1989	2,502,529	1,063,216	42
1990	3,350,400	1,882,777	56
1991	4,924,871	3,452,922	70
1992	4,993,449	3,433,995	69
1993	3,062,207	1,196,911	39
1994	2,839,926	1,089,096	38
1995	3,867,160	1,854,690	48
1996	4,157,927	1,993,122	48
1997	5,284,861	2,717,749	51
1998	5,599,801	2,786,677	50
1999	5,393,789	2,806,568	52
2000	5,008,096	2,903,052	58
2001	5,142,750	2,822,404	55

Source: Reference 2.5-11

Table 2.5-35 Taxable Value of Property in Frenchtown Township(in thousands of dollars)(Sheet 1 of 2)

		1988	1989	1990	1991	1992	1993	1994	1995
Industrial	Dollar total	704,294	810,408	828,039	833,739	841,360	836,232	764,600	754,412
	Percent of Total	67	77	78	79	80	79	72	71
Agricultural	Dollar total	11,610	11,456	12,202	13,427	13,364	13,269	12,620	12,364
	Percent of Total	1	1	1	1	1	1	1	1
Commercial	Dollar total	48,252	69,881	82,261	96,867	96,192	100,480	102,967	104,479
	Percent of Total	5	7	8	9	9	9	10	10
Residential	Dollar total	103,324	109,992	123,971	143,329	146,672	170,925	185,992	197,071
	Percent of Total	10	10	12	14	14	16	18	19
Developmental	Dollar total	547,000	640,650	698,900	762,550	561,100	590,287	661,200	813,338
	Percent of Total	-	-	-	-	-	-	-	-
Utility	Dollar total	189,246	69,446	102,554	82,259	91,483	100,835	73,067	96,222
	Percent of Total	18	7	10	8	9	10	7	9
Total Ad valorem		1,057,272	1,071,824	1,149,727	1,170,383	1,189,633	1,222,330	1,139,907	1,165,360

Table 2.5-35 Taxable Value of Property in Frenchtown Township (in thousands of dollars) (Sheet 2 of 2)

		1996	1997	1998	1999	2000	2001	2002
Industrial	Dollar total	775,929	784,316	779,260	810,131	795,857	727,976	659,469
	Percent of Total	73	74	74	77	75	69	62
Agricultural	Dollar total	12,411	12,644	12,720	12,357	11,224	11,390	11,719
	Percent of Total	1	1	1	1	1	1	1
Commercial	Dollar total	101,481	104,367	112,199	116,489	123,456	137,704	149,677
	Percent of Total	10	10	11	11	12	13	14
Residential	Dollar total	211,334	221,295	238,454	257,494	279,994	304,702	327,777
	Percent of Total	20	21	23	24	26	29	31
Developmental	Dollar total	704,706	878,225	0	0	0	0	0
	Percent of Total	-	-	-	-	-	-	-
Utility	Dollar total	81,338	87,772	74,682	75,802	54,947	69,832	72,132
	Percent of Total	8	8	7	7	5	7	7
Total Advalorem		1,183,197	1,211,272	1,217,315	1,272,274	1,265,479	1,251,603	1,220,774

Notes:

1. Values in the Developmental Category include property ready for development but for which no clear category had been established. This category was dropped by the assessor's office in 1998. After that time such property was assigned to other use categories.
2. Utility Values Represent personal property tax only—real property value included in industrial table.
3. Properties eligible for Tax abatement under act 198 I.F.T (Industrial Facilities Tax), and Act 342 (Commercial Facilities Tax) have been included at 50% of actual taxable value to accurately reflect their tax generation.

Source: Reference 2.5-11

Table 2.5-36 Per Capita Michigan State Taxes and U.S. Rank (2004)

	Per Capita				Per $1,000 Personal Income			
	Michigan		Ohio		Michigan		Ohio	
Tax	**Value ($)**	**Rank**	**Value($)**	**Rank**	**Value ($)**	**Rank**	**Value ($)**	**Rank**
Total Taxes	3,313	25	3419	21	103.28	21	109.73	10
Property Taxes	1,186	16	981	26	39.96	15	31.48	24
General Sales Taxes	781	27	809	23	24.36	29	25.95	23
Selective Sales Taxes	314	39	267	47	9.78	41	8.58	48
Individual Income Taxes	630	32	1064	8	19.63	36	34.15	5
Corporate Income Taxes	182	9	93	22	5.68	6	2.97	21
Motor Fuel Taxes	107	43	135	23	3.34	42	4.34	21
Tobacco Product Taxes	99	2	49	22	3.08	2	1.57	22

Source: Reference 2.5-84

Table 2.5-37 Michigan General Property Tax Collection (2004 and 2005)

	2004 Levy		2005 Levy	
Jurisdiction	**Amount ($)**	**Percent of Total**	**Amount ($)**	**Percent of Total**
School	5,440,921,510	52.47	5,710,027,883	52.36
City	2,178,716,784	21.01	2,294,324,115	21.04
County	1,918,051,074	18.50	2,017,064,502	18.5
Township	743,252,490	7.17	793,380,177	7.27
Village	88,174,916	0.85	91,050,743	0.83
Total Levy	10,369,116,774	100.00	10,905,847,420	100.00

Source: Reference 2.5-85

Table 2.5-38 Treasury Administered Taxes and Fee Collected on a Cash Basis(In Thousands of Dollars)

Type of Revenue	10/1/01 to 9/30/02	10/1/02 to 9/30/03	10/1/03 to 9/30/04	10/1/04 to 9/30/05	10/1/05 to 9/30/06
Net Individual Income Tax	6,260,348	5,845,697	5,912,261	6,038,578	6,242,883
Industrial/Commercial Facilities Tax	149,889	156,406	154,267	141,384	136,783
Sales Tax	6,492,547	6,408,508	6,457,613	6,609,944	6,589,230
State Education Tax	1,578,743	1,776,174	1,542,252	1,794,026	1,900,206
State Housing Development Service Fee	7,911	8,409	9,092	7,060	9,001
Environmental Protection Regulatory Fee (e)	60,929	58,459	58,422	59,167	55,784
Use Tax	1,315,629	1,236,133	1,317,494	1,396,395	1,391,289
Utility Property Tax	140,841	133,276	114,702	99,535	91,660
Total of all Revenues	20,617,594	20,413,332	20,389,235	21,267,440	21,530,516

Source: Reference 2.5-85

Table 2.5-39 Regional Housing Information (2000) (Sheet 1 of 2)

		Occupied Housing			Vacant Housing	
County	**Total Housing Units**	**Total Occupied Units / Dwellings**	**Owner Occupied Units / Dwellings**	**Renter Occupied Units / Dwellings**	**Total Vacant Units**	**Seasonal, Recreational, Occasional Use**
Monroe County, MI	56,471	53,772	43,536	10,236	2,699	364
Wayne County, MI	826,145	768,440	511,837	256,603	57,705	2,448
Jackson County, MI	62,906	58,168	44,503	13,665	4,738	1,887
Lenawee County, MI	39,769	35,930	28,102	7,828	3,839	1,911
Livingston County, MI	58,919	55,384	48,757	6,627	3,535	1,553
Macomb County, MI	320,276	309,203	243,964	65,239	11,073	1,122
Oakland County, MI	492,006	471,115	352,125	118,990	20,891	3,778
St. Clair County, MI	67,107	62,072	49,419	12,653	5,035	1,921
Washtenaw County, MI	131,069	125,327	74,830	50,497	5,742	1,114
Erie County, OH	35,909	31,727	22,847	8,880	4,182	2,172
Fulton County, OH	16,232	15,480	12,392	3,088	752	83
Henry County, OH	11,622	10,935	8,806	2,129	687	62
Lucas County, OH	196,259	182,847	119,492	63,355	13,412	613
Ottawa County, OH	25,532	16,474	13,285	3,189	9,058	7,836
Sandusky County, OH	25,253	23,717	17,852	5,865	1,536	282
Seneca County, OH	23,692	22,292	16,751	5,541	1,400	87
Wood County, OH	47,468	45,172	31,953	13,219	2,296	206
Essex, Ontario	NA	141,300	103,125	38,170	NA	NA
Chatham-Kent, Ontario	NA	42,085	30,370	11700	NA	NA
Lambton, Ontario	NA	50,165	37,775	12,255	NA	NA
Total Region	**2,436,635**	**2,288,055**	**1,640,451**	**647,604**	**148,580**	**27,439**
State						
Michigan	4,234,279	3,785,661	2,793,124	992,537	448,618	233,922
Ohio	4,783,051	4,445,773	3,072,522	1,373,251	337,278	47,239
Canadian Units in Region/Province		233,550	171,270	62,125		

Table 2.5-39 Regional Housing Information (2000) (Sheet 2 of 2)

		Occupied Housing			Vacant Housing	
County	Total Housing Units	Total Occupied Units / Dwellings	Owner Occupied Units / Dwellings	Renter Occupied Units / Dwellings	Total Vacant Units	Seasonal, Recreational, Occasional Use
Ontario, Canada	NA	4,219,415	2,862,300	1,351,365	NA	NA

Source: Reference 2.5-65, Reference 2.5-75, Reference 2.5-76, and Reference 2.5-77

Table 2.5-40 Regional Occupied Housing Stability Characteristics (2000)*

Year Moved In	Units	Percent
1999 - 2000	340,899	17.37
1995 - 1998	545,843	27.82
1990 - 1994	313,243	15.96
1980 – 1989	311,690	15.88
1970 – 1979	215,220	10.97
1969 or earlier	235,326	11.99
Occupied Housing Units	1,962,221	

* Methodology: CBG estimating approach (see Subsection 2.5.1)

Source: Reference 2.5-65

Table 2.5-41 Change in Monroe, Wayne, and Lucas County Housing Characteristics (2000 to 2006)

	Monroe County 2000	Monroe County 2006	Percent Change	Wayne County 2000	Wayne County 2006	Percent Change	Lucas County 2000	Lucas County 2006	Percent Change
Total Housing Units	56,471	63,061	12	826,145	842,440	2	196,259	202,849	3
Occupied	53,772	58,376	9	768,440	718,160	-7	182,847	179,911	-2
Owner	43,536	47,420	9	511,837	492,485	-4	108,339	117,528	8
Renter	10,236	10,956	7	256,603	225,675	-12	63,152	62,383	-1
Vacant	2,699	4,685	74	57,705	124,280	115	13,412	22,938	71
Monthly Owner Costs (Median Dollars)									
Mortgaged	1,012	1,368	35	942	1,359	44	900	1,215	35
Non-Mortgaged	291	430	48	308	465	51	294	459	56
Renter Costs (Median Dollars)	549	695	27	530	719	36	484	594	23

Source: Reference 2.5-86 through Reference 2.5-93

Table 2.5-42 Adequacy of Structures in Regional Areas (2000)

	Occupied Housing Units	Lacking Complete Plumbing Facilities		Lacking Complete Kitchen Facilities		No Telephone Service		Greater than 1 Occupant per Room	
		Housing Units	%	Housing Units	%	Housing Units	%	Housing Units	%
Michigan	3,785,661	16,971	0.45	17,844	0.47	99,747	2.63	113,944	3.01
Ohio	4,445,773	19,407	0.44	23,805	0.54	97,917	2.20	73,499	1.65
Monroe County, MI	53,772	170	0.32	161	0.30	1,116	2.08	1,001	1.86
Wayne County, MI	768,440	5404	0.70	5,509	0.72	32,158	4.18	38,522	5.01
Jackson County, MI	58,168	193	0.33	291	0.50	1,684	2.90	1,214	2.09
Lenawee County, MI	35,930	146	0.41	131	0.36	909	2.53	672	1.87
Livingston County, MI	55,384	129	0.23	150	0.27	645	1.16	832	1.50
Macomb County, MI	309,203	753	0.24	711	0.23	4,166	1.35	7,585	2.45
Oakland County, MI	471,115	1356	0.29	1,614	0.34	5,949	1.26	11,886	2.52
St. Clair County, MI	62,072	165	0.27	244	0.39	1,527	2.46	1,035	1.67
Washtenaw County, MI	125,327	483	0.39	545	0.43	1,617	1.29	3,956	3.16
Erie County, OH	31,727	120	0.38	65	0.20	469	1.48	372	1.17
Fulton County, OH	15,480	57	0.37	42	0.27	255	1.65	219	1.41
Henry County, OH	10,935	34	0.31	28	0.26	311	2.84	169	1.55
Lucas County, OH	182,847	688	0.38	712	0.39	3,722	2.04	3,392	1.86
Ottawa County, OH	16,474	58	0.35	35	0.21	285	1.73	222	1.35
Sandusky County, OH	23,717	31	0.13	184	0.78	370	1.56	355	1.50
Seneca County, OH	22,292	113	0.51	210	0.94	606	2.72	297	1.33
Wood County, OH	45,172	90	0.20	217	0.48	554	1.23	616	1.36
Total	2,288,055	9,990	0.44	10,849	0.47	56,343	2.46	72,345	3.16

Source: Reference 2.5-65

Table 2.5-42-A Housing Information for the Fermi 3 Region Counties (Sheet 1 of 4)

MICHIGAN REGION COUNTIES	Monroe	Wayne	Oakland	Livingston	Macomb
	2007	2007	2007	2007	2007
Total housing units	63,421	839,201	524,762	72,458	352,987
Occupied units	57,333	706,198	480,262	67,027	327,470
Vacant units	6,088	133,003	44,500	5,431	25,517
Owner occupied units	46,343	483,232	367,412	57,418	260,960
Renter occupied units	10,899	222,966	112,850	9,609	66,510
Year moved in, percent					
2005 or later	25.3	24.5	25	23	23.6
2000-2004	24.8	22.5	25.2	28.7	26.8
1990-1999	25	22.4	25.4	28.5	25.3
1980-1989	9.7	11.6	12	9	10.4
1970-1979	7.7	9.6	7.1	7.8	6.8
1969 or earlier	7.5	9.4	5.3	3	7.1
Monthly Owner Costs (median)					
Mortgaged	$1,455	$1,369	$1,750	$1,716	$1,448
Non-mortgaged	$430	$466	$573	$495	$464
Renter costs	$678	$719	$829	$860	$702
Percent w/o complete plumbing	0.2	0.5	0.2	0.1	0.2
Percent w/o complete kitchen	0.2	0.5	0.3	0.0	0.3
Percent w/o telephone service	10.3	7.3	4.1	4.1	6.4
Percent with > 1 occupant / room	0.7	2.2	1.4	0.6	1.1

Table 2.5-42-A Housing Information for the Fermi 3 Region Counties (Sheet 2 of 4)

MICHIGAN REGION COUNTIES	Washtenaw	Jackson	Lenawee	St. Clair
	2007	2007	2007	2007
Total housing units	147,047	67,964	42,932	73,260
Occupied units	133,075	60,965	38,000	65,343
Vacant units	13,972	6,999	4,932	7,917
Owner occupied units	87,094	44,960	32,146	50,652
Renter occupied units	45,981	16,005	5,854	14,691
Year moved in, percent				
2005 or later	35.6	26.6	21.6	24.9
2000-2004	26.4	21.9	24.1	27.4
1990-1999	21.3	25	24.5	22.2
1980-1989	7.7	11.7	13.3	12.2
1970-1979	4.8	6.5	7.4	8.0
1969 or earlier	4.2	8.3	9.2	5.3
Monthly Owner Costs (median)				
Mortgaged	$1,817	$1,217	$1,217	$1,309
Non-mortgaged	$579	$370	$387	$433
Renter costs	$827	$664	$610	$657
Percent w/o complete plumbing	0.4	0.6	0.3	0.0
Percent w/o complete kitchen	0.5	0.5	1.1	0.4
Percent w/o telephone service	7.2	4.9	7.1	9.4
Percent with > 1 occupant / room	1.4	1.2	0.7	1.5

Table 2.5-42-A Housing Information for the Fermi 3 Region Counties (Sheet 3 of 4)

OHIO REGION COUNTIES	Wood	Lucas	Fulton	Ottawa
	2007	2007	2005-2007	2005-2007
Total housing units	51,950	203,251	17,162	26,897
Occupied units	48,917	178,773	15,841	18,125
Vacant units	3,033	24,478	1,321	8,772
Owner occupied units	34,143	119,621	12,938	14,001
Renter occupied units	14,774	59,152	2,903	4,124
Year moved in				
2005 or later	31	28.7	16.1	14.8
2000 to 2004	24.2	24	27.1	30.1
1990-1999	21	21.3	26.3	23.3
1980-1989	10.8	11.9	11.8	13.9
1970-1979	6.5	7.0	9.3	9.7
1969 or earlier	6.7	7.2	9.5	8.3
Monthly Owner Costs (median)				
Mortgaged	$1,340	$1,225	$1,220	$1,259
Non-mortgaged	$429	$452	$411	$410
Renter costs	$616	$610	$615	$662
Percent w/o complete plumbing	0.2	0.2	0.0	0.3
Percent w/o complete kitchen	0.5	0.6	0.1	0.3
Percent w/o telephone service	7.3	4.6	4.3	6.2
Percent with > 1 occupant / room	1.2	0.9	1.8	0.1

Table 2.5-42-A Housing Information for the Fermi 3 Region Counties (Sheet 4 of 4)

OHIO REGION COUNTIES	Henry	Sandusky	Seneca	Erie
	2005-2007	2005-2007	2005-2007	2005-2007
Total housing units	12,031	26,070	24,354	37,334
Occupied units	11,172	23,915	22,311	31,874
Vacant units	859	2,155	2,043	5,460
Owner occupied units	9,209	17,819	17,141	23,385
Renter occupied units	1,963	6,096	5,170	8,489
Year moved in, percent				
2005 or later	15.4	14.2	14.7	16
2000 to 2004	26.4	30.5	23	28.2
1990-1999	22.3	24.4	25.6	25.1
1980-1989	13.9	12.6	14.3	11.3
1970-1979	10.2	8.6	10.8	9.2
1969 or earlier	11.8	9.6	11.6	10.1
Monthly Owner Costs (median)				
Mortgaged	$1,049	$1,069	$974	$1,252
Non-mortgaged	$390	$377	$332	$423
Renter costs	$618	$525	$505	$626
Percent w/o complete plumbing	0.2	0.1	0.4	0.1
Percent w/o complete kitchen	0.5	0.8	0.5	0.2
Percent w/o telephone service	3.8	3.5	4.8	4.5
Percent with > 1 occupant / room	1.0	1.2	0.9	1.0

Sources: U.S. Census Bureau American FactFinder, Selected Housing Characteristics: 2007, Data Set: 2007 American Community Survey 1-Year Estimates, and Selected Housing Characteristics: 2005-2007, Data Set 2005-2007 American Community Survey 3-Year Estimates

Table 2.5-42-B Forecast of Occupied Housing Units (also Number of Households) by County, Southeast Michigan, 1990-2035

	Historical		Forecast Period				
County	**1990**	**2000**	**2010**	**2020**	**2030**	**2035**	**Avg. Annual Growth Rate, Forecast Period**
Livingston	38,887	55,382	71,662	75,478	80,870	82,789	0.58%
Macomb	264,991	309,203	345,922	359,554	380,124	390,916	0.49%
Monroe	46,508	53,772	60,772	63,307	67,709	69,388	0.53%
Oakland	410,448	471,115	503,230	521,504	555,775	573,433	0.52%
St. Clair	52,882	62,072	67,702	71,536	76,787	78,485	0.59%
Washtenaw	104,527	125,232	140,386	144,705	151,819	157,411	0.46%
Wayne	780,535	768,440	740,284	717,116	738,524	747,632	0.04%
Region	1,698,818	1,845,218	1,929,959	1,953,201	2,051,607	2,100,055	0.34%

Source: *2035 Forecast for Southeast Michigan*, April 2008, SEMCOG, Table 2. Household Change by County, Southeast Michigan, 1990-2035, p. 14

Table 2.5-42-C Mobile Home Parks in Monroe County, 2006 (Sheet 1 of 2)

Name	2001	2004	2006
Americana Mobile Home Park	122	122	122
Bennett Mobile Home Park	28	28	28
Carleton Mobile Home Park	228	228	228
Hometown Country Heritage Mobile Home Park	213	213	213
Dundee Meadows Mobile Home Park	80	80	80
Elizabeth Woods Mobile Home Park	369	369	369
Erie Mobile Home Park	20	20	20
Flat Rock Village Mobile Home Park	332	332	332
Frenchtown Villa Mobile Home Park	692	692	692
Hidden Creek Mobile Home Park	351	351	351
Holiday South Mobile Home Park	152	152	152
Inverness Mobile Home Park	518	518	518
Kimberly Estates Mobile Home Park	388	387	388
Meadowbrook Estates Mobile Home Park	455	453	455
Mill Race Shores Mobile Home Park	97	97	97
Monroe Gardens Mobile Home Park	29	29	29
Newport Farms Mobile Home Park	513	513	513
North Towne Meadows Mobile Home Park	386	386	386
Oakridge Estates Mobile Home Park	620	621	620
Oakwood Mobile Home Park	67	65	65
Pleasantville Mobile Home Park	152	152	152

Table 2.5-42-C   Mobile Home Parks in Monroe County, 2006 (Sheet 2 of 2)

Name	2001	2004	2006
Raisin Ridge Mobile Home Park	262	307	319
Shamrock Village Mobile Home Park	76	76	76
South Huron River Mobile Home Park	48	48	48
Sunny South Villa Mobile Home Park	68	68	68
The Orchards Mobile Home Park	200	393	394
Tiny Village Mobile Home Park	22	22	22
Willow Green Mobile Home Park	434	429	434
Yorkshire Manor Mobile Home Park	280	280	280
Total	**7,209**	**7,431**	**7,451**

Source: *2006, Annual Building Activities Report*, Monroe County Planning Department, Table 6.2 Authorized Manufactured Housing Communities, 2001-2006, p. 44

Table 2.5-42-D Mobile Home Parks and Sites in Southeast Michigan, 2000-2006

Area	No. of Manufactured Housing Parks		No. of Sites in Manufactured Housing Parks		Percent Change
	2000	2006	2000	2006	2000-2006
Livingston County	22	23	3,273	4,363	33.3
Macomb County	42	43	15,020	15,709	4.6
Monroe County	29	29	6,568	7,451	13.4
Oakland County	64	63	18,536	18,395	-0.8
St. Clair County	32	32	5,829	5,989	2.7
Washtenaw County	25	27	5,683	6,779	19.3
Wayne County	67	68	15,077	15,835	5.0
Southeast Michigan	281	285	69,986	74,521	6.5

SEMCOG, the Southeast Michigan Council of Governments, *Manufactured Housing Parks and Sites in Southeast Michigan, 2000-2006*, December 2006, page 3.

Table 2.5-42-E Twenty-Year History of Building Permit Activity in Southeast Michigan

Year	Total New Units	Units Demolished	Net Total Units
1989	21,567	6,980	14,587
1990	17,648	5,831	11,817
1991	14,838	4,910	9,928
1992	16,707	4,420	12,287
1993	17,289	4,219	13,070
1994	21,027	3,518	17,509
1995	20,976	7,182	13,794
1996	23,441	9,556	13,885
1997	22,112	5,988	16,124
1998	25,888	5,606	20,282
1999	22,951	6,224	16,727
2000	21,236	5,692	15,544
2001	19,620	6,009	13,611
2002	21,359	3,705	17,654
2003	23,273	2,579	20,694
2004	25,151	4,058	21,093
2005	18,400	3,434	14,966
2006	10,158	2,781	7,377
2007	5,235	2,573	2,662
2008	3,074	4,154	-1,080

SEMCOG, the Southeast Michigan Council of Governments, *Residential Construction in Southeast Michigan, 2008*, April 2009, Table 5. 20-Year History of Building Permit Activity in Southeast Michigan, page 4

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 1 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Lotus Bed & Breakfast, The	Monroe	0	Bed and Breakfast
Camp Lord Willing Management RV Park & Campground	Monroe	0	Campgrounds
Harbortown RV Park	Monroe	0	Campgrounds
Monroe County Fairgrounds	Monroe	0	Campgrounds
Wm. C. Sterling State Park	Monroe	0	Campgrounds
America's Best Value Inn & Suites	Monroe	0	Hotel/Motel
Baymont Inn & Suites - Monroe	Monroe	0	Hotel/Motel
Best Western Prestige Inn - Monroe	Monroe	0	Hotel/Motel
Comfort Inn of Monroe	Monroe	0	Hotel/Motel
Hampton Inn - Monroe	Monroe	0	Hotel/Motel
Holiday Inn Express Hotel & Suites - Monroe	Monroe	0	Hotel/Motel
Hotel Sterling	Monroe	0	Hotel/Motel
Knights Inn - Monroe	Monroe	0	Hotel/Motel
Motel 7 - Monroe	Monroe	0	Hotel/Motel
Sunset Motel	Monroe	0	Hotel/Motel
Travel Inn - Monroe	Monroe	0	Hotel/Motel
Island House Resorts at Lake Erie, Luna Pier	Luna Pier	6	Cabins and Cottages
Bedford Inn	Erie	8	Hotel/Motel
The Vine Camp & Lodge	Temperance	11	Cabins/ Campgrounds
Wilderness Campground	Dundee	13	Cabins/ Campgrounds
Country Inns & Suites-Dundee	Dundee	13	Hotel/Motel
Days Inn & Suites	Dundee	13	Hotel/Motel
Holiday Inn Express & Suites/Splash Universe Water Park Resorts	Dundee	13	Hotel/Motel
Quality Inn - Dundee	Dundee	13	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 2 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Monroe County KOA Kampground	Petersburg	15	Cabins/Campgrounds
Pirolli Park Campground	Petersburg	15	Campgrounds
Totem Pole Park	Petersburg	15	Campgrounds
Hampton Inn & Suites	Toledo (OH)	16	Hotel/Motel
Fairfield Inn & Suites - Toledo/North by Marriott	Toledo (OH)	17	Hotel/Motel
Covered Wagon Camp Resort	Ottawa Lake	18	Cabins/ Campgrounds
Comfort Inn - North	Toledo (OH)	18	Hotel/Motel
KC Campground	Milan	19	Campgrounds
Wayne County Fairgrounds	Belleville	19	Campgrounds
Comfort Inn - Belleville	Belleville	19	Hotel/Motel
Hampton Inn - Belleville	Belleville	19	Hotel/Motel
Holiday Inn Express Hotel and Suites - Belleville	Belleville	19	Hotel/Motel
Sleep Inn - Flat Rock	Flat Rock	19	Hotel/Motel
Sleep Inn - Milan	Milan	19	Hotel/Motel
Star Motel	Milan	19	Hotel/Motel
Super 8 - Belleville	Belleville	19	Hotel/Motel
The Pet Resort, Inc.	Belleville	19	Hotel/Motel
The Casey-Pomeroy House	Toledo (OH)	21	Bed and Breakfast
Best Western Woodhaven Inn	Woodhaven	22	Hotel/Motel
Holiday Inn Express Hotel and Suites - Woodhaven	Woodhaven	22	Hotel/Motel
Crowne Plaza Toledo	Toledo (OH)	22	Hotel/Motel
Park Inn Toledo	Toledo (OH)	22	Hotel/Motel
Americas Best Value Inn & Suites-Detroit Airport	Romulus	23	Hotel/Motel
Baymont Inn & Suites - Romulus	Romulus	23	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 3 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Best Western Gateway International	Romulus	23	Hotel/Motel
Clarion Hotel - Detroit Metro Airport	Romulus	23	Hotel/Motel
Comfort Inn - Metro Detroit Airport	Romulus	23	Hotel/Motel
Courtyard by Marriott - Detroit Metro Airport	Romulus	23	Hotel/Motel
Crowne Plaza Hotel - Detroit Metro Airport	Romulus	23	Hotel/Motel
Days Inn - Detroit Metro Airport	Romulus	23	Hotel/Motel
Detroit Metro Airport Hilton Suites	Romulus	23	Hotel/Motel
Detroit Metro Airport Marriott	Romulus	23	Hotel/Motel
Fairfield Inn & Suites Detroit Metro Airport Romulus	Romulus	23	Hotel/Motel
Four Points by Sheraton Detroit Metro Airport	Romulus	23	Hotel/Motel
Hilton Garden Inn - Romulus	Romulus	23	Hotel/Motel
Howard Johnson Metro Airport	Romulus	23	Hotel/Motel
LaQuinta Inn - Romulus	Romulus	23	Hotel/Motel
Lexington Hotel - Metro Airport	Romulus	23	Hotel/Motel
Metro Inn--Detroit Metro Airport	Romulus	23	Hotel/Motel
Metropolitan Hotel - Detroit airport	Romulus	23	Hotel/Motel
Quality Inn & Suites	Romulus	23	Hotel/Motel
Ramada Inn - Metro Airport	Romulus	23	Hotel/Motel
Rodeway Inn	Romulus	23	Hotel/Motel
Super 8 - Romulus	Romulus	23	Hotel/Motel
Comfort Inn East	Oregon (OH)	23	Hotel/Motel
Holiday Inn Express/Oregon	Oregon (OH)	23	Hotel/Motel
Sleep Inn & Suites	Oregon (OH)	23	Hotel/Motel
B&B Railroad Depot Bed & Breakfast	Oregon (OH)	23	Bed and Breakfast

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 4 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Maumee Bay State Park	Oregon (OH)	23	Campground
Parish House Inn	Ypsilanti	24	Bed and Breakfast
The Queen's Residence	Ypsilanti	24	Bed and Breakfast
Detroit Greenfield RV Park	Ypsilanti	24	Campgrounds
Guyton Homestead	Ypsilanti	24	Condos and Rentals
Parish House Inn	Ypsilanti	24	Historic Inns
The Queen's Residence	Ypsilanti	24	Historic Inns
Ann Arbor Marriott Ypsilanti at Eagle Crest Resort	Ypsilanti	24	Hotel/Motel
Trenton Motor Inn	Trenton	24	Hotel/Motel
Mansion View Bed & Breakfast	Toledo (OH)	24	Bed and Breakfast
Comfort Inn Westgate	Toledo (OH)	25	Hotel/Motel
Ramada Hotel & Conference Center	Toledo (OH)	25	Hotel/Motel
Red Roof Inn - Toledo Westgate	Toledo (OH)	25	Hotel/Motel
Ambassador Motel	Taylor	26	Hotel/Motel
Comfort Inn & Suites of Taylor	Taylor	26	Hotel/Motel
Ramada Inn Downriver	Taylor	26	Hotel/Motel
Red Roof Inn - Taylor	Taylor	26	Hotel/Motel
Super 8 - Taylor	Taylor	26	Hotel/Motel
Bishop Brighton Bed and Breakfast	Wyandotte	27	Bed and Breakfast
Bishop Brighton Bed and Breakfast	Wyandotte	27	Historic Inns
Comfort Inn & Suites - Maumee	Maumee (OH)	27	Hotel/Motel
Days Inn Toledo-South	Toledo (OH)	27	Hotel/Motel
Grosse Ile Pilot House	Grosse Ile	28	Historic Inns
Almar Motel of Southgate	Southgate	28	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 5 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Comfort Suites - Southgate	Southgate	28	Hotel/Motel
Days Inn - Canton	Canton	28	Hotel/Motel
Fairfield Inn - Canton	Canton	28	Hotel/Motel
Grosse Ile Pilot House	Grosse Ile	28	Hotel/Motel
Hampton Inn & Suites-Detroit/Canton	Canton	28	Hotel/Motel
Holiday Inn Express Hotel and Suites - Canton	Canton	28	Hotel/Motel
Holiday Inn Southgate - Detroit South	Southgate	28	Hotel/Motel
Hollywood Motel	Southgate	28	Hotel/Motel
La Quinta Inn - Canton	Canton	28	Hotel/Motel
Maplelawn Motel	Canton Township	28	Hotel/Motel
Motel 6 - Southgate	Southgate	28	Hotel/Motel
Super 8 - Canton	Canton	28	Hotel/Motel
Willow Acres	Canton	28	Hotel/Motel
Baymont Inn & Suites - Toledo/Northwood	Northwood (OH)	28	Hotel/Motel
Residence Inn By Marriott - Toledo/Maumee	Maumee (OH)	28	Hotel/Motel
Blissfield Bed and Breakfast	Blissfield	29	Bed and Breakfast
Hiram D. Ellis Inn	Blissfield	29	Bed and Breakfast
Blissfield Bed and Breakfast	Blissfield	29	Historic Inns
Hiram D. Ellis Inn	Blissfield	29	Historic Inns
Avon-Bungalow Motel	Inkster	29	Hotel/Motel
White House Inn Motel	Inkster	29	Hotel/Motel
Hilton Toledo	Toledo (OH)	29	Hotel/Motel
The Homestead Bed and Breakfast	Saline	30	Bed and Breakfast
The Homestead Bed and Breakfast	Saline	30	Historic Inns

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 6 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Allen Park Motor Lodge	Allen Park	30	Hotel/Motel
Best Western Greenfield Inn - Allen Park	Allen Park	30	Hotel/Motel
Holiday Inn Express and Suites at Greenfield Village	Allen Park	30	Hotel/Motel
Paradise Motel	Westland	30	Hotel/Motel
Heights Motel	Dearborn Heights	31	Hotel/Motel
Sleep Inn & Suites - Lincoln Park	Lincoln Park	31	Hotel/Motel
Maumee Bay Resort & Conference Center	Maumee (OH)	31	Hotel/Motel
932 Penniman, A Bed and Breakfast	Plymouth	32	Bed and Breakfast
Ann Arbor Bed & Breakfast	Ann Arbor	32	Bed and Breakfast
Apple and Pear Street Bed & Breakfast	Ann Arbor	32	Bed and Breakfast
Burnt Toast Inn	Ann Arbor	32	Bed and Breakfast
Cadgwith Too Bed and Breakfast	Ann Arbor	32	Bed and Breakfast
Claire's Guesthouse	Ann Arbor	32	Bed and Breakfast
Davies House in Georgetown	Ann Arbor	32	Bed and Breakfast
First Street Garden Inn	Ann Arbor	32	Bed and Breakfast
Steller House B and B	Ann Arbor	32	Bed and Breakfast
The Eighth Street Trekkers' Lodge	Ann Arbor	32	Bed and Breakfast
The Library Bed & Breakfast	Ann Arbor	32	Bed and Breakfast
Vitosha Guest Haus	Ann Arbor	32	Bed and Breakfast
Bellanina Guest House	Ann Arbor	32	Condos and Rentals
Clinton Inn	Clinton	32	Historic Inns
First Street Garden Inn	Ann Arbor	32	Historic Inns
Steller House B and B	Ann Arbor	32	Historic Inns
The Dahlmann Campus Inn	Ann Arbor	32	Historic Inns

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 7 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Vitosha Guest Haus	Ann Arbor	32	Historic Inns
A Victory Inn & Suites	Ann Arbor	32	Hotel/Motel
Bell Tower Hotel	Ann Arbor	32	Hotel/Motel
Best Western Executive Plaza - Ann Arbor	Ann Arbor	32	Hotel/Motel
Candlewood Suites - Ann Arbor	Ann Arbor	32	Hotel/Motel
Comfort Inn Plymouth Clocktower	Plymouth	32	Hotel/Motel
Comfort Inn & Suites	Ann Arbor	32	Hotel/Motel
Comfort Inn and Suites - Ann Arbor	Ann Arbor	32	Hotel/Motel
Courtyard by Marriott - Ann Arbor	Ann Arbor	32	Hotel/Motel
Days Inn - Ann Arbor	Ann Arbor	32	Hotel/Motel
Embassy Hotel	Ann Arbor	32	Hotel/Motel
Extended Stay America	Ann Arbor	32	Hotel/Motel
Extended Stay Detroit/Ann Arbor	Ann Arbor	32	Hotel/Motel
Fairfield Inn by Marriott Ann Arbor	Ann Arbor	32	Hotel/Motel
Four Points by Sheraton Ann Arbor	Ann Arbor	32	Hotel/Motel
Hampton Inn North - Ann Arbor	Ann Arbor	32	Hotel/Motel
Hampton Inn South - Ann Arbor	Ann Arbor	32	Hotel/Motel
Hawthorn Suites - Ann Arbor	Ann Arbor	32	Hotel/Motel
Hilton Garden Inn Plymouth	Plymouth	32	Hotel/Motel
Holiday Inn & Suites Ann Arbor-Boardwalk	Ann Arbor	32	Hotel/Motel
Holiday Inn Express Hotels & Suites - Ann Arbor	Ann Arbor	32	Hotel/Motel
Holiday Inn near the University of Michigan	Ann Arbor	32	Hotel/Motel
Kensington Court Hotel	Ann Arbor	32	Hotel/Motel
Lamp Post Inn	Ann Arbor	32	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 8 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Microtel Inn & Suites - Ann Arbor	Ann Arbor	32	Hotel/Motel
Motel 6 - Ann Arbor	Ann Arbor	32	Hotel/Motel
Quality Inn & Suites-Ann Arbor	Ann Arbor	32	Hotel/Motel
Red Roof Inn - Ann Arbor - University North	Ann Arbor	32	Hotel/Motel
Red Roof Inn - Plymouth	Plymouth	32	Hotel/Motel
Red Roof Inn- U of M - South - Ann Arbor	Ann Arbor	32	Hotel/Motel
Residence Inn By Marriott - Ann Arbor	Ann Arbor	32	Hotel/Motel
The Dahlmann Campus Inn	Ann Arbor	32	Hotel/Motel
The Inn at Michigan League	Ann Arbor	32	Hotel/Motel
The Inn at St. John's	Plymouth	32	Hotel/Motel
Weber's Inn	Ann Arbor	32	Hotel/Motel
Country Inn & Suites- South	Rossford (OH)	32	Hotel/Motel
Hampton Inn & Suites - Toledo Perrysburg	Rossford (OH)	32	Hotel/Motel
Dearborn Bed & Breakfast	Dearborn	33	Bed and Breakfast
The Dearborn Inn, A Marriott Hotel	Dearborn	33	Historic Inns
A Victory Inn	Dearborn	33	Hotel/Motel
Americas Best Value Inn - Detroit/Dearborn	Dearborn	33	Hotel/Motel
Courtyard by Marriott - Dearborn	Dearborn	33	Hotel/Motel
Hampton Inn - Dearborn	Dearborn	33	Hotel/Motel
Hyatt Regency Dearborn	Dearborn	33	Hotel/Motel
Metro Inn - Dearborn	Dearborn	33	Hotel/Motel
Red Roof Inn - Dearborn	Dearborn	33	Hotel/Motel
The Dearborn Inn, A Marriott Hotel	Dearborn	33	Hotel/Motel
The Ritz-Carlton, Dearborn	Dearborn	33	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 9 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
TownePlace Suites - Dearborn	Dearborn	33	Hotel/Motel
Village Inn of Dearborn	Dearborn	33	Hotel/Motel
Comfort Suites - Toledo/Perrysburg	Perrysburg (OH)	33	Hotel/Motel
Country Inn & Suites - Toledo/Maumee	Maumee (OH)	33	Hotel/Motel
Hilton Garden Inn - Toledo/Perrysburg	Perrysburg (OH)	33	Hotel/Motel
Holiday Inn Express	Perrysburg (OH)	33	Hotel/Motel
Holiday Inn French Quarter	Perrysburg (OH)	33	Hotel/Motel
Perrysburg Inn	Perrysburg (OH)	33	Hotel/Motel
Red Roof Inn - Maumee	Maumee (OH)	33	Hotel/Motel
Guesthouse Bed & Breakfast	Perrysburg (OH)	33	Bed and Breakfast
Stony Ridge KOA Kampground / East	Perrysburg (OH)	33	Campground
The Chicago Street Suite	Tecumseh	34	Bed and Breakfast
Rentalbug Vacation Rentals	Tecumseh	34	Cabins and Cottages
Indian Creek Camp & Conference Center	Tecumseh	34	Campgrounds
Best Western Laurel Park Suites - Livonia	Livonia	34	Hotel/Motel
Comfort Inn - Livonia	Livonia	34	Hotel/Motel
Courtyard by Marriott - Detroit/Livonia	Livonia	34	Hotel/Motel
Days Inn - Livonia	Livonia	34	Hotel/Motel
Detroit Marriott Livonia	Livonia	34	Hotel/Motel
Embassy Suites - Livonia	Livonia	34	Hotel/Motel
Fairfield Inn - Livonia	Livonia	34	Hotel/Motel
Hyatt Place Detroit/Livonia	Livonia	34	Hotel/Motel
Quality Inn and Suites - Livonia	Livonia	34	Hotel/Motel
Radisson Detroit-Livonia Hotel and Conference Center	Livonia	34	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 10 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Residence Inn Detroit - Livonia	Livonia	34	Hotel/Motel
Royal Motor Inn	Livonia	34	Hotel/Motel
Super 8 - Livonia	Livonia	34	Hotel/Motel
Tecumseh Inn and Suites	Tecumseh	34	Hotel/Motel
TownePlace Suites by Marriott	Livonia	34	Hotel/Motel
Courtyard By Marriott - Holland	Holland (OH)	34	Hotel/Motel
Hawthorn Suites-Toledo/Holland	Holland (OH)	34	Hotel/Motel
Knights Inn - Toledo West	Maumee (OH)	34	Hotel/Motel
Quality Inn - Holland/Toledo Airport	Holland (OH)	34	Hotel/Motel
Red Roof Inn - Holland	Holland (OH)	34	Hotel/Motel
Extended Stay America	Holland (OH)	35	Hotel/Motel
Fairfield Inn - Toledo/Maumee	Maumee (OH)	35	Hotel/Motel
Fraser Inn, The	Northville	36	Bed and Breakfast
Fraser Inn, The	Northville	36	Historic Inns
Dorchester Motel	Redford	36	Hotel/Motel
Hampton Inn - Northville	Northville	36	Hotel/Motel
Holiday Inn Express - Northville	Northville	36	Hotel/Motel
Traveler's Motor Inn	Redford	36	Hotel/Motel
StudioPLUS - Maumee	Maumee (OH)	36	Hotel/Motel
Super 8 Motel	Maumee (OH)	36	Hotel/Motel
Econo Lodge - Toledo/Maumee	Maumee (OH)	37	Hotel/Motel
Hampton Inn - Toledo/Maumee	Maumee (OH)	37	Hotel/Motel
Comfort Inn- Southwest Toledo/Maumee	Maumee (OH)	38	Hotel/Motel
Days Inn - Maumee/Toledo	Maumee (OH)	38	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 11 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Holiday Inn/ Toledo-Maumee	Maumee (OH)	38	Hotel/Motel
Motel 6	Toledo (OH)	38	Hotel/Motel
Staybridge Suites - Maumee/Toledo	Maumee (OH)	38	Hotel/Motel
Oakwood Corporate Housing	Novi	39	Condos and Rentals
Country Inn & Suites - Novi	Novi	39	Hotel/Motel
Country Meadow Motel	South Lyon	39	Hotel/Motel
Courtyard by Marriott-Novi	Novi	39	Hotel/Motel
Crown Plaza - Novi	Novi	39	Hotel/Motel
Doubletree Hotel - Detroit/Novi	Novi	39	Hotel/Motel
Fairlane Motel	Novi	39	Hotel/Motel
Hotel Baronette	Novi	39	Hotel/Motel
Residence Inn Novi	Novi	39	Hotel/Motel
Sheraton Detroit Novi	Novi	39	Hotel/Motel
Staybridge Suites-Detroit/Novi	Novi	39	Hotel/Motel
Towne Place Suites - Novi	Novi	39	Hotel/Motel
Days Inn - Swanton/Toledo Airport	Swanton (OH)	39	Hotel/Motel
Homewood Suites Hotel	Maumee (OH)	40	Hotel/Motel
Briar Oaks Inn B & B	Adrian	41	Bed and Breakfast
Dobson House Bed & Breakfast	Detroit	41	Bed and Breakfast
Inn on Ferry Street	Detroit	41	Bed and Breakfast
Murray Hill Motel	Detroit	41	Bed and Breakfast
The Inn at 97 Winder	Detroit	41	Bed and Breakfast
The Woodbridge STAR	Detroit	41	Bed and Breakfast
Camp Sequoia	Adrian	41	Cabins and Cottages

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 12 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Camp Sequoia	Adrian	41	Campgrounds
Lake Hudson Recreation Area	Adrian	41	Campgrounds
Lenawee County Fair & Event Grounds	Adrian	41	Campgrounds
Downtown Living	Detroit	41	Condos and Rentals
Over the Rainbow	Whitmore Lake	41	Condos and Rentals
Inn on Ferry Street	Detroit	41	Historic Inns
Omni Detroit Hotel River Place	Detroit	41	Historic Inns
The Inn at 97 Winder	Detroit	41	Historic Inns
The Westin Book Cadillac Detroit	Detroit	41	Historic Inns
The Woodbridge STAR	Detroit	41	Historic Inns
A Victory Inn & Suites	Detroit	41	Hotel/Motel
Atheneum Suite Hotel and Conference Center	Detroit	41	Hotel/Motel
Best Western of Whitmore Lake	Whitmore Lake	41	Hotel/Motel
Carlton Lodge	Adrian	41	Hotel/Motel
Comfort Inn - Downtown Detroit	Detroit	41	Hotel/Motel
Corktown Inn	Detroit	41	Hotel/Motel
Courtyard by Marriott - Detroit Downtown	Detroit	41	Hotel/Motel
Detroit Marriott at the Renaissance Center	Detroit	41	Hotel/Motel
DoubleTree Dearborn	Detroit	41	Hotel/Motel
Doubletree Guest Suites Fort Shelby/Detroit Downtown	Detroit	41	Hotel/Motel
Hilltop Motel	Detroit	41	Hotel/Motel
Hilton Garden Inn - Detroit Downtown	Detroit	41	Hotel/Motel
Holiday Inn Express - Adrian	Adrian	41	Hotel/Motel
Holiday Inn Express Hotel and Suites - Downtown Detroit	Detroit	41	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 13 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Hotel St. Regis	Detroit	41	Hotel/Motel
MGM Grand Detroit	Detroit	41	Hotel/Motel
Milner Hotel	Detroit	41	Hotel/Motel
Motel 6 - Adrian	Adrian	41	Hotel/Motel
MotorCity Casino Hotel	Detroit	41	Hotel/Motel
Murray Hill Motel	Detroit	41	Hotel/Motel
Omni Detroit Hotel River Place	Detroit	41	Hotel/Motel
Residence Inn By Marriott - Detroit Dearborn	Detroit	41	Hotel/Motel
Stay Inn - Downtown Detroit	Detroit	41	Hotel/Motel
Super 8 - Adrian	Adrian	41	Hotel/Motel
The Leland	Detroit	41	Hotel/Motel
The Shorecrest Motor Inn	Detroit	41	Hotel/Motel
The Westin Book Cadillac Detroit	Detroit	41	Hotel/Motel
Westin Detroit Metro Airport	Detroit	41	Hotel/Motel
Gotta-Scrap Inn	Manchester	42	Bed and Breakfast
Camp Wathana Lodge & Camp Rentals	Southfield	42	Cabins and Cottages
Evans Lake Resort	Tipton	42	Cabins and Cottages
Hideaway Cove	Tipton	42	Cabins and Cottages
Camp Wathana Lodge & Camp Rentals	Southfield	42	Campgrounds
Haas Lake Park	New Hudson	42	Campgrounds
Ja Do Campground	Tipton	42	Campgrounds
Gotta-Scrap Inn	Manchester	42	Historic Inns
Best Western Southfield Inn	Southfield	42	Hotel/Motel
Candlewood Suites	Farmington Hills	42	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 14 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Candlewood Suites - Detroit/Southfield	Southfield	42	Hotel/Motel
Comfort Inn - Farmington Hills	Farmington Hills	42	Hotel/Motel
Comfort Suites - Southfield	Southfield	42	Hotel/Motel
Courtyard by Marriott - Southfield	Southfield	42	Hotel/Motel
Courtyard by Marriott- Farmington Hills	Farmington Hills	42	Hotel/Motel
Days Inn - Southfield	Southfield	42	Hotel/Motel
Detroit Marriott Southfield	Southfield	42	Hotel/Motel
Embassy Suites Hotel Detroit - Southfield	Southfield	42	Hotel/Motel
Fairfield Inn - Farmington Hills	Farmington Hills	42	Hotel/Motel
Hampton Inn - Southfield	Southfield	42	Hotel/Motel
Hawthorne Suites - Southfield	Southfield	42	Hotel/Motel
Hilton Inn Southfield	Southfield	42	Hotel/Motel
Holiday Inn Hotel & Suites - Farmington Hills / Novi	Farmington Hills	42	Hotel/Motel
Holiday Inn Southfield	Southfield	42	Hotel/Motel
Homestead Village - Southfield	Southfield	42	Hotel/Motel
Knights Inn - Detroit/Farmington Hills	Farmington Hills	42	Hotel/Motel
Marvins Garden Inn	Southfield	42	Hotel/Motel
Plaza Hotel Southfield	Southfield	42	Hotel/Motel
Red Roof Inn - Farmington Hills	Farmington Hills	42	Hotel/Motel
SpringHill Suites - Southfield	Southfield	42	Hotel/Motel
Westin Southfield Detroit	Southfield	42	Hotel/Motel
Baymont Inn & Suites - Toledo/Maumee	Maumee (OH)	42	Hotel/Motel
Comfort Suites Detroit/ Novi- Wixom	Wixom	43	Hotel/Motel
Embassy Motel	Oak Park	43	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 15 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Rentalbug Vacation Rentals	Ferndale	45	Bed and Breakfast
Rentalbug Vacation Rentals	Ferndale	45	Cabins and Cottages
Rentalbug Vacation Rentals	Ferndale	45	Condos and Rentals
Rentalbug Vacation Rentals	Ferndale	45	Historic Inns
Lacasa Park Hotel	Hazel Park	46	Hotel/Motel
Grand Commerce Inn Bed & Breakfast	Commerce Township	47	Bed and Breakfast
Milford Guesthouse Bed and Breakfast	Milford	47	Bed and Breakfast
The Wren's Nest Bed & Breakfast	West Bloomfield	47	Bed and Breakfast
Proud Lake Recreation Area	Commerce Township	47	Cabins and Cottages
Camp Dearborn	Milford	47	Campgrounds
Proud Lake Recreation Area	Commerce Township	47	Campgrounds
The Wren's Nest Bed & Breakfast	West Bloomfield	47	Historic Inns
Hampton Inn - Detroit/Novi	Commerce Township	47	Hotel/Motel
Travelodge - Royal Oak	Royal Oak	47	Hotel/Motel
Canterbury Chateau	Brighton	48	Bed and Breakfast
Chelsea House Victorian Inn	Chelsea	48	Bed and Breakfast
Lyndon Oaks	Chelsea	48	Bed and Breakfast
Waterloo Gardens Bed & Breakfast	Chelsea	48	Bed and Breakfast
Island Lake Resort Motel	Brighton	48	Cabins and Cottages
Waterloo Recreation Area	Chelsea	48	Cabins and Cottages
Huron-Clinton Metropolitan Authority	Brighton	48	Campgrounds
Waterloo Recreation Area	Chelsea	48	Campgrounds
Barclay Inn - Birmingham	Birmingham	48	Hotel/Motel
Comfort Inn - Chelsea	Chelsea	48	Hotel/Motel

Table 2.5-42-F Accomodations within 50 miles of Monroe (Sheet 16 of 16)

Establishment	City	Miles from Monroe City	Establishment Type
Courtyard by Marriott - Brighton	Brighton	48	Hotel/Motel
Holiday Inn Express - Birmingham	Birmingham	48	Hotel/Motel
Holiday Inn Express - Chelsea	Chelsea	48	Hotel/Motel
Holiday Inn Express Hotel & Suites - Brighton	Brighton	48	Hotel/Motel
Homewood Suites by Hilton - Brighton	Brighton	48	Hotel/Motel
Island Lake Resort Motel	Brighton	48	Hotel/Motel
The Townsend Hotel	Birmingham	48	Hotel/Motel
Best Western Troy- Madison Inn	Madison Heights	49	Hotel/Motel
Econo Lodge - Madison Heights	Madison Heights	49	Hotel/Motel
Fairfield Inn - Madison Heights	Madison Heights	49	Hotel/Motel
Hampton Inn - Madison Heights	Madison Heights	49	Hotel/Motel
Knights Inn - Madison Heights	Madison Heights	49	Hotel/Motel
Radisson Kingsley Inn- Bloomfield Hills	Bloomfield Hills	49	Hotel/Motel
Red Roof Inn - Madison Heights	Madison Heights	49	Hotel/Motel
Residence Inn By Marriott - Troy/Madison Heights	Madison Heights	49	Hotel/Motel
Super 8 - Clawson	Clawson	49	Hotel/Motel

Notes:

1. All cities are located in Michigan unless otherwise psecified.
2. Reference 1-Pure Michigan, Michigan's Official Travel and Tourism Site, "Places to Stay" available online at http://www.michigan.org/Places-to-Stay/Default.aspx. Accessed on November 18, 2009.
3. Reference 2-Destination Toledo Convention and Visitors Bureau, "Accommodations," available online at http://www.dotoledo.org/gtcvb/members/display.asp?id=accommodations. Accessed on November 18, 2009.

Table 2.5-43 Data for Monroe County School Districts and Charter Schools (2005-2006 School Year)

Agency Name	City	Number of Schools	Students	Teachers	Student/ Teacher Ratio	Type
Airport Community School District	Carleton	6	3,151	158.5	19.9	Regular School District
Bedford Public Schools	Temperance	7	5,368	297.5	18.0	Regular School District
Dundee Community Schools	Dundee	4	1,704	90.1	18.9	Regular School District
Ida Public School District	Ida	3	1,740	98.5	17.7	Regular School District
Jefferson Schools (Monroe)	Monroe	6	2,408	123.1	19.6	Regular School District
Mason Consolidated Schools (Monroe)	Erie	4	1,466	98.6	14.9	Regular School District
Monroe ISD	Monroe	4	989	95	10.4	Regional District
Monroe Public Schools	Monroe	13	6,987	359.9	19.4	Regular School District
New Bedford Academy	Lambertsville	1	166	10.4	16.0	Other Education Agency
Summerfield School District	Petersburg	3	825	46	17.9	Regular School District
Triumph Academy	Monroe	1	381	14	27.2	Other Education Agency
Whiteford Agricultural Schools	Ottawa Lake	3	778	43.5	17.9	Regular School District
Total	Monroe County	55	25,963	1,435.1	18.1	NA

Source: Reference 2.5-94

Table 2.5-44 Wayne County School District Information (2005-2006 School Year) (Sheet 1 of 4)

District Name	Number of Students	Number of Schools
Detroit City School District	133,255	235
Plymouth-Canton Community Schools	18,579	26
Dearborn City School District	18,158	36
Livonia Public Schools	18,108	34
Wayne-Westland Community School District	13,946	26
Taylor School District	10,709	20
Grosse Pointe Public Schools	8,919	16
Northville Public Schools	6,978	12
Van Buren Public Schools	6,303	12
Southgate Community School District	5,753	12
Lincoln Park Public Schools	5,425	13
Woodhaven-Brownstown School District	5,398	9
Garden City School District	5,346	9
Wyandotte City School District	5,156	11
Redford Union School District	4,405	10
Romulus Community Schools	4,354	11
Allen Park Public Schools	3,699	6
Gibraltar School District	3,582	8
Highland Park City Schools	3,508	6
South Redford School District	3,423	7
Crestwood School District	3,418	5
Hamtramck Public Schools	3,309	7
Trenton Public Schools	3,112	6
Dearborn Heights School District #7	2,871	6
Melvindale-North Allen Park Schools	2,774	4
Riverview Community School District	2,612	5
Westwood Community Schools	2,498	6
Huron School District	2,388	5
Detroit Academy Of Arts And Sciences	2,380	3

Table 2.5-44 Wayne County School District Information (2005-2006 School Year) (Sheet 2 of 4)

District Name	Number of Students	Number of Schools
Grosse Ile Township Schools	2,017	4
River Rouge School District	1,993	4
Flat Rock Community Schools	1,875	5
School District Of The City Of Inkster	1,568	4
Cesar Chavez Academy	1,372	3
Summit Academy North	1,309	3
Old Redford Academy	1,251	3
Star International Academy	1,218	1
City Of Harper Woods Schools	1,216	3
Ecorse Public School District	1,170	4
Michigan Technical Academy	1,160	4
YMCA Service Learning Academy	1,119	1
Chandler Park Academy	1,110	3
University Preparatory Academy	1,098	3
Cherry Hill School Of Performing Arts	1,069	1
Edison Public School Academy	1,052	1
Plymouth Educational Center	919	1
Advanced Technology Academy	869	1
Marvin L. Winans Academy Of Performing Arts	866	1
Allen Academy	827	1
Woodward Academy	773	1
Academy For Business And Technology	712	2
Voyageur Academy	707	2
Canton Charter Academy	687	1
Warrendale Charter Academy	683	1
Detroit Merit Charter Academy	680	1
Metro Charter Academy	653	1
Detroit Community High School	649	2
Creative Montessori Academy	621	1

Table 2.5-44 Wayne County School District Information (2005-2006 School Year) (Sheet 3 of 4)

District Name	Number of Students	Number of Schools
George Washington Carver Academy	617	1
Riverside Academy	588	2
West Village Academy	571	1
Keystone Academy	567	1
Detroit Enterprise Academy	554	1
Colin Powell Academy	536	1
Detroit Premier Academy	520	1
Dearborn Academy	488	1
Hope Of Detroit Academy	482	2
Henry Ford Academy	478	1
Dove Academy Of Detroit	467	1
Hope Academy	457	1
Joy Preparatory Academy	456	2
Weston Technical Academy	456	1
Nataki Talibah Schoolhouse Of Detroit	418	1
George Crockett Academy	417	2
Life Skills Center Of Metropolitan Detroit	408	1
Thomas-Gist Academy	402	2
Hamtramck Academy	391	1
Trillium Academy	373	1
Summit Academy	372	1
Business Entrepreneurship, Science, Tech. Academy	371	1
David Ellis Academy	369	1
Blanche Kelso Bruce Academy	366	8
Pierre Toussaint Academy	359	1
Universal Academy	347	1
Academy Of Detroit-West	346	2
Bridge Academy	330	1
Marilyn F. Lundy Academy	314	1

Table 2.5-44 Wayne County School District Information (2005-2006 School Year) (Sheet 4 of 4)

District Name	Number of Students	Number of Schools
Academy Of Westland	313	1
Ross Hill Academy	311	2
Timbuktu Academy Of Science And Technology	303	1
Aisha Shule/Web Dubois Prep. School	302	1
Charlotte Forten Academy	281	1
Northpointe Academy	273	1
Commonwealth Community Devel. Academy	268	1
Gaudior Academy	261	1
M.L. King Jr. Education Center	258	1
Detroit School Of Industrial Arts	256	1
Frontier International Academy	240	1
Academy Of Inkster	239	1
Heart Academy	230	1
Hanley International Academy	206	1
American Montessori Academy	190	1
Dr. Charles Drew Academy	182	1
Center For Literacy And Creativity	161	1
Universal Learning Academy	158	1
Michigan Health Academy	148	1
Benjamin Carson Academy	147	1
Casa Richard Academy	144	1
Covenant House Life Skills Center East	111	1
Discovery Arts And Technology Psa	98	1
Covenant House Life Skills Center West	77	1
Wayne Resa	57	3
Covenant House Life Skills Center Central	0	1
Totals	359,643	700

Source: Reference 2.5-95

Table 2.5-45 Lucas County School District Information (2005-2006 School Year) (Sheet 1 of 2)

District Name	Number of Students	Number of Schools
Toledo City	30,423	58
Sylvania City	7,713	12
Washington Local	6,926	12
Anthony Wayne Local	4,249	6
Oregon City	3,929	7
Springfield Local	3,898	6
Maumee City	2,895	6
Ohio Virtual Academy	2,890	1
Alternative Education Academy	2,556	1
Ottawa Hills Local	996	2
Phoenix Academy Community School	594	1
Winterfield Venture Academy	531	1
Bennett Venture Academy	417	1
Toledo Academy Of Learning	413	1
Toledo School For The Arts	389	1
Alliance Academy Of Toledo	361	1
Academy Of Business & Tech	337	1
Lake Erie Academy	303	1
Horizon Science Academy Toledo	287	1
George A. Phillips Academy	270	1
Life Skills Center Of Toledo	265	1
Englewood Peace Academy	229	1
Glass City Academy	218	1
Paul Laurence Dunbar Academy	201	1
Aurora Academy	195	1
Wildwood Environmental Academy	181	1
Imani Learning Academy	172	1
Horizon Science Academy-Springfield	151	1
Toledo Accelerated Academy	150	1

Table 2.5-45 Lucas County School District Information (2005-2006 School Year) (Sheet 2 of 2)

District Name	Number of Students	Number of Schools
Brigadoon Academy Community School	145	1
Performing Arts School Of Toledo	123	1
Summit Academy Toledo	117	1
Polly Fox Academy Community School	114	1
Eagle Academy	112	1
Meadows Choice Community	104	1
Victory Academy Of Toledo	98	1
Summit Academy Secondary School - Toledo	73	1
M.O.D.E.L. Community School	70	1
The Autism Academy Of Learning	51	1
Lucas	N/A	5
Totals	73,146	140

Note:
"N/A" means the data are not available or not applicable

Source: Reference 2.5-96

Table 2.5-46 Revenues and Expenditures by School District in Monroe County (2004 – 2005) (Sheet 1 of 6)

		Amount ($)	Amount/Student	Percent
Airport Community School District	Total Revenue:	27,420,000	8,342	
	Revenue by Source			
	Federal:	876,000	267	3
	Local:	6,653,000	2,024	24
	State:	19,891,000	6,051	73
	Total Expenditures:	27,235,000	8,286	
	Total Current Expenditures:	25,266,000	7,687	
	Instructional Expenditures:	15,427,000	4,693	61
	Student and Staff Support:	1,780,000	542	7
	Administration:	2,870,000	873	11
	Operations, Food Service, other:	5,189,000	1,579	21
	Total Capital Outlay:	1,072,000	326	
	Construction:	454,000	138	
Bedford Public Schools	Total Revenue:	45,247,000	8,311	
	Revenue by Source	985,000	181	2
	Federal:	10,142,000	1,863	22
	Local:	34,120,000	6,267	75
	State:			
	Total Expenditures:	44,551,000	8,184	
	Total Current Expenditures:	41,270,000	7,581	
	Instructional Expenditures:	25,575,000	4,698	62
	Student and Staff Support:	3,402,000	625	8
	Administration:	4,486,000	824	11
	Operations, Food Service, other:	7,807,000	1,434	19
	Total Capital Outlay:	1,220,000	224	
	Construction:	0	0	

Table 2.5-46 Revenues and Expenditures by School District in Monroe County (2004 – 2005) (Sheet 2 of 6)

		Amount ($)	Amount/Student	Percent
Dundee Community Schools	Total Revenue:	15,727,000	9,311	
	Revenue by Source			
	Federal:	319,000	189	2
	Local:	6,493,000	3,844	41
	State:	8,915,000	5,278	57
	Total Expenditures:	15,536,000	9,198	
	Total Current Expenditures:	13,345,000	7,901	
	Instructional Expenditures:	7,793,000	4,614	58
	Student and Staff Support:	782,000	463	6
	Administration:	1,822,000	1,079	14
	Operations, Food Service, other:	2,948,000	1,745	22
	Total Capital Outlay:	761,000	451	
	Construction:	619,000	366	
Ida Public School District	Total Revenue:	14,618,000	8,445	
	Revenue by Source			
	Federal:	219,000	127	1
	Local:	2,903,000	1,677	20
	State:	11,496,000	6,641	79
	Total Expenditures:	14,930,000	8,625	
	Total Current Expenditures:	13,906,000	8,034	
	Instructional Expenditures:	8,426,000	4,868	61
	Student and Staff Support:	1,301,000	752	9
	Administration:	1,485,000	858	11
	Operations, Food Service, other:	2,694,000	1,556	19
	Total Capital Outlay:	906,000	523	
	Construction:	272,000	157	

Table 2.5-46 Revenues and Expenditures by School District in Monroe County (2004 – 2005) (Sheet 3 of 6)

		Amount ($)	Amount/Student	Percent
Jefferson Schools	Total Revenue:	23,450,000	9,192	
	Revenue by Source			
	Federal:	448,000	176	2
	Local:	14,379,000	5,637	61
	State:	8,623,000	3,380	37
	Total Expenditures:	24,184,000	9,480	
	Total Current Expenditures:	23,967,000	9,395	
	Instructional Expenditures:	14,608,000	5,726	61
	Student and Staff Support:	1,476,000	579	6
	Administration:	2,897,000	1,136	12
	Operations, Food Service, other:	4,986,000	1,955	21
	Total Capital Outlay:	38,000	15	
	Construction:	0	0	
Mason Consolidated Schools	Total Revenue:	13,731,000	9,203	
	Revenue by Source			
	Federal:	439,000	294	3
	Local:	4,856,000	3,255	35
	State:	8,436,000	5,654	61
	Total Expenditures:	14,933,000	10,009	
	Total Current Expenditures:	12,586,000	8,436	
	Instructional Expenditures:	6,712,000	4,499	53
	Student and Staff Support:	1,101,000	738	9
	Administration:	2,144,000	1,437	17
	Operations, Food Service, other:	2,629,000	1,762	21
	Total Capital Outlay:	1,325,000	888	
	Construction:	48,000	32	

Table 2.5-46 Revenues and Expenditures by School District in Monroe County (2004 – 2005) (Sheet 4 of 6)

		Amount ($)	Amount/Student	Percent
Monroe ISD	Total Revenue:	42,750,000	0	
	Revenue by Source			
	Federal:	6,232,000	0	15
	Local:	26,139,000	0	61
	State:	10,379,000	0	24
	Total Expenditures:	42,088,000	0	
	Total Current Expenditures:	28,674,000	0	
	Instructional Expenditures:	11,368,000	0	40
	Student and Staff Support:	12,363,000	0	43
	Administration:	2,682,000	0	9
	Operations, Food Service, other:	2,261,000	0	8
	Total Capital Outlay:	615,000	0	
	Construction:	205,000	0	
Monroe Public Schools	Total Revenue:	60,436,000	8,560	
	Revenue by Source			
	Federal:	2,885,000	409	5
	Local:	23,406,000	3,315	39
	State:	34,145,000	4,836	56
	Total Expenditures:	58,872,000	8,339	
	Total Current Expenditures:	54,405,000	7,706	
	Instructional Expenditures:	30,681,000	4,346	56
	Student and Staff Support:	5,140,000	728	9
	Administration:	6,551,000	928	12
	Operations, Food Service, other:	12,033,000	1,704	22
	Total Capital Outlay:	1,959,000	277	
	Construction:	1,121,000	159	

Table 2.5-46 Revenues and Expenditures by School District in Monroe County (2004 – 2005) (Sheet 5 of 6)

		Amount ($)	Amount/Student	Percent
New Bedford Academy	Total Revenue:	1,160,000	7,945	
	Revenue by Source			
	Federal:	26,000	178	2
	Local:	59,000	404	5
	State:	1,075,000	7,363	93
	Total Expenditures:	986,000	6,753	
	Total Current Expenditures:	834,000	5,712	
	Instructional Expenditures:	422,000	2,890	51
	Student and Staff Support:	14,000	96	2
	Administration:	279,000	1,911	33
	Operations, Food Service, other:	119,000	815	14
	Total Capital Outlay:	11,000	75	
	Construction:	0	0	
Summerfield School District	Total Revenue:	6,516,000	7,739	
	Revenue by Source			
	Federal:	160,000	190	2
	Local:	998,000	1,185	15
	State:	5,358,000	6,363	82
	Total Expenditures:	6,662,000	7,912	
	Total Current Expenditures:	6,364,000	7,558	
	Instructional Expenditures:	3,706,000	4,401	58
	Student and Staff Support:	583,000	692	9
	Administration:	827,000	982	13
	Operations, Food Service, other:	1,248,000	1,482	20
	Total Capital Outlay:	214,000	254	
	Construction:	5,000	6	

Table 2.5-46 Revenues and Expenditures by School District in Monroe County (2004 – 2005) (Sheet 6 of 6)

		Amount ($)	Amount/Student	Percent
Triumph Academy	Total Revenue:	2,788,000	11,333	
	Revenue by Source			
	Federal:	320,000	1,301	11
	Local:	666,000	2,707	24
	State:	1,802,000	7,325	65
	Total Expenditures:	2,754,000	11,195	
	Total Current Expenditures:	2,754,000	11,195	
	Instructional Expenditures:	926,000	3,764	34
	Student and Staff Support:	150,000	610	5
	Administration:	646,000	2,626	23
	Operations, Food Service, other:	1,032,000	4,195	37
	Total Capital Outlay:	0	0	
	Construction:	0	0	
Whiteford Agricultural Schools	Total Revenue:	6,422,000	8,276	
	Revenue by Source			
	Federal:	81,000	104	1
	Local:	1,937,000	2,496	30
	State:	4,404,000	5,675	69
	Total Expenditures:	6,599,000	8,504	
	Total Current Expenditures:	5,999,000	7,731	
	Instructional Expenditures:	3,740,000	4,820	62
	Student and Staff Support:	344,000	443	6
	Administration:	796,000	1,026	13
	Operations, Food Service, other:	1,119,000	1,442	19
	Total Capital Outlay:	132,000	170	
	Construction:	29,000	37	

Source: Reference 2.5-97

Table 2.5-47 Expenditures for Public Elementary and Secondary School Districts (2004 – 2005)

State and independent charter school districts	Median Expenditures Per Pupil				
	Current $ Expenditures		Capital Outlays ($)	Other Programs and Payments to State and Local Governments ($)	Interest on Long-Term Debt ($)
	Total	Instruction Related			
United States	9,392	5,326	398	19	136
Michigan	9,103	5,225	273	67	351
Ohio	8,687	4,948	338	113	126

Source: Reference 2.5-98

Table 2.5-48 Monroe County Recreational Facilities(Sheet 1 of 12)

		Parks		
Park Type	**Name**	**Location**	**Facilities**	**Acres**
County Parks	Heck Park	Monroe City	Vietnam Veterans Memorial and Museum, playground, pavilion, sled hill, trails, basketball, exercise court	15
	Nike Park	Frenchtown Twp.	picnic area, soccer fields, playground, model aircraft area, dog training area	80
	Vienna Park	Bedford Twp.	ball diamonds, soccer fields, natural area, picnic area, shelters, playground, disk golf course	57
	Waterloo Park	Monroe Twp.	walking path, fishing pier, river access, canoe landing, exercise court, picnic shelter	9
	West County Park	Dundee Twp.	natural habitat, river access, benches, shelters	60
	Total			**221**
State Owned Parks	Sterling State Park	Monroe/Frenchtown Twp.	Lake Erie beach, boat launch, campground, play ground, nature trails	1,300
	Petersburg State Game Area	Summerfield Twp. hunting	hunting	935
	Pointe. Mouillee State Game Area	Berlin Twp (also Wayne Co.)	hunting, fishing, shooting range, boat ramp	3,466
	Erie State Game Area	Erie Twp.	hunting, boat launch	1,519
	I-75 Rest Area	Monroe Twp.	rest rooms, picnic area, tourist information	25
	U.S.-23 Rest Area	Summerfield Twp.	rest rooms, picnic area, tourist information	28
	I-275 Rest Area	Ash Twp.	rest rooms, picnic area, tourist information	35
	Bolles Harbor Access Site	Monroe Twp.	boat launch, fishing, restrooms, parking	77
	Otter Creek Access Site	LaSalle Twp.	Lake Erie access, fishing pier, restrooms	26
	Swan Creek Access Site	Berlin Twp.	boat ramp, fishing, restrooms	2
	Total			**7,413**

Table 2.5-48 Monroe County Recreational Facilities (Sheet 2 of 12)

Parks

Park Type	Name	Location	Facilities	Acres
City & Township Parks	Ash Twp. Unity Park	Ash	proposed - ball diamonds, trail, water recreation	27.3
	Carr Park	Bedford	picnic shelter, playground, ball diamond, tennis, basketball	5.3
	Lewis Anstead Park	Bedford	undeveloped	56.0
	Parmelee Park	Bedford	nature trails, basketball, playground, picnic sites, lighted ball diamonds, tennis courts	8.8
	Samaria Park	Bedford	playground, community center building, picnic sites, trails, ball diamonds	13.2
	White Park	Bedford	playground, picnic sites, ball diamonds, exercise trail, basketball, tennis	28.1
	Ash-Carleton Park	Carleton	ball diamonds, playground, trails, picnic sites, tennis, natural area, basketball	23.1
	Rod Park	Dundee Twp.	ball diamonds, natural area	19.1
	Dundee Soccer Fields	Dundee Village	soccer fields	7.8
	Ford Park	Dundee Village	river access, picnic sites	2.9
	Triangle Park	Dundee Village	gazebo, benches	0.2
	Wolverine Park	Dundee Village	playground, basketball, tennis, horseshoes, boat ramp, fishing, picnicking, community bldg	4.0
	South Erie Park	Erie	playground, ball diamonds, picnic sites	18.1
	Frenchtown Kiwanis Park	Frenchtown	ball diamonds, playground, picnic sites, natural area	14.8
	Frenchtown Twp. Hall Park	Frenchtown	ball diamonds, playground, picnic sites, tennis courts, walking trail, sledding hill, rec. building	12.2
	Frenchtown Park #3	Frenchtown	under development - softball, soccer, playground	16.0
	Ida Twp. Park	Ida	playground, horseshoes, pathway, picnic area	10.8
	Luna Pier beach & pier	Luna Pier	fishing pier, picnic sites, Lake Erie beach	6.4
	Water Tower Park	Luna Pier	playground, ball diamond, tennis, basketball, picnic area	12.4
	Maybee Community Park	Maybee	ball diamonds, playground	10.9
	Wilson Park	Milan City	ball diamonds, trails, picnic sites, playground	24.0
	Hellenberg Park	Monroe City	ball diamonds, river access, natural area	13.0
	Loranger Square	Monroe City	picnic tables, historic site, gazebo, fountain	1.0

Table 2.5-48 Monroe County Recreational Facilities (Sheet 3 of 12)

Parks

Park Type	**Name**	**Location**	**Facilities**	**Acres**
City & Township Parks (continued)	Munson Park	Monroe City	ball diamonds, playground, soccer fields, picnic sites, sledding hill, tennis courts	240
	Navarre Field	Monroe City	ball diamonds, tennis courts, playground	8.5
	River Walk	Monroe City	riverside walking path	0.9
	Roessler Field	Monroe City	ball diamonds, river access	11.1
	St. Mary's Park	Monroe City	playground, amphitheater, picnic sites, tennis, basketball	3.4
	Veteran's Park	Monroe City	playground, river access, picnic areas	7.8
	Monroe Charter Twp. Community Park	Monroe Twp.	proposed/under development - ball diamonds, nature trail, basketball, volleyball, tennis, playground	37.0
	Perry Park	Petersburg	playground	0.4
	Fernstrom Park	Petersburg	river access, picnic sites	8.2
	Raisinville Twp.	Raisinville	undeveloped, river access, natural area	17.9
	Dodge Bros. Park	S. Rockwood	natural area, river access	25.8
	HCMA Property	S. Rockwood	natural area, river access	34.5
	LaBo Park	S. Rockwood	fishing access, picnic sites	0.4
	Village Park	S. Rockwood	ball diamonds, ice skating	10.2
	Whiteford Park	Whiteford	proposed/under development - ball diamonds, trails, soccer, fossil dig	80.0
	Total			**821.5**
Neighborhood and Subdivision Parks	Bicentennial Park	Bedford	gazebo, foot bridge	1.0
	Bridgeway	Bedford	none	2.6
	Canterbury Forest	Bedford	none	0.9
	Colonial (Cranbrook)	Bedford	playground, picnic tables	0.9
	Colonial (Middlebury)	Bedford	none	1.3
	Colonial (Ridgedale)	Bedford	none	1.2
	Colonial (Wellsley)	Bedford	none	1.2
	Cottonwood	Bedford	none	0.3
	Crosscreeks (Indian Creek)	Bedford	none	14.6

Table 2.5-48 Monroe County Recreational Facilities (Sheet 4 of 12)

Park Type	Name	Location	Facilities	Acres
			Parks	
Neighborhood and Subdivision Parks (continued)	Crosscreeks (Ryan Common Area)	Bedford	none	1.7
	Green Hills Community	Bedford	pool, clubhouse, tennis	13.4
	Hooverdale - Windingbrook	Bedford	none	8.7
	Inverness	Bedford	playground	0.7
	Jamie Park (Kimberly Oaks)	Bedford	none	4.8
	Lambert Estates	Bedford	none	1.2
	Miller Park	Bedford	play area	1.6
	Mohawk Trails	Bedford	playground, basketball	0.3
	Shenandoah Hills	Bedford	none	0.5
	Silas and Julia Smith Park	Bedford	picnic sites, basketball, playgrounds	2.1
	Tanglewood	Bedford	none	0.8
	Woodstream Acres	Bedford	none	0.8
	Northtowne Meadows	Bedford	playground, tennis court	1.6
	Valleybrook Park	Bedford	none	2.8
	Wildhaven	Bedford	none	3.2
	Carleton MHP	Carleton Village	playground	0.2
	Yorkshire Manor MHP	Carleton Village	playground	0.4
	Waterworks Park (Jaycees)	Dundee Village	playground	0.3
	Maplewood Park	Erie Twp.	playground, ball diamond, basketball, picnic area	4.1
	Morin Point Park	Erie Twp.	playground	1.6
	Bay Crest Assn.	Frenchtown	beach access	4.0
	Brest Bay Grove	Frenchtown	beach, playground, picnic	5.5
	Detroit Beach Assn.	Frenchtown	beach	2.3
	Detroit Beach Assn.	Frenchtown	playground	4.2
	Detroit Beach Assn.	Frenchtown	playground, basketball	5.4
	Detroit Beach Assn.	Frenchtown	playground, picnic shelter	7.3
	Erie Shores Assn.	Frenchtown	beach access, picnic grounds	0.7
	Erie Shores Assn.	Frenchtown	playground, picnic, basketball, ball diamond	2.1

Table 2.5-48 Monroe County Recreational Facilities (Sheet 5 of 12)

Parks

Park Type	Name	Location	Facilities	Acres
Neighborhood and Subdivision Parks (Continued)	Frenchtown Villa	Frenchtown	pool, clubhouse	0.4
	Frenchtown Villa	Frenchtown	playground	0.6
	Grand Beach Assn.	Frenchtown	playground, tennis, basketball, ball diamond, picnic	4.7
	Indian Trails Assn.	Frenchtown	ball diamond	0.6
	Indian Trails Assn.	Frenchtown	play equipment, tennis court, basketball	1.0
	Indian Trails Assn.	Frenchtown	beach access, club house	1.0
	Indian Trails Assn.	Frenchtown	playground, basketball	1.5
	Kimberly Estates	Frenchtown	pool, tennis, clubhouse	1.5
	Pleasantville	Frenchtown	basketball	5.1
	Pte. Aux Peaux Farms Assn	Frenchtown	beach access	3.2
	Pte. Aux Peaux Farms Assn	Frenchtown	play equipment, shelter, basketball, ball diamond	2.7
	Stony Pt. Beach Assn.	Frenchtown	none	0.5
	Stony Pt. Beach Assn.	Frenchtown	beach access	1.0
	Stony Pt. Beach Assn.	Frenchtown	playground, basketball	3.2
	Stony Pt. Peninsula Assn.	Frenchtown	play area, swings	5.0
	Woodland Beach Assn.	Frenchtown	playground, ball diamond	2.9
	Woodland Beach Assn.	Frenchtown	ball diamond	3.1
	Woodland Beach Assn.	Frenchtown	playground, beach	10.5
	Luna Pier Park	Luna Pier	playground	0.6
	Seventh Street Park	Luna Pier	playground, ball diamond	0.9
	Arbor/Lorain Park	Monroe City	playground	0.1
	Cairns Field	Monroe City	playground, ball diamond	4.2
	Calgary Park	Monroe City	playground, pavilion	2.0
	Cranbrook Park	Monroe City	picnic area, natural area	7.2
	Depot Square	Monroe City	none	0.1
	Hoffman Park	Monroe City	playground, picnic area	5.2
	James / Hendricks Park	Monroe City	none	2.3
	Lavender Park	Monroe City	tennis, playground, picnic	1.3
	Memorial Park	Monroe City	benches, cemetery	0.7

Table 2.5-48 Monroe County Recreational Facilities (Sheet 6 of 12)

Parks

Park Type	Name	Location	Facilities	Acres
Neighborhood and Subdivision Parks (continued)	Mill Race Park	Monroe City	river access	11
	Oak Forest Park	Monroe City	natural area	8.2
	Orchard Center	Monroe City	playground, basketball	2.6
	Plum Creek Park	Monroe City	playground. basketball, picnic area	2.0
	Rauch Park	Monroe City	playground	3.4
	Soldier & Sailors Park	Monroe City	playground, benches, shuffleboard, horseshoes	5.2
	St. Antoine's Park	Monroe City	historic site, benches	0.3
	Winston Park	Monroe City	playground, benches	0.3
	Evergreen Acres	Monroe Twp.	none	0.9
	Avalon Beach Assn. Park	Monroe Twp.	beach access, basketball	1.0
	Bolles Harbor Assn. Park	Monroe Twp.	playground, basketball, tennis, ball diamond	8.0
	Parkside	Monroe Twp.	river access	4.7
	Ravenwood	Monroe Twp.	playground, shelter	2.0
	S. Monroe Townsite	Monroe Twp.	playground, ball diamond, basketball, tennis	4.6
	Total			**233.6**

Table 2.5-48 Monroe County Recreational Facilities (Sheet 7 of 12)

Site	Location	Owner	Facilities	Acres
Pointe. Mouillee Access Site	Berlin	State of Michigan	boat launch	1.0
Swan Creek Access Site	Berlin	State of Michigan	boat launch, restrooms	1.3
Wolverine Park	Dundee Village	Village of Dundee	boat launch	4.0
Game Area	Erie	State of Michigan	boat launch	2.9
Sterling State Park	Frenchtown	State of Michigan	boat launch, docks	1,300
Luna Pier boat launch	Luna Pier	City of Luna Pier	boat launch	9.0
Public Access Site	Luna Pier	Consumers Power	fishing access	1.5
Hellenburg Park	Monroe	City of Monroe	boat launch	2.0
Bolles Harbor	Monroe Twp.	State of Michigan	boat launch, restrooms	77.1
Hoffman Mem. Pier	Monroe Twp.	Monroe Twp.	fishing pier	0.4
Waterloo Park	Monroe Twp.	Monroe County	fishing pier, canoe landing	11.3
	Total			**1410.5**

Table 2.5-48 Monroe County Recreational Facilities (Sheet 8 of 12)

Monroe County Campgrounds

Campground	Location	Modern Sites	Primitive Sites	Acres
Wilderness Retreat	Dundee Twp.	50	0	50.5
Camp Lord Willing	Frenchtown	30	36	28.2
Sterling State Park (public)	Frenchtown	256	0	1,300
KC Campground	London	50	50	20.6
Harbortown RV Resort	Monroe Twp.	250	0	30.5
Monroe Co. KOA	Summerfield	249	0	41.9
Pirolli Park	Summerfield	100	50	68.7
Totem Pole Park	Summerfield	121	0	34.6
Covered Wagon Campground	Whiteford	100	13	18.7
	Total	**1206**	**149**	**1593.7**

Table 2.5-48 Monroe County Recreational Facilities (Sheet 9 of 12)

Monroe County Marinas

Marina	Location	Boat Slips
Lake Pointe Marina	Berlin	68
Swan Boat Club	Berlin	127
Swan Yacht Basin	Berlin	29
Andrew’s Boat Dock	Erie	145
Blair’s Marina	Erie	80
Burlen’s Dock	Erie	35
Erie Bay Harbor Marina	Erie	227
Folden Marina	Erie	22
Halfway Marina	Erie	39
John Fisher’s Marina	Erie	32
JoJo’s Marina	Erie	57
Lands End Marina	Erie	32
Lost Peninsula Marina	Erie	300
River Café & Marina	Erie	6
State Line Marina	Erie	141
T & L Marine	Erie	10
Tom’s Boat Dock	Erie	39
Estral Beach Island Marina	Estral Beach	69
Brest Bay Marina	Frenchtown	358
Detroit Beach Boat Club	Frenchtown	94
Lighthouse Harbor Marina	LaSalle	177
North Cape Yacht Club	LaSalle	150
Otter Creek Marina	LaSalle	75
Toledo Beach Marina	LaSalle	555

Table 2.5-48 Monroe County Recreational Facilities (Sheet 10 of 12)

Monroe County Marinas

Marina	Location	Boat Slips
Luna Pier Harbour Club	Luna Pier	392
Roe’s Riverside Bait & Tackle	Monroe City	14
Riverfront Marina	Monroe City	155
Mooner’s Marina	Monroe City	34
Charlie's Boat & Bait	Monroe Twp.	50
Clarks Landing	Monroe Twp.	24
Erie Party Shoppe & Docks	Monroe Twp.	70
Harbor Marine	Monroe Twp.	20
Monroe Boat Club	Monroe Twp.	88
Monroe Marina	Monroe Twp.	42
OPM Club	Monroe Twp.	28
Trout’s Yacht Basin	Monroe Twp.	94
LaPlaisance Creek Marina	Monroe Twp.	68
	Total	**3,946**

Table 2.5-48 Monroe County Recreational Facilities (Sheet 11 of 12)

Shooting Ranges and Sportsmen's Club

Range/Club	Township
Southern Mich. Sportsmen’s Club	Bedford Twp.
Dundee Sportsman’s Club	Dundee Twp.
Mudjaw Bowman Lodge	Erie Twp.
Carleton Sportsmen’s Club	Exeter Twp.
Century Gun Club	Exeter Twp.
East Rockwood Sportsman’s Club	Exeter Twp.
Brest Bay Sportsman’s Club	Frenchtown Twp.
London Sportsmen Rod & Gun Club	London Twp.
Maybee Sportsmen’s Club	London Twp.
Sexy Pheasant Hunting Preserve	Milan Twp.
Monroe Rod & Gun Club	Monroe Twp.
Monroe Rifle & Pistol Club	Raisinville Twp.
Canvasback Gun Club	Raisinville Twp.
Ottawa Lake Sportsman’s Club	Whiteford Twp.

Table 2.5-48 Monroe County Recreational Facilities (Sheet 12 of 12)

Miscellaneous Recreational Facilities

Facility	Location	Description	Acres
Flat Rock Speedway	Ash Twp.	race track	32
VFW Post 4093	Ash Twp.	ball diamonds, picnic shelter	8
Brookwood Swim Club	Bedford Twp.	private swim club	5
Douglas Meadows Stables	Bedford Twp.	private stables	21
Forestview Lanes	Bedford Twp.	bowling, volleyball	9
Howard's Riding Academy	Bedford Twp.	private stables	11
Hunter's Run Riding Stables	Bedford Twp.	private stables	50
Lambertville Civic Club	Bedford Twp.	sports fields, clubhouse	8
Soda Park	Bedford Twp.	ball diamonds	20
Windsong Stables	Bedford Twp.	private stables	17
Fireman's Park	Berlin Twp.	picnic area, shelter	7
	Total		188

Source: Reference 2.5-12

Table 2.5-49 List of Recreation and Lodging Facilities within a 10-mi Radius (Sheet 1 of 3)

County	Type	Township	Facility Name	Compass Direction from Fermi	Distance (miles) From Fermi	Period of Operation
Monroe	Golf Course	Ash	Carleton Glen Golf Club	NW	9.75	Summer
Monroe	Race Track	Ash	Flat Rock Speedway	NNW	8.5	Summer
Monroe	Park	Berlin	Berlin Twp. Park	NNW	4.12	Summer
Monroe	Golf Course	Berlin	Lilac Golf Course	NNW	3.23	Summer
Monroe	Park	Berlin	Pointe Mouille State Game Area	NE	5.5	Yr. Round
Monroe	Marina Aquatic	Berlin	Swan Yacht Basin	NNW	1.39	Summer
Monroe	Golf Course	Berlin	Wesburn Golf Course	N	7.51	Summer
Monroe	Marina/ Aquatic	Frenchtown	Brest Bay Marina	SW	2.42	Yr. Round
Monroe	Camp Grounds	Frenchtown	Camp Lord Willing	W	7.09	Yr. Round
Monroe	Park	Frenchtown	Heck Park	WSW	6.2	Summer
Monroe	Park	Frenchtown	Munson Park	WSW	9.49	Summer
Monroe	Historic Site	Frenchtown	Navarre-Anderson Trading Post	WSW	10.6	Yr. Round
Monroe	Park	Frenchtown	Nike Park	WNW	6.5	Summer
Monroe	Golf Course	Frenchtown	Old Town Golf and Sportland	W	5.98	Summer
Monroe	Golf Course	Frenchtown	Raisin River Golf Club	WSW	5.66	Summer
Monroe	Golf Course	Frenchtown	Sandy Creek Golf Course	W	8.7	Summer
Monroe	Park	Frenchtown	Sterling State Park	SW	5.18	Summer
Monroe	Park	Monroe	Hellenburg Park	WSW	7.26	Summer
Monroe	Golf Course	Monroe	Monroe Golf and Country Club	WSW	6.36	Summer
Monroe	Marina/ Aquatic	Monroe	Riverfront Marina	WSW	7.1	Summer
Monroe	Park	Monroe	Veteran’s Park	WSW	8.6	Summer
Monroe	Marina/ Aquatic	Monroe Twp.	Bolles Harbor	SW	9.1	Summer

Table 2.5-49 List of Recreation and Lodging Facilities within a 10-mi Radius (Sheet 2 of 3)

County	Type	Township	Facility Name	Compass Direction from Fermi	Distance (miles) From Fermi	Period of Operation
Monroe	Marina/ Aquatic	Monroe Twp.	Erie Party Shoppe & Docks	SW	9.24	Yr. Round
Monroe	Lodging	Monroe Twp.	Harbortown RV Resort	SW	8.73	Summer
Monroe	Marina/ Aquatic	Monroe Twp.	Harbor Marine	SW	9.14	Summer
Monroe	Golf Course	Monroe Twp.	Links at Lake Erie	SW	8.91	Summer
Monroe	Marina/ Aquatic	Monroe Twp.	Miller Boat Livery	SW	9.24	Summer
Monroe	Fairgrounds	Monroe Twp.	Monroe County Fairgrounds	WSW	10.65	Yr. Round
Monroe	CampGrounds	Monroe Twp.	Sunny South Villa	WSW	9.87	Summer
Monroe	Marina/ Aquatic	Monroe Twp.	Trout's Yacht Basin	SW	10.16	Summer
Monroe	Park	Monroe Twp.	Waterloo Park	WSW	9.1	Summer
Wayne	Park	Brownstown	Lake Erie Metropark	NNE	7.87	Yr. Round
Wayne	Marina/ Aquatic	Gibraltar	Humbug Marina Inc.	NNE	9.79	Summer
Wayne	Marina/ Aquatic	Gibraltar	Island Marina	NNE	9.3	Summer
Wayne	Park	Rockwood	Mercure Park	N	7.56	Summer
Monroe	Lodging	Frenchtown	Cross Country Inn	WSW	5.53	Yr. Round
Monroe	Lodging	Frenchtown	Hampton Inn	WSW	5.65	Yr. Round
Monroe	Lodging	Frenchtown	Hometown Inn	WSW	5.53	Yr. Round
Monroe	Lodging	Frenchtown	Travel Inn	WSW	5.69	Yr. Round
Monroe	Lodging	Monroe	Knights Inn	WSW	6	Yr. Round
Monroe	Lodging	Monroe	Holiday Inn Express Hotel & Suites	WSW	6.14	Yr. Round
Monroe	Lodging	Monroe	Sunset Motel	WSW	8.25	Yr. Round
Monroe	Lodging	Monroe Twp.	Amerihost Inn	SW	8.87	Yr. Round
Monroe	Lodging	Monroe Twp.	Comfort Inn	SW	9.33	Yr. Round

Table 2.5-49 List of Recreation and Lodging Facilities within a 10-mi Radius (Sheet 3 of 3)

County	Type	Township	Facility Name	Compass Direction from Fermi	Distance (miles) From Fermi	Period of Operation
Monroe	Lodging	Monroe Twp.	Hollywood Motel	WSW	9.19	Yr. Round
Monroe	Lodging	Monroe Twp.	I-75 Rest Area	SW	10.21	Yr. Round
Monroe	Lodging	Monroe Twp.	Motel Seven	WSW	9.52	Yr. Round
Wayne	Lodging	Flat Rock	Seaway Motel	N	10.12	Yr. Round
Wayne	Lodging	Flat Rock	Sleep Inn	N	9.06	Yr. Round

Source: Reference 2.5-99

Table 2.5-50 Township Zoning Reviews By Requested District (2004)

Township	Total Cases	Agriculture	Rural Estate	Single Family	Multi-Family	Mobile Home	PBO	Commercial	Freeway Service	PUD	Text
Ash	7		2	2				2	1		
Bedford	10			5	1	1	1			1	2
Berlin	8			5						1	2
Dundee	3							1			2
Erie	2										2
Exeter	2										2
Frenchtown	14			3		1		6			4
Ida	4										4
LaSalle	2										2
London	2	2									
Milan	4	1									3
Monroe	3			2							1
Raisinville	3	2									1
Summerfield	1							1			
Whiteford	3			1				1			1
Total*	68	5	2	18	1	2	1	11	1	2	26

Note: Discrepancies in some totals are due to multiple-district rezoning requests
Source: Reference 2.5-31

Table 2.5-51 Land Use and Change for Frenchtown Township, Monroe County, and Wayne County (2000)

Land Use / Land Cover (in acres)	Frenchtown Township Acreage	%	Change 1990-2000	%	Monroe County Acreage	%	Change 1990-2000	%	Wayne County Acreage	%	Change 1990-2000	%
Residential	5,373	19.3	993	22.7	53,028	14.8	9,778	22.6	159,966	40.5	7,307	4.8
Single-Family	5,239	18.8	950	22.2	52,564	14.6	9,675	22.6	149,807	38.0	6,769	4.7
Multiple-Family	134	0.5	42	46.1	463	0.1	102	28.3	10,160	2.6	538	5.6
Non-Residential	3,752	13.5	594	18.8	20,500	5.7	3,714	22.1	109,873	27.8	8,471	8.4
Commercial and Office	639	2.3	95	17.5	3,049	0.8	735	31.8	23,547	6.0	1,811	8.3
Industrial	413	1.5	312	308.4	3,012	0.8	878	41.1	26,168	6.6	2,728	11.6
Institutional	389	1.4	32	9.1	1,915	0.5	200	11.6	17,100	4.3	845	5.2
Transportation, Communication, and Utility	1,250	4.5	-17	-1.3	6,991	1.9	446	6.8	24,004	6.1	1,583	7.1
Cultural, Outdoor Recreation, and Cemetery	1,059	3.8	171	19.2	5,533	1.5	1,455	35.7	19,054	4.8	1,504	8.6
Under Development	178	0.6	150	544.3	910	0.3	741	438.3	5,338	1.4	3,775	241.4
Active Agriculture	14,111	50.8	-1,838	-11.5	223,332	62.2	-17,029	-7.1	25,844	6.5	-20,338	-44.0
Grassland and Shrub	957	3.4	111	13.1	12,322	3.4	2,385	24.0	27,499	7.0	-4,155	-13.1
Woodland and Wetland	2,618	9.4	118	4.7	39,442	11.0	-175	-0.4	49,701	12.6	1,325	2.7
Extractive and Barren	0	0.0	0	-	2,435	0.7	1,032	73.5	2,208	0.6	488	28.4
Water	808	2.9	-128	-13.7	7,338	2.0	-445	-5.7	4,152	1.1	339	8.9
Total Acres	27,797	100.0	0	0.0	359,308	100.0	0	0.0	394,651	100.0	0	0.0

Source: Reference 2.5-100 and Reference 2.5-101

Table 2.5-52 Frenchtown Township Water System Pumpage (1995-2001)

Year	Average Day Demand (Millions of Gallons per Day)	Percent Increase	Maximum Day Demand (Million of Gallons per Day)
1995	1.53	-	3.03
1996	1.63	6.5	3.03
1997	1.66	1.8	2.47
1998	1.91	15.1	3.88
1999	2.07	8.4	3.49
2000	1.97	-4.8	3.38
2001	2.10	6.6	3.73

Source: Reference 2.5-11

Table 2.5-53 Monroe County Fire Departments (Sheet 1 of 2)

	Type	Run By	Fire Stations	Career Firefighters	Volunteer Firefighters	Paid per Call Firefighters	Non-Firefighting Employees	Non-Firefighting Volunteers
Ash Township Volunteer Fire Department	Volunteer	Local	2	0	40	0	0	0
Bedford Fire Department #2	Volunteer	Local	1	0	30	0	0	0
Berlin Township Fire Department #2	Volunteer	Local	1	0	0	23	0	0
Dundee Township Fire Department	Volunteer	Local	1	0	28	0	0	0
Erie Township Fire Department	Volunteer	Local	1	0	22	0	0	0
Estral Beach Fire Department	Volunteer	Local	1	0	0	15	0	0
Exeter Fire Department	Volunteer	Local	1	0	26	0	0	0
Frenchtown Township Fire Department	Mostly Career	Local	4	22	0	17	1	0
LaSalle Township Volunteer Fire Department	Volunteer	Local	1	0	0	0	0	0
London - Maybee – Raisinville	Volunteer	Local	1	0	21	0	0	0
Milan Area Fire Department	Volunteer	Local	1	0	0	36	1	0
Monroe City Fire Department	Career	Local	3	41	0	0	0	0
Monroe Township Volunteer Fire Department	Volunteer	Local	1	0	0	27	1	0
Morin Point Fire Department	Volunteer	Local	1	0	29	0	0	3
Ottawa Lake Volunteer Fire Department	Volunteer	Local	1	0	22	0	0	0
Summerfield Township Volunteer Fire Department	Volunteer	Local	1	0	0	26	0	0

Table 2.5-53 Monroe County Fire Departments (Sheet 2 of 2)

	Type	Run By	Fire Stations	Career Firefighters	Volunteer Firefighters	Paid per Call Firefighters	Non-Firefighting Employees	Non-Firefighting Volunteers
Whiteford Township Volunteer Fire Department	Volunteer	Local	0	0	22	0	0	0
Total			**22**	**63**	**240**	**144**	**3**	**3**

Source: Reference 2.5-102

Table 2.5-54 Primary Regional Hospitals and Health Care Facilities (Sheet 1 of 2)

Wayne County Area (Excluding Detroit)		
Facility's Name	**Address**	**Phone Number**
Annapolis Hospital	33155 Annapolis Rd, Wayne	734-467-4000
Bon Secours Hospital	468 Cadieux Rd, Grosse Pointe	313-343-1501
Garden City Osteopathic Hospital	6245 N. Inkster Rd, Garden City	734-421-3300
Heritage Hospital	10000 Telegraph Rd, Taylor	313-295-5000
Oakwood Hospital	18101 Oakwood Blvd, Dearborn	313-593-7000
Redford Community Hospital	25210 Grand River Ave, Redford	313-531-6200
Seaway Hospital	5450 Fort St, Trenton	313-671-3800
Vencor Hospital-Detroit	26400 W. Outer Dr, Lincoln Park	313-386-2000
Annapolis Westland Center	2345 Merriman Rd, Westland	734-467-2300
Cottage Hospital	159 Kercheval Ave, Grosse Pointe Farms	313-884-8600
Henry Ford Wyandotte Hospital	2333 Biddle Ave, Wyandotte	313-284-2400
Oakwood Downriver Medical Center	25750 W. Outer Dr, Lincoln Park	313-383-6000
Oakwood Springwells Health Center	10151 Michigan Ave, Dearborn	313-436-2400
St. Mary Hospital	35475 Five Mile Rd, Livonia	734-464-4800
VA Medical Center	3415 Southfield Rd, Allen Park	313-562-6000
Detroit		
Children's Hospital of Michigan	3901 Beaubien St, Detroit	313-745-0073
Detroit Receiving Hospital	4201 St. Antoine, Detroit	313-745-3000
Grace Hospital	6071 W. Outer Dr, Detroit	313-966-3300
Harper Hospital	3990 John Rd, Detroit	313-745-9375
Hutzel Hospital	4707 St. Antoine, Detroit	313-745-7171
Rehabilitation Institute	261 Mack, Detroit	313-745-9700
Detroit Riverview Hospital	7733 E. Jefferson Ave, Detroit	313-499-3000
Henry Ford Health System	600 Fisher Building, Detroit	313-876-8700
Henry Ford Health System	1 Ford Place, Detroit	313-874-5005
Henry Ford Hospital	2799 W. Grand Blvd, Detroit	313-876-2600
Holy Cross Hospital	4777 E. Outer Dr, Detroit	313-369-9100

Table 2.5-54 Primary Regional Hospitals and Health Care Facilities (Sheet 2 of 2)

Wayne County Area (Excluding Detroit)

Facility's Name	Address	Phone Number
Mercy Hospital	5555 Conner, Detroit	313-579-4210
Michigan Health Center	2700 Martin Luther King Dr, Detroit	313-361-8000
St. John Hospital & Medical Center	22101 Moross Rd, Detroit	313-343-7310
Michigan Health Care Corp	7430 Second Ave, Detroit	313-874-9110
Mount Carmel Mercy Hospital	6071 W. Outer Dr, Detroit	313-927-7000
Saratoga Community Hospital	15000 Gratiot, Detroit	313-245-1200
	Toledo	
St. Vincent Mercy Medical Center	2213 Cherry St, Toledo	419-251-3232
Mercy Children's Hospital	2222 Cherry St, Toledo	419- 251-8000
St. Anne Mercy Hospital	3404 W. Sylvania Ave, Toledo	419- 407-2663
St. Charles Mercy Hospital	2600 Navarre Ave, Toledo	419- 696-7200
The Toledo Hospital	2142 N. Cove Blvd, Toledo	419- 291-4000
Toledo Children's Hospital	2142 N. Cove Blvd, Toledo	419- 291-5437
Flower Hospital	5200 Harroun Rd, Toledo	419- 824-1444
Bay Park Community Hospital	2801 Bay Park Dr, Toledo	419- 690-7900
Saint Luke's Hospital	5901 Monclova Rd, Toledo	419- 893-5911
Medical University of Ohio	3000 Arlington Ave, Toledo	419- 383-4000
Hospice of Northwest Ohio	30000 E. River Rd, Toledo	419- 661-4001
Hospice of Northwest Ohio	800 S. Detroit Ave, Toledo	419- 661-4001

Source: Reference 2.5-103 and Reference 2.5-104

Table 2.5-55 Frenchtown Township and Monroe County Commuter and Resident Destination Table (2000) (Sheet 1 of 2)

	Frenchtown Township			Monroe County		
		Workers	Percent		Workers	Percent
Origin of Workers Employed in Frenchtown Township and Monroe County	Frenchtown Township	1,838	24.8	Monroe County	35,202	72.5
	Monroe	1,520	20.5	Lucas County, OH	4,456	9.2
	Monroe Township	779	10.5	Wayne County	4,111	8.5
	La Salle Township	301	4.1	Washtenaw County	1,085	2.2
	Raisinville Township	261	3.5	Lenawee County	1,074	2.2
	Lucas County, OH	257	3.5	Oakland County	565	1.2
	Bedford Township	244	3.3	Wood County, OH	384	0.8
	Ash Township or Carleton	193	2.6	Macomb County	235	0.5
	Berlin Township (Monroe), Estral Beach, or South Rockwood	181	2.4	Fulton County, OH	122	0.3
	Exeter Township or Maybee	143	1.9	Jackson County	115	0.2
	Elsewhere	1,696	22.9	Elsewhere	1,177	2.4
	Total	7,413	100.0	**Total**	48,526	100.0

Table 2.5-55 Frenchtown Township and Monroe County Commuter and Resident Destination Table (2000) (Sheet 2 of 2)

	Frenchtown Township			Monroe County		
		Workers	Percent		Workers	Percent
Where Residents of Frenchtown Township and Monroe County Work	Monroe	2,276	23.9	Monroe County	35,202	51.1
	Frenchtown Township	1,838	19.3	Lucas County, OH	12,654	18.4
	Monroe Township	635	6.7	Wayne County	12,161	17.7
	Detroit	381	4.0	Washtenaw County	4,587	6.7
	Ash Township or Carleton	329	3.5	Oakland County	1,256	1.8
	Romulus	286	3.0	Lenawee County	817	1.2
	Dearborn	261	2.7	Wood County, OH	778	1.1
	Berlin Township (Monroe), Estral Beach, or South Rockwood	241	2.5	Macomb County	369	0.5
	Lucas County, OH	240	2.5	Livingston County	132	0.2
	Trenton	215	2.3	Fulton County, OH	87	0.1
	Elsewhere	2,816	29.6	Elsewhere	792	1.2
	Total	**9,518**	**100.0**	**Total**	**68,835**	**100.0**

Source: Reference 2.5-48 and Reference 2.5-49

Table 2.5-56 Transportation Profile for Frenchtown Township & Monroe County (2000)

	Frenchtown Township					Monroe County				
Transportation to Work	**Census 1990**	**Percent**	**Census 2000**	**Percent**	**Percent Change 1990-2000**	**Census 1990**	**Percent**	**Census 2000**	**Percent**	**Percent Change 1990-2000**
Drove Alone	6,843	87.0%	8,381	87.9%	1.0%	50,793	85.4%	60,671	88.1%	2.8%
Carpooled or Vanpooled	771	9.8%	826	8.7%	-1.1%	5,780	9.7%	5,627	8.2%	-1.5%
Public Transportation	31	0.4%	45	0.5%	0.1%	187	0.3%	285	0.4%	0.1%
Walked	92	1.2%	110	1.2%	-0.0%	1,149	1.9%	704	1.0%	-0.9%
Other Means	44	0.6%	47	0.5%	-0.1%	381	0.6%	289	0.4%	-0.2%
Worked at Home	88	1.1%	121	1.3%	0.2%	1,202	2.0%	1,259	1.8%	-0.2%
Total	7,869	100.0%	9,530	100.0%	0.0%	59,492	100.0%	68,835	100.0%	0.0%

Source: Reference 2.5-48 and Reference 2.5-49

Table 2.5-57 Michigan Department of Transportation Scheduled Projects in Monroe County (2008-2012)

Route	Location	Type of Work	2008	2009	2010	2011	2012
I-275	I-275 SB over Telegraph Road (US-24)	Overlay-Deep	Con				
I-275	I-275 NB over Telegraph Road (US-24)	Overlay-Deep	Con				
I-275 SB	I-275 SB (RAMP) over I-75	Overlay-Deep			Con		
I-75	South Huron river Drive over I-75	Bridge Replacement	Con				
I-75	Sterns Road over I-75	Bridge Replacement		Con			
I-75	I-75 NB over Plum Creek	Overlay-Deep			Con		
I-75	I-75 SB over Plum Creek	Overlay-Deep			Con		
I-75	I-75 over Industrial Tracks	Overlay-Deep			Con		
I-75	I-75 over Conrail Industrial tracks	Overlay-Deep			Con		
I-75	LaPlaisance Road over I-75	Overlay-Shallow			Con		
I-75	I-75 over Huron River	Bridge Replacement	Con				
US-24	US-24 over Little Sandy Creek	Culvert Replacement			Con		

Con-Construction (refers to actual building phase of project)

Source: Reference 2.5-105

Table 2.5-58 Proposed Transportation Projects within Monroe County (Sheet 1 of 2)

Project Name	Project Limits	Proposed Work	Legal Jurisdiction	First year of Project
Beaches and Tripper	Frenchtown Twp	Operate new bus service	LETC	2008
New Bedford dial-a-ride	Bedford Twp	Operate new service	LETC	2008
I-75	under South River Drive	Replace bridge	MDOT	2008
I-275	2 bridge locations in Monroe County	Deep overlay	MDOT	2008
I-275	under Newport Rd	Bridge deck patching	MDOT	2008
I-75	over Huron River	Replace bridge	MDOT	2008
Seventh Street W	Union to Monroe	Curb replacement and resurfacing	Monroe	2008
Cooper Street	from 7th to Front St	Reconstruct	Monroe	2008
N Custer	at Custer Drive	Signalize intersection	Monroe	2008
E Front St	from Conant to I-75	Resurface	Monroe	2008
Sterns Road	Lewis Avenue to U.S. 24	Rehabilitate roadway	Monroe CRC	2008
Lakeside	From Strausburg to Minx	Rubblizing and resurfacing	Monroe CRC	2008
Various Roads	Countywide	Rehabilitate roadway	Monroe CRC	2008
Various Rural Roads	Countywide	Rehabilitate roadway	Monroe CRC	2008
Various Roads	Countywide	Rehabilitate roadway	Monroe CRC	2008
Lewis Avenue	from 1,100' N of Sterns to Ann Arbor Railroad track	Resurface road	Monroe CRC	2008
Wilcox Rd	at S Branch of Nacon Drain	Rehabilitate bridge	Monroe CRC	2008
Petersburg Rd	over Raisin River	Rehabilitate bridge	Monroe CRC	2008
Brewer Rd	at Swamp Raisin Ck	Rehabilitate bridge	Monroe CRC	2008
Newport Rd	Joanne to Swan Creek Rd	Add center left-turn lane	Monroe CRC	2008
US-24	over Sandy Creek	Replace bridge	MDOT	2009

Table 2.5-58 Proposed Transportation Projects within Monroe County (Sheet 2 of 2)

Project Name	Project Limits	Proposed Work	Legal Jurisdiction	First year of Project
I-75	Sterns Road over I-75	Bridge Replacement	MDOT	2009
E Third St	from Front to Monroe	Rehabilitate roadway	Monroe	2009
Custer Dr	from N Custer to W Elm	Rehabilitate roadway	Monroe	2009
Bedford Urban Preservation	Various locations	Rehabilitate roadway	Monroe CRC	2009
Finzel Rd	at Stoney Creek Overflow	Rehabilitate bridge	Monroe CRC	2009
I-75	5 Bridges along I-75	Rehabilitate bridges	MDOT	2010
I-275 SB	over I-75	Rehabilitate roadway	MDOT	2010
W Seventh St	from Telegraph to Union	Rehabilitate roadway	Monroe	2010
Scott St	from Sixth to Front	Rehabilitate roadway	Monroe	2010
E First St	from Winchester to Conant	Rehabilitate roadway	Monroe	2010
N Custer	at Custer	Install signal	Monroe	2010
N Custer	at de Lafayette	Install signal	Monroe	2010
Sumpter Rd	from Oakville Waltz to Colf	Pavement patching	Monroe CRC	2010
US-24	from Stewart Road to Mall	Rehabilitate roadway	MDOT	2011
E Elm	from Monroe to N Dixie	Rehabilitate roadway	Monroe	2011
N Dixie	from Elm to Spaulding	Rehabilitate roadway	Monroe	2011
Oakville Waltz Preservation	Various lengths	Rehabilitate road	Monroe CRC	2011

Table 2.5-59 Minor Airports

Name	Location	Aircraft Based on Site	Distance from Fermi Site (Miles)	Direction from Fermi Site
Newport Woods Airport	Newport, Michigan	5	3	NW
Mills Field	Erie, Michigan	3	3	N
Carls Airport	South Rockwood, Michigan	-	6	NNW
Wickenheiser Airport	Carleton, Michigan	3	7	NW
Custer Airport	Monroe, Michigan	39	9	W
Gross Ile Municipal Airport	Detroit/Gross Ile, MI	88	11	NNE
Erie Aerodrome	Erie, Michigan	4	18	SW
Toledo Suburban Airport	Lambertville, Michigan	34	25	SW
Gradolph Field Airport	Petersburg, Michigan	2	25	W

Source: Reference 2.5-106 through Reference 2.5-114

Table 2.5-60 Regional Ports

	Company	Berths	Depth (feet)	Length (feet)
Port of Monroe		1	18	1,000
		1	21	1,500
Port of Detroit	DSC Ltd.	1	26.5 (Seaway Depth)	900
	Detroit marine Terminals	-	27 (Seaway depth)	2,100
	Nicholson Terminal and Dock Company	-	27 (Seaway depth)	3,400
	Michigan Marine Terminal: Rouge River	1	Seaway depth	650
	Hickman Williams and Company	1		
	Motor City Intermodal Distributio	1	28 (Seaway depth)	500
Port of Toledo	The Andersons, Kuhlman Drive facility	1	28	1,000
	ADM Grain Company	2	28	800
	The Andersons, Edwin Drive Facility	1	28	1,030
	CSX Transportation/Toledo Docks	4	27	1,000 to 1,500
	Midwest Terminals of Toledo International	7	28	4,100
	Kuhlman Corporation	1	28	600 +

Table 2.5-60 Regional Ports

	Company	Berths	Depth (feet)	Length (feet)
Port of Windsor	Canadian Salt Company	T dock	26	730
	Windsor grain Terminal: ADM-Agri Industries	1	29	1,300
	Modern Limited	1 plus 1 wharf	Full Seaway Depth	2,400
	Canadian Maritime Ltd.	Drive on/off truck ferry ramps	-	-
	Southwestern Sales West Location	1	Full Seaway Depth	1,400
	Sterling	1	27	1,000
	Marine Fuels	-	27	1,000
	Canada Building Materials	-	Full Seaway Depth	736
	LaFrage Construction Materials	-	Full Seaway Depth	1,100
	Dieppe Dock	-	-	1,200
	Ford Motor Company Dock	-	-	1,800
	Southwestern Sales East Location	-	Full Seaway Depth	700
	Essroc Italcementi Group and the Dunn Group	-	26	1,000

Source: Reference 2.5-115 through Reference 2.5-118

Table 2.5-61 Monroe County Tourist Attractions

Name/address	Brief Description
Eby Log Cabin Monroe County Fairgrounds Monroe, MI 48161	A wood log cabin constructed by Alsace emigrants John and Elizabeth Eby and family, in 1859.
Farmer Charlie's Maze Adventures & Haunted Hayride 6421 N. Stony Creek Rd Monroe, MI 48161	A fall attraction that offers food, maze exploration, hayrides, and a pumpkin patch.
Holtz Christmas Tree Plantation 9381 Day Road Monroe, MI 48162	A winter attraction offering patrons the chance to cut their own Christmas Tree.
Martha Barker Country Store Museum 3815 N. Custer Road Monroe, MI 48162	A replica of a common country store circa 1918. The exhibits are authentic, with artifacts donated by local families and businesses.
Monroe County Historical Museum & The George A. Custer Exhibits 126 S. Monroe Street Monroe, MI 48161	The museum houses a large collection of 18th & 19th century artifacts relating to Southeast Michigan.
Monroe County Labor History Museum 41 W. Front St. Downtown Monroe , MI 48161	The Museum illustrates the importance of Monroe County to the American labor movement.
Monroe County Vietnam Veterans Historical Museum North Dixie Highway Norman Heck Park Monroe, MI 48162	The historical museum is staffed by actual Vietnam Veterans that tell their story.
Monroe Multi-Sports Complex 333 N. Dixie Hwy. I-75 Exit 15 Monroe, MI 48162	The facility offers public skating & drop-in hockey.
Navarre-Anderson Trading Post 3775 North Custer Road Monroe, MI 48162	The Trading Post complex is set up to represent a French pioneer homestead along the River Raisin.

Table 2.5-61 Monroe County Tourist Attractions

Name/address	Brief Description
Old Town Golf and Sportland 6724 N. Monroe Street Monroe, MI 48162	Consists of a par 3 golf course, driving range, batting cages, miniature golf, and putting green.
River Raisin Battlefield Visitor Center 1403 East Elm Avenue Monroe, MI 48162	Contains displays, and full-size British & American soldiers, as well as a fiber-optic map presentation on the Battle of the River Raisin.

Source: Reference 2.5-119

Table 2.5-62 Archaeological Sites Located Within Two Miles of Fermi 3

Number	Name	Period	NRHP Status
20MR207	Holmquist M-33	Prehistoric	Unevaluated
20MR702	Fermi II	Prehistoric	Unevaluated
20MR703	Gustafson	Archaic period	Unevaluated
20MR746	Webb	Nineteenth Century	Unevaluated

Table 2.5-63 NRHP-Listed and NRHP-Eligible Above-ground Resources within 10 Miles of Fermi 3

Name	City or Township/County	Date Listed on the NRHP or Determined Eligible for Listing on the NRHP
Custer, George Armstrong Equestrian Monument	Monroe/Monroe	12/9/1994 (L)[1]
Detroit River Light Station	Rockwood vicinity/Monroe	8/4/1983 (L)
East Elm – North Macomb Street Historic District	Monroe/Monroe	5/6/1982 (L)
Gibraltar Road Bridge	Gibraltar/Wayne	09/29/1995 (E)[2]
Horse Island Drive Bridge	Gibraltar/Wayne	1992 (E)
Horse Island Drive Bridge	Gibraltar/Wayne	07/01/1992 (E)
Horse Island Drive Bridge	Gibraltar/Wayne	07/01/1992 (E)
I-75 Bridge	Monroe/Monroe	04/12/2004 (E)
Jefferson Avenue Bridge	Brownstown Twp/Wayne	2/10/2000 (L)
Loranger, Edward, House	Monroe vicinity/Monroe	5/31/1984 (L)
McClelland, Governor Robert House	Monroe/Monroe	9/3/1971 (L)
Monroe Armory	Monroe/Monroe	11/07/2002 (E)
Navarre-Anderson Trading Post	Monroe/Monroe	7/31/1972 (L)
Nims, Rudolph House	Monroe/Monroe	10/18/1972 (L)
Old Village Historic District	Monroe/Monroe	5/6/1982 (L)
St. Mary's Academy Historic District	Monroe/Monroe	1981 (E)
Saint Mary's Church Complex	Monroe/Monroe	5/6/1982 (L)
Sawyer House	Monroe/Monroe	11/23/1977 (L)
South Pointe Drive Bridge	Grosse Ile/Wayne	3/15/2000 (L)
Weis Manufacturing Company	Monroe/Monroe	10/26/1981 (L)
---	Frenchtown Twp/Monroe	11/09/1995 (E)
---	Frenchtown Twp/Monroe	11/18/1998 (E)

Notes:
1. L – Listed on the NRHP
2. E – Determined Eligible for listing on the NRHP

Table 2.5-64 Previously Recorded Archaeological Sites within 1.5 Miles of the Proposed Project Area (Sheet 1 of 3)

Name/Number	Period	NRHP Status
20WA367	Prehistoric	Not Eligible
20WA368	Late Nineteenth Century, Early Twentieth Century	Not Eligible
20WA369	Mid-Twentieth Century	Not Eligible
20WA210	Prehistoric	Not Eligible
20WA207	Prehistoric	Not Eligible
20WA208	Prehistoric	Not Eligible
20WA209	Early Archaic	Not Eligible
20WA192	Middle Woodland	Unevaluated
20WA193	Prehistoric	Unevaluated
20WA194	Early Archaic, Late Archaic	Unevaluated
20WA206	Late Woodland	Not Eligible
20WA211	Nineteenth Century	Not Eligible
20WA41	Prehistoric	Unevaluated
David Brooks House	Nineteenth Century	Unevaluated
D.E. Morey’s House	Nineteenth Century	Unevaluated
20WN172	Woodland	Unevaluated
20WN173	Prehistoric	Unevaluated
20WN128	Prehistoric	Unevaluated
20WN129	Prehistoric	Unevaluated
A. Anderson’s House	Nineteenth Century	Unevaluated
St. John’s House	Nineteenth Century	Unevaluated
20WN928[‡]	Prehistoric	Not Eligible
20WN929	Prehistoric	Not Eligible
20WN930	Prehistoric	Not Eligible
20WN927[‡]	Woodland	Not Eligible
20WN961	Late Woodland	Not Eligible
20WN972[‡]	Late Woodland	Not Eligible
20WN973[‡]	Prehistoric	Not Eligible

Table 2.5-64 Previously Recorded Archaeological Sites within 1.5 Miles of the Proposed Project Area (Sheet 2 of 3)

Name/Number	Period	NRHP Status
20WN974	Prehistoric	Not Eligible
20WN975	Prehistoric	Not Eligible
20WN976‡	Late Woodland	Not Eligible
20WN1034	Prehistoric	Not Eligible
20WN1035	Prehistoric	Not Eligible
20WN1036	Nineteenth Century, Twentieth Century	Not Eligible
20WN1037	Nineteenth Century, Twentieth Century	Unevaluated
20WN1038	Nineteenth Century, Twentieth Century	Not Eligible
20WN1039	Nineteenth Century, Twentieth Century	Not Eligible
20WN1040	Nineteenth Century, Twentieth Century	Not Eligible
20WN1041	Nineteenth Century, Twentieth Century	Not Eligible
20WN1042	Nineteenth Century, Twentieth Century	Not Eligible
20WN1043‡	Nineteenth Century, Twentieth Century	Not Eligible
20WN130	Woodland	Unevaluated
20WN931	Twentieth Century	Not Eligible
20WN932	Prehistoric	Not Eligible
20WN933	Prehistoric	Not Eligible
20WN934	Late Woodland	Not Eligible
20WN935	Prehistoric	Not Eligible
20WN936	Nineteenth Century	Not Eligible
20WN937	Late Woodland	Not Eligible
20WN938	Prehistoric	Not Eligible
20WN939	Prehistoric	Not Eligible
20WN940	Prehistoric	Not Eligible
20WN941	Prehistoric	Not Eligible
20WN942	Prehistoric	Not Eligible
20WN943	Prehistoric	Not Eligible
20WN944	Prehistoric, Historic	Not Eligible
20WN946	Prehistoric	Not Eligible

Table 2.5-64 Previously Recorded Archaeological Sites within 1.5 Miles of the Proposed Project Area (Sheet 3 of 3)

Name/Number	Period	NRHP Status
20WN947	Prehistoric	Not Eligible
20WN948	Prehistoric	Not Eligible
20WN949	Late Archaic, Late Woodland	Not Eligible
20WN950	Prehistoric	Not Eligible
20WN951	Prehistoric	Not Eligible
20WN952	Prehistoric	Not Eligible
20WN953	Prehistoric	Not Eligible
20WN954	Prehistoric	Not Eligible
20WN955	Prehistoric	Not Eligible
20WN956	Prehistoric	Not Eligible
20WN957	Prehistoric	Not Eligible
20WN958	Late Archaic	Not Eligible
20WN959	Prehistoric	Not Eligible
20WN960	Prehistoric	Not Eligible
Butler’s House	Nineteenth Century	Unevaluated
Richards House	Nineteenth Century	Unevaluated
20WN246	Prehistoric	Unevaluated
20WN247	Prehistoric	Unevaluated
20MR190	Prehistoric	Unevaluated
20MR497	Prehistoric	Unevaluated

‡ Site crossed by the Sumpter-Post Road junction to Milan substation transmission line route

Table 2.5-65 Minority and Low-Income Community Block Group (CBG) Populations within the 50-mi Region

County	Total CBGs	Minority CBGs	Percent Minority	Low-Income CBGs	Percent Low-Income
Jackson County, MI	7	0	0.00	0	0.00
Lenawee County, MI	72	4	5.56	1	1.39
Livingston County, MI	64	1	1.56	0	0.00
Macomb County, MI	539	10	1.86	5	0.93
Monroe County, MI	126	1	0.79	1	0.79
Oakland County, MI	720	129	17.92	20	2.78
Washtenaw County, MI	260	47	18.08	33	12.69
Wayne County, MI	2125	1124	52.89	428	20.14
Erie County, OH	48	7	14.58	3	6.25
Fulton County, OH	18	0	0.00	0	0.00
Henry County, OH	3	0	0.00	0	0.00
Lucas County, OH	433	113	26.10	71	16.40
Ottawa County, OH	39	0	0.00	0	0.00
Sandusky County, OH	57	2	3.51	1	1.75
Seneca County, OH	8	0	0.00	0	0.00
Wood County, OH	77	0	0.00	9	11.69
Michigan CBGs[1]	3913	1316	33.63	488	12.47
Ohio CBGS[2]	683	122	17.86	84	12.30
Total	4596	1438	31.29	572	12.45

Notes:
1. The CBG count is only for the part of Michigan that lies within the 50-mile radius of Fermi 3.
2. The CBG count is only for the part of Ohio that lies within the 50-mile radius of Fermi 3.

Table 2.5-66 Michigan and Ohio Population, by Race (2000)

	Total Population	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and other Pacific Is.	Hispanic or Latino (of any race)	Some Other Race/Two or More Races	Percent Minority
Michigan	9,938,444	7,806,691	1,412,742	58,479	176,510	2692	323,877	157,453	21.45
Ohio	11,353,140	9,538,111	1,301,307	24,486	132,633	2749	217,123	136,731	15.99

Table 2.5-67 Low-Income Populations in Michigan and Ohio

Poverty Status in 1999

	Total Population	Families	Individuals	Percent of Individuals in Poverty	Percent of Families in Poverty
Michigan	9,938,444	192,376	1,021,605	10.5	7.4
Ohio	11,353,140	235,026	1,170,698	10.6	7.8

Table 2.5-68 Regional Migrant Labor Statistics

	Farms with Hired Labor	Migrant Labor on Farms with Hired Labor	Percentage of Farms with Migrant Labor
Michigan Counties			
Monroe	268	35	13.1
Wayne	52	5	9.6
Jackson	185	18	9.7
Lenawee	232	7	3.0
Livingston	180	0	0.0
Macomb	118	27	22.9
Oakland	170	4	2.4
St. Clair	253	13	5.1
Washtenaw	246	5	2.0
Michigan	12,279	1412	11.5
Ohio Counties			
Lucas	136	24	17.7
Erie	75	10	13.3
Fulton	211	7	3.3
Henry	123	10	8.1
Ottawa	95	18	19.0
Sandusky	207	12	5.8
Seneca	127	5	3.9
Wood	240	9	3.8
Ohio	16,585	518	3.1

Source: Reference 2.5-126 and Reference 2.5-127

Table 2.5-69 Summary of Fermi Ambient Sound Level Survey Results (Sheet 1 of 2)

Receptor	Latitude / Longitude Location Description	Approximate Distance to Fermi 2	Ambient Sound Levels: Lowest L_{90} / Time	Ambient Sound Levels: L_{dn} (24-hour)[1]	Noise Sources Observed
NML-1	41°56‘48.552“N / 83°15‘33.696“W In ROW across from residence at 6108 Pointe aux Peaux Road	1.05 mi	34 dBA / 0:00 hour (see Figure 2.5-34)	54 dBA	Distant highway traffic, dogs barking, local traffic, Fermi plant faintly audible
NML-2	41°58‘4.116“N / 83°16‘5.340“W Fermi site fenceline at intersection of Fisher Street and Langton Road; approx. 180 m southeast of residence on Langton Road	0.50 mi	32 dBA / 0:00 hour (see Figure 2.5-34)	62 dBA	Birds, distant highway traffic, train, brief distant gunfire from Fermi firing range, Fermi cooling towers faintly audible
NML-3	41°58‘55.416“N / 83°16‘1.956“W In ROW across from residence at 5735 Trombley Road	1.06 mi	32 dBA / 1:00 hour (see Figure 2.5-34)	63 dBA	Train, birds, distant highway traffic, brief distant gunfire from Fermi firing range, Fermi plant faintly audible during nighttime measurements
NML-4	41°57‘1.800“N / 83°16‘52.428“W On Brest Road west of residences on Sycamore Road	1.43 mi	40 dBA / 0:30	Not measured	Distant highway traffic, birds, wind chimes, train, Fermi plant faintly audible
NML-5	41°57‘33.732“N / 83°16‘51.780“W On Toll Road east of Fermi site; approx. 140 m southwest of residence	1.16 mi	39 dBA / 18:25	Not measured	Distant highway traffic, coyotes, dogs, birds, Fermi plant not audible during survey
NML-6	41°58‘9.516“N / 83°16‘47.604“W Transmission line noise measurement on Leroux Road, approx. 100 m northeast of intersection with Enrico Fermi Drive	1.10 mi	42 dBA / 1:05[2]	Not measured	Distant highway traffic, faint transmission line noise, Fermi plant not audible

Table 2.5-69 Summary of Fermi Ambient Sound Level Survey Results (Sheet 2 of 2)

Receptor	Latitude / Longitude Location Description	Approximate Distance to Fermi 2	Ambient Sound Levels Lowest L_{90} / Time	 L_{dn} (24-hour)[1]	Noise Sources Observed
NML-7	41°58‘45.840“N / 83°15‘18.468“W Outside the Swan Boat Club on Brancheau Road north of Fermi site	0.72 mi	37 dBA / 17:06	Not measured	Transformer hum (from boat club unit), dogs, distant highway traffic, brief gunfire from Fermi firing range, wind noise from overhead transmission lines, flag pole rattle, Fermi 2 cooling towers audible during survey

Notes:

1. Based on hourly measurements from approximately 3:00 a.m. on November 27, 2007 until 3:00 a.m. on November 28, 2007.
2. Nighttime measurement only at this location.

Table 2.5-70 Fermi 2 Property Tax History

Year	Plant Property Taxes	Nuclear Fuel Property Taxes	Total Property Taxes
2007	17,806,833	1,251,114	19,057,947
2006	18,742,125	1,271,056	20,013,181
2005	20,961,668	1,889,733	22,851,401
2004	23,112,014	1,499,404	24,611,418
2003	25,093,888	1,109,558	26,203,446
2002	27,864,577	1,641,822	29,506,399
5 Year Total	133,581,105	8,662,687	142,243,792

Table 2.5-71 Frenchtown Charter Township 2007 Millage Composition

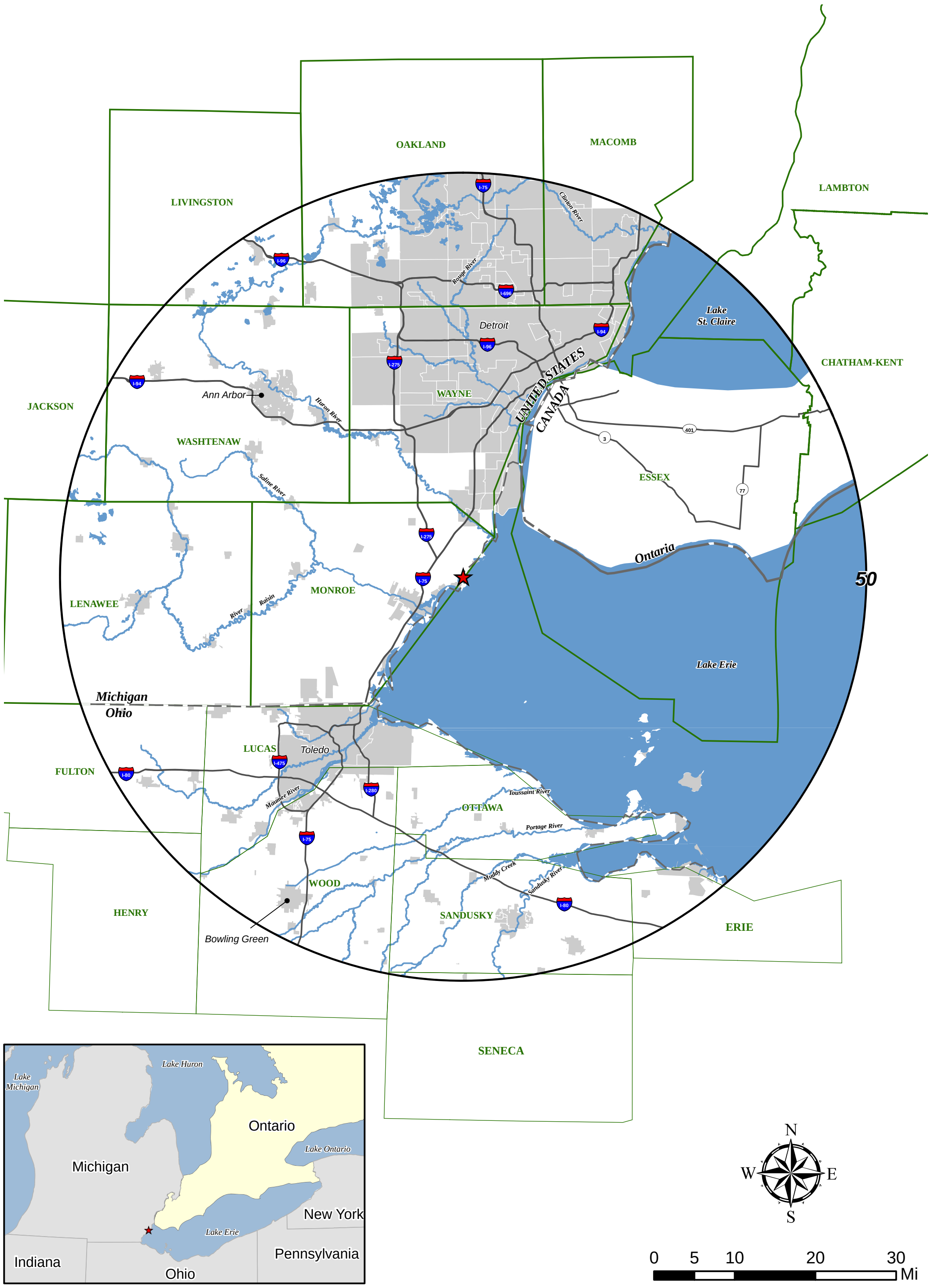
County		School Districts	Homestead	Non-Homestead
Summer Allocated	4.7952	Monroe Schools		
Winter Allocated	0.0000	State Education (Summer)	6.0000	6.0000
Jail Bond		Operating		18.0000
Senior Citizen	0.5000	Building & Site	0.9985	0.9985
Total County:	5.2952	Total Monroe Schools:	6.9985	24.9985
Monroe I.S.D.		Airport Schools		
Tech. Enhancement	0.9866	State Education (Summer)	6.0000	6.0000
Allocated	0.2897	Operating		18.0000
Voled Operating	3.4778	Building & Site	1.8282	1.8282
Total I.S.D:	4.7541	Total Airport Schools:	7.8262	25.8282
Monroe County Community College		Jefferson Schools		
Allocated	1.2108	State Education (Summer)	6.0000	6.0000
Operating	0.9686	Operating		18.0000
Total MCCC:	2.1794	Total Jefferson Schools:	6.0000	24.0000
Frenchtown Township				
Operating	2.7166			
Water Debt	1.5000	Resort Authority		2.8154
Lake Erie Transit	0.4733			
Fire Department	2.0000			
Total FT Township:	6.6699			
Monroe County Library	1.0000			
Total without school or Resort	19.9186			

Table 2.5-72 Average Direct and Indirect Taxes and Capital Expenditures for Fermi 2 (2002-2007)

O&M Expenditures	2002-2007 Averages ($)(4)	Estimated Direct Sales Tax ($)(4)	Estimated Indirect Sales Tax ($)(4)
Detroit Edison Labor	62,092	0	2,235 (1)
Contract Labor	33,267	0	1,198 (1)
Material & Equipment	10,496	315 (2)	0
Dues & Assessments	8,188	$0	0
Outage Levelization	6,004	90 (2)(3)	108 (1)(3)
Other Direct Resources	2,229	0	0
Accounting	-53	0	0
Employee Benefits	43,006	0	0
Total O&M	165,228		
Capital Expenditures			
Total Capital	49,950	749 (2)(3)	899 (1)(3)
Totals		1,154	4440

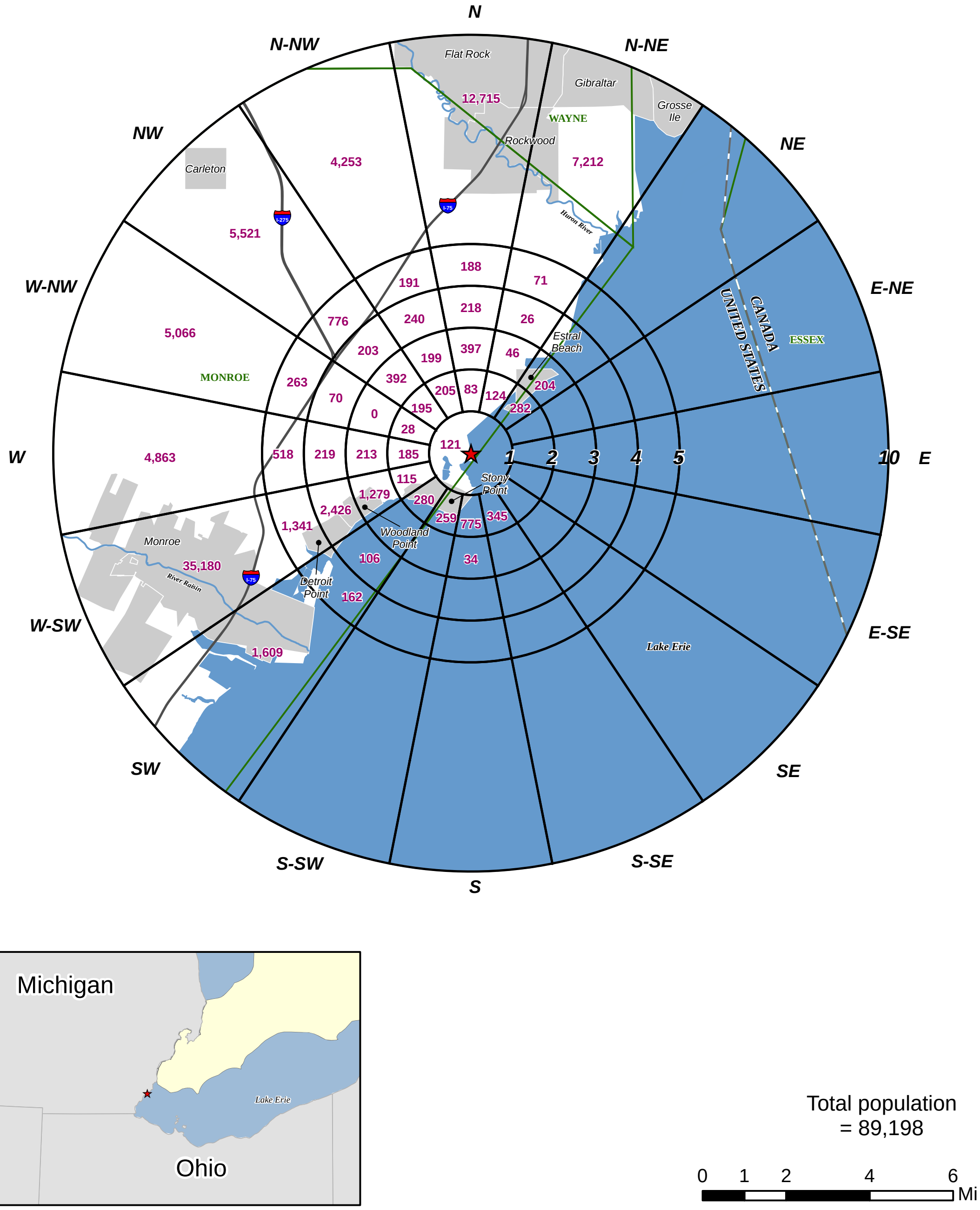
Notes:
1. Assumes 60% of labor costs are subject to Michigan/Ohio sales taxes.
2. Assumes 50% of material & equipment are subject to Michigan/Ohio sales taxes.
3. Assumes costs are 50% labor costs and 50% material & equipment costs.
4. Thousands of dollars.

Figure 2.5-1 United States and Canadian Counties Wholly or Partly within a 50-mi Radius of Fermi 3 (latitude: 41º 57' 39" N, longitude: 83º 15' 43" W)



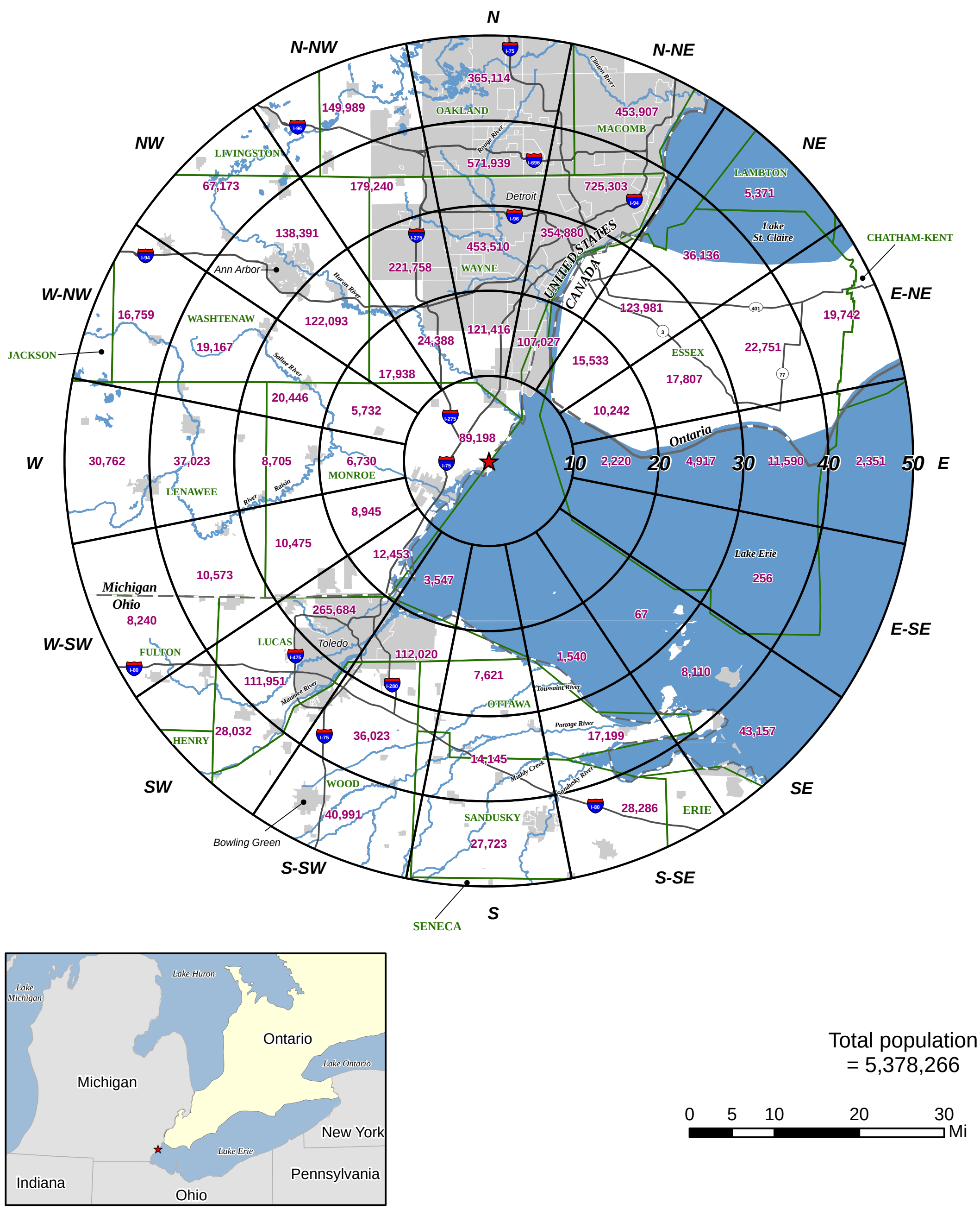
Source: Reference 2.5-4

Figure 2.5-2 Resident Population Distribution by Segment, 0 to 10 Miles (Segmented Concentric Circles) From Fermi 3 (2000)



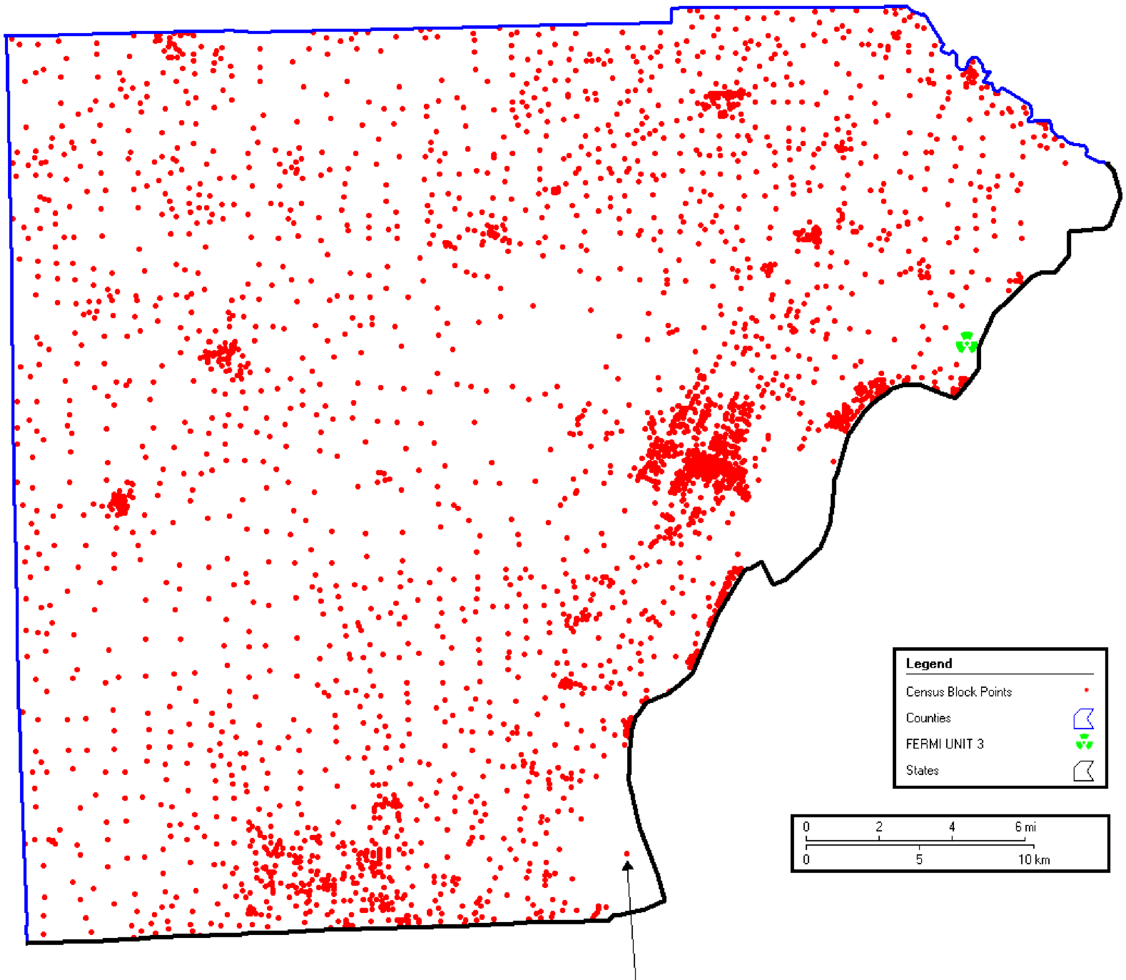
Source: Reference 2.5-4

Figure 2.5-3 Resident Population Distribution by Segment, 0 to 50 Miles (Segmented Concentric Circles) From Fermi 3 (2000)



Source: Reference 2.5-4

Figure 2.5-4 Census Block Points within Monroe County, MI

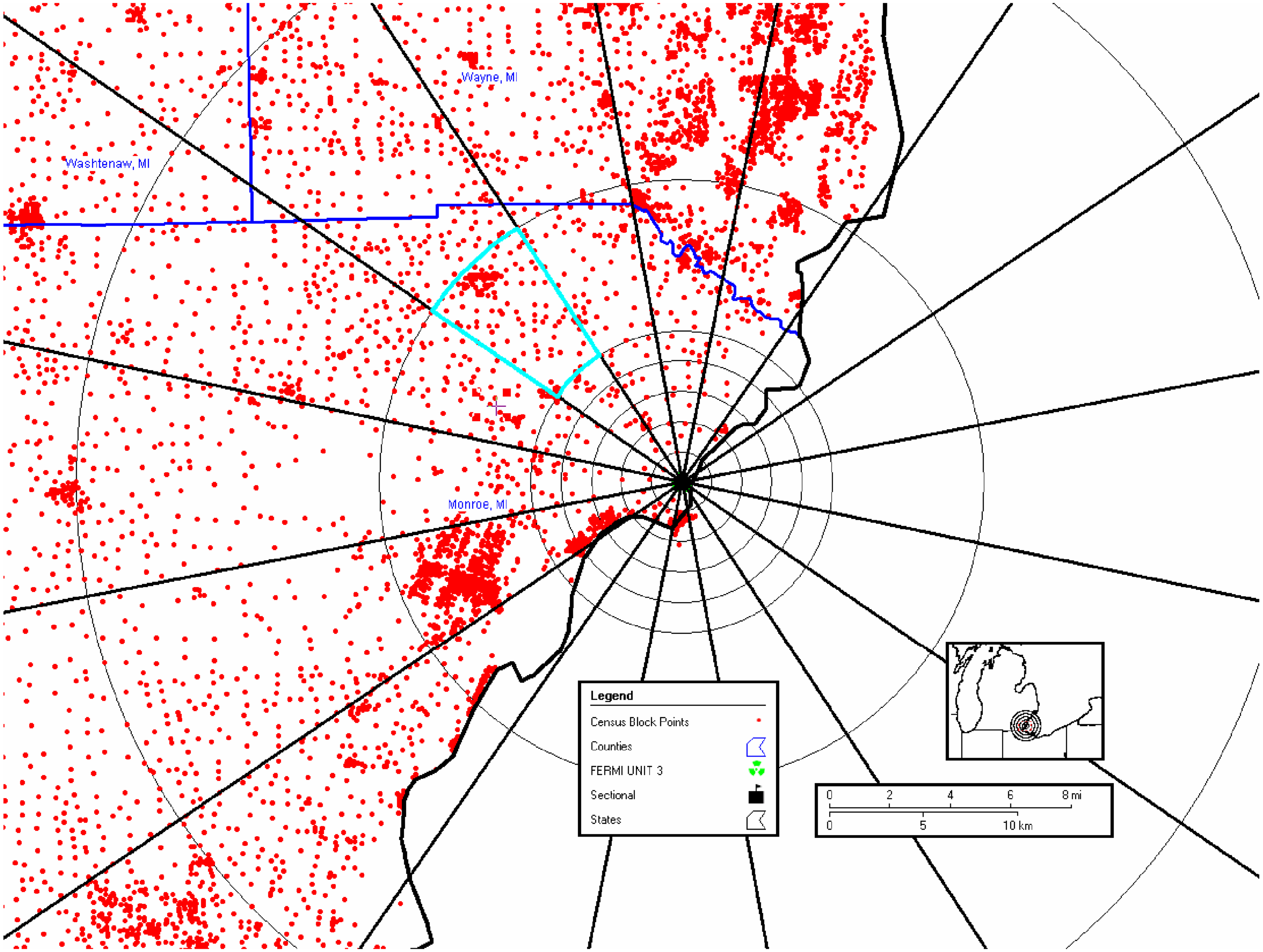


Census 2000 Census Block Data

ST-CNTY-TRACT-BLOCK	Total Population	Housing Units	White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and other Pacific Islander	Some other race	Two or more races	Hispanic or Latino of any race
26-115-8337.00-2039	11	3	8	0	0	0	0	0	3	0

Source: Reference 2.5-4

Figure 2.5-5 Census Block Points within Each Segment



Source: Reference 2.5-4

Figure 2.5-6 Resident and Transient Population Distribution by Segment, 0 to 10 Miles (Segmented Concentric Circles) From Fermi 3 (2000)

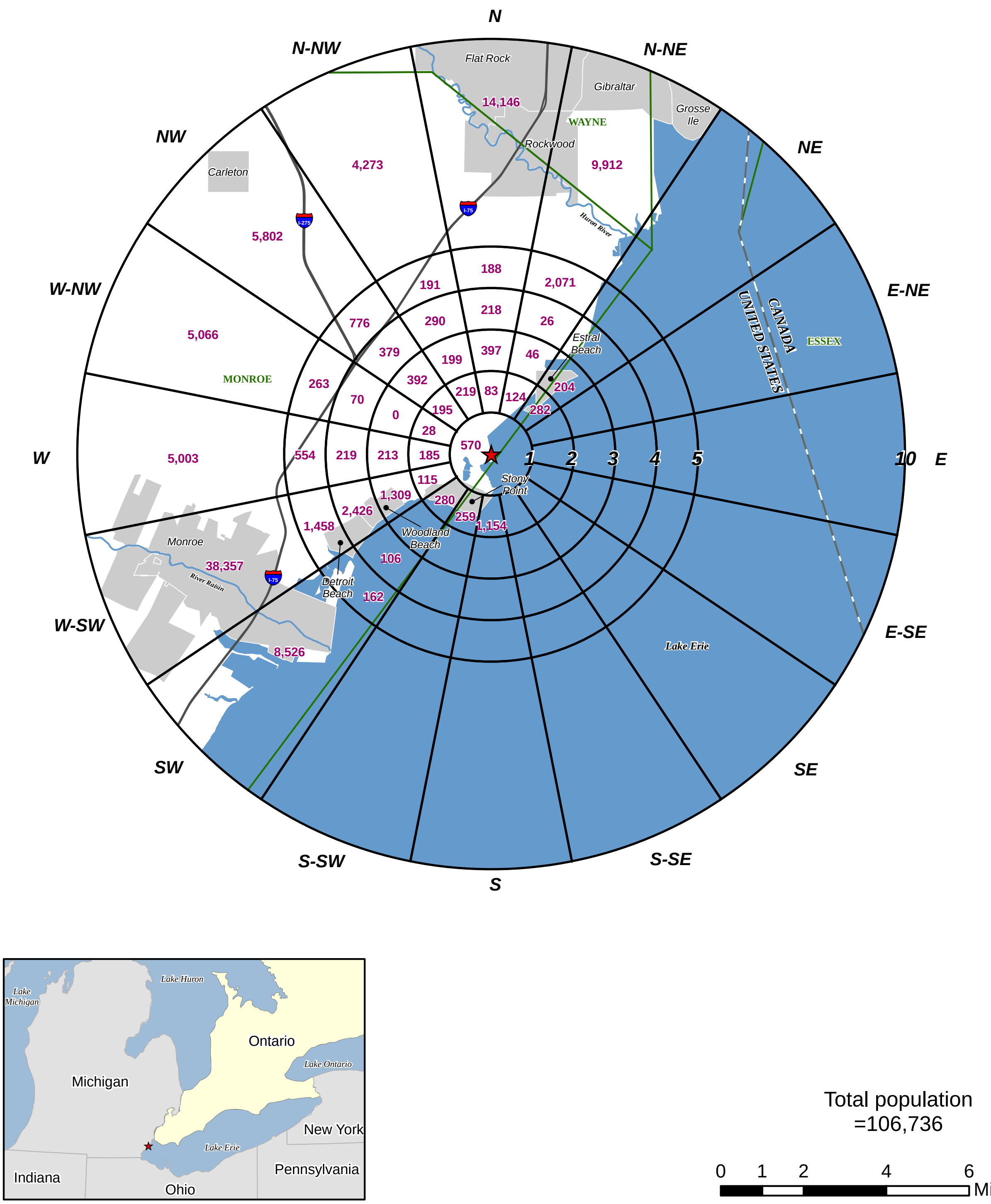


Figure 2.5-7 Resident and Transient Population Distribution by Segment, 0 to 50 Miles (Segmented Concentric Circles) From Fermi 3 (2000)

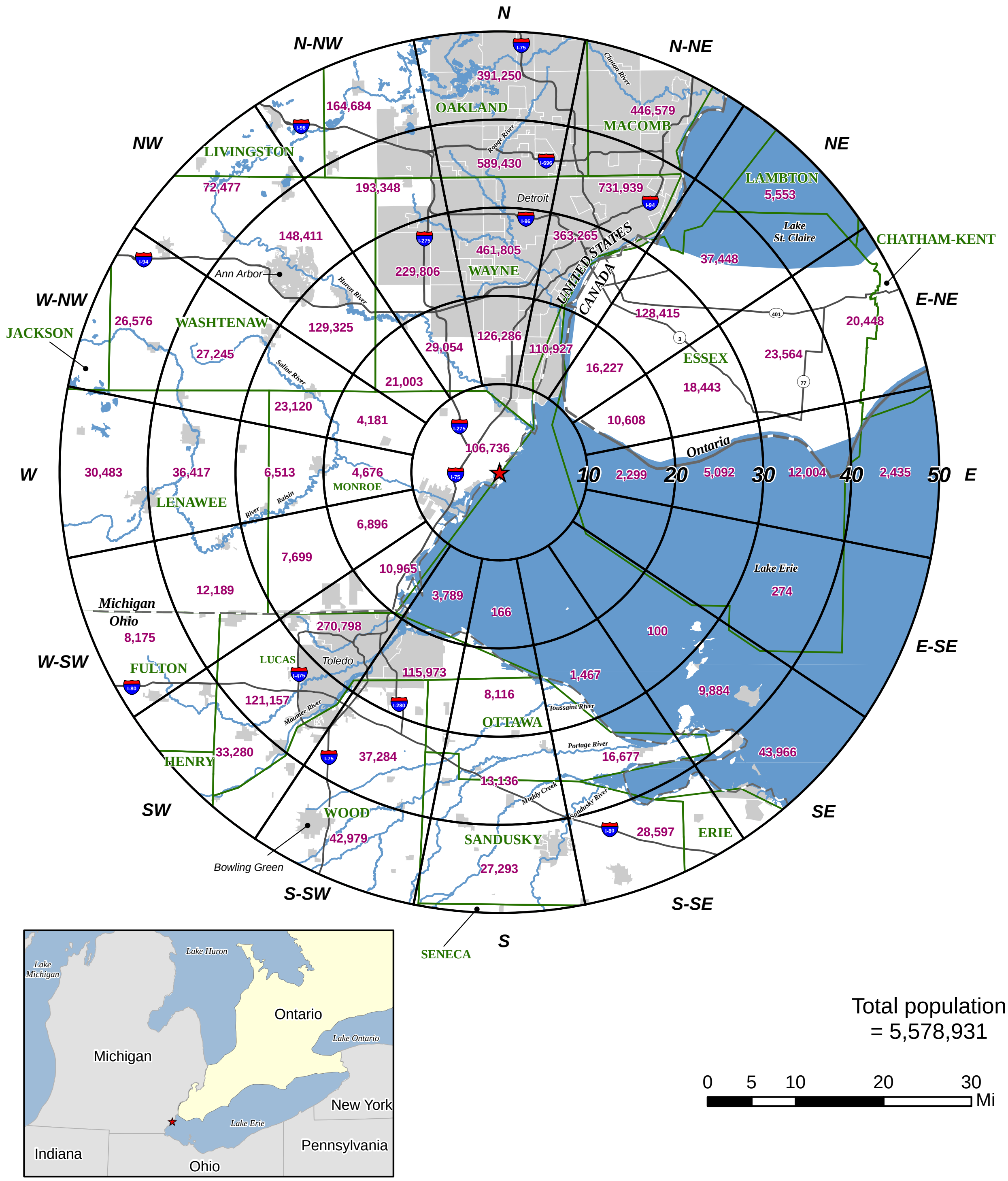


Figure 2.5-8 Example: Sectional Population Growth Rate Calculation

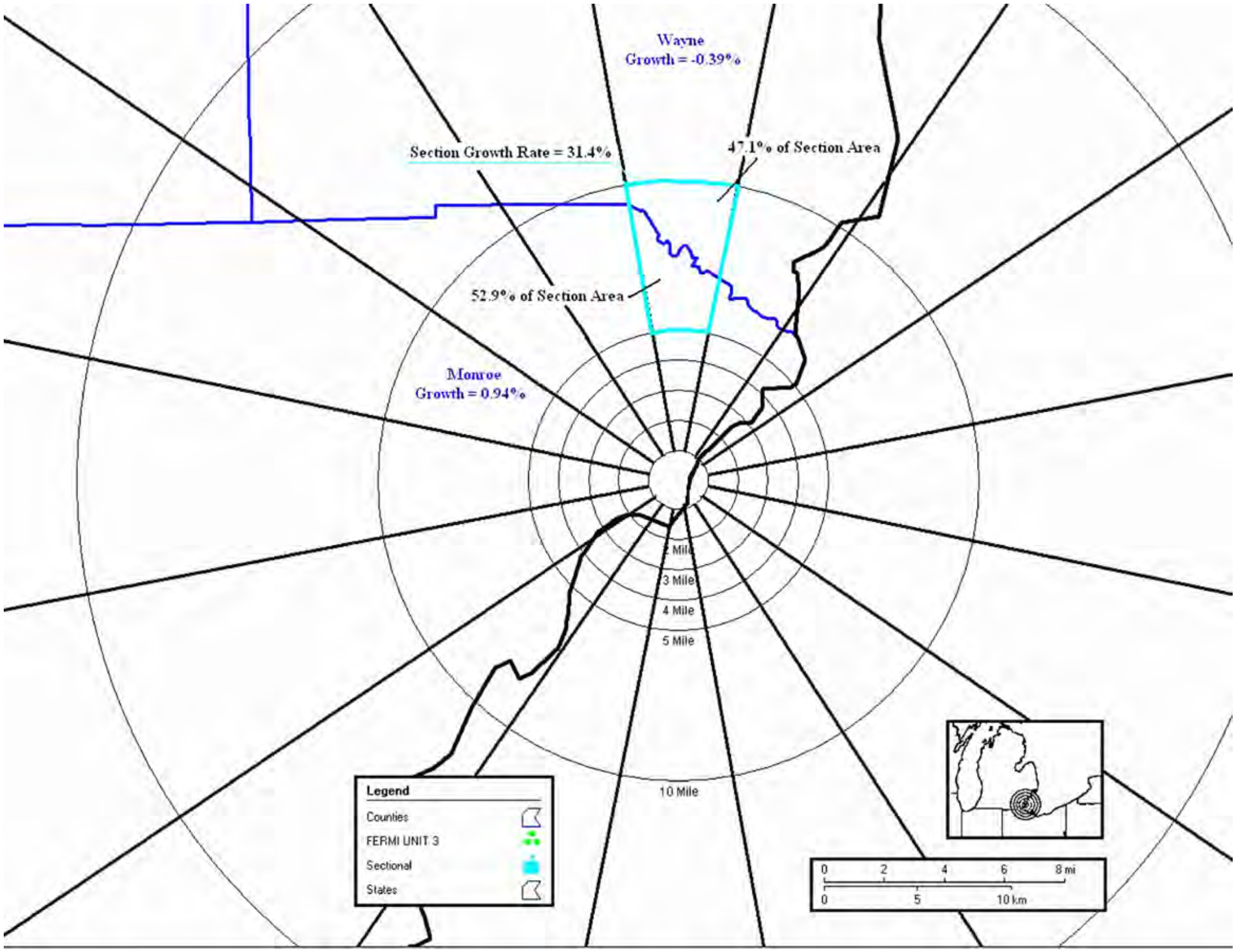
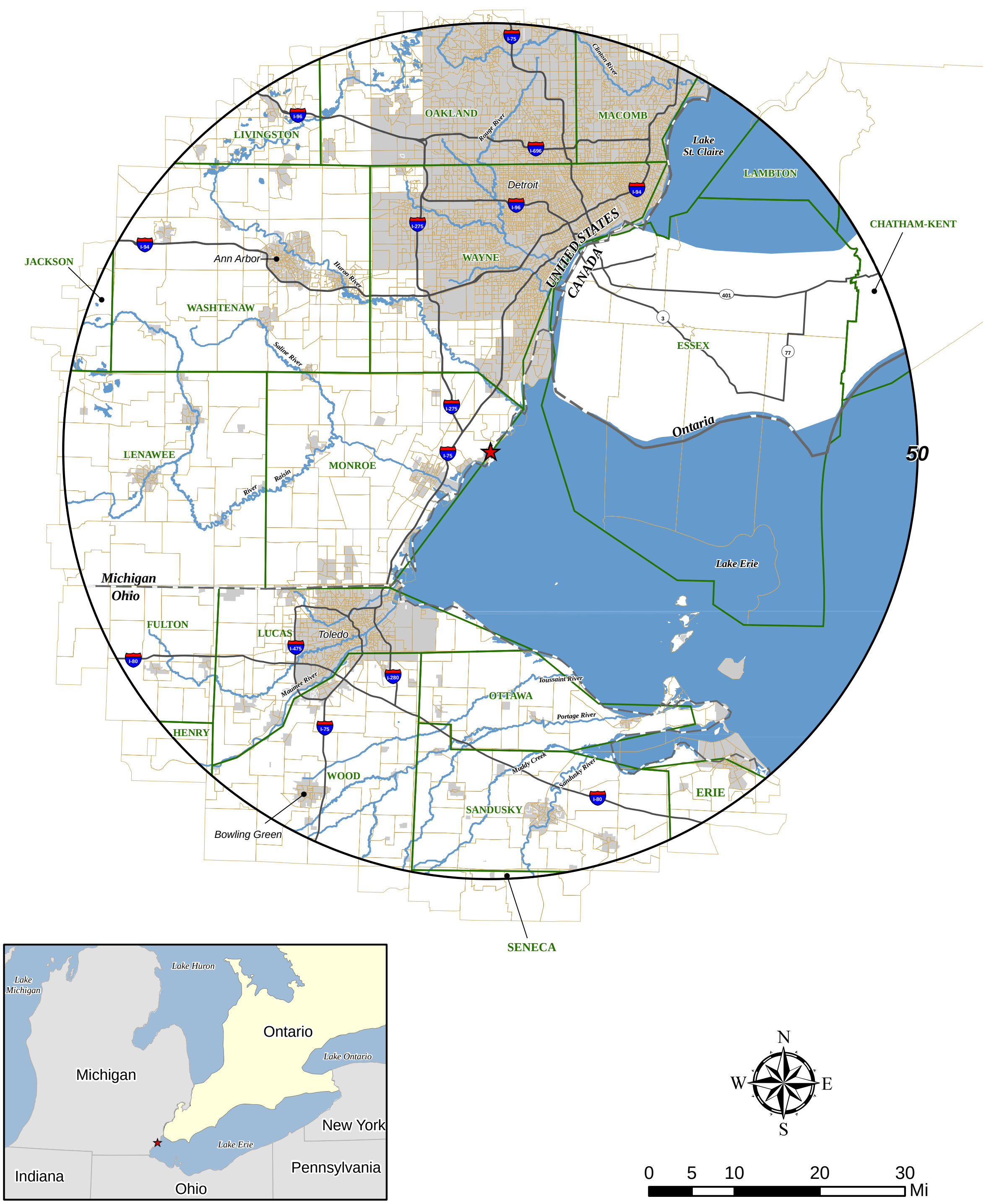
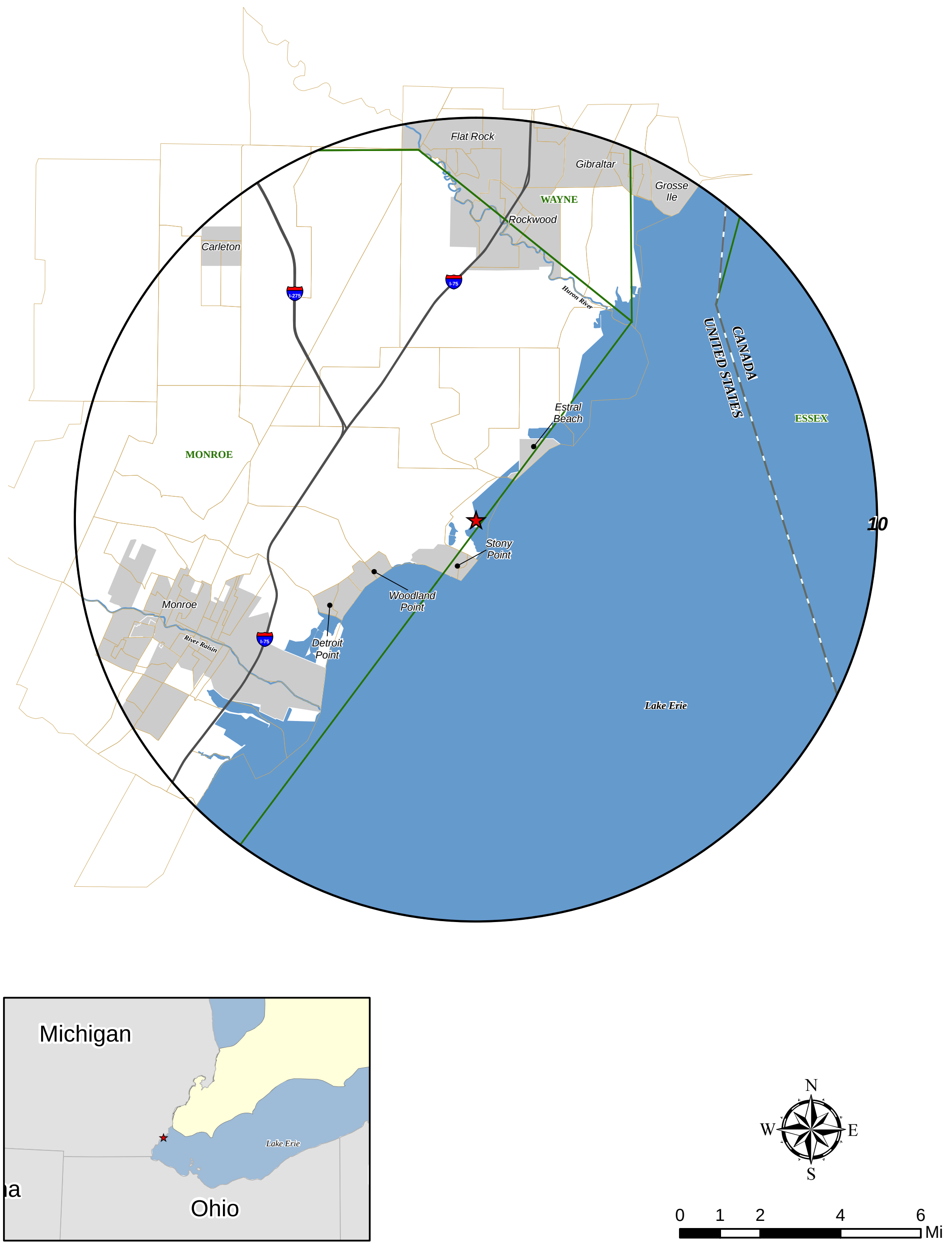


Figure 2.5-9 Regional Census Block Groups (CGBs) within 50-Mile Radius of Fermi 3



Source: Reference 2.5-3

Figure 2.5-10 Census Block Groups (CBGs) within 10-Mile Radius of Fermi 3



Source: Reference 2.5-3

Figure 2.5-11 Census Block Groups (CBGs) within 3-Mile Radius of Fermi 3 (the LPZ area)

Source: Reference 2.5-3

Figure 2.5-12 Detroit CSA

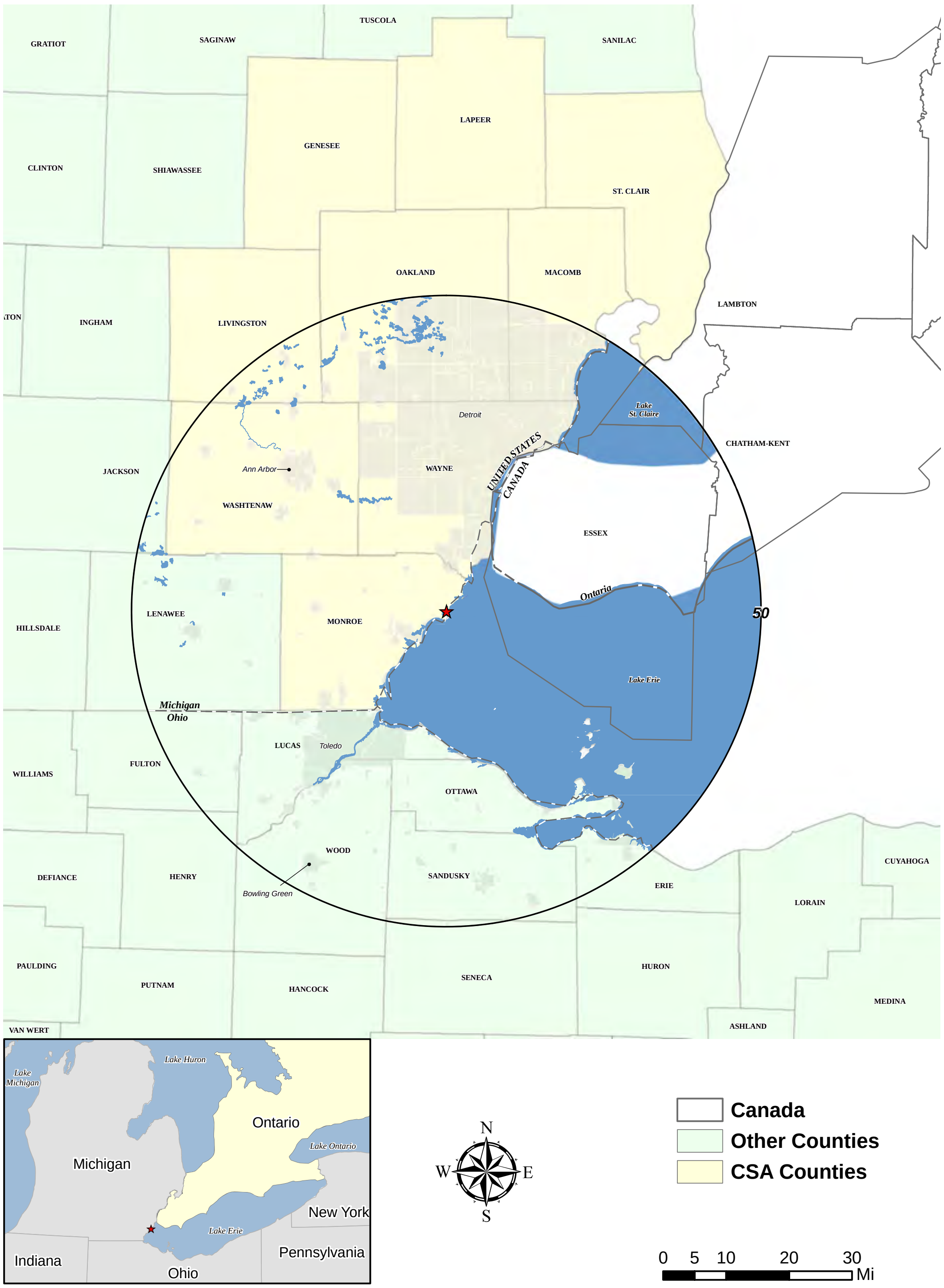


Figure 2.5-13 Toledo MSA

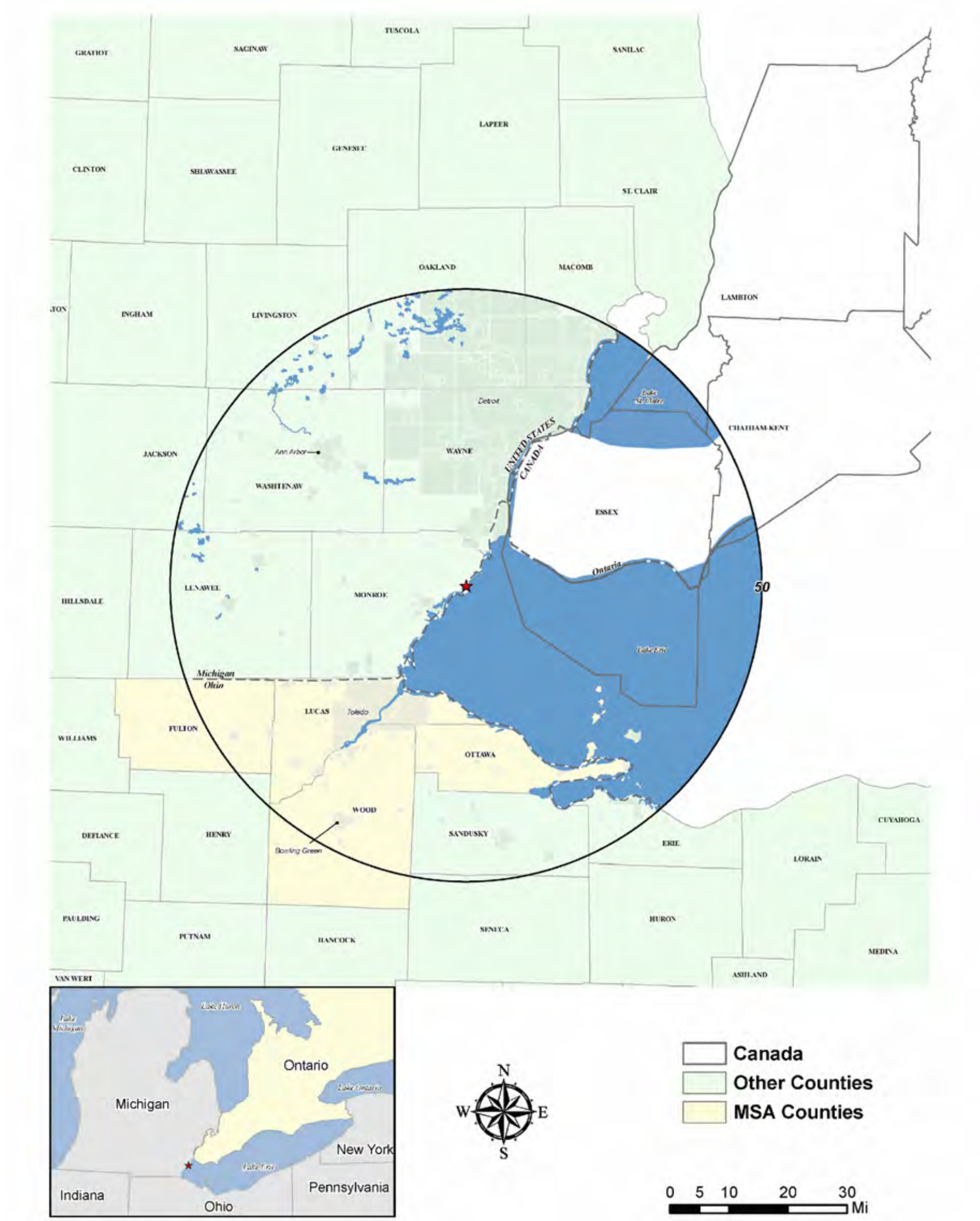


Figure 2.5-14 Small Population Centers

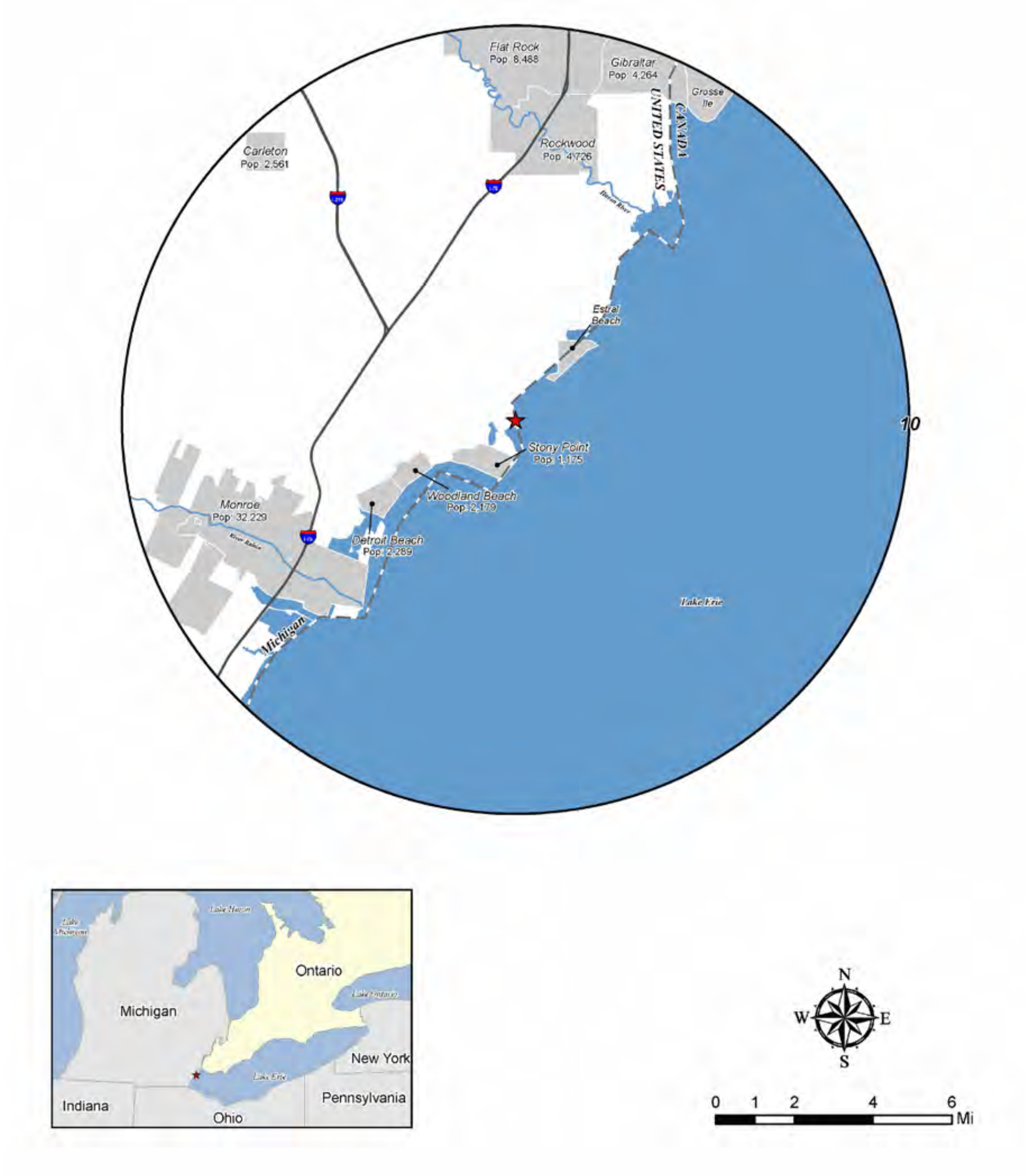
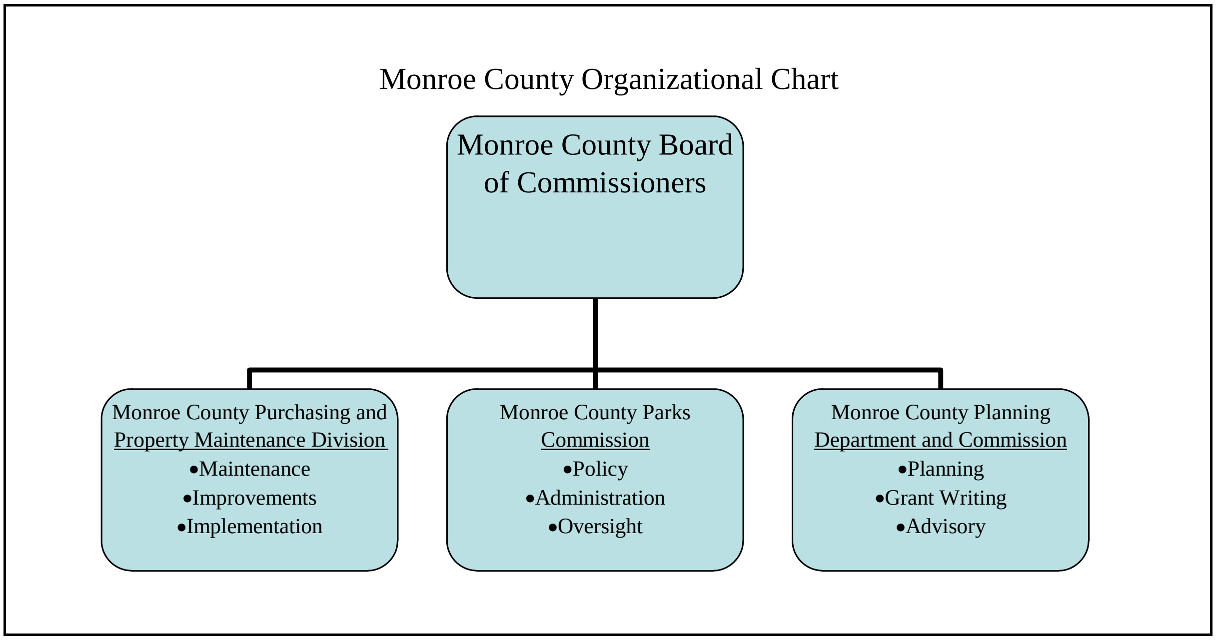


Figure 2.5-15 Monroe County Organization Chart



Source: Reference 2.5-12

Figure 2.5-16 Natural, Public, and Recreation Areas within the 50-mi Region

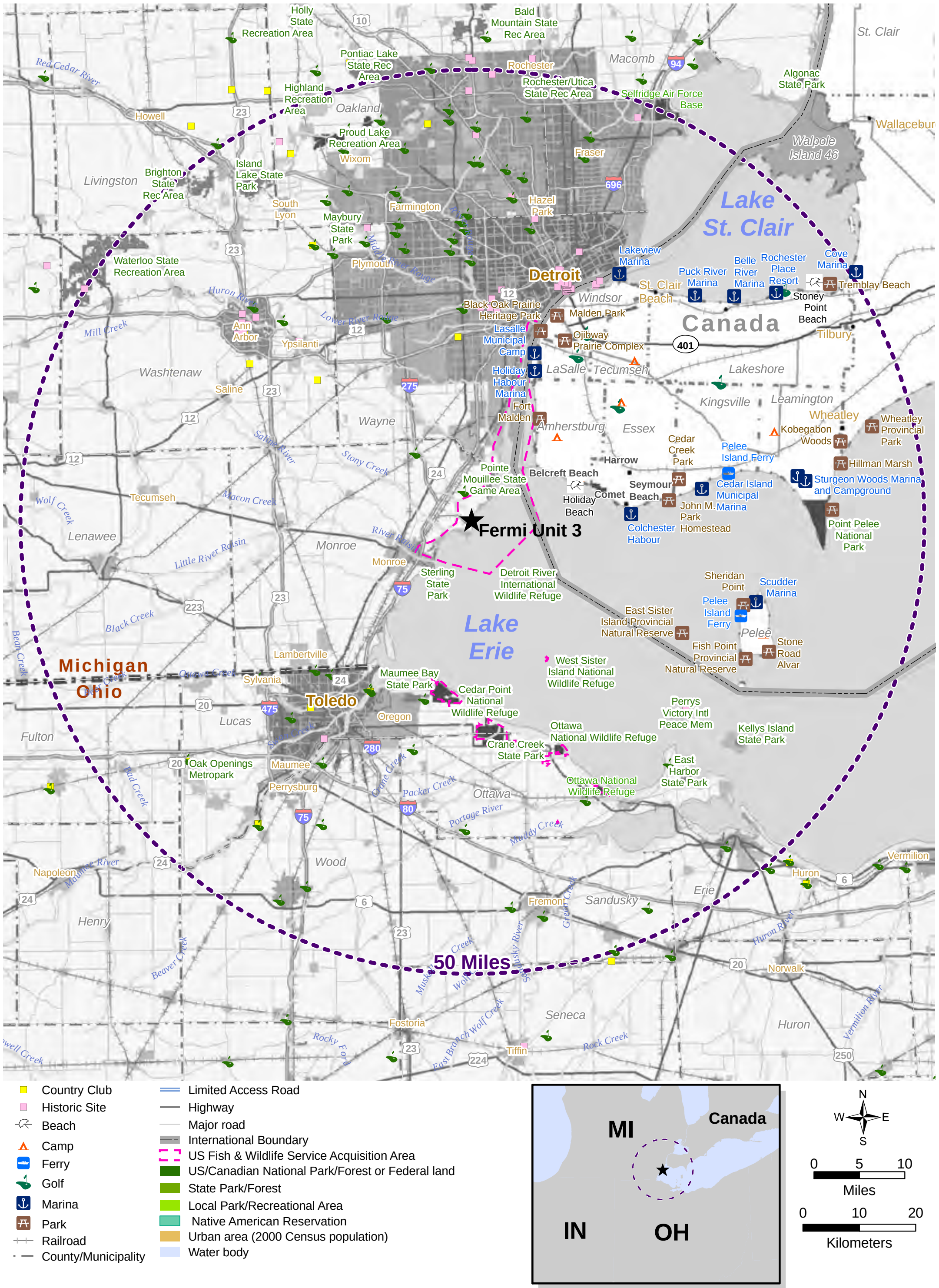


Figure 2.5-17 Frenchtown Existing Land Use

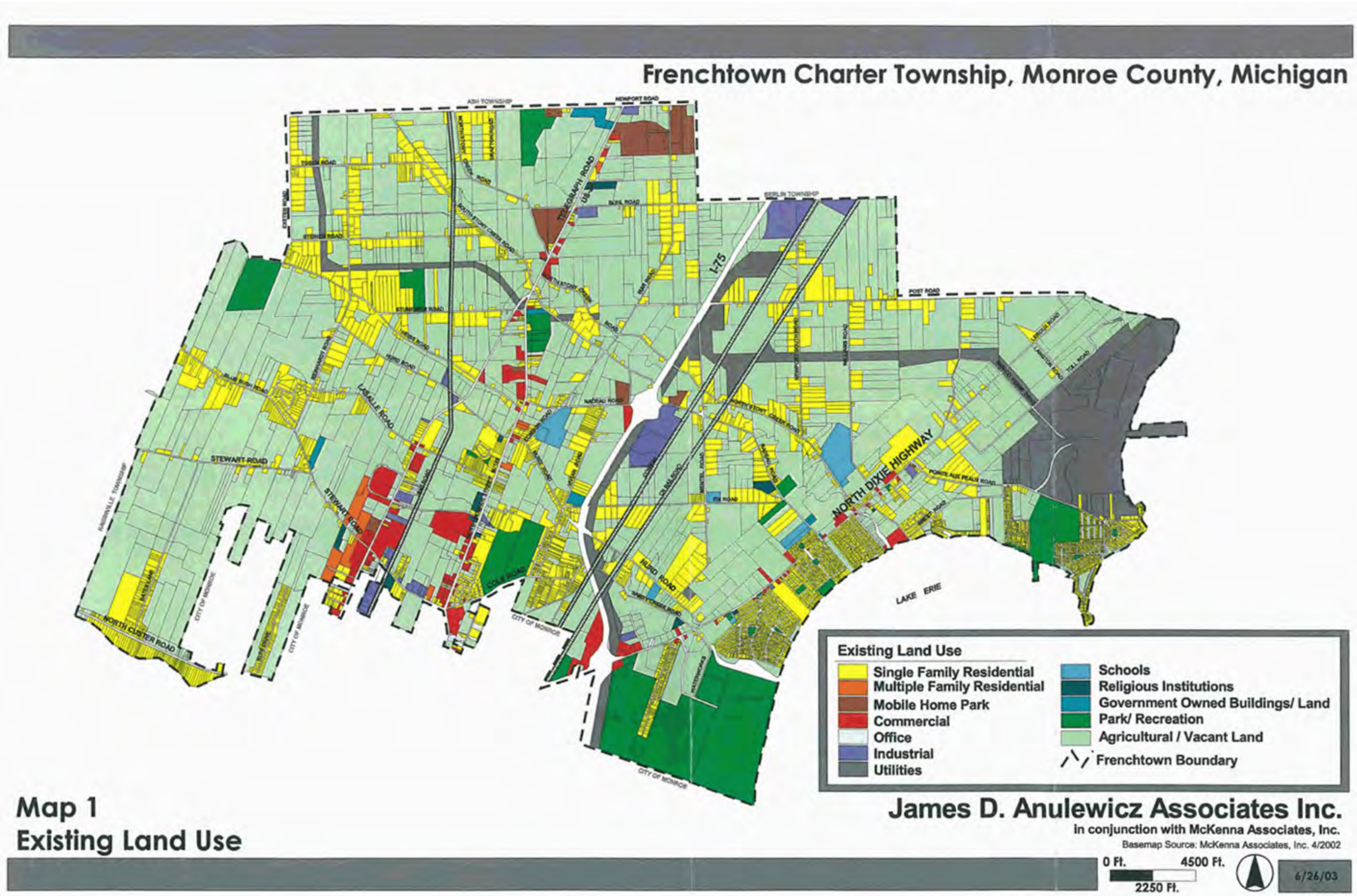


Figure 2.5-18 Frenchtown Future Land Use

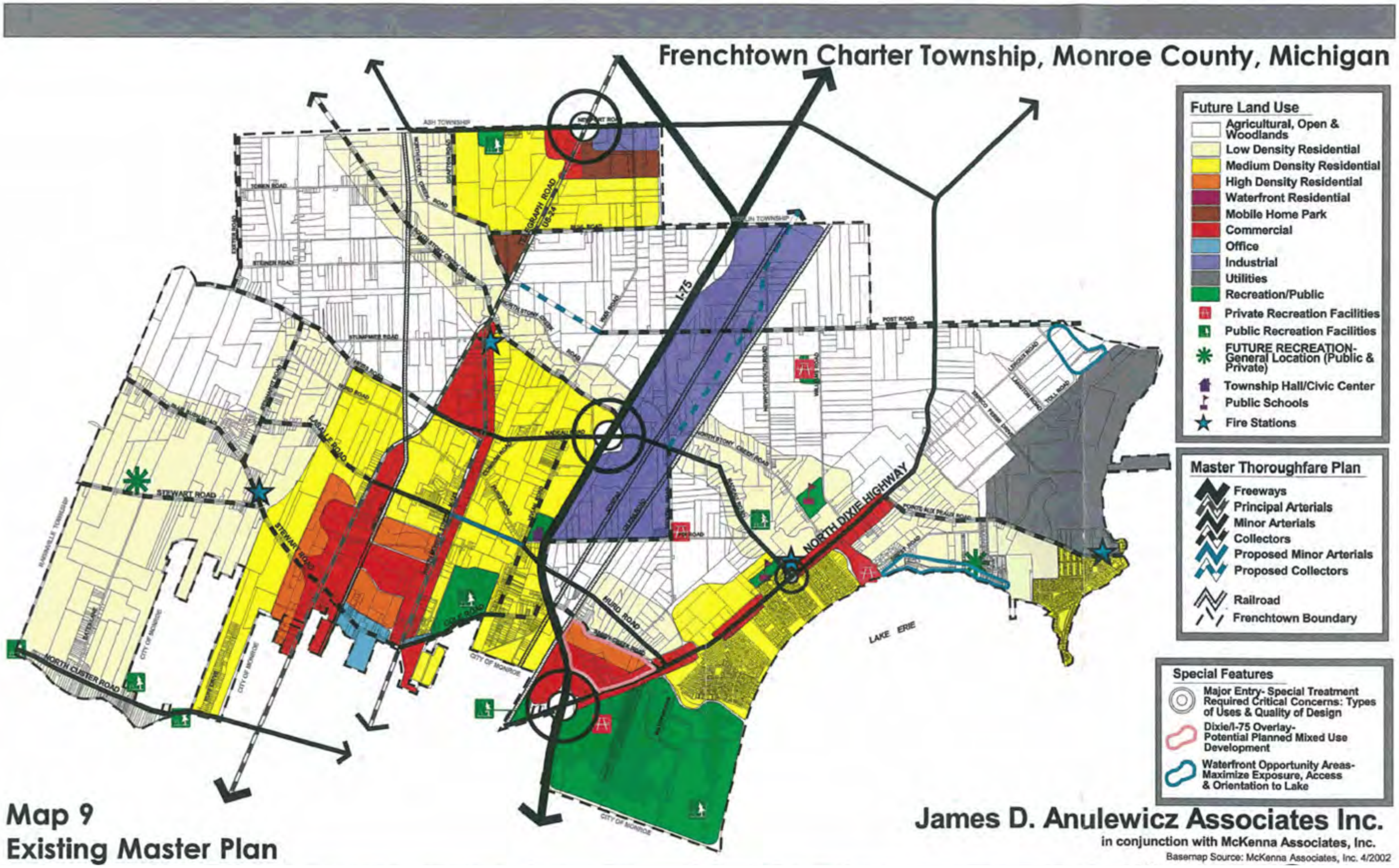


Figure 2.5-19 Frenchtown Water Service Areas

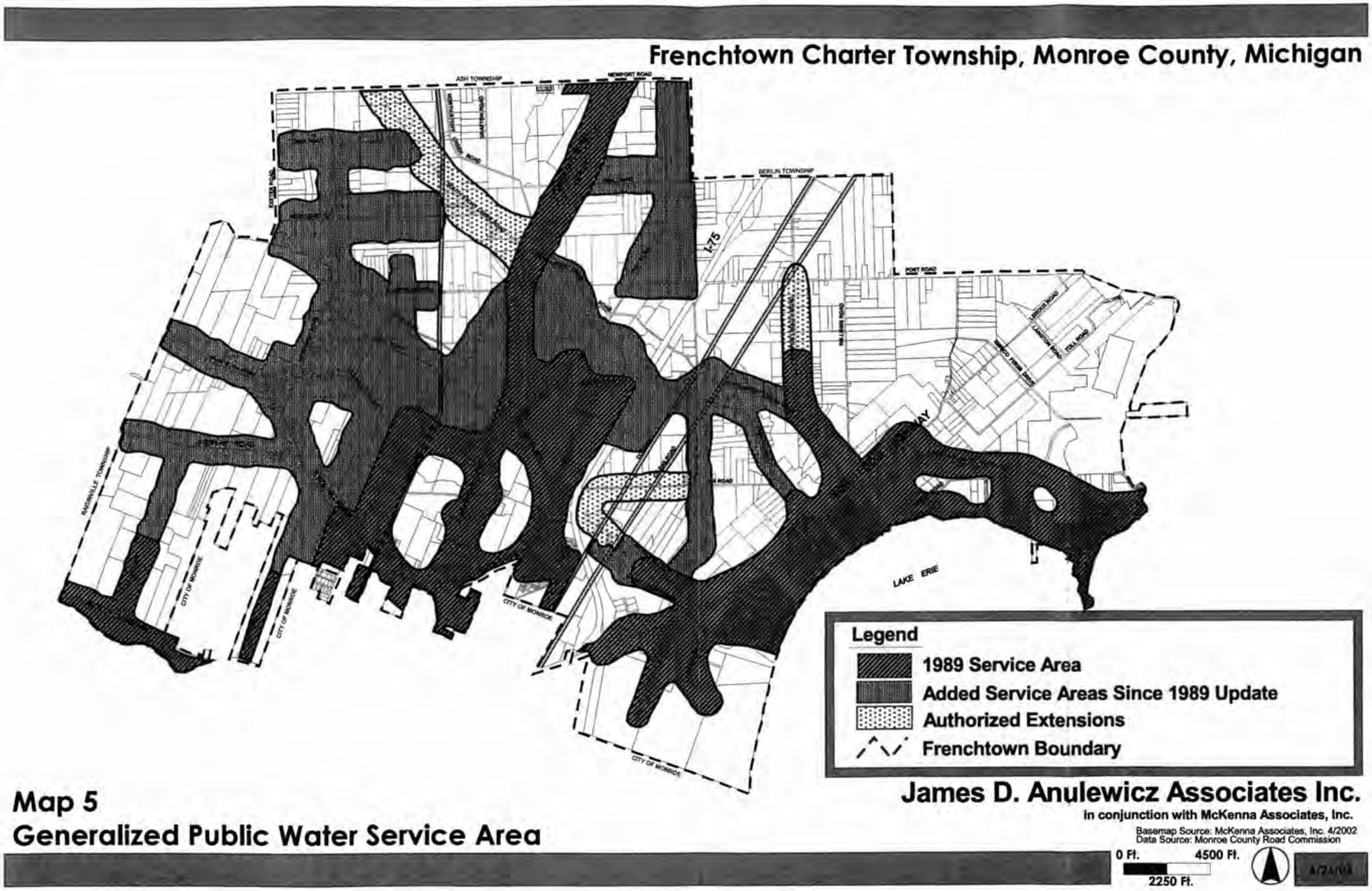


Figure 2.5-20 Frenchtown Sewer Service Areas

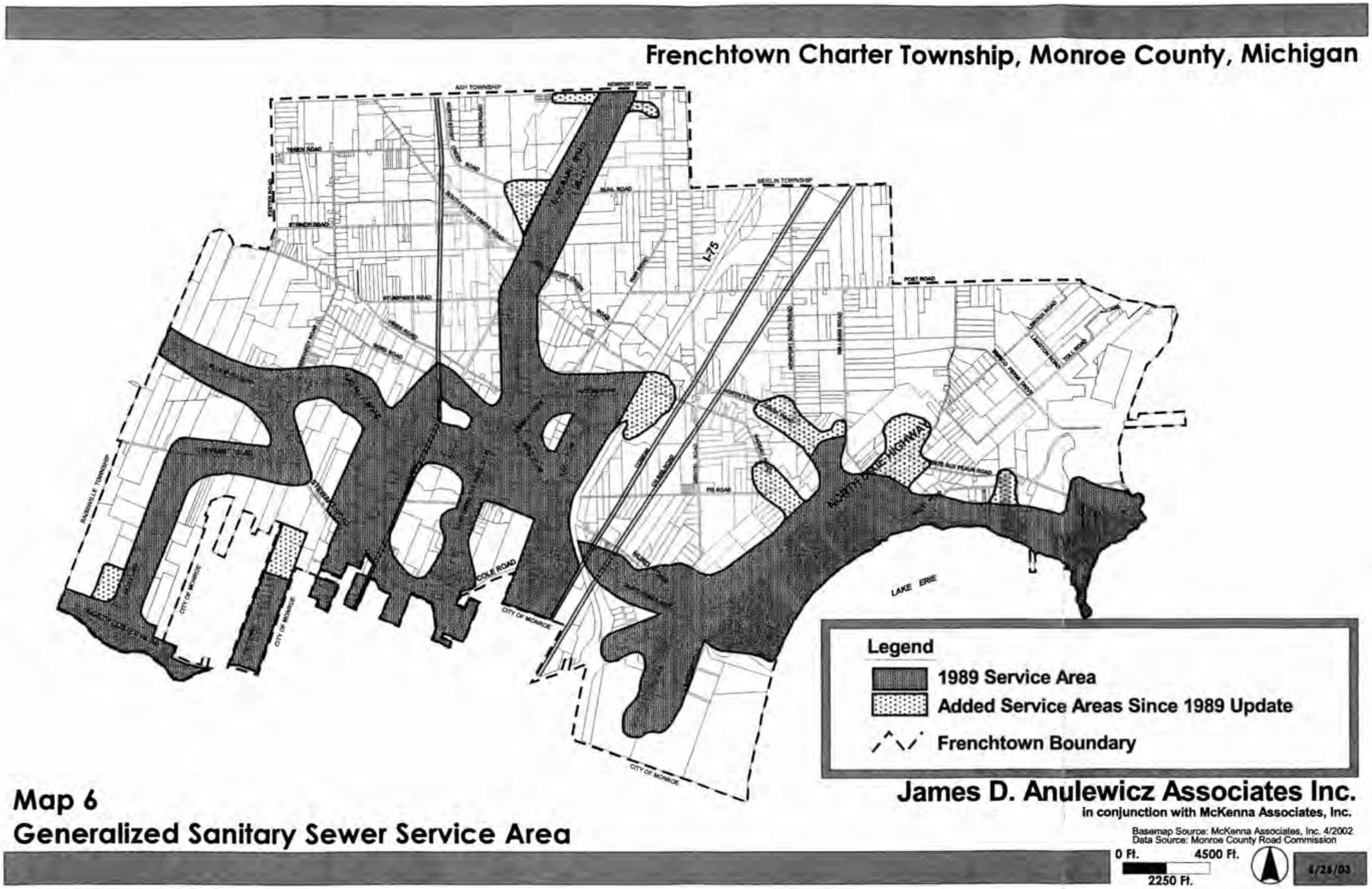
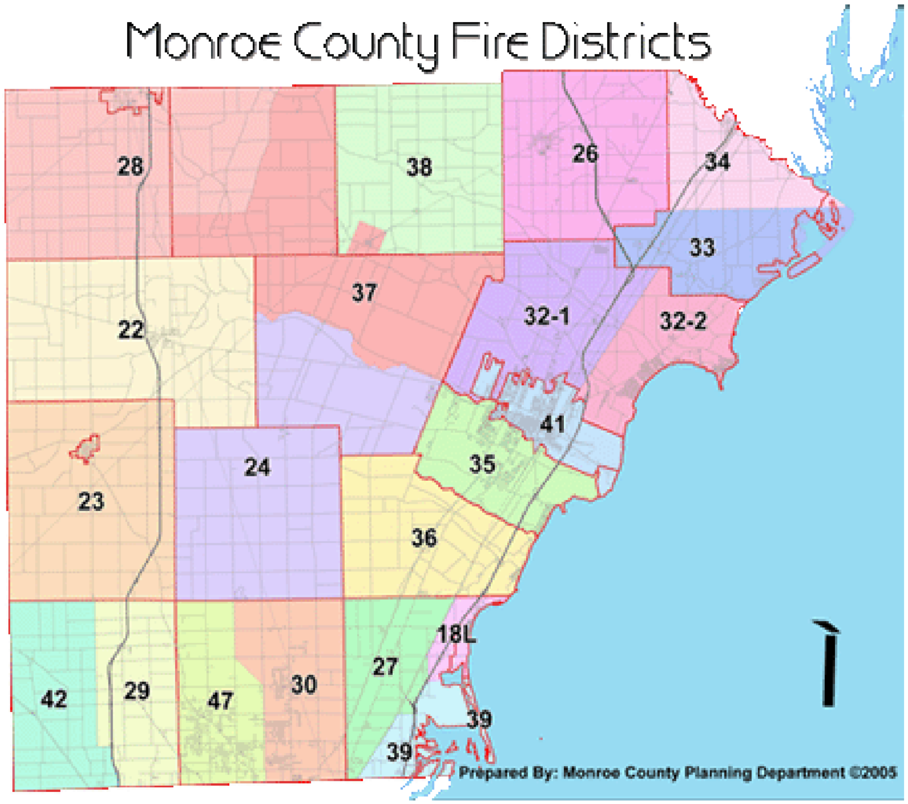


Figure 2.5-21 Monroe County Fire Districts



Fire Department	Twp/City/Village
18L - Luna Pier	City of Luna Pier
22 - Dundee	Dundee Twp
23 - Summerfield	Summerfield Twp
24 - Ida	Ida (Village)
24 - Ida	Raisinville Twp
24 - Ida	Ida Twp
26 - Ash	Carleton Village
26 - Ash	Ash Twp
27 - Erie	Erie Twp
28 - Milan	Milan Twp
28 - Milan	London Twp
29 - Whiteford	Whiteford Twp
30 - Bedford (Temperance)	Bedford Twp
32-1 Frenchtown	Frenchtown Twp
32-2 Frenchtown	Frenchtown Twp
33 - Newport	Berlin Twp
34 - South Rockwood	Berlin Twp
35 - Monroe	Monroe Twp
36 - LaSalle	LaSalle Twp
37 - London-Maybee-Raisinville	London Twp
37 - London-Maybee-Raisinville	Raisinville Twp
37 - London-Maybee-Raisinville	Maybee Village
38 - Exeter	Exeter Twp
39 - Morin Point	Erie Twp
41 - Monroe	Monroe City
41 - Monroe	Monroe City
42 - Ottawa Lake	Whiteford Twp
47 - Bedford (Lambertville)	Bedford Twp
58 - Estral Beach	Estral Beach Village

Source: Reference 2.5-44

Figure 2.5-22 Frenchtown Fire Department Locations

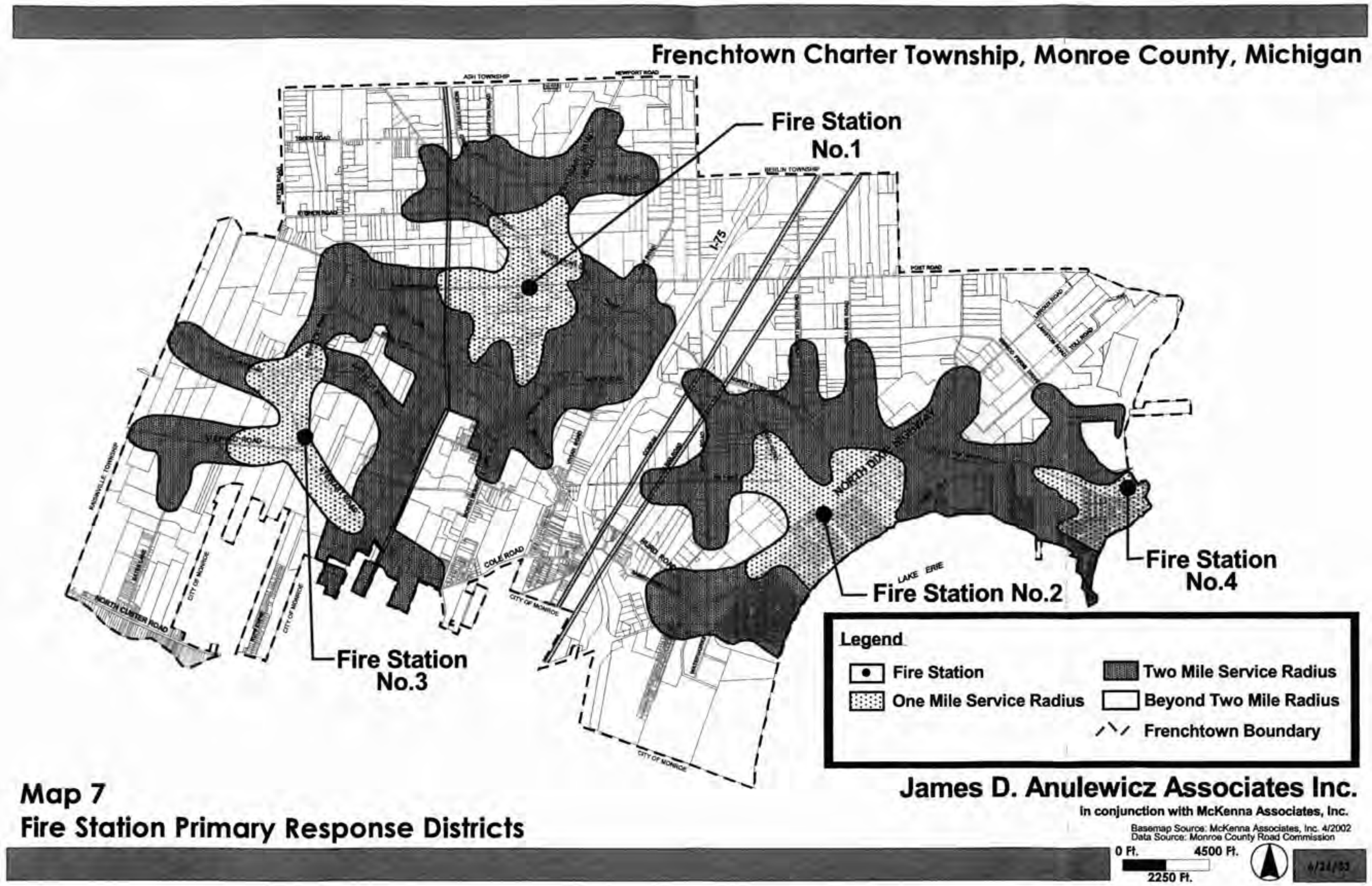


Figure 2.5-23 Frenchtown Road Network

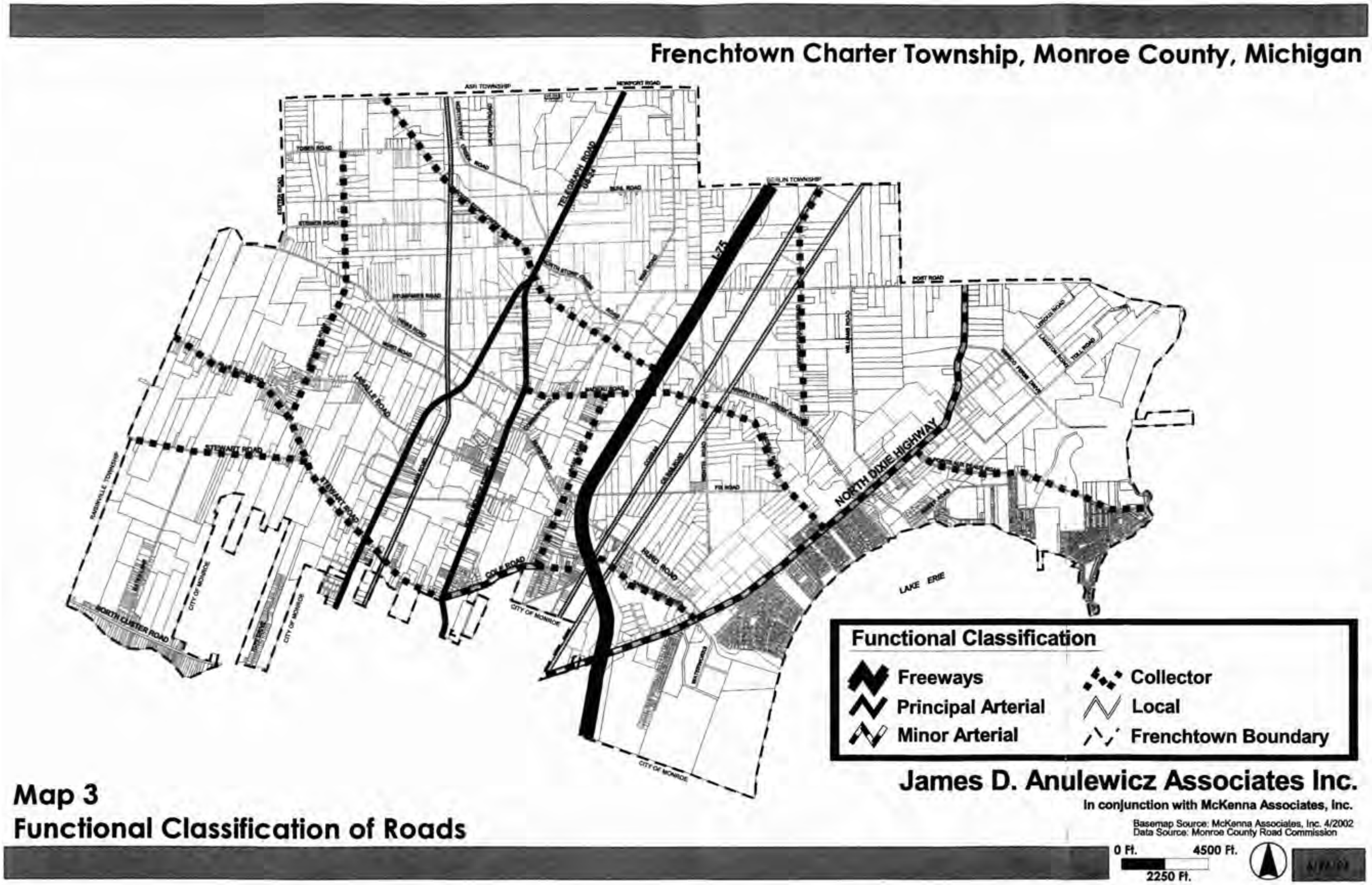


Figure 2.5-24 Traffic Volumes Frenchtown Master Township

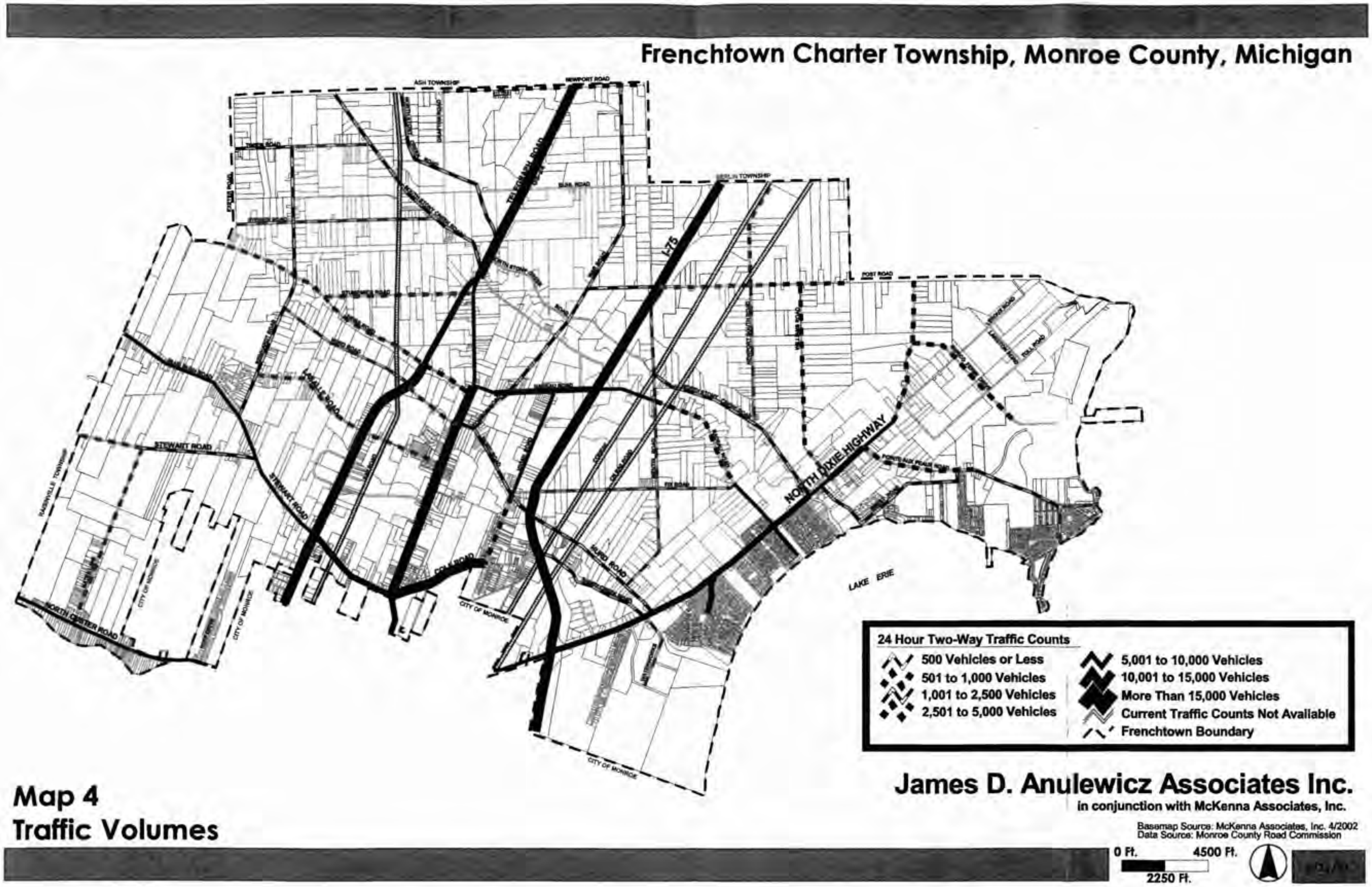


Figure 2.5-25 Traffic Counts within a 5-Mile Radius of the Fermi Site

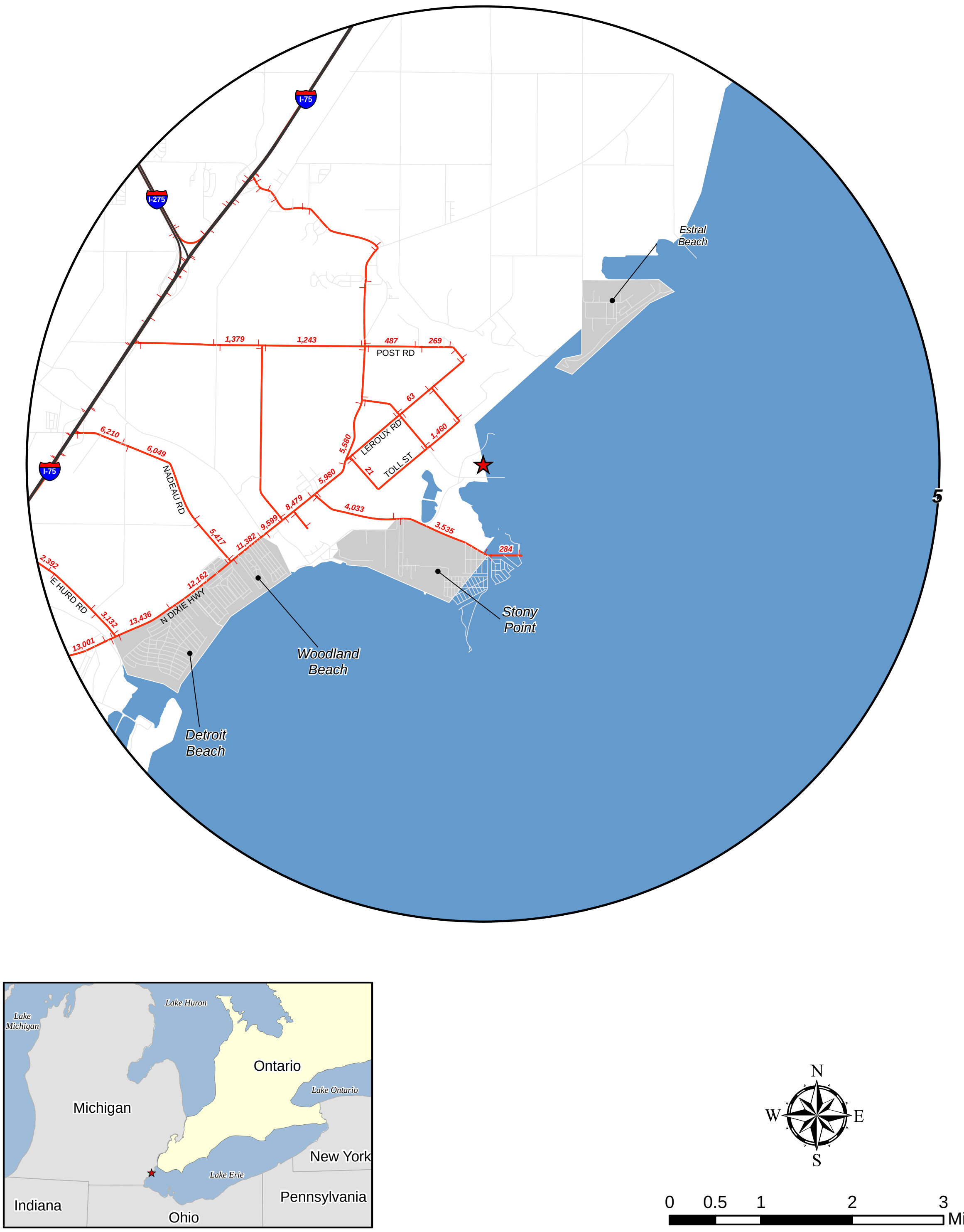


Figure 2.5-26 Fermi to Milan Transmission Line Cultural Resources Preliminary Survey

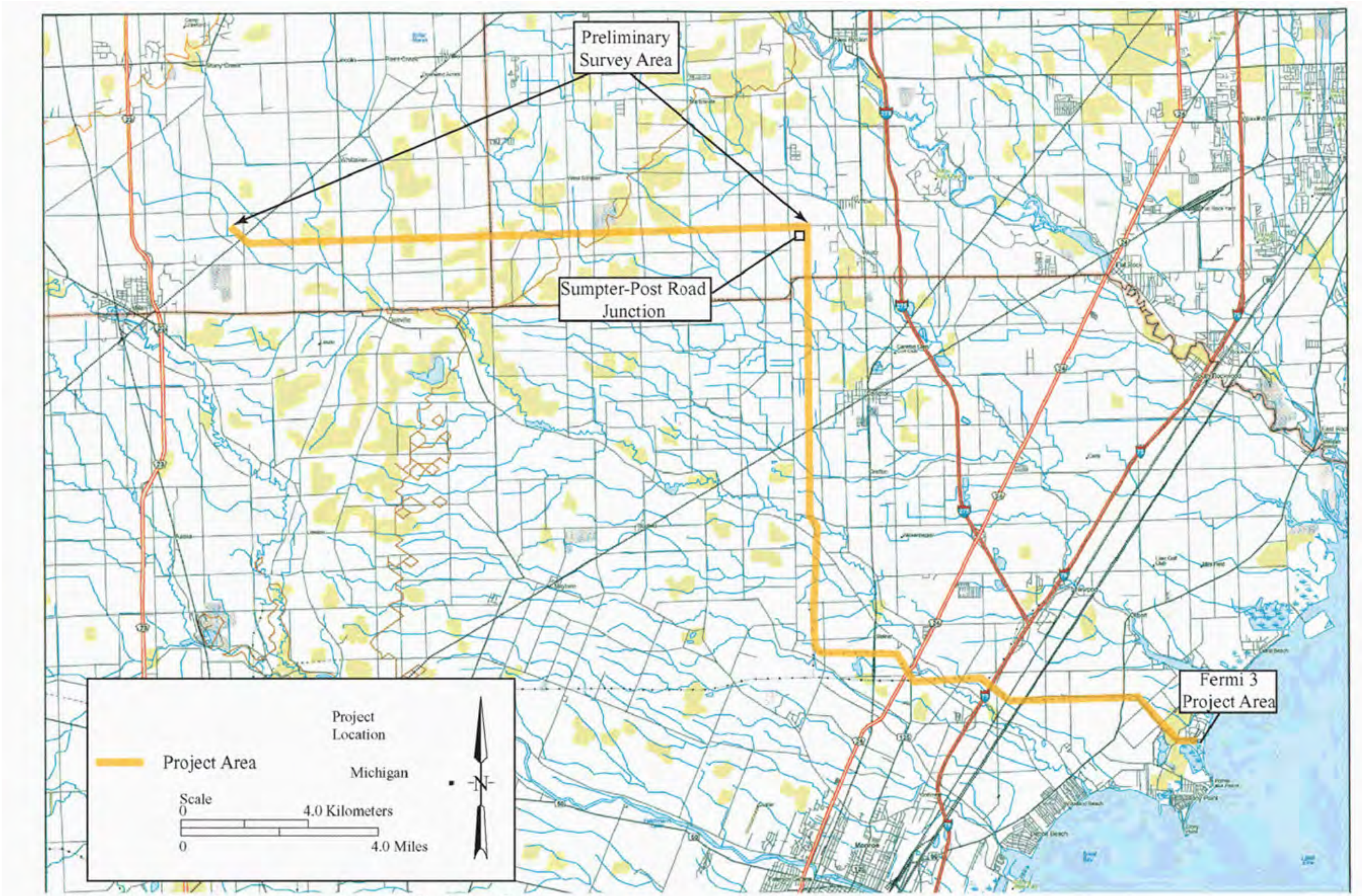


Figure 2.5-27 Fermi 3 Project Archaeological Area of Potential Effect

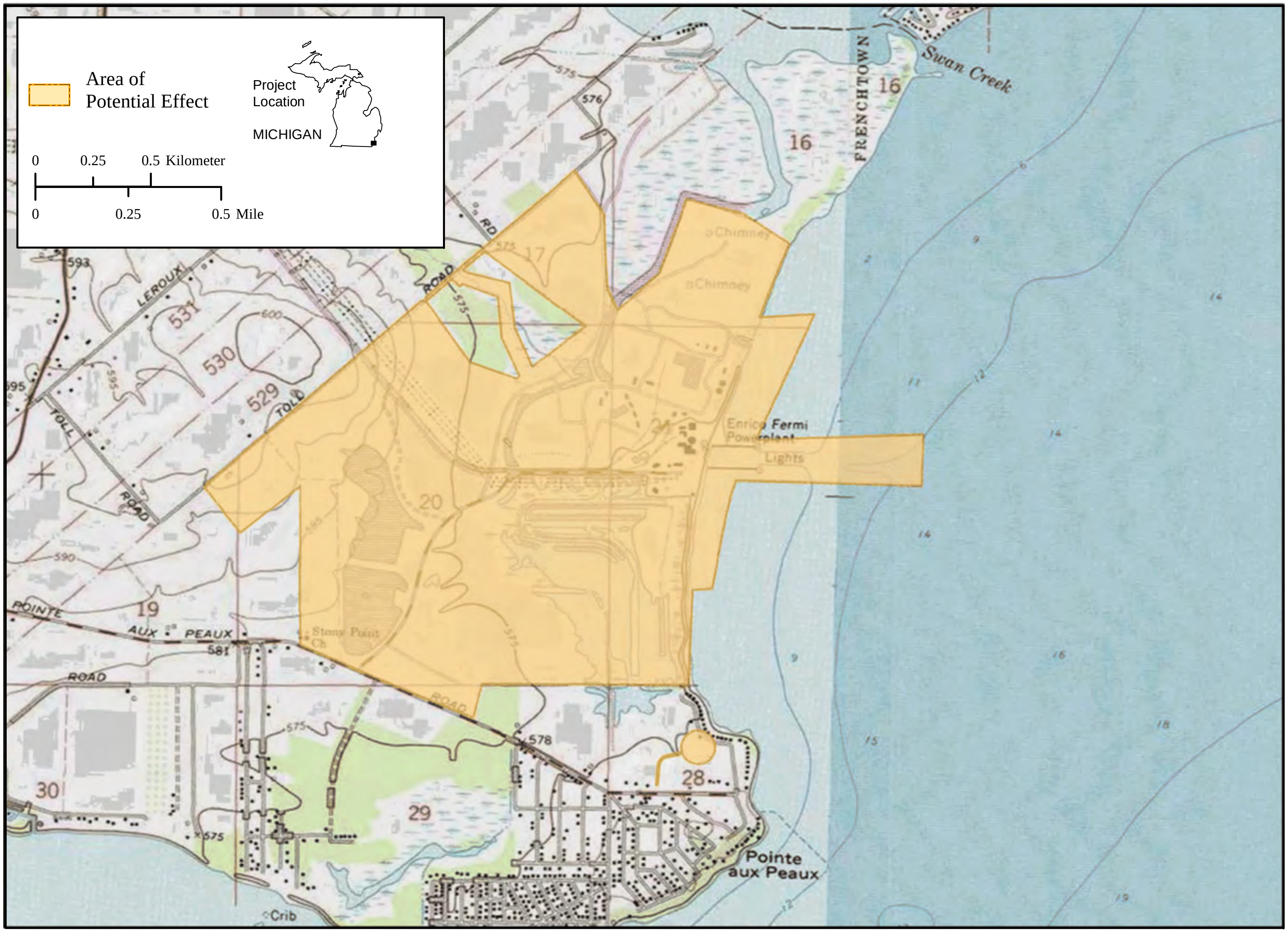


Figure 2.5-28 Fermi 3 Project Above-Ground Cultural Resources Area of Potential Effect

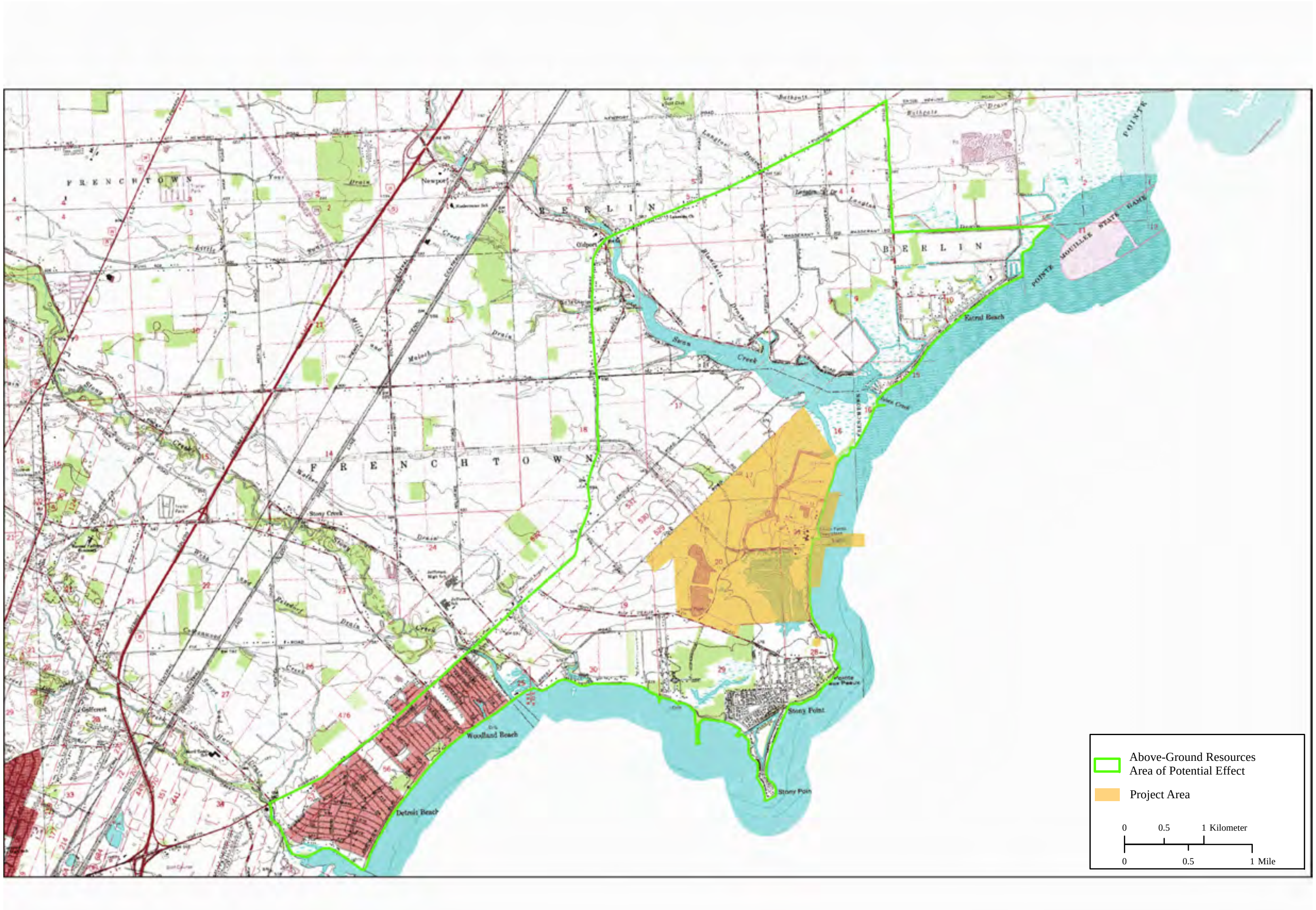


Figure 2.5-29 Minority Counties in the Fermi 3 Region

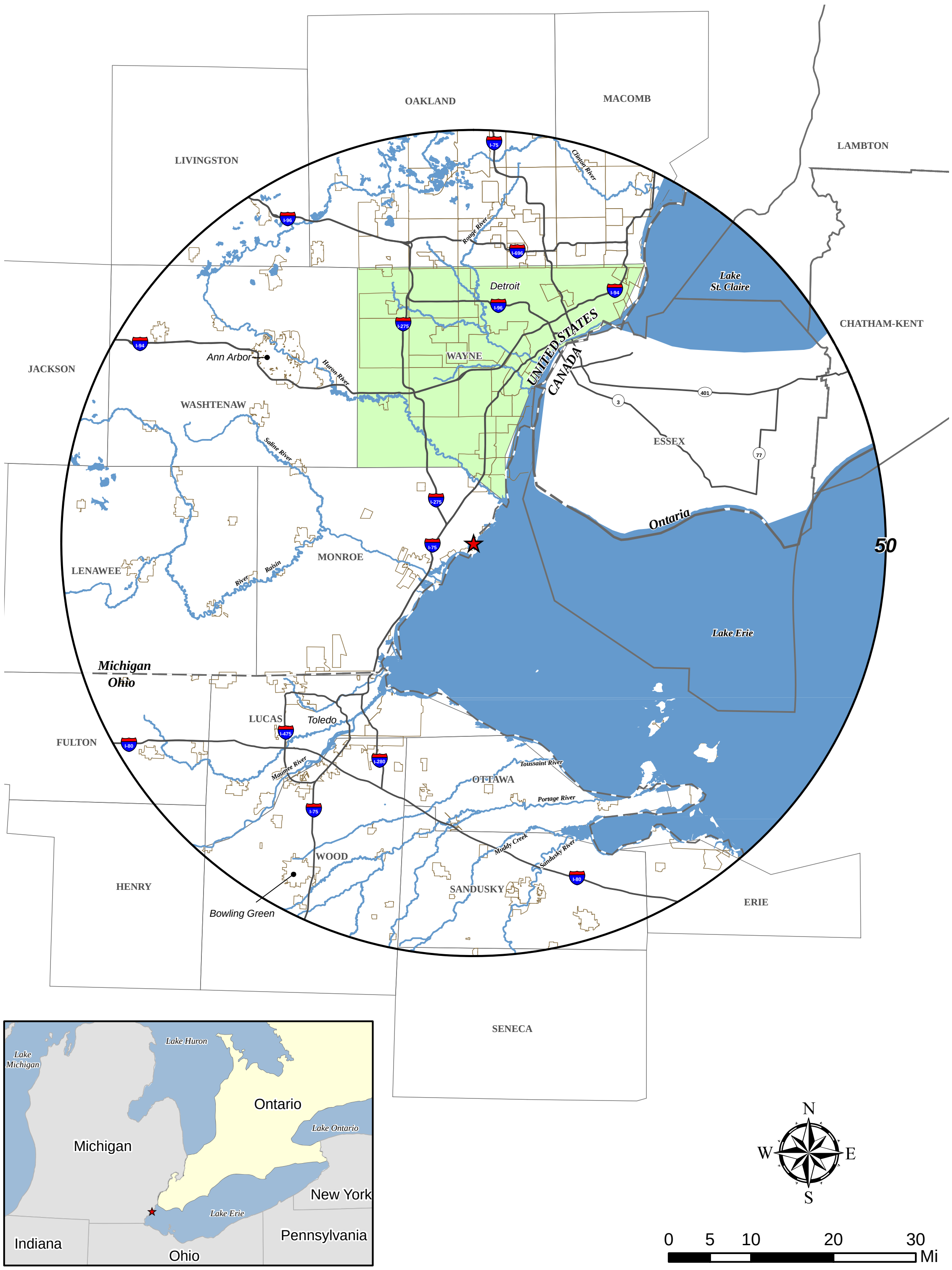


Figure 2.5-30 Minority Census Block Groups (CBGs) in the Fermi Region

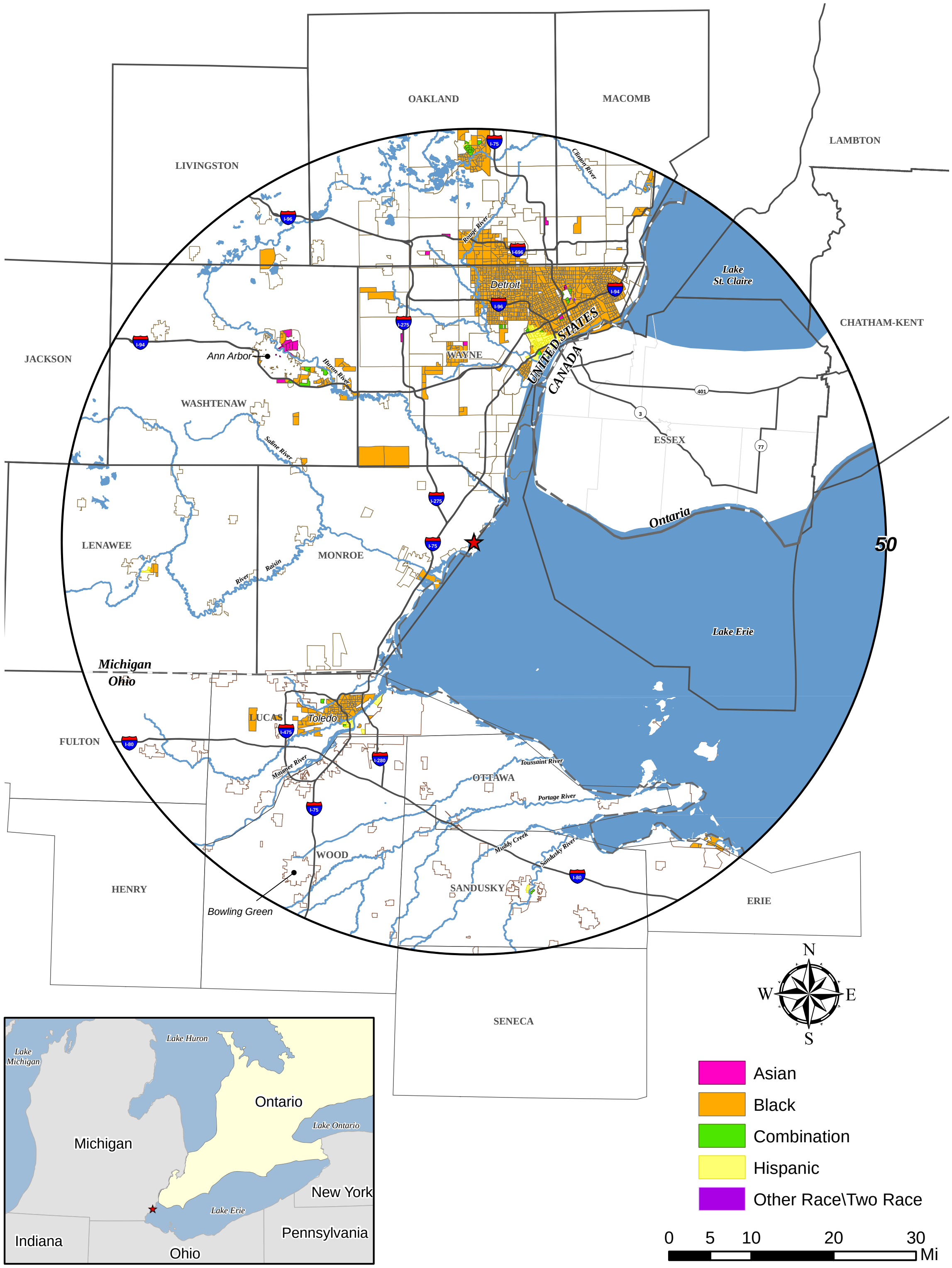


Figure 2.5-31 Low Income Census Block Groups (CBGs) in the Fermi Region

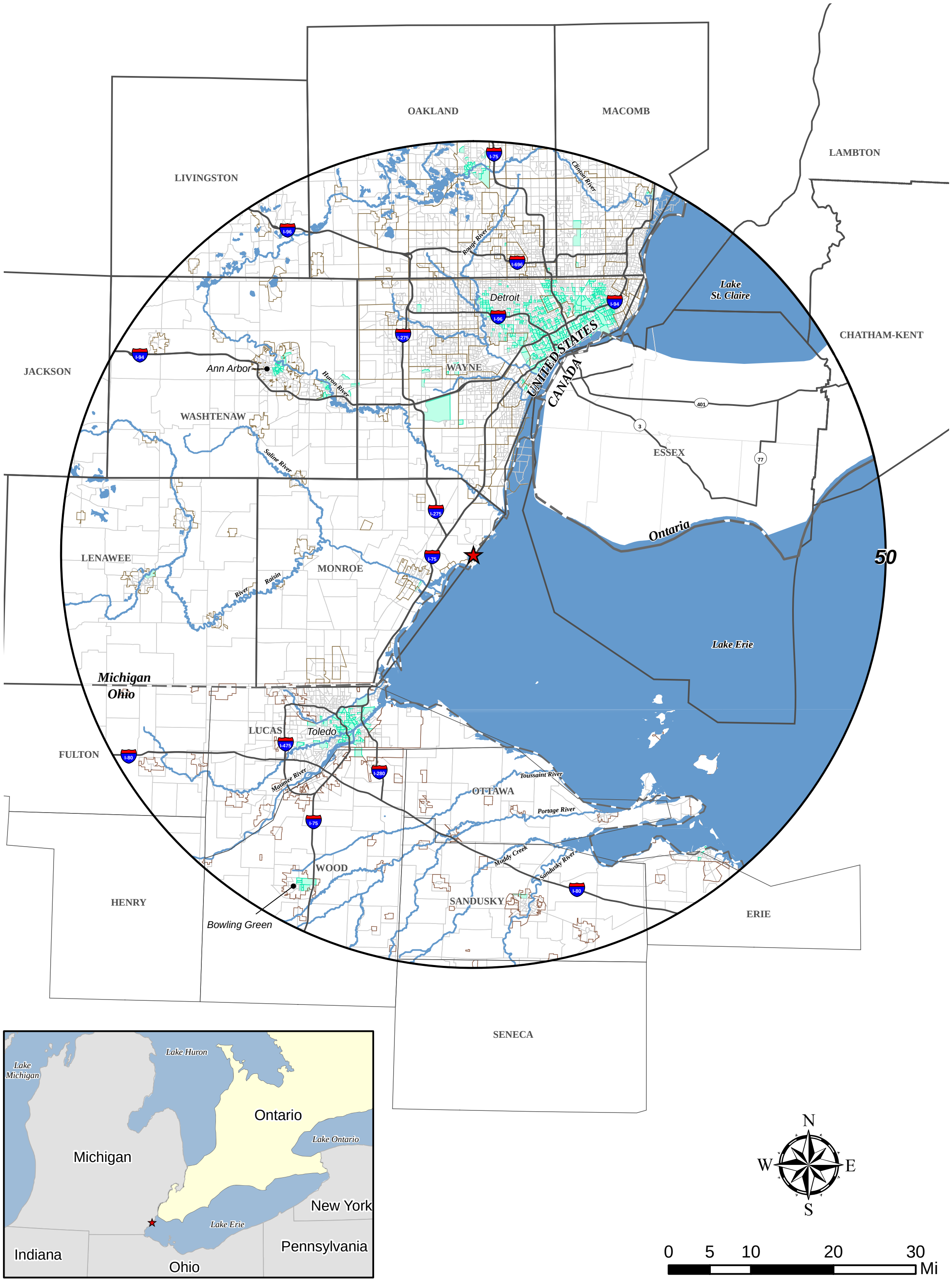


Figure 2.5-32 Fermi Noise Monitoring Locations (NMLs)

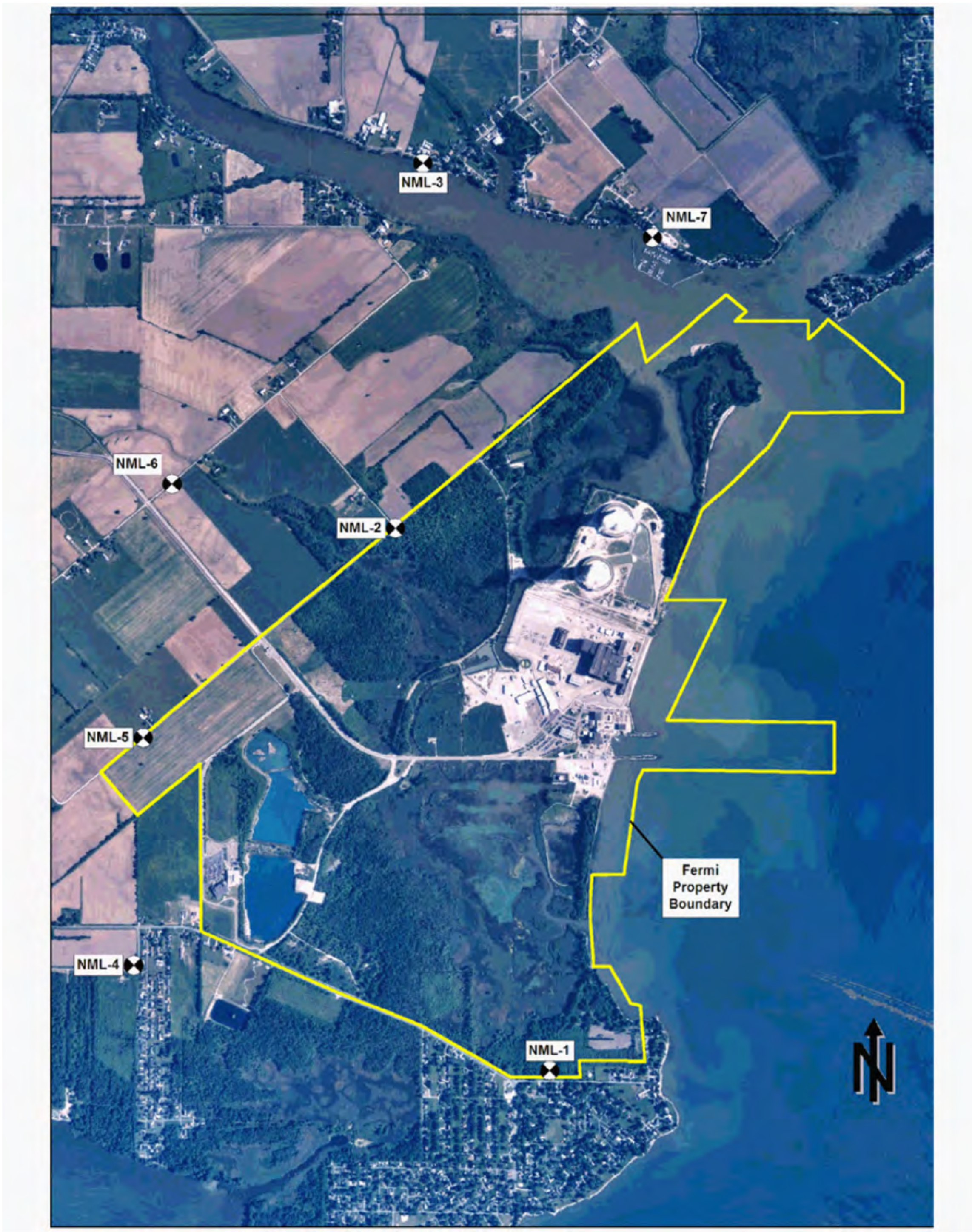


Figure 2.5-33 Hourly Equivalent Continuous Sound Levels (L_{eq}) for NMLs 1-3, November 27-28, 2007

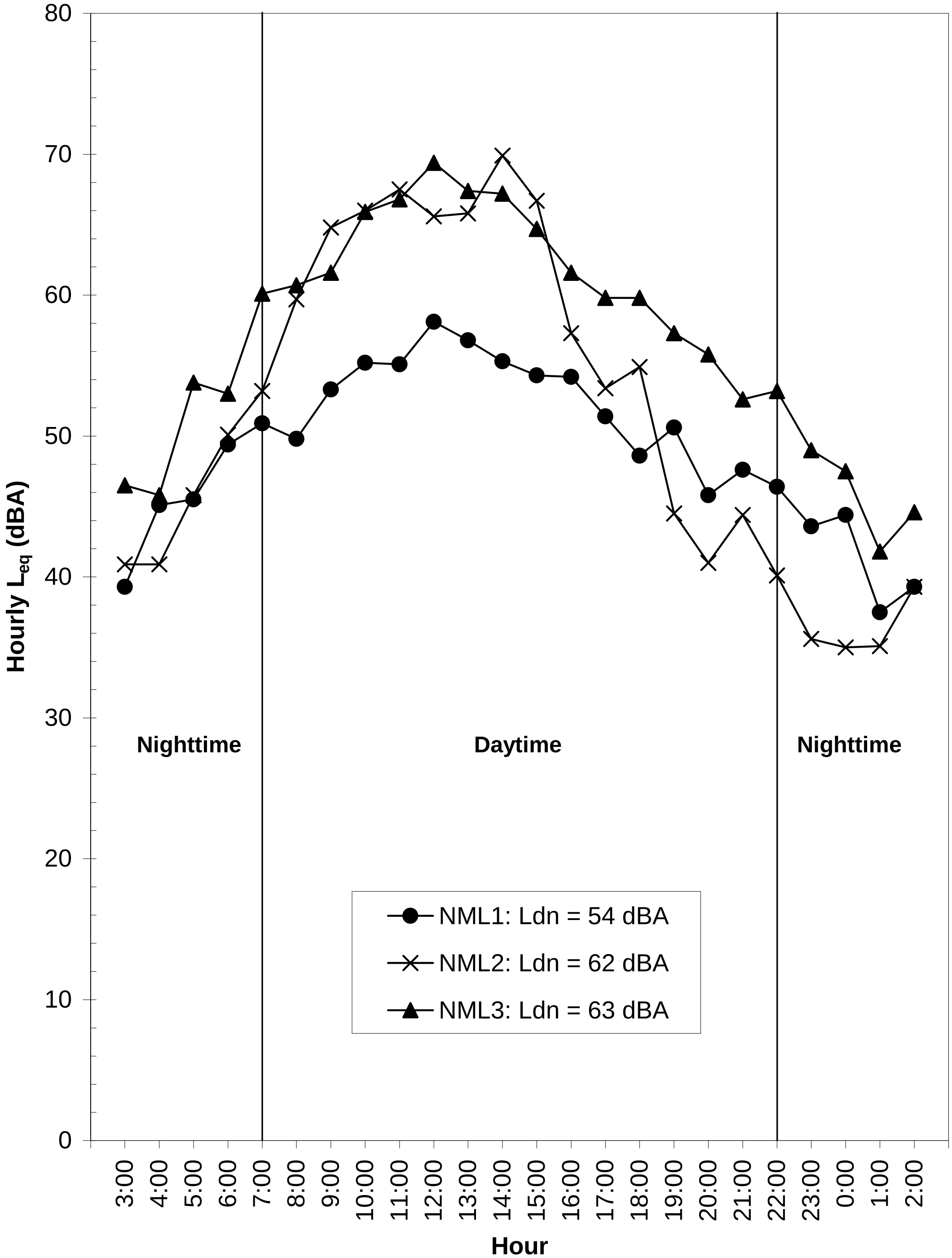
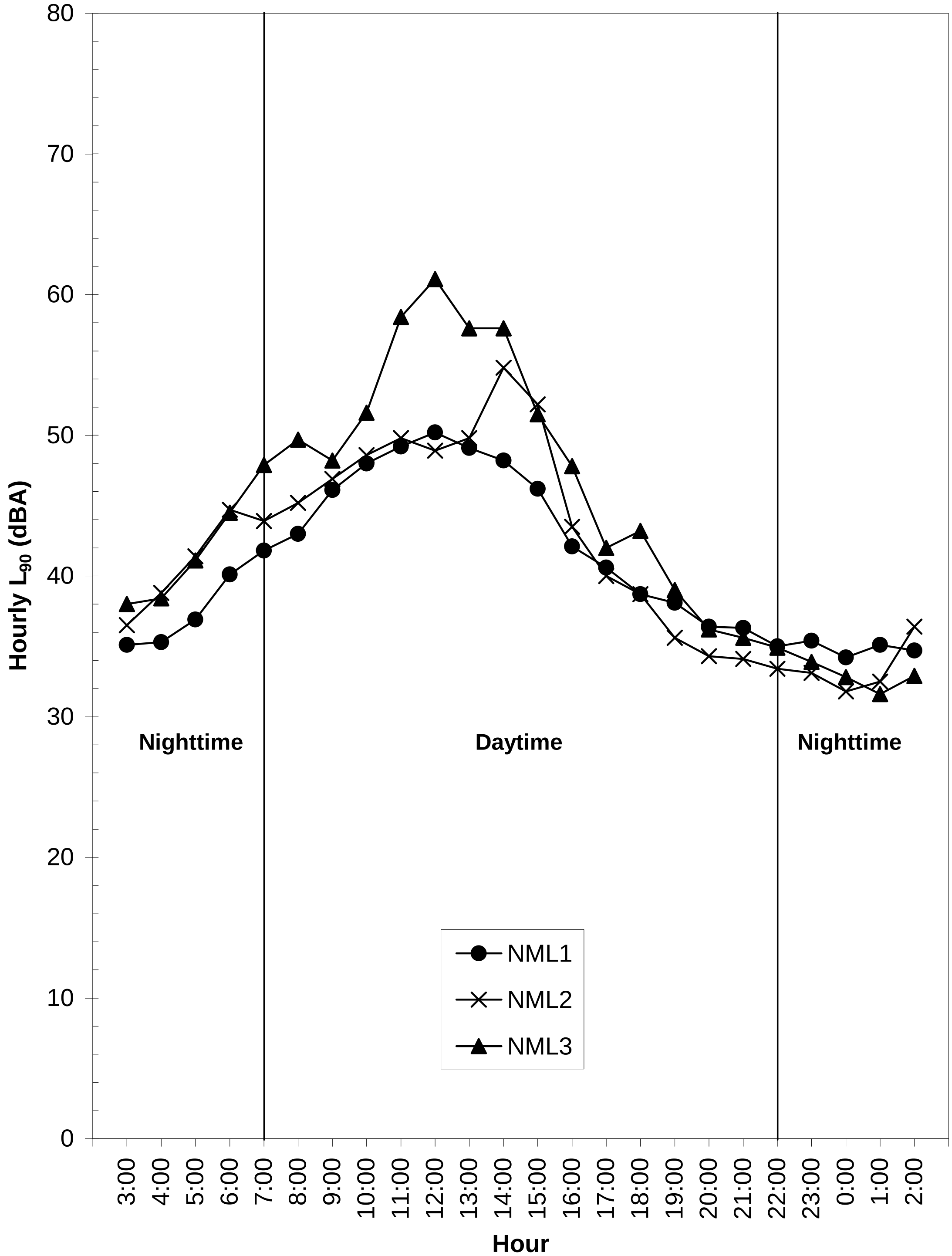


Figure 2.5-34 Hourly L_{90} Sound Levels for NMLs 1-3, November 27-28, 2007



2.6 Geology

This section presents the geology and geologic environmental impacts for Fermi 3. A description of the physiography, geology, seismology, and tectonics for Fermi 3 is presented in FSAR Section 2.5. FSAR Section 2.5 provides a level of detail appropriate for the proposed ESBWR design.

The impacts of the site geology on the plant are covered in FSAR Section 2.5. Descriptions of the geologic structures, tectonics, and seismic hazards are in FSAR Subsection 2.5.1.1.4, FSAR Subsection 2.5.1.2.4, FSAR Subsection 2.5.2, and FSAR Subsection 2.5.3. Descriptions of the non-seismic geologic hazards are in FSAR Subsection 2.5.1.1.5 and FSAR Subsection 2.5.1.2.5. A description of the engineering geology is in FSAR Subsection 2.5.1.2.6, and the potential effects of human activity are in FSAR Subsection 2.5.1.2.6.7. Identification of the sampling pattern and the justification for its selection, the sampling method, pre-analysis treatment, and analytic techniques are presented in FSAR Subsection 2.5.4.2.2.2. The geologic environmental impact, which is defined as the impact of the construction and operation of the plant on the geology, is summarized in Subsection 2.6.5.

2.6.1 **Topography**

Fermi 3 is located in the Eastern Lake section of the Central Lowlands physiographic province. A description of the physiography, geomorphology, and topography of the Fermi 3 200-mi radius site region is in FSAR Subsection 2.5.1.1.1. The 25-mi radius site vicinity, 5-mi radius site area, and 0.6 mi radius site location is described in FSAR Subsection 2.5.1.2.1.

2.6.2 **Stratigraphy**

The stratigraphy below Fermi 3 includes Precambrian igneous and metamorphic rocks, Cambrian through Silurian sedimentary rocks, and Quaternary glacial and lacustrine sediments. A description of the stratigraphy of the Fermi 3 site region is in FSAR Subsection 2.5.1.1.3 and site vicinity is described in FSAR Subsection 2.5.1.1.2.3.

2.6.3 **Soil and Rock Types**

A variety of sedimentary rocks, sediments, and soils were encountered during the Fermi 3 subsurface investigation. Material descriptions and geotechnical properties of the soil and rock units are covered in FSAR Subsection 2.5.4.

2.6.4 **Tectonics and Seismology**

Fermi 3 is located in the stable continental region of the North American Craton, which is characterized by low earthquake activity and low stresses. Descriptions of the tectonics and seismology of the site region and site vicinity can be found in FSAR Subsection 2.5.1.1.4, FSAR Subsection 2.5.1.2.4, FSAR Subsection 2.5.1.2.6.6, FSAR Subsection 2.5.2, and FSAR Subsection 2.5.3.

2.6.5 Geologic Environmental Impact

Based on the Fermi 3 geologic conditions described in FSAR Subsection 2.5.1, adverse impacts on the geology are not anticipated as a result of the construction or operation of Fermi 3. Items considered in evaluating if Fermi 3 could cause adverse impacts include the following:

- Grouting will be used to control groundwater flow into the excavation for Fermi 3. Grouting will increase the strength of the fractured dolomite bedrock providing a positive effect on the geologic environment.
- If blasting is required, vibrations will be controlled so as to not affect the existing Fermi 2 plant. No off-site effects of blasting are anticipated.
- The excavation for Fermi 3 will remove the glacial till, which acts as an upper confining layer for the bedrock aquifer. The excavation will be backfilled with granular fill, which will result in a hydraulic connection between the groundwater in the fill overlying the glacial till and the groundwater in the bedrock. Similar hydraulic connections currently exist at the following locations on the Fermi site:
    - At Fermi 2, excavation extended into the bedrock and granular fill was used as backfill. Therefore, the backfill approach for Fermi 2 and Fermi 3 is similar.
    - At the Quarry Lakes located southwest of Fermi 3 the overburden was removed, and the bedrock was excavated for use as borrow for Fermi 2.

  These existing hydraulic connections have not created any known adverse impacts to the geologic environment. Under current conditions at Fermi 3, the hydraulic gradient is downward from the groundwater in the fill to the groundwater in the bedrock (FSAR Subsection 2.4.12). The hydraulic connection may locally lower the groundwater level of the groundwater in the fill in the vicinity of Fermi 3.
- The absence of capable faults (FSAR Subsection 2.5.1 and FSAR Subsection 2.5.3) eliminates the possibility for a surface rupture as a result of construction or operation of the proposed facility.
- Surface rebound/settlement during construction of the facility that might affect the drainage of surface water will be limited to the excavation, the Fermi 3 footprint, and immediate surroundings.
- No natural slopes exist in the proximity of Fermi 3 that could be adversely affected by the foundation excavation, loading resulting from construction, and infiltration of precipitation resulting from the excavation or surface modifications.
- Disposal of excavated material might be required either onsite or offsite. Generally accepted methods will be employed to control erosion of this material at the disposal site. Potential methods include silt fences, seeding, and drainage control. Soil surfaces exposed during construction will be protected to mitigate their erosion and control surface runoff.

- Vertical groundwater cut-offs, with technologies such as slurry walls, grout curtains, or freeze walls, will be used to control groundwater migration into the excavation; thus, reducing drawdown of groundwater adjacent to the excavation.

2.6.6 References

None.

2.7 Meteorology and Air Quality

This section describes the general climate of the Fermi site and the surrounding regional meteorological and air quality conditions. This section also documents the range of meteorological conditions that would likely exist during the construction and operation of Fermi 3. Data presented includes a climatological summary of normal and extreme values of several meteorological parameters recorded by National Weather Service (NWS) meteorological instruments located in Detroit (Detroit Metropolitan Airport) and Flint, Michigan, Toledo, Ohio and the Fermi onsite meteorological station. Supplemental meteorological data from four NWS Cooperative Observation Program (COOP) stations with data sets dating back 30 years or more were also added to the analysis of the region surrounding the Fermi site. Air quality data obtained from the Michigan Department of Environmental Quality (MDEQ) monitors was also used to discuss the regional air quality surrounding Fermi 3. The regional climate and air quality conditions that surround the Fermi site are described in Subsection 2.7.1 and Subsection 2.7.2, respectively. Details regarding severe weather conditions that are observed in the Fermi region are provided in Subsection 2.7.3, while the description of the local meteorology and topographic description for the Fermi site is located in Subsection 2.7.4 and Subsection 2.7.5, respectively. Short- and long-term diffusion estimates of radiation, as they relate to dose concentrations to the public and surrounding area are presented in Subsection 2.7.6.

2.7.1 General Regional Climate

The following climatology for Fermi 3 uses data from the NWS first-order stations at Detroit Metropolitan Airport, Toledo, and Flint, as well as four NWS COOP stations located within fifty miles of the Fermi site. The above stations have long return periods of meteorological parameters that provide the regional climatology representative of the Fermi region. The meteorological data obtained for this climatology were collected and processed by the National Oceanic and Atmospheric Administration's (NOAA) Midwestern Regional Climate Center (MRCC) and National Climatic Data Center (NCDC).

Table 2.7-1 contains the distances and directions of the meteorological observing stations relative to the Fermi site as shown in Figure 2.7-1. Detroit Metropolitan Airport is the closest first-order station to the site with a long-term history of recording hourly wind speed and direction, temperature, precipitation, atmospheric moisture content (i.e., dew-point temperature, relative humidity, and wet-bulb temperature), barometric pressure, and the occurrence of weather phenomenon such as thunderstorms and fog (Reference 2.7-1). Flint and Toledo are additional NWS first-order stations with long-term climatological periods of record (Reference 2.7-2 and Reference 2.7-3). Table 2.7-2 through Table 2.7-4 display the various meteorological parameters in the annual Local Climatological Data Summaries (LCD) for Detroit Metropolitan Airport, Flint, and Toledo, respectively. The four COOP meteorological stations used in this climatology have complete or nearly complete data sets that extend back 30 years or greater (Reference 2.7-4 through Reference 2.7-7).

2.7.1.1 General Climate

The Fermi site is located along the western Lake Erie shoreline and south of the Detroit metropolitan area. The general climate of the Fermi site and the surrounding region can be described as humid continental, experiencing both warm and humid summers and severe winters. Lake Erie largely influences the overall temperature, wind, and precipitation characteristics of the site and surrounding region. The higher thermal capaCity of the lake moderates the daily temperature extremes that are found further inland, especially during the spring, summer, and fall seasons. Annually, the region experiences approximately six days below 0ºF and only 12 days above 90ºF (Reference 2.7-1). The temperature contrast of the coastal boundary also produces lake and land breezes that are most prominent during the summer in the Fermi region. During the late spring and summer seasons, the lake breezes generally form by afternoon and bring cooler air from above the lake to locations along the shoreline, effectively lowering the daily maximum temperature. During the late summer and fall, land breezes continue the moderation effect by bringing cooler air located further inland to the shoreline areas. At night during the spring, summer, and fall, the lake, with its greater heat capacity, moderates low temperatures along the shoreline. During late December, ice typically forms over the lake and decreases its influence on the coastal areas (Reference 2.7-8). The ice cover during most years thaws by the middle of March, which prolongs cooler temperatures through parts of the spring season for the Fermi region.

The meteorological conditions in the Fermi region are also influenced by the high frequency of surface low pressure systems and cloudiness during the late fall and winter, as well as early spring (Reference 2.7-9). During the later half of spring and summer, the mean track of surface low pressure systems shifts north of the region and the Fermi region experiences an increase in sunshine and warmer monthly temperatures.

Overall precipitation amounts vary slightly from month to month throughout the year (Reference 2.7-1). During the winter, the mean track of surface low pressure systems is positioned over or just south of the Fermi region and increases the frequency of precipitation (Reference 2.7-9). Surface low pressure systems come from the west, northwest and southwest during the winter and bring the possibility of rain, freezing rain, sleet, and snow. Heavy snows are possible throughout the winter and can result in significant accumulations. During the summer, the mean track of surface low pressure systems shifts north of the region, however monthly rainfall values are higher than any other season. The number of days per month with thunderstorms is approximately 6 days during June, July, and August, which is higher than any other months (Reference 2.7-1). Thunderstorms during the summer bring the potential of heavy rainfall and severe weather.

2.7.1.2 Normal, Mean, and Extreme Climatological Conditions

This section discusses 30-year normals, as well as long-term means and historical extremes for temperature, water vapor, precipitation, and wind that characterize the meteorological conditions in the region surrounding the Fermi site.

Table 2.7-2 contains long-term normals, means and extremes for Detroit Metropolitan Airport in Detroit, located approximately 17 miles north-northwest of the Fermi site. Table 2.7-3 and

Table 2.7-4 exhibit long-term meteorological information for Flint and Toledo. Flint and Toledo are located 74 miles to the north-northwest and 38 miles southwest of the Fermi site, respectively.

The purpose of this section is to demonstrate that the long-term data reported at the three NWS first-order meteorological stations, as well as the four COOP stations are representative of the short- and long-term climate characteristics of the region surrounding the Fermi site. Subsection 2.7.1.2.1 through Subsection 2.7.1.2.4 provide more detailed discussions of specific meteorological parameters of interest.

2.7.1.2.1 **Wind Conditions**

Based upon 39 years of wind data at Detroit Metropolitan Airport, the annual prevailing wind direction is 240 degrees or southwest (Reference 2.7-1). Monthly prevailing winds in Detroit are generally southwest during all months except during the spring when they are northwest. At Flint and Toledo the annual prevailing wind direction is also southwest (Reference 2.7-2 and Reference 2.7-3), but both stations have different monthly variations when compared to Detroit. Monthly winds for Toledo, like Detroit, are southwest during all but the spring season when they become east-northeast. Monthly wind directions for Flint are also southwest during the majority of the year, however winds become westerly during February and March, east-northeasterly during April, and more southerly during May. The differences in the late winter and spring prevailing wind directions between Detroit and the Flint and Toledo stations can be attributed to the transition of the mean track of surface low pressure systems to the north. During this transition the path of surface low pressure systems greatly varies, and wind patterns across the region can be different. The variation in the path of the surface low pressure systems, as well as the general weakening of the jet stream, can explain the complexity of wind directions at the three first-order stations during the late winter and spring months.

During the most recent 23-year period, the annual mean wind speed for Detroit Metropolitan Airport is 9.9 mph (Reference 2.7-1). In comparison, Flint and Toledo have slightly lower annual mean wind speeds, 9.3 and 9.1 mph, respectively (Reference 2.7-2 and Reference 2.7-3). Seasonally, the highest seasonal mean wind for all three stations is during the winter and spring months as shown in Table 2.7-2 through Table 2.7-4. The lowest seasonal mean wind speed occurs during the summer months for Detroit (8.4 mph), Flint (7.7 mph), and Toledo (7.2 mph). The highest monthly mean wind speed for Detroit occurs in January with a value of 11.6 mph. Flint and Toledo also have their highest monthly mean wind speed during January; however, their values are slightly lower (10.8 mph). During January the mean track of surface low pressure systems is positioned over the Fermi region, which increases the frequency of surface low pressure systems, and therefore wind speeds. The lowest monthly mean wind speed for the three first-order stations is during August when the mean track of surface low pressure systems migrates well north of the region. The overall variation of monthly wind speeds is consistent for the three first-order stations, and therefore these values represent values characteristic of locations in the Fermi region.

Extreme winds for design basis purposes are discussed in Subsection 2.7.3.2. Wind data summaries for the Fermi onsite meteorological station are discussed in Subsection 2.7.4.2 and Subsection 2.7.4.3.

2.7.1.2.2 Temperature

Table 2.7-5 presents normal annual temperatures for the three NWS first-order and four COOP stations in the Fermi region during the period 1971-2000. The daily normal temperature for the stations are generally uniform with only minor differences apparent between the two COOP stations closer to the shoreline of Lake Erie and the other stations located further inland or stationed near metropolitan cities. The slight difference in the daily normal temperatures across the Fermi region can be explained by looking at the daily maximum and minimum temperatures. Stations that are closer to the shoreline, specifically Monroe and Windsor, have a slightly higher minimum temperature due to the heat content of Lake Erie. While the other NWS first-order and COOP stations are also influenced by the effects of Lake Erie, Monroe and Windsor are closer to the shoreline and further from metropolitan areas, as a result have slightly higher mean daily minimum temperatures and lower daily maximum temperatures. The observation stations at Detroit Metropolitan Airport are also influenced by the heat island effect that is created by large metropolitan areas. The heat island effect likely explains how the daily minimum temperature for Detroit Metropolitan Airport is warmer than the Monroe and Windsor stations.

During the summer months of June, July, and August, mean daily maximum and minimum temperatures at Detroit Metropolitan Airport average 81°F and 60°F, respectively (Reference 2.7-1). In comparison, at Flint and Toledo summer mean daily maximum temperatures are 80°F and 82°F, respectively, while mean daily minimum temperatures are 56°F and 59°F, respectively (Reference 2.7-2 and Reference 2.7-3). Table 2.7-6 contains climatological extreme maximum and minimum temperatures for the NWS first-order and COOP stations (Reference 2.7-2, Reference 2.7-3, Reference 2.7-5, Reference 2.7-10 through Reference 2.7-14). The highest daily maximum temperature recorded at Detroit Metropolitan Airport was 104°F in June of 1988; however, a temperature of 105°F was recorded in July of 1934 at the nearby Detroit City Airport (Reference 2.7-1 and Reference 2.7-11). The highest temperature recorded at Toledo and Flint is 105°F and 101°F, respectively, occurring in July of 1936 and 1995, respectively (Reference 2.7-2 and Reference 2.7-13). The highest temperature recorded at the NWS COOP sites is 108°F, occurring at the Adrian 2 NNE observation station during July of 1934 (Reference 2.7-10).

During the winter months, the variation of the mean daily minimum temperature is higher between the stations, while the mean daily maximum temperature remains nearly uniform across the region. Mean daily maximum temperatures during the winter at Detroit Metropolitan Airport and Toledo are 34°F, while Flint, which is further north, averages a temperature of 30°F (Reference 2.7-1, Reference 2.7-2, and Reference 2.7-3). The mean daily minimum temperatures for Detroit Metropolitan Airport and Toledo are 20°F and 19°F, respectively. Flint, which is further inland and influenced less by the Great Lakes, has a mean daily minimum temperature of 16°F during the winter season. The major track of surface low pressure systems during wintertime is over the Fermi region, which allows frequent episodes of arctic air (Reference 2.7-9). During a normal winter, there are 45.6 days where the maximum temperature fails to rise above freezing (Reference 2.7-1). However, the Canadian air masses that usher in arctic air to the Fermi region pass over Lake Michigan, which adds heat and moisture to the air mass. The lake effect produced by the Great Lakes produces an excess of cloudiness during the winter and a moderation of the extreme arctic temperatures. Table 2.7-6 summarizes the extreme minimum temperatures recorded at the NWS first-order and COOP station around the Fermi region. The coldest temperature recorded was -26°F at the Adrian 2 NNE station during January of 1892 (Reference 2.7-10). The extreme low values of minimum temperature confirm that the region is exposed to arctic air masses. Furthermore, the stations that are closest to the Lake Erie shoreline have slightly warmer values than those stations further inland, indicating the effect of Lake Erie on extreme temperatures in the Fermi region.

2.7.1.2.3 **Atmospheric Moisture**

Atmospheric moisture in the region surrounding the Fermi site is influenced by Lake Erie and the other surrounding Great Lakes. The content of moisture in the atmosphere is measured through several parameters (relative humidity, dew-point temperature, and wet-bulb temperature) and can be evaluated by looking at the long-term history of the daily, monthly and annual means for the stations in the Fermi region.

Relative Humidity

As shown in Table 2.7-2 through Table 2.7-4, mean annual relative humidity values at Detroit, Flint and Toledo average 71-73 percent (Reference 2.7-1, Reference 2.7-2, and Reference 2.7-3). Nighttime relative humidity is highest in the late summer and early fall and lowest during the spring months. Daytime humidity readings are highest during the late fall and winter seasons. Daily relative humidity values are typically highest around 0700 EST, while lowest relative humidity values occur during early and mid afternoon.

Wet-Bulb Temperature

The mean annual wet-bulb temperature at Detroit Metropolitan Airport is 45.0ºF based upon 23 years of record (Reference 2.7-1). July has the highest mean monthly wet-bulb temperature with a value of 65.9ºF. The lowest monthly mean wet-bulb temperature is 23.7ºF, which occurs in January. Toledo and Flint have mean annual wet-bulb temperatures of 45.5ºF and 43.6ºF, maximum mean monthly wet-bulbs of 66.5ºF and 64.6ºF, and minimum mean monthly wet-bulbs of 24.2ºF and 22.1ºF, respectively (Reference 2.7-2 and Reference 2.7-3). Detroit and Toledo have slightly higher mean annual wet-bulb temperatures than Flint due to their closer proximity to Lake Erie. While Flint is surrounded by the Great Lakes and is approximately 43 miles from Saginaw Bay, it is located further inland than the other first-order stations and can experience lower minimum temperatures.

Dew-point Temperature

Table 2.7-2 provides mean monthly and annual dew-point temperatures for Detroit Metropolitan Airport, indicating a mean annual dew-point of 40.3ºF. In comparison, Table 2.7-3 and Table 2.7-4 show that the mean annual dew-point temperature for Flint and Toledo are 39.4ºF and 41.1ºF, respectively. While the differences in mean annual dew-point are small between the stations, it is apparent that stations that are further south and closer to Lake Erie have slightly higher moisture content. Mean dew-point temperatures for every month at Detroit Metropolitan Airport are lower than the mean dew-point for Toledo, but are higher than the values for Flint. According to Table 2.7-2, Table 2.7-3 and Table 2.7-4 the maximum mean monthly dew-point temperature occurs in July for all first-order stations. The minimum mean monthly dew-point temperature occurs in January, when the mean monthly temperature is the lowest. During the late winter and spring, the difference in mean monthly dew-point between the first-order stations is greatest, while the differences are smallest during the fall and early winter seasons. It is apparent that the content of atmospheric moisture can be directly correlated to the latitude of the station and, to a smaller extent, the distance from Lake Erie in the region of the Fermi site.

2.7.1.2.4 **Precipitation**

Annual Precipitation

Annual precipitation in the region ranges from just under 30 inches in northeastern Michigan to near 40 inches for the remainder of the state (Reference 2.7-16). Table 2.7-5 presents normal annual rainfall totals for the four COOP and three first-order stations surrounding the Fermi site. Overall, annual rainfall is uniform across the region with the Windsor, Ann Arbor and Adrian stations having the highest annual amounts. The consistent annual rainfall totals for the stations within 50 miles of the Fermi site demonstrates the regional nature of precipitation events.

Monthly Precipitation

Table 2.7-2 displays normal monthly precipitation amounts at Detroit Metropolitan Airport, showing precipitation is fairly consistent throughout the year. Normal monthly precipitation amounts for Flint and Toledo are displayed in Table 2.7-3 and Table 2.7-4 and confirm the uniform nature of precipitation year round. The highest monthly precipitation for Detroit (3.55 inches) and Toledo (3.80 inches) occurs during June, while it is during September for Flint (3.76 inches). The lowest monthly precipitation occurs in February for the three first-order stations when monthly amounts between 1.35 and 1.88 inches are common.

Maximum 24-hour and Monthly Precipitation

Table 2.7-6 displays the maximum 24-hour precipitation amounts recorded for the NWS first-order and COOP stations in the region of the Fermi site. Excessive amounts of precipitation have fallen at all of the observation stations in a 24-hour period. The highest amount of precipitation in a 24-hour period is 6.04 inches, occurring at Flint during September of 1950. For all meteorological stations the 24-hour precipitation amounts occurred between the months of May through September. Table 2.7-6 also contains the maximum monthly precipitation amounts for the meteorological stations surrounding the Fermi site. All maximum amounts of precipitation for the NWS stations occurred between the months of June through August. The highest extreme monthly rainfall occurred at Flint during August of 1975 when 11.04 inches was reported. Earlier it was mentioned that the mean track of surface low pressure systems during the summer months retreats well north of southeast Michigan. While the frequency of surface low pressure systems decreases during the summer season, the intensity of precipitation from thunderstorms contributes to the higher precipitation amounts during the summer months in the Fermi region.

Snow and Ice

Surface low pressure systems during the wintertime can bring a combination of rain, freezing rain, sleet and snow. During a typical year frozen precipitation is possible starting in October and ending in May. Table 2.7-5 presents normal annual snowfall amounts for the meteorological stations surrounding the Fermi site. Normal annual snowfall distributions for the three first-order stations indicate that annual snowfall increases for stations located farther north.

The threat of heavy snowfall is present throughout the wintertime for the Fermi region. Maximum 24-hour snowfall amounts are listed in Table 2.7-6 for each meteorological station. The highest snowfall amount in a 24-hour period is 24.5 inches, occurring near the Detroit City Airport in April 1886. For all meteorological stations listed in Table 2.7-6, the maximum 24-hour snowfall amounts occurred between the months of November through April. Maximum 2- and 3-day snow fall totals were also obtained for the Fermi region from the NCDC United States Snow Climatology online database. The highest 2- and 3-day snowfall reported from the database is 56.6 cm (22.3 inches) occurring at Flint (Reference 2.7-15) The Snow Climatology online database does not include snow records that would capture the maximum 24-hour snowfall that occurred in 1886. Since the maximum 2- and 3-day snowfall, obtained from Snow Climatology online database, is less than the maximum 24-hour snowfall, it is appropriate that the maximum 24-hour snowfall also be the maximum 2- and 3-day snowfall for the Fermi site. The maximum monthly snowfall is 148.6 cm (58.5 inches) which occurred at Ann Arbor during February 1923 (Reference 2.7-10). The remainder of meteorological stations in Table 2.7-6 have maximum monthly snowfall amounts that range between 29.0 and 38.4 inches. While there is much variability among the maximum 24-hour and monthly snowfall amounts, the region surrounding the Fermi site can experience significant snowfalls anytime during the winter season.

2.7.2 Regional Air Quality

2.7.2.1 Background Air Quality

The Fermi site is located in the northeastern tip of Monroe County and along the western shoreline of Lake Erie. Air quality at the Fermi site is heavily influenced by the Detroit Metropolitan area and surrounding emission sources. The MDEQ evaluates the air quality in the Detroit Metropolitan area with a network of monitors mostly located in Wayne County, north of the Fermi site. The MDEQ routinely monitors the U.S. Environmental Protection Agency (USEPA) criteria pollutants of NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}, and Ozone. While Monroe County is a member of the Metropolitan Interstate Toledo Air Quality Control Region (AQCR), it is also included in the Detroit-Ann Arbor air quality designation area. The Detroit-Ann Arbor air quality designation area is currently classified as a PM2.5 non-attainment area for violations of the 1997 annual standard and the 2006 24-hour standard (Reference 2.7- 17). The county is also currently classified as a maintenance area for the 8-hour ozone standard after being reclassified to attainment on June 29,2009 by the EPA (Reference 2.7-17). Monroe County is in attainment for all other criteria pollutants (Reference 2.7-17). The USEPA as of March 12, 2008 strengthened the definition of ozone non-attainment areas as those that record 8-hour average ozone levels of 0.075 parts per million (ppm) or higher (Reference 2.7-18). For $PM_{2.5}$ the USEPA considers areas in violation of the annual standard when the 3-year average of the weighted annual mean PM2.5 concentration is equal to or exceeds 15 μg/m^3 and in violation of the 2006 24-hour standard when the 3-year average of the 98th percentile of the 24-hour concentration is equal to or exceeds 35 μg/m^3.

Maximum concentrations for the 24-hour $PM_{2.5}$ and 8-hour ozone pollutants were obtained from monitors in Monroe and Wayne County. The highest annual $PM_{2.5}$ concentration reported between 1999 and 2006 is 20.1 μg/m^3, occurring at the Dearborn monitor located west of downtown Detroit and the highest 24-hour $PM_{2.5}$ concentration over this same period is 58 μg/m^3 (98th percentile) occurring at the Allen Park monitor located southwest of downtown Detroit in Wayne County (Reference 2.7-19). Between 2003 and 2007, the highest 8-hour ozone concentration recorded was 104 ppb (0.104 ppm), measured at the East Seven Mile monitor located in northeastern Wayne County (Reference 2.7-20). The next closest non-attainment area for a USEPA criteria pollutant is Lorain County, Ohio which is part of the Cleveland Metropolitan air shed (also non-attainment for ozone and $PM_{2.5}$), located approximately 60 miles east-southeast of the Fermi site (Reference 2.7-17). There are no Class I Areas that are located within 186 miles of the Fermi site (Reference 2.7-21). Given the minor nature of air emissions associated with operations of Fermi 3 (discussed below), this distance is sufficiently far as to not warrant a concern.

2.7.2.2 **Projected Air Quality**

Worker vehicles and various types of construction activities and equipment will lead to releases of the non-attainment and maintenance area pollutants and their precursors (i.e., $PM_{2.5}$, NO_X, SO_2, or VOC). Since Monroe County is considered a maintenance area for the 8-hour ozone standard and a non-attainment area for $PM_{2.5}$, the Fermi 3 project-related emissions are compared to conformity applicability thresholds provided in 40 CFR 51, Subpart W. Estimated emissions of $PM_{2.5}$, NO_X, SO_2, and VOC during the construction phase of the project are not expected to exceed the conformity applicability thresholds provided in 40 CFR 51, Subpart W indicating that a conformity determination for the construction phase is not required.

Air emissions of criteria pollutants during operation of Fermi 3 will be minor given the nature of a nuclear facility and its lack of significant gaseous exhausts of effluents to the air. Sources of air emissions for Fermi 3 include two standby diesel generators, two ancellary diesel generators, an auxiliary boiler, and two diesel fire pumps, as well as a natural draft cooling tower (NDCT) and two 4-cell mechanical draft cooling towers (MDCT). The combustion sources mentioned above will be designed for efficiency and operated with good combustion practices on a limited basis throughout the year (often only for testing). Given their small magnitude of size and infrequent operation, these emissions will not only have little effect on the nearby ozone maintenance and $PM_{2.5}$ non-attainment areas, but will have minimal impact on the local and regional air quality as well. Estimated emissions during the operational phase of the project are not expected to exceed the conformity applicability thresholds provided in 40 CFR 51, Subpart W indicating that a conformity determination for the operational phase is not required. The air emissions from the listed equipment are regulated by the MDEQ.

The Fermi 3 cooling towers will not be a source of the typical combustion-related criteria pollutants or other toxic emissions. They will, however, emit small amounts of particulate matter as drift. The towers will be equipped with drift eliminators designed to limit drift to 0.001 percent or less of total water flow. Additionally, the primary normal heat sink (NHS) for Fermi 3 is a NDCT. The height of the tower will allow for good dispersion of the drift and not allow localized concentrations of particulate matter to be realized. The minor nature of the effects of the new cooling towers on visibility and air quality, including potential for increases in ambient temperature and moisture, icing, fogging, and salt deposition, are discussed in further detail in Subsection 5.3.3.1. In addition, Subsection 4.4.1 will discuss the emissions expected during Fermi 3 construction activities, while Subsection 5.8.1 will discuss the emissions expected during operation of Fermi 3, including the estimated work force vehicular emissions.

2.7.2.3 **Air Stagnation**

The main components of air stagnation are light winds and weak vertical mixing. Light winds can also be associated with weak or poor horizontal mixing of the atmosphere which has the general effect of leading to restrictive horizontal and vertical dispersion and thus air stagnation (Reference 2.7-22). Along with wind speed, wind direction plays a key roll in horizontal mixing as winds with non-persistent directions can also lead to poor dispersion, especially under light wind speeds when the air may re-circulate. Finally, temperature inversions are also associated with little to no vertical mixing of the atmosphere and, therefore, air stagnation. Analyses of inversions are discussed in Subsection 2.7.2.5 while the persistence of wind speeds and directions are covered in Subsection 2.7.4.3.

Air stagnation episodes typically occur when high pressure systems (anti-cyclones) have a strong influence on the regional weather for four days or more. These systems often lead to generally light winds and little vertical mixing due to a general sinking of the air in their vicinity. The region surrounding the Fermi site can expect approximately 10 days per year of air stagnation, or two episodes per year (Reference 2.7-22). The mean duration of each air stagnation episode typically is three to four days.

Air stagnation conditions primarily occur during the second half of the summer and early fall seasons that runs from July through September. This is a result of the migration of the mean track of surface low pressure systems to areas well north of the Fermi site, which creates weaker pressure and temperature gradients, and therefore weaker wind circulations during this period. Wang & Angell confirm that air stagnation episodes in the region surrounding the Fermi site begin to occur in June and July (Reference 2.7-22). The number of air stagnation episodes reaches a maximum during August before decreasing in magnitude during September and October. During the fall season the mean track of surface low pressure systems moves south and positions itself over southeastern Michigan and increases the frequency of surface low pressure systems and monthly wind speeds, therefore decreasing the possibility of air stagnation (Reference 2.7-9).

2.7.2.4 **Mean Monthly Mixing Heights**

The mixing height (or depth) is the height above the surface in which air can freely mix vertically without the help of additional atmospheric forcing mechanisms. George C. Holzworth presented monthly mixing heights for the continental United States based on upper-air data from the period 1960-1964 (Reference 2.7-23). Seasonal morning and afternoon mixing heights for the region surrounding the Fermi site were interpolated from Holzworth's analysis. In general, morning mixing heights are lowest in the summer and fall seasons and highest in the winter season. Afternoon mixing heights are the highest in the summer and lowest in the winter.

The mean annual and monthly mixing heights for White Lake, Michigan, located 52 miles north-northwest of the Fermi site, were calculated using daily morning and afternoon mixing height data obtained from the NCDC (Reference 2.7-24). The NCDC calculated the mixing heights from data recorded during the morning and afternoon release of weather balloons at the White Lake National Weather Service office that measures the vertical temperature and wind information of the atmosphere. Surface wind data from Detroit Metropolitan Airport were used by the NCDC in conjunction with the weather balloon data to create daily mixing heights for the region. The calculated mean monthly and annual mixing heights for White Lake during 2003-2007 are presented in Table 2.7-7. The values shown in the table follow the same trends found by Holzworth (Reference 2.7-23).

2.7.2.5 Inversions

The frequency and persistence of temperature inversions may also indicate periods where air stagnation is highest. Frequency and persistence of inversions were calculated annually and monthly utilizing the difference in temperature (ΔT) between the 10- and 60-meter levels obtained from the Fermi onsite meteorological tower data during the period 2003 through 2007. The presence of an inversion was defined as anytime $\Delta T>0$ for the hour. A summary of the frequency and persistence of inversion conditions is presented in Table 2.7-8 which shows for 42,800 hours analyzed during the 5-year period an inversion was present a total of 13,098 hours, equivalent of 30.6 percent of the total hours. Many of the inversions were short-lived as 48.5 percent of all inversions that occurred lasted six hours or less. Almost all the inversions lasted less then 24 hours with only 1.3 percent of all the inversions lasting longer then 24 hours. In the five years of data used, the longest inversion lasted 76 hours. Table 2.7-9 through Table 2.7-20 present the persistence of inversions tallied for each month. These tables show that the inversions are more common during March through October, however, are most prominent during the summer months of June, July, and August. This corresponds well with the findings by Wang & Angell that the number of days with air stagnation is highest during July through September (Reference 2.7-22). The increase in the number of inversions and air stagnation is a result of the jet stream retreating to the north of the Fermi site during the summer months, which in return creates the warmest temperatures and lowest wind speeds (Reference 2.7-9).

2.7.3 Severe Weather Phenomena

2.7.3.1 Thunderstorms and Lightning

Table 2.7-2 indicates that Detroit Metropolitan Airport averages nearly 33 days per year where thunder is at least heard (Reference 2.7-1). The highest seasonal rate of occurrence for thunderstorms is during the summertime (June-August) when around 54 percent of all thunderstorm days occur. July specifically has the highest occurrence of thunderstorms with on average 6.3 days reported. The mean number of thunderstorm days per month is lowest during the late fall and winter seasons, reaching a minimum of 0.2 days per month in January.

The frequency of lightning strikes to earth can be estimated using a method from the Electric Power Research Institute (EPRI). The method is presented by the U.S. Department of Agriculture Rural Utilities Service in a publication titled *Summary of Items of Engineering Interest*. The formula assumes a relationship between the number of thunderstorm days per year (T) and the number of lightning strikes to hit earth per square mile (N) (Reference 2.7-25):

$$N = 0.31T$$

Using the above formula and the previously given average of 33 days of thunderstorms per year, the average number of lightning strikes is then calculated as 10 strikes per square mile per year or nearly four strikes per square kilometer per year for the Fermi region. This calculation compared well with the 1996-2000 flash density map created by Vaisala which indicates that the Fermi site is located in the region that averages around 1-4 strikes per square kilometer per year (Reference 2.7-26).

For a more detailed look at the average number of strikes to occur near the reactor (i.e., within a 1,000 foot radius or 0.113 mi^2), the following ratio was applied:

10 strikes/mi^2 per year x 0.113 mi^2 = 1.13 strikes/year

that may strike near Fermi 3 (within 1,000 feet).

2.7.3.2 Extreme Winds and High Wind Events

Extreme Winds

Wind loading on plant structures is estimated using a 3-second wind gust at 10-meters above ground level to create a basic wind speed for regions across the United States. The American Society of Civil Engineers (ASCE) and Structural Engineering Institute (SEI) classify the Fermi region into Exposure Category C (Reference 2.7-27). From the Engineering Weather Data, Version 1.0 CD-ROM, the maximum basic wind speed with a 50 year recurrence interval is 90 mph for Detroit City Airport (Reference 2.7-28). Applying a 50-year to 100-year wind multiplier of 1.07 supplied by the ASCE and SEI in Table C6-7 of SEI/ASCE 7-05 the maximum basic wind speed for the Fermi site increases to 96.3 mph (Reference 2.7-27).

Local and regional records of maximum wind speeds occurring from thunderstorms and other high wind events present values higher than the above maximum basic wind speed. According to the NCDC on-line storm database the highest wind speed recorded for Monroe County is 95.5 mph on May 21, 2004 (Reference 2.7-29). Using the same NCDC on-line storm database, the highest wind speed recorded in the surrounding counties is 103.6 mph, occurring in Wayne and Lucas Counties on July 22, 1960 and July 4, 1969, respectively. For comparison, a maximum 2-minute wind speed of 61 mph along with a corresponding 78 mph 5-second wind gust was recorded at Detroit Metropolitan Airport in May of 2004 (Reference 2.7-1). Wind data records from the LCD for Detroit Metropolitan Airport span back only 11 years. The observed wind speeds from the NCDC database indicate that thunderstorms can produce wind speeds in excess of 100 mph at the Fermi site.

High Wind Events

This section provides the frequency of occurrence of winds greater than 50 knots, in accordance with the Nuclear Regulatory Commission (NRC) Regulatory Guide 4.2. Storm reports that include wind speeds of 50 knots or greater occur with many types of weather phenomenon such as thunderstorms and tornadoes. Wind reports for thunderstorms and tornadoes were obtained from the NCDC on-line storm database for the following five-county area surrounding the Fermi site: Lenawee, Monroe, Washtenaw, Wayne and the Ohio County of Lucas. While not all five counties may have been actively reporting high wind events in the early years of the time period, the 1955-1959 period featured 1.6 high wind events per year. The subsequent 10-year periods of 1960-1969, 1970-1979, and 1980-1989 averaged 2.9, 2.4, and 4.2 high wind events per year respectively. An analysis of the high wind events on a decade by decade basis over the five-county area does not show a significant statistical trend over the first four decades. In fact, the variability in the average number of high wind events per decade over the first four decades may be explained by natural variability as they each reported similar numbers of high wind events.

Furthermore, some of the reported high wind events likely occurred simultaneously in several of the five counties. High wind events can be caused by individual thunderstorms that have a cellular structure or by thunderstorms that have become linear along a squall line or cold front. A line of thunderstorms can cause wind damage along an elongated path, while the wind damage caused by cellular type thunderstorms is typically isolated in nature.

Between January 1, 1955 and December 31, 2007 there have been 816 reports of wind events that were 50 knots or greater in the five-county area (Reference 2.7-29). The highest wind speed reported was 90 knots (103.6 mph) in Wayne and Lucas Counties on July 22, 1960 and July 4, 1969. Many of the reports for high winds contained in the NCDC on-line storm database do not specify wind speeds and therefore may underestimate the count of wind events 50 knots or greater in the region of the Fermi site.

Between January 1, 1950 and December 31, 2007, 110 tornadoes were reported in the five-county area (Reference 2.7-29). All tornadoes are categorized as F0 or stronger on the Enhanced Fujita (EF) scale, thereby containing wind speeds greater than 50 knots (Reference 2.7-30). Additional discussion of tornadoes in the region surrounding the Fermi site is given in Subsection 2.7.3.3.

2.7.3.3 **Tornadoes and Waterspouts**

Waterspouts

Waterspouts are considered to be the counterpart of tornadoes, but over large bodies of water. Waterspouts are also much smaller than an average tornado and contain wind speeds that are typically less than 50 mph. Conditions favorable for waterspout formation are when a cool air mass passes over the warm waters of Lake Erie. The resulting instability can support the formation of waterspouts, most frequently during the late summer and fall season. A search for reported waterspouts in the NCDC online storm database resulted in eight occurrences off the shoreline of Lucas and Monroe counties since 1993 (Reference 2.7-29). The closest occurrence to the Fermi site was a report of several waterspouts off the shoreline of Stony Point in Monroe County on the morning of July 26, 1998 (Reference 2.7-31). Therefore, waterspouts can occur near and at the Fermi site, but are not considered to be of frequent occurrence.

Tornadoes

"Design-Basis Tornado (DBT) and Tornado Missiles for Nuclear Power Plants" (Regulatory Guide 1.76) published in March 2007, was used to determine the design parameters that should be considered in the event that the most severe tornado strikes the Fermi site. In addition, DBT wind speeds for the Fermi site, utilizing information from the "Tornado Climatology of the United States" (NUREG/CR-4461 Rev. 2) published in February of 2007 are presented here. NUREG/CR-4461 Rev. 2 is an update to Rev. 1 that recalculated the tornado climatology using the EF scale for the time period of 1950 through August 2003. The relationship of the damage intensity to the tornado maximum wind speed in the new EF scale is as follows (Reference 2.7-30):

EF0	65-85 mph
EF1	86-110 mph
EF2	111-135 mph
EF3	136-165 mph
EF4	166-200 mph
EF5	201+ mph

The EF scale uses the fastest 3-second wind speeds as opposed to the fastest quarter mile wind speeds used in the original Fujita Scale. The result of this new methodology is lower DBT maximum wind speeds as shown in Table 1 of Regulatory Guide 1.76. NUREG/CR-4461 Rev. 2 also introduces a term to account for the finite dimensions of structures as well as the variation of wind speed along and across the tornado footprint. The seven DBT values deemed critical by Regulatory Guide 1.76 when designing nuclear facilities are as follows:

- Tornado Strike Probability
- Maximum Wind Speed
- Translational Speed
- Maximum Rotational Speed
- Radius of Maximum Rotational Speed
- Pressure Drop
- Rate of Pressure Drop

Tornado Strike Probability

NUREG/CR-4461 Rev. 2 divides the United States into 2-degree latitude/longitude boxes containing the number of tornado events reported from 1950 through August 2003. Figure 5-7 of NUREG/CR-4461 Rev. 2 shows that the Fermi site is located near the center of the 2-degree box bound between the 82 degree and 84 degree West longitudes and the 41 degree and 43 degree North latitudes. Adjacent 2-degree boxes to the west and southwest contain significantly higher numbers of tornado events. However, the 2-degree box that contains the Fermi site includes Lake

Saint Clair and western parts of Lake Erie, which may explain the decreased number of tornado events. In order to calculate the strike probability specifically for the Fermi site, a 2-degree latitude/longitude box centered on the location of the Fermi site was chosen to mirror the 2-degree box presented in NUREG/CR-4461 Rev. 2. A 2-degree box centered on the Fermi 3 reactor provides a conservative basis for calculating the probability of a tornado striking the Fermi site. Guidelines for calculating strike probability are presented in NUREG/CR-4461 Rev 2. Following the NUREG/CR-4461 Rev. 2 methodology, the strike probability for a point structure in any given year is given by:

$$P_p = A_t / NA_r$$

Where:

P_p= Tornado strike probability for a point structure per year, regardless of wind speed

A_t= Total area impacted by tornadoes within a region of interest in N years

N = Number of years of tornado record

A_r= Area of the region of interest

The 2-degree latitude/longitude box is based on the centerline of the Fermi 3 reactor vessel. The 2-degree box encompasses 13 counties in Michigan, 17 counties in Ohio, and three counties in the Canadian Province of Ontario that are either fully or partially inside the box. The number of tornadoes occurring in the 2-degree box was obtained from the NCDC on-line storm database and Environment Canada database for the 54-year period of January 1, 1950 through December 31, 2003. As shown below, the number of tornadoes for each EF scale class is displayed. On average 9.83 tornadoes per year occurred in the 2-degree box based on the 531 tornadoes that were reported during the 54-year period (Reference 2.7-29 and Reference 2.7-32). The total area impacted by tornadoes in the 2 degree box, shown below, can be found by multiplying the number of tornadoes in each EF scale class by the expected values for tornado segment statistics in the central United States found in Table 2-10 of NUREG/CR-4461 Rev. 2.

	F0	F1	F2	F3	F4	F5	Total
Number of Tornadoes	172	193	120	26	19	1	531
Expected Value of Tornado Area (mi^2) (a)	0.0341	0.3374	1.1784	3.0857	4.7263	6.0152	
Total Tornado Area (mi^2)=A_t	587	65.12	141.41	80.23	89.80	6.02	388.43

a) From Table 2-10, NUREG/CR-4461, Rev. 2

The total area of the 2-degree box is calculated by summing the areas of Michigan, Ohio, and Canadian counties inside the 2-degree box. County areas provided from the U.S. Census Bureau and Canada's National Statistical Agency estimates a total area of 18,583.87 mi^2 (Reference 2.7-33 and Reference 2.7-34). Using a total tornado area of 388.43 mi^2 (A_t), a 2-degree box area of

18,583.87 mi^2 (A_r), and a time period of 54 years (N), the calculated strike probability (P_p) for the Fermi site becomes 3.87 X 10^{-4} or a recurrence interval of once every 2584 years.

In comparison, Table 5-1 in NUREG/CR-4461 Rev. 2 shows the calculated probability of a tornado striking any point in the central United States as 3.58 X 10^{-4} or a recurrence interval of once every 2793 years. The results demonstrate that the statistics for the 2-degree boxes centered on the Fermi site provide a more accurate estimate of the probability of a tornado striking the Fermi site rather than utilizing the generalized value for the central United States.

Regulatory Guide 1.76 defines DBT characteristics for nuclear power plants that have a tornado strike probability greater than 1.0 X10^{-7}. The calculated Fermi site tornado strike probability of 3.87 X10^{-4} exceeds the above probability threshold which requires the Fermi 3 to meet the design requirements of Regulatory Guide 1.76. Table 1 from Regulatory Guide 1.76 presents the remaining six DBT characteristics for new reactors located in the United States whose tornado strike probabilities exceed the 1.0 X 10^{-7} threshold. According to Table 1, since the Fermi site is located in Region I, the DBT characteristics are as follows:

DBT Characteristics	Fermi site [(a)]
Maximum wind speed (mph)	230
Translational speed (mph)	46
Maximum rotational speed (mph)	184
Radius of maximum rotational speed (ft)	150
Pressure drop (psi)	1.2
Rate of pressure drop (psi/sec)	0.5

a) From Table 1 of Regulatory Guide 1.76

2.7.3.4 **Hail**

A study authored by Joseph T. Schaefer estimates that the 1 x 1 degree box surrounding the Fermi site averages 16.5 reports of severe hail (hail diameter ≥ 0.75 inches) per year (Reference 2.7-35). Schaefer's study examined hail reports from the period 1955-2002. In order to include the most recent five years, hail reports were obtained from the NCDC on line storm database for the Michigan Counties of Lenawee, Monroe, Washtenaw, Wayne, and the Ohio County of Lucas. The five-county area surrounding the Fermi site reported 576 severe hail events over a 53-year period of January 1, 1955 through December 31, 2007 producing an average of 10.9 occurrences of severe hail per year, which is somewhat lower than the findings by Schaefer (Reference 2.7-29). However, the total area of the five-counties is less than that of the 1 x 1 degree box used by Schaefer, and thereby explains the difference among the two estimates.

Out of the 576 severe hail reports, 87 were reported as large hail (hail diameter ≥ 1.75 inches) (Reference 2.7-29). The largest hail report was 4.00 inches, occurring in Wayne County on November 13, 1955 and Monroe County on March 27, 1991. Figure 2.7-2 shows the distribution of severe hail events for each month. The majority of hail events in the five-county area occur during the months of May, June, and July. During the 53 year period there were no reports of hail during the winter months of December and January. Figure 2.7-3 provides the distribution of hail events across each of the five counties. The counties surrounding Monroe County and the location of

Fermi 3 contain higher occurrences of severe hail events. While not all five counties may have been actively reporting severe hail events between 1955 and 1959, there was an average of 2.0 severe hail events reported per year in the five-county area during this period. By comparison between 1960 and 1979, a period when all five counties were included in the reporting of severe hail events, an average of 1.9 severe hail events per year were reported over the same five-county area for the period between 1960 and 1969 and an average of 2.2 severe hail events per year were reported over the same five-county area for the period between 1970 and 1979. The overall frequency of hail reports has steadily increased during the last few decades. It is reasonable to assume the increase may be explained by the improved technology of Doppler radars, cell phones, and the increased public awareness of reporting hail events (Reference 2.7-35).

2.7.3.5 **Ice Storms**

Freezing rain is defined as an accretion of ice resulting from liquid precipitation striking a frozen surface (e.g., tree branches or power lines) and freezing. Typically the liquid droplets are supercooled droplets falling through an air layer of sub-freezing temperatures, during their descent to the ground. The weight of the ice accretion on surface objects can become sufficient to cause damage to trees and power lines, as well as slow down or even halt transportation on ice covered roads and bridges. The surface air temperature during most freezing rain events typically ranges between 25ºF and 32ºF (Reference 2.7-36). Ice pellets are also a common occurrence at the Fermi site during wintertime storms. Ice pellets are created when a snowflake melts during its descent to the ground, but then refreezes as it falls through a sub-freezing air layer near the surface.

<u>Frequency of Occurrence</u>

Cortinas et al. analyzed freezing rain and ice pellets events for the Fermi region during the period 1976-1990 (Reference 2.7-37). In particular, freezing rain and ice pellet events are most common from December to March, although a few events have occurred in November and April. The Fermi site averages approximately 4-5 days per year when an observation of freezing rain has occurred, while ice pellets are reported four days per year.

Ice storm reports were obtained from the NCDC on-line storm database in order to estimate the frequency of occurrence and duration of freezing rain events at the Fermi site. A total of 24 freezing rain events were reported in the five-county area surrounding the Fermi site during the period 1993-2007 (Reference 2.7-29). Table 2.7-21 displays the dates of the freezing rain events and the reported accumulations. In some cases amounts of freezing rain amounted to only a trace or were not available from the storm data records. From the data the frequency of freezing rain events during the 15-year period is 1.6 events per year (24 events/15 years). The highest ice accumulation displayed in Table 2.7-21 occurred during March 13, 1997 when a major ice storm struck southeastern Michigan and deposited ice accumulations of 1.5-2.5 inches from Detroit to Ann Arbor and south to the Ohio-Michigan state line. A general search for ice storms in the five-county area prior to 1993 resulted in an ice storm producing a higher amount. During January 26-27, 1967 a storm produced freezing rain and sleet that lasted nearly 24 hours and ice accumulations of up to 3 inches across northwestern Ohio and parts of southern Michigan

(Reference 2.7-38). The Fermi site and surrounding region is characterized by frequent ice storms that have the potential of producing significant ice accumulations during the winter and early spring.

2.7.3.6 Drought

Monthly values of precipitation are nearly consistent throughout the year in the region surrounding the Fermi site; however, droughts do happen from time to time. A good way to analyze periods where droughts may have occurred is to analyze the extreme dry stretches over a period of time. In order to find the extreme dry periods, hourly precipitation data was analyzed for Detroit Metropolitan Airport during the period 1961-2007. During a stretch from June 17 through July 13, 1963 (644 hours or 26.8 days), the Detroit Metropolitan Airport recorded no measurable precipitation (Reference 2.7-39 through Reference 2.7-41). This was the longest dry stretch that occurred during the 1961-2007 time period. A useful tool that assesses the severity of drought conditions is the Palmer Drought Index (PDI) (Reference 2.7-42). According to an analysis performed by the NCDC, 10 extreme droughts (PDI values of less than -4.0) have occurred in Michigan between 1900 and February 2008 (Reference 2.7-43). One of the episodes of extreme drought corresponds with the longest dry stretch observed at Detroit Metropolitan Airport during June of 1963. Overall the frequency of extreme droughts has decreased since 1940.

2.7.4 Local Meteorology

Measurements from the Fermi onsite meteorological tower, located approximately one-quarter mile from the Fermi 3 reactor building, will be used in this section to characterize the local meteorology conditions at the Fermi site. The onsite meteorological tower (the details of which are contained in Section 6.4) collects wind speed, wind direction, dew-point temperature, precipitation, and the ambient temperature at the 10-meter and 60-meter levels. The meteorological monitoring system uses the vertical temperature difference (ΔT) between the 10- and 60-meter levels to compute the atmospheric stability. The hourly averages of wind speed and direction, as well as the estimated atmospheric stability collected from the onsite tower are archived in a digital format that meets the format described in Appendix A of Regulatory Guide 1.23. Hourly data from the most recent five years (2003 through 2007) was obtained in order to perform the analysis of the local meteorology of the Fermi site. Data recovery rates for all meteorological parameters collected at the Fermi onsite meteorological station are greater than 94 percent. Wet-bulb temperature, relative humidity, and the occurrence of fog and visibility are not collected at the Fermi onsite meteorological station; however, data from the nearby Detroit Metropolitan Airport has been used to supplement Fermi site data. Extreme values of temperature, rainfall, and snowfall have also been obtained for several COOP stations within a 50-mile radius of the Fermi site since those parameters are better representative from a regional perspective.

2.7.4.1 Normal, Mean, and Extreme Values

Regional normal, mean, and extreme values of temperature, wind, moisture and precipitation were discussed in Subsection 2.7.1.1. In order to demonstrate that the long-term data reported at the NWS first-order meteorological stations are representative of the Fermi site, this section provides a more comprehensive analysis of these parameters in comparison with the conditions at the Fermi site.

2.7.4.1.1 Temperature

Table 2.7-22 presents mean monthly and annual temperature for the 10- and 60-meter levels at the Fermi site, as well as the 10-meter temperature at Detroit Metropolitan Airport. In order to show the comparison of temperature at Detroit Metropolitan Airport and the Fermi site, temperature data is analyzed for a 5-year period during 2003 through 2007. From Table 2.7-22, it is apparent that while mean annual temperatures are comparable, the mean monthly values can be considerably different at the Fermi site. The reason they are different can be explained by comparing the locations of the two stations. The Fermi site is located along the shoreline of Lake Erie and experiences moderating effects resulting from the onshore and offshore lake breezes, the higher heat capaCity of the lake, and the wintertime lake ice cover. During the wintertime, Lake Erie generally becomes ice covered by the middle of December (Reference 2.7-8). During this period, the ice over Lake Erie shuts off the moderating effects of the water's higher heat content. As a result, the air over the lake fluctuates in temperature as land does and mean monthly temperatures for December, January, and February between the two stations are nearly identical. During the spring, the lake ice melts by the middle of March, but the water temperatures remain cold (Reference 2.7-8). This results in cooler temperatures at the Fermi site when compared to the farther inland Detroit Metropolitan Airport. As the lake water warms up during the summertime, the lake produces a moderating effect on temperatures due to its higher heat capacity, and temperature differences along the shoreline produce onshore and offshore lake breezes. As a result, monthly temperatures remain slightly cooler at the Fermi site in comparison with the Detroit Metropolitan Airport. Lake temperatures remain warm through the fall season and the heat capacity effect helps keep monthly temperatures warmer at the Fermi site. The mean monthly and annual temperatures for the Fermi site are slightly different than those for Detroit Metropolitan Airport due to the effects of being on the Lake Erie shoreline. However, these effects are small when comparing the overall closeness of the mean annual temperatures for the Fermi site and Detroit Metropolitan Airport. Therefore, the mean annual temperatures of the Detroit Metropolitan Airport are characteristic of the temperature conditions for the Fermi site for longer climatological periods.

Long-term climatological values of temperature for Detroit Metropolitan Airport are presented in Subsection 2.7.1.2.2 and summarized in Table 2.7-2 and Table 2.7-5. As shown in Table 2.7-2, the mean daily temperature for the 48-year period is 49.2ºF. Mean daily maximum temperatures are highest in July (83.3ºF) and lowest in January (31.0ºF). Mean daily minimum temperatures are highest in July (62.1ºF) and lowest in January (16.9ºF). To illustrate the extreme maximum and minimum values of temperature which are characteristic of the Fermi site, hourly temperature data was analyzed for the first-order and COOP stations. Table 2.7-6 presents extreme values of temperature in the region surrounding the Fermi site. The table shows that temperatures have risen as high as 108ºF and dropped as low as -26ºF in the region surrounding the Fermi site. In general, the Fermi site is vulnerable to both extreme heat in the summer and arctic cold temperatures during the winter months.

2.7.4.1.2 Atmospheric Moisture

Subsection 2.7.1.2.3 discussed the long-term monthly and annual characteristics of dew-point, relative humidity, and wet-bulb temperature in the Fermi region. It also was discovered that the magnitude of atmospheric moisture content for stations in the Fermi region is directly related to the latitude of the station and, to a smaller extent, the distance from the Lake Erie shoreline. This relationship indicates that moisture parameters at Detroit Metropolitan Airport, only 17 miles north-northwest from the Fermi site, are representative of the conditions at the Fermi site.

Atmospheric moisture content at the Fermi site is influenced by Lake Erie and the other Great Lakes. Table 2.7-2 provides annual and monthly values of relative humidity and wet-bulb temperature for Detroit Metropolitan Airport. The values in Table 2.7-2 can be used to describe the long-term characteristics of relative humidity and wet-bulb temperature at the Fermi site.

Table 2.7-23 contains annual and monthly summaries of dew-point temperature calculated from data obtained from the Fermi onsite meteorological tower for the time period 2003-2007. During the 5-year period the mean annual dew-point temperature for the Fermi site is 37.6ºF. As would be expected, the mean monthly dew-point temperature values are highest during July and August (58.1°F) and lowest in February (15.7°F). Extreme values of dew-point temperature are also displayed in Table 2.7-23. The highest dew-point temperature measured at the Fermi site is 74.7ºF corresponding with the summer season, while the lowest dew-point temperature of -21.8ºF occurred during the winter season. The last column in Table 2.7-23 shows that mean monthly diurnal variations in dew-point vary the least during the summer and early fall when mean dew-point temperatures are the highest.

2.7.4.1.3 **Precipitation**

The Fermi onsite meteorological station measures rainfall and the liquid equivalent of snowfall on a daily basis. During the process of analyzing the Fermi site precipitation data, it was discovered that the precipitation sensor malfunctioned several times during the 2003-2007 period, resulting in much higher annual precipitation amounts than observed at surrounding observation stations. For this reason, precipitation records for Detroit Metropolitan Airport will be used in this section to describe the precipitation characteristics of the Fermi site. Detroit Metropolitan Airport is the nearest first-order station that has a long period-of-record for reporting precipitation. Normal annual and monthly rainfall values were discussed in Subsection 2.7.1.2.4 and summarized in Table 2.7-2 and Table 2.7-5. These tables indicate that the Fermi region is annually characterized as having consistent precipitation amounts during the year and routine wintertime snowfall. These values are reasonably uniform over the region as to indicate that these stations are representative of precipitation averages that would be observed at the site.

<u>Maximum 24-Hour and Monthly Precipitation</u>

Maximum 24-hour and monthly precipitation totals for the region are discussed in Subsection 2.7.1.2.4 and summarized in Table 2.7-6 for the NWS first-order and COOP stations presented in the Fermi region. The highest 24-hour precipitation amount is 6.04 inches, occurring during September 1950 at Flint (Reference 2.7-2). The highest monthly precipitation was also observed at Flint with an amount of 11.04 inches during August 1975. The maximum precipitation values are reasonably uniform across the area given that precipitation can be highly influenced by individual thunderstorms which can be local in nature hitting one station and not another. It is therefore considered that the precipitation data are representative of precipitation extremes that might be observed at the site.

Total Hours of Precipitation and 1-Hour Precipitation Rate Distribution

Hourly precipitation data for Detroit Metropolitan Airport was obtained from the NCDC for the most recent 5-year time period (2003-2007) to identify the precipitation intensity frequencies in the region surrounding the Fermi site (Reference 2.7-44). Detroit Metropolitan Airport is the closest NWS first-order station that has reliable precipitation records and as discussed above is representative of the precipitation trends at the Fermi site. Table 2.7-24 presents the distribution of hourly precipitation amounts in various intensity categories for each month during the 2003-2007 timeframe. Precipitation was recorded approximately 15.95 percent of the time during the 5-year period. January has the highest occurrence of hourly precipitation while September has the lowest. This corresponds with the location of the mean track of surface low pressure systems, which is over the southeast Michigan during the winter and well north of the region during the summer and early fall seasons. Additionally, as expected, precipitation is most frequent in lighter intensity categories with the majority of hourly precipitation having accumulations less than 0.10 inches.

Precipitation Wind Roses

Monthly and annual precipitation roses for Detroit Metropolitan Airport were created to correlate hourly precipitation with wind direction for the Fermi region during the 2003-2007 timeframe and are presented in Figure 2.7-4 through Figure 2.7-16. A randomization scheme using EPA's computer program PCRAMMET was applied to the hourly wind direction data used to create the precipitation roses to eliminate the typical concentration toward the four cardinal directions (i.e., N, E, S, and W). As shown in Figure 2.7-4, annually, the majority of hourly precipitation events, regardless of intensity, occur when winds are from the east and east-northeast with secondary maximum occurring equally from the north and south directions. As can be seen in both Table 2.7-24 and Figure 2.7-4, a significant amount of the hourly precipitation events were less than 0.10 inches. In addition, it appears from the annual precipitation rose that winds from the southwest and south-southwest yield the highest percentage of hourly rainfall events with intensities greater than 0.50 inches.

Snowfall

Mean annual snowfall, as well as 24-hour snowfall and maximum monthly values were discussed in Subsection 2.7.1.2.4. Table 2.7-5 and Table 2.7-6 present climatological normal and extreme values of snowfall, respectively, for the first-order and COOP stations in the region of the Fermi site. As indicated in these tables, annual amounts of snow vary greatly amongst the stations, and the region is characterized by heavy snow events. The highest 24-hour snowfall is 24.5 inches at the Detroit City Airport located north-northeast of the Fermi site, occurring during April 1886 (Reference 2.7-11). The highest 2- and 3-day and maximum monthly snowfall is 22.7 inches and 58.5 inches, respectively, which occurred at Flint and Ann Arbor, respectively (Reference 2.7-10 and Reference 2.5-16).

2.7.4.1.4 Fog and Heavy Fog

Fog

Fog is reported at NWS first-order stations when the horizontal visibility is less than or equal to 6 miles and the difference between the temperature and dew-point is 5°F or less. Detroit Metropolitan Airport is the nearest NWS station that routinely observes visibility and fog. Detroit Metropolitan Airport is located 17 miles north-northwest of the Fermi site and has a similar elevation and relative proximity to Lake Erie. Table 2.7-25 displays the mean annual, mean monthly, and frequency of hours that reported fog during the period 1961-1995 (Reference 2.7-39 and Reference 2.7-40). On an annual basis, fog occurs 12.7 percent of the hours during a calendar year (1112 hours). The highest monthly averages occur during November and December when 14.8 percent (107 hours) and 17.4 percent (130 hours) of total monthly hours, respectively, report fog. Fog is least frequent during June and July when fog only occurs 65 and 69 hours per month, respectively.

Heavy Fog

Mean annual and monthly values of hours with heavy fog, as well as frequency of hours of heavy fog are presented in Table 2.7-25. Heavy fog is defined as a horizontal visibility less than or equal to 0.25 miles. Annually, Detroit Metropolitan Airport averages 60.2 hours per year where heavy fog is reported. Heavy fog most frequently occurs December through March when 8 to 11 hours per month report heavy fog. During April through July, heavy fog is least likely to occur since only 1 to 2 hours each month report heavy fog.

2.7.4.2 Wind Direction and Wind Speeds

Wind direction and speed are two of the main components that define the dispersion characteristics of a site. Wind speed and direction can be classified on macro, synoptic, meso, or micro spatial scales. Macro and synoptic scales typically cover areas of 40 to 4,000 mi^2 (100 to 10,000 km^2). The influences on these two scales include features such as oceans and other large bodies of water, continents, and mountain ranges.

Meso and micro scale features better represent the general wind characteristics of the Fermi site and surrounding region. Meso-scale features typically cover areas of 0.4 to 40 mi^2 (1 to 100 km^2) and are influenced by such things as local vegetation and river valleys. Micro-scale features are spatially 0.4 mi^2 (1 km^2) or less and include the proximity of the Fermi onsite meteorological tower to the Fermi 3 cooling tower, Lake Erie, and general site specific land use characteristics of the immediate location.

The influence of these smaller scale features may be seen by evaluating local wind data both at the Fermi site and the nearby Detroit Metropolitan Airport. Table 2.7-26 presents the mean monthly and annual wind speeds at the Fermi site and Detroit Metropolitan Airport. The mean annual wind speed for the 10- and 60-meter level at the Fermi site is 6.57 mph and 12.74 mph, respectively. The mean annual wind speed at Detroit Metropolitan Airport is 8.75 mph at the 10-meter level (Reference 2.7-41). The difference in the wind speeds between Detroit Metropolitan Airport and the 10-meter level at the Fermi site can be explained by the macro and micro-scale features such as the land use characteristics of the site. Detroit Metropolitan Airport lies in a suburban area of Detroit that is relatively flat and provides a broad sample of prevailing wind direction and speed of the region. The Fermi site is located along the western shoreline of Lake Erie and is influenced by onshore and offshore lake breezes, which can have the effect of altering the wind speed and direction at the Fermi site when compared to stations further inland. Furthermore, the meteorological tower is located east of a grove of trees that is located less than ten times the obstruction height recommended in Regulatory Guide 1.23. The potential impact of the trees, for upwind sectors (i.e., west-southwest clockwise to north-northwest sectors), is to reduce the indicated wind speed at the 10 meter elevation, especially when the frequency of winds from upwind sectors is the highest. This occurs during late fall, winter, and early spring months when the jet stream is located over southeastern Michigan, which coincides with the largest difference of wind speeds at the 10 meter elevation between the Fermi site and Detroit Metropolitan Airport. Wind speeds at the 60-meter level are considerably higher than wind speeds at the 10-meter level for the Fermi site and Detroit Metropolitan Airport. This can be attributed to the higher exposure height of the instrument which measures wind speeds that are less reduced by the frictional effect of the earth's surface.

Wind Roses-Detroit Metropolitan Airport

Figure 2.7-17 through Figure 2.7-29 contain the 10-meter annual and monthly wind roses presenting the distribution of wind speed at 22.5 degree intervals for Detroit Metropolitan Airport during the 5-year period of 2003-2007 (Reference 2.7-41). A randomization scheme using EPA's computer program PCRAMMET was applied to the hourly wind direction data used to create the precipitation roses to eliminate the typical concentration toward the four cardinal directions (i.e., N, E, S, and W).

The annual wind rose plot in Figure 2.7-17 shows that winds at Detroit Metropolitan Airport predominantly blow from southwesterly directions. According to the annual 2006 LCD, the prevailing wind direction for Detroit Metropolitan Airport is from 240 degrees (west-southwesterly) (Reference 2.7-1). Monthly wind roses for Detroit Metropolitan Airport are presented in Figure 2.7-18 to Figure 2.7-29. The transition is apparent from dominant northwesterly and northerly winds during the spring months to southwesterly wind directions during the summer through fall months as the Bermuda High develops over the southeast United States and the mean track of surface low pressure systems shifts north of the Fermi region. During May through September, the number of calm hours increase and the wind directions often become light and variable, corresponding with the months having the highest number of air stagnation episodes (Reference 2.7-22). Detroit Metropolitan Airport considers calm hours as those with wind speeds less than three knots. As the mean track of surface low pressure systems begins to move south and closer to southeastern Michigan during late the fall and winter, northwesterly and westerly wind directions become more frequent.

Wind Roses-Fermi 10-meter Level

Annual and monthly wind roses for the 10-meter level at the Fermi site are depicted in Figure 2.7-30 through Figure 2.7-42. These figures show wind speeds and directions at 22.5 degree intervals by direction at the Fermi site for the 2003 through 2007 time period.

Figure 2.7-30 indicates that annually winds are southwesterly most often, occurring approximately 10 percent of the time. Winds with a northwesterly component are the second most common direction for the 10-meter level at the Fermi site. Apparent is the increase of easterly and southeasterly winds annually at the Fermi site when compared to Detroit Metropolitan Airport at the same level. During the spring, summer, and early fall, onshore lake breezes occur frequently at the Fermi site. The breezes form as air temperatures over land heat up faster than the air above the waters of Lake Erie. By afternoon a sharp temperature difference forms along the shoreline and a wind circulation develops that produces easterly through southeasterly winds at the Fermi site. Onshore lake breezes can also increase wind speeds along the shoreline, while inland stations are experiencing lighter winds. Also noticeable on the annual wind rose for the Fermi 10-meter level are the high occurrence of winds less than four knots. The wind roses for the Fermi site consider calm hours as those with wind speeds less than 1 knot, partially explaining the large drop in percentage when compared to annual calm hours at Detroit Metropolitan Airport. Furthermore, the meteorological tower is located east of a grove of trees that is located less than ten times the obstruction height recommended in Regulatory Guide 1.23. The potential impact of the trees, for upwind sectors (i.e., westsouthwest clockwise to north-northwest sectors), is to reduce the indicated wind speed at the 10 meter elevation. Figure 2.7-31 through Figure 2.7-42 present the monthly wind roses for the 10-meter level at the Fermi site. In general, the dominant wind patterns for each month at the Fermi site are very similar to those for the Detroit Metropolitan Airport. However, the tables for March through October at the Fermi site 10-meter level show the increase in easterly through southeasterly wind directions that are a result of onshore lake breezes.

Wind Roses-Fermi 60-meter Level

Figure 2.7-43 presents the annual wind rose at the 60-meter level for the Fermi site. Apparent is the similarity of the Fermi site 60-meter annual wind rose for the Detroit Metropolitan Airport 10-meter level. East through southeast winds remain higher at the Fermi site in comparison to Detroit Metropolitan Airport due to the occurrence of the onshore lake breeze. The wind speeds, as expected, are somewhat higher at all directions as compared to the lower 10-meter tower since the higher level can capture wind speeds that are less affected by the frictional effects of the earth's surface. Monthly wind roses for the 60-meter level are represented by Figure 2.7-44 through Figure 2.7-55. As expected, wind speeds become somewhat lighter during from May to September, as the Bermuda High over the southeast United States influences the region. During the late spring and summer months, the onshore lake breezes produce the easterly through southeasterly winds. As the normal daytime temperatures begin to become cooler during September and October, the waters of Lake Erie remain relatively warm, creating a strong temperature gradient along the coastline. As explained earlier, a wind circulation develops; however, since the air above Lake Erie is warmer, winds blow from the land towards the water. The monthly wind roses for September and October indicate the presence of the offshore winds with a higher frequency of west and west-northwest winds. By mid-December the temperatures of the lake reach freezing temperatures and ice forms, ending the possibility of offshore winds. The minor differences of the wind direction and speed due to the land and lake breezes shown in the 10- and 60-meter wind roses and the similarity of the dominant wind directions across the region indicate that the wind conditions described in this section accurately depict the diffusion conditions for the Fermi site.

2.7.4.3 Wind Persistence

Persistence of wind direction is a measurement of the duration of the transport of air from a specific direction to locations downwind. It reflects the possible amount of time that radioactive contamination or any other type of pollution may travel in the same or a similar direction. The dilution potential of the pollutant as it moves downstream of its source is directly proportional to wind speed. Higher wind speeds lead to increased dilution while lower wind speeds create less dilution.

Table 2.7-27 through Table 2.7-50 show the persistence of wind direction and speed at both the 10-meter and 60-meter tower levels, respectively, for 22.5 degree (single) and 67.5 degree (three adjoining) wind sector widths for various wind speeds at the Fermi site during the 5-year period of 2003 through 2007. The longest recorded single sector persistence was from the north and southwest (31 hours) for the 10-meter level and from the west-southwest direction (36 hours) for the 60-meter level. For three adjoining sectors, the 10-meter level and 60-meter level recorded the longest persistence from the west-southwest (158 hours). Tables containing summaries of wind persistence for all wind speeds and at both the 10- and 60-meter levels indicate that winds are most likely to be persistent from the southwest direction for single sector widths and from the west-southwest for three adjoining sector widths. In addition, the final row in the tables displays the average persistent hours for each wind direction and provides a method for determining which direction winds are most likely to persist longer. For the 10-meter level, the wind is most likely to persist longer from the south-southwest and southwest directions for single and three adjoining sector widths, respectively. A persistent wind is most likely to last longer at the 60-meter level for west-southwest and southwest wind directions for single sector and three adjoining sector widths, respectively.

Table 2.7-51 through Table 2.7-62 present the persistence of wind direction and speed at the 10-meter level for the single sector and three adjoining sectors for various wind speeds at Detroit Metropolitan Airport during the 2003 through 2007 time period (Reference 2.7-41). At the 10-meter level (the only level at Detroit Metropolitan Airport), the longest persistent wind blew from the north-northwest and lasted 24 hours for a single sector. For three adjoining sectors the longest persistent wind lasted 67 hours from the southwest. Table 2.7-51 and Table 2.7-57 present wind persistence summaries for all wind speeds for the single sector and three adjoining sector widths, respectively. The most likely direction for a wind to be persistent for both single and three adjoining sector widths is south. Wind is most likely to persist longer when blowing from the north and north-northeast for single and three adjoining sector widths, respectively. Previously in Subsection 2.7.4.2 the noticeable increase of east through southeast winds at the Fermi site was discussed and attributed to the onshore lake breeze that develops during the spring and summer seasons. The wind persistence summaries indicate that for those directions the Fermi site experiences a higher percentage of persistent wind occurrences than the Detroit Metropolitan Airport. Furthermore, when winds are persistent from the east through southeast directions they continue for longer hours at the Fermi site.

2.7.4.4 Atmospheric Stability

Atmospheric diffusion, independent of the effects of wind speed, is proportional to the stability of the atmosphere and has a large impact on potential vertical and horizontal dispersion of radioactive contamination or any other type of pollutant in the ambient air. Atmospheric stability can generally be classified as unstable, neutral, and stable. During stable conditions, diffusion is at its lowest levels while under unstable conditions diffusion is at its highest levels. Pasquill-Gifford developed seven categories measuring atmospheric stability that are accepted and used by the NRC. The various categories can be determined by the difference in temperature (ΔT) between two temperature measurement levels normalized to 100 meters. As defined in Regulatory Guide 1.23, the following categories of atmospheric stability reflect the ΔT in degrees Celsius per 100 meters.

Class A	Extremely Unstable	$\Delta T/\Delta Z \leq -1.9$
Class B	Moderately Unstable	$-1.9 < \Delta T/\Delta Z \leq -1.7$
Class C	Slightly Unstable	$-1.7 < \Delta T/\Delta Z \leq -1.5$
Class D	Neutral Stability	$-1.5 < \Delta T/\Delta Z \leq -0.5$
Class E	Slightly Stable	$-0.5 < \Delta T/\Delta Z \leq +1.5$
Class F	Moderately Stable	$+1.5 < \Delta T/\Delta Z \leq +4.0$
Class G	Extremely Stable	$+4.0 < \Delta T/\Delta Z$

Table 2.7-63 presents mean annual and monthly wind speeds for the 60-meter level at the Fermi site for each of the Pasquill-Gifford stability categories. Annually the mean wind speeds are highest when the stability at the Fermi site is neutral, while mean wind speeds are the lowest under extremely stable conditions, characteristic of high pressure systems. Table 2.7-63 also contains the annual and monthly distribution of stability categories. The Fermi site experienced neutral and slightly stable conditions approximately 56 percent of the total number of hours during the 5-year period. Unstable conditions (Classes A, B, and C combined) occurred approximately 30 percent of the total hours.

Table 2.7-64 through Table 2.7-79 present the annual Joint Frequency Distributions (JFD) of wind speed and direction by stability category at the 10- and 60-meter levels of the Fermi onsite meteorological tower for the 2003 through 2007 time period. It is noticeable from the JFD for the 10-meter level that for stable conditions (Classes E, F, and G) the observations with wind speeds less than 4 mph occur most frequently, implying that stable conditions generally are associated with light winds. Tables for the 60-meter level suggest that for stable conditions wind speeds are most frequently 8-13 mph, which can be explained by the fact that the 60-meter level wind speeds are less affected by the friction of the earth’s surface. For unstable conditions (Classes A, B, and C), there is more variance in the wind speeds categories at both the 10- and 60-meter levels, inferring that unstable conditions are associated with many wind speeds. Therefore, the stability summaries for the 10- and 60-meter levels indicate the air dispersion conditions that can be expected at the Fermi site during accidental and routine radiation releases for different stability scenarios.

2.7.5 **Topographical Description and Potential Modifications**

The impacts resulting from modification of the local topography during construction of Fermi 3 on the local meteorological characteristics are expected to be minor. These impacts will be limited to the construction of a natural draft cooling tower (NDCT) and 4-cell mechanical draft cooling tower (MDCT), as well as the reactor building and other plant structures. This section will discuss the regional topography and the estimated extent of the impacts of the construction of a new facility on the meteorological parameters at the Fermi site.

Regional Topography

The Fermi site is located in the northeastern part of Monroe County and along the western shoreline of Lake Erie. Figure 2.7-56 and Figure 2.7-57 show topographic features within five and 50 miles, respectively, of the Fermi site. The terrain in the region of the Fermi site is mainly flat plains that gently slope to higher elevation west and northwest of the Fermi site. Approximately 30 miles west and northwest of the Fermi site are the Irish Hills which contain elevations as high as 1146 feet above mean sea level. The Fermi site is relatively flat and has a general elevation of approximately 583 feet. Figure 2.7-58 shows the terrain elevation profiles for each of the sixteen 22.5 degree compass directions to a distance of five miles from the site. The waters of Lake Erie are approximately 1526 feet east of the Fermi 3 reactor building. Figure 2.7-58 presents similar terrain profiles out to 50 miles from the Fermi site.

Estimated Impacts of Facility Construction

Construction activities for Fermi 3 are not expected to impact the local climate of the site significantly. Fermi 3 will be located southwest of the Fermi 2 reactor building. Fermi 3 will be located in the southwest portion of the Fermi site that is already cleared of trees and may only require minor additional grading. Any influence of the grading on the micro-scale climate will be minimal during construction and will be limited to the Fermi 3 site and the immediate surrounding area. This will lead to minimal change in the overall topography around the Fermi site, and thus will not represent a significant alteration to the flat and gently sloping topographic character of the area and region around the site. Additionally, construction of new roads to accommodate the construction traffic for the new facility and the addition of buildings, parking areas and other structures should have little to no effect on the local meteorology of the site.

2.7.6 **Atmospheric Dispersion Factors**

This section discusses the determination of atmospheric dispersion factors at various locations. The section discusses the models used, various inputs, and the results.

2.7.6.1 **Short-Term (Accident) Diffusion Estimates**

Basis

To evaluate potential health effects of design basis accidents at Fermi 3, a hypothetical accident is postulated to predict upper-limit concentrations and doses that might occur in the event of a containment release to the atmosphere. To evaluate the effects of design basis accidents, Section 7.1 of NUREG-1555, Environmental Standard Review Plan, Standard Review Plans for

Environmental Reviews for Nuclear Power Plants, October 1999 (NUREG-1555), specifically requires the applicant to account for the 50-percentile X/Q values at appropriate distances from the release points of effluents to the atmosphere. Site-specific meteorological data covering the 6-year period of record from 2002 through 2007 was used to quantitatively evaluate such a hypothetical accident at the site. Onsite data provides representative measurements of local dispersion conditions appropriate to the Fermi site and a 6-year period of record is considered to be reasonably representative of long-term conditions. The meteorological tower is located east of a grove of trees that is located less than ten times the obstruction height recommended in Regulatory Guide 1.23. The impact of the trees, for upwind sectors, is to reduce the indicated wind speed at the 10 meter elevation. For determination of the atmospheric dispersion factors used in the analysis of off-site design basis accident (PAVAN) using the lower indicated wind speed provides conservative results.

According to 10 CFR 100, it is necessary to consider the doses for various time periods immediately following the onset of a postulated containment release at the Exclusion Area Boundary (EAB) and for the duration of exposure for the Low Population Zone (LPZ). Meteorological data has been used to determine various postulated accident conditions as specified in NRC Regulatory Guide 1.145, “Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants.” Compared to a stack release, a ground-level release usually results in higher ground-level concentrations at downwind receptors because of less dilution from shorter traveling distances. Since the ground-level release scenario provides a bounding case, stack releases are not considered.

The PAVAN computer program as described in NUREG/CR-2858 (Reference 2.7-45), is used to estimate downwind ground-level air concentrations (X/Q) at the EAB and LPZ for potential accidental releases of radioactive material to the atmosphere. The X/Q values are estimated for various time periods ranging up to 30 days. This assessment is required by 10 CFR 100.

The EAB for Fermi 3, shown in Figure 2.1-3 and Figure 2.1-4, is a circle centered at the Reactor Building with a radius of 2928 feet (892 m). The LPZ for Fermi 3 is a 3-mile (4828-m) radius circle centered at the Reactor Building. For the purposes of determining X/Q values and subsequent radiation dose analyses, an effective EAB and LPZ are determined. These are referred to as the Dose Calculation EAB and the Dose Calculation LPZ. A circle is drawn from the center of the Reactor Building that encompasses the postulated design basis accident release locations. The Dose calculation EAB and LPZ are defined as the distance between this circle and the EAB. The Dose Calculation EAB is completely within the actual plant EAB; thus, the X/Q values are higher.

The PAVAN program implements the guidance provided in Regulatory Guide 1.145. Mainly, the program computes X/Q values at the EAB and LPZ for each combination of wind speed and atmospheric stability class for each of 16 downwind direction sectors (i.e., north, north-northeast, northeast, etc.). The X/Q values calculated for each direction sector are then ranked in descending order, and an associated cumulative frequency distribution is derived based on the frequency distribution of wind speeds and stabilities for the complementary upwind direction sector.

The calculated X/Q values are also ranked independently of wind direction into a cumulative frequency distribution for the entire site. The PAVAN program then selects the X/Qs that are equaled or exceeded 5 percent of the total time.

The PAVAN program conservatively has been configured to calculate offsite X/Q values assuming no credit for building wake effects.

The PAVAN program input data and assumptions are presented below:

- Meteorological data: 6-year (2002-2007) composite onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability.
- Type of release: Ground-level
- Wind sensor height: 10 meters
- Vertical temperature difference: between 10 m to 60 m
- Number of wind speed categories: 14
- Release height: 10 meters (default height)
- Distances from release point to Dose Calculation EAB for all downwind sectors: 740 meters
- Distances from release point to Dose Calculation LPZ for all downwind sectors: 4670 meters

<u>PAVAN Modeling Results</u>

Based on the upper envelope of the ordered 5-percent overall site limit X/Q values as calculated by the PAVAN model, the 50-percentile overall site (i.e., non-direction specific) X/Qs at the Dose Calculation EAB and LPZ are estimated to be 5.675E-05 sec/m^3 and 4.026E-06 sec/m^3, respectively. This model predicted X/Q values represent a 0- to 2-hour time interval. The LPZ X/Q values for intermediate time periods (i.e., 8 hours, 16 hours, 72 hours, and 624 hours) were determined by logarithmic interpolation between the 50-percential 0- to 2-hour X/Q value at the Dose Calculation LPZ and the corresponding annual average X/Qs. These results, along with the 50-percentile, 0- to 2-hour and the annual average X/Q values, are summarized below:

Location	0-2 hours X/Q (sec/m^3)	0-8 hours X/Q (sec/m^3)	8-24 hours X/Q (sec/m^3)	1-4 days X/Q (sec/m^3)	4-30 days X/Q (sec/m^3)	Annual Average X/Q (sec/m^3)
Dose Calculation EAB	5.675E-05					4.09E-05
Dose Calculation LPZ	4.026E-06	3.057E-06	2.664E-06	1.977E-06	1.287E-06	7.62E-07

2.7.6.2 Long-Term (Routine) Diffusion Estimates

Basis

The NRC-sponsored XOQDOQ computer program, as described in NUREG/CR-2919 (Reference 2.7-47), is used to estimate χ/Q values due to routine releases of gaseous effluents to the atmosphere. The XOQDOQ program has the primary function of calculating annual average χ/Q values and annual average relative deposition (D/Q) values at receptors of interest (e.g., at the site boundary and at the nearest residence, vegetable garden, etc.). The χ/Q and D/Q values due to intermittent releases, which occur during routine operation, may also be evaluated using the XOQDOQ program.

The XOQDOQ program implements the assumptions outlined in Regulatory Guide 1.111. The program assumes that the material released to the atmosphere follows a Gaussian distribution around the plume centerline. In estimating concentrations for longer time periods, the Gaussian distribution is assumed to be evenly distributed within a given directional sector. A straight-line trajectory is assumed between the release point and all receptors.

The XOQDOQ program input data and assumptions are presented below:

- Meteorological data: 6-year (2002-2007) and 5-year (1985-1989) composite onsite joint frequency distributions of wind speed, wind direction, and atmospheric stability. The meteorological tower is located east of a grove of trees that is located less than ten times the obstruction height recommended in Regulatory Guide 1.23. The impact of the trees, for upwind sectors, is to reduce the indicated wind speed at the 10 meter elevation. For determination of the atmospheric dispersion factors used in the analysis of offsite routine releases the XOQDOQ program was run for both the 2002-2007 and 1985-1989 met data and both sets of results are reported.
- Type of release: Ground-level (Radwaste Building stack); mixed-mode (Reactor Building/Fuel Building and Turbine Building stacks)
- Wind sensor height: 10 meters
- Vertical temperature difference: between 10 m to 60 m
- Number of wind speed categories: 14
- Release height: 10 meters (default height) for ground-level release; 52.77 m for Reactor Building/Fuel Building stack (mixed-mode); 71.30 m for Turbine Building stack (mixed-mode)
- Building area: 350 m^2 for ground-level release, conservatively set to zero to neglect the building wake credit for the mixed-mode releases
- Adjacent building height: N/A for ground-level release; 48.20 m for Reactor Building/Fuel Building stack (mixed-mode); 52.0 m for Turbine Building stack (mixed-mode)
- Average Vent Velocity: N/A for ground-level release; 17.78 m/s for Reactor Building/Fuel Building stack (mixed-mode); 17.78 m/s for Turbine Building stack (mixed-mode)

- Inside Vent Diameter: N/A for ground-level release; 2.40 m for Reactor Building/Fuel Building stack (mixed-mode); 1.95 m for Turbine Building stack (mixed-mode)
- Distances from release point to site boundary, nearest residence, nearest garden, nearest sheep, nearest goat, nearest meat cow, and nearest milk cow for all downwind sectors
- Dry deposition is considered for all releases
- Continuous release is assumed
- Site and regional topography are included

As discussed in Regulatory Guide 1.111, Section C.3.c, for long term averages, dose calculations considering dry deposition only are not usually changed significantly by consideration of wet deposition. The effects of wet deposition would be considered for sites that have a well-defined rainy season corresponding to the grazing season. Based on examination of the meteorological data, the precipitation at the Fermi site is spread through-out the year, thus dry deposition is appropriate.

The distances from the release point to the site boundary, nearest residence, garden, sheep, goat, meat cow, and milk cow receptors in each downwind sector are presented in Table 2.7-80 through Table 2.7-86.

<u>XOQDOQ Modeling Results</u>

Table 2.7-87 through Table 2.7-95 and Table 2.7-120 through Table 2.7-140 and Tables Table 2.7-108 through Table 2.7-119 summarize the maximum relative concentration and relative deposition (i.e., X/Q and D/Q) values predicted by the XOQDOQ program for the site boundary and the identified receptors in the Fermi 3 area due to routine releases of gaseous effluents assuming a ground-level release from the Radwaste Building stack and mixed-mode releases from the Reactor Building/Fuel Building stack and the Turbine Building stack. Distances to the receptors are shown in Tables 2.7-80 through 2.7-86 and are determined from a circle that encompasses the possible release locations. The listed X/Q values reflect several plume depletion scenarios that account for radioactive decay (i.e., no decay, and the default half-life decay periods of 2.26 and 8 days). In Table 2.7-87 through Table 2.7-95 and Table 2.7-108 through Table 2.7-119, X/Q and D/Q values are presented for those sectors identified in Table 2.7-80 through Table 2.7-86. Tables Table 2.7-120 through Table 2.7-140 provide corresponding results based on the 1985-1989 met data.

Table 2.7-96 through Table 2.7-107 summarize annual average X/Q values (no decay and undepleted; 2.26 day decayed and undepleted; 8 day decayed and depleted) and D/Q values for the XOQDOQ program's 22 standard radial distances between 0.25 and 50 miles and for the program's 10 distance-segment boundaries between 0.5 and 50 miles downwind along each of the 16 standard direction radials (i.e., separated by 22.5°) based on the 2002-2007 met data. Table 2.7-141 through Table 2.7-152 provide similar results based on the 1985-1989 met data.

Fermi 3 is located on the shore of Lake Erie and a portion of the effluent could be transported across Lake Erie prior to reaching populations. Trajectories over extensive water surfaces could result in larger atmospheric diffusion rates (i.e., decreased dispersion) when compared to over land trajectories due to differences in surface roughness and static stability (Reference 2.7-48). To account for this decreased dispersion, the stability classifications for the met data for the upwind sectors were adjusted to the next higher stability classification. For example, for upwind sectors, the hours in stability class A were moved to stability class B and so forth. The annual average X/Q results are based on the Joint Frequency Distributions based on these stability adjustments.

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Table 2.7-1 National Weather Service First–Order and Cooperative Observing Stations Surrounding the Fermi Site

Station[1]	State	County	Approximate Distance from Fermi Site (miles) [(2)]	Relative Direction to Fermi Site	Elevation (feet)
Monroe	MI	Monroe	8	WSW	590
Detroit (Detroit Metropolitan Airport)	MI	Wayne	17	NNW	631
Windsor	ON	Essex	27	NNE	622
Ann Arbor (University of Michigan)	MI	Washtenaw	33	NW	900
Toledo	OH	Lucas	38	SW	674
Adrian 2 NNE	MI	Lenawee	39	W	760
Flint	MI	Genesee	74	NNW	770

Notes:
1. Numeric and letter designators following a station name (Adrian 2 NNE) indicate the station's distance in miles and direction relative to the place name.
2. The Corpscon 6.0.1 conversion program was used to convert Lat/Long (NAD 83) to UTM (NAD 83) for each site location. Distances above are from the current Fermi Site facility to the listed location.

Sources: Reference 2.7-1 through Reference 2.7-7

Table 2.7-2 Local Climatological Data Summary for Detroit, Michigan (Sheet 1 of 4)

NORMAL, MEANS, and EXTREMES
DETROIT (KDTW)

LATITUDE: 42° 12'N	LONGITUDE: -83° 20'W	ELEVATION (FT): GRND: 631 BARO: 631	TIME ZONE: EASTERN (UTC-5)	WBAN: 94847

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	31.1	34.4	45.2	57.8	70.2	79.0	83.4	81.4	73.7	61.2	47.8	35.9	58.4
	MEAN DAILY MAXIMUM	48	31.0	34.3	44.5	58.2	69.7	78.9	83.3	81.3	74.1	61.6	48.2	35.7	58.4
	HIGHEST DAILY MAXIMUM	48	62	70	81	89	93	104	102	100	98	91	77	69	104
	YEAR OF OCCURRENCE		1995	1999	1998	1977	1988	1988	1988	1988	1976	1963	1968	1998	JUN 1988
	MEAN OF EXTREME MAXS.	48	50.1	52.9	68.9	79.5	85.9	91.8	93.7	91.7	88.6	79.8	67.5	54.9	75.4
	NORMAL DAILY MINIMUM	30	17.8	20.0	28.5	38.4	49.4	58.9	63.6	62.2	54.1	42.5	33.5	23.4	41.0
	MEAN DAILY MINIMUM	48	16.9	19.0	27.1	37.7	47.9	57.3	62.1	60.8	53.3	41.8	32.8	22.6	39.9
	LOWEST DAILY MINIMUM	48	-21	-15	-4	10	25	36	41	38	29	17	9	-10	-21
	YEAR OF OCCURRENCE		1984	1985	2003	1982	1966	1972	1965	1982	1974	1974	1969	1983	JAN 1984
	MEAN OF EXTREME MINS.	48	-2.5	0.6	9.8	23.5	34.3	44.2	50.5	49.2	37.9	27.3	18.1	3.2	24.7
	NORMAL DRY BULB	30	24.5	27.2	36.9	48.1	59.8	69.0	73.5	71.8	63.9	51.9	40.7	29.6	49.7
	MEAN DRY BULB	48	24.0	26.7	35.9	47.9	58.8	68.3	72.7	71.1	63.7	51.7	40.5	29.3	49.2
	MEAN WET BULB	23	23.7	25.7	32.3	42.6	52.7	61.7	65.9	65.0	58.1	47.0	37.5	28.0	45.0
	MEAN DEW POINT	23	19.2	20.8	26.4	36.0	47.0	57.0	61.8	61.5	54.1	42.5	32.9	23.9	40.3
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.0	0.5	2.8	5.0	2.9	0.8	0.0	0.0	0.0	12.0
	MAXIMUM <= 32	30	16.7	12.9	4.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.4	10.3	45.6
	MINIMUM <= 32	30	28.5	24.7	21.7	8.7	0.5	0.0	0.0	0.0	0.1	4.0	15.8	25.8	129.8
	MINIMUM <= 0	30	3.1	2.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	6.4
H/C	NORMAL HEATING DEG. DAYS	30	1270	1074	886	527	219	41	5	12	121	426	742	1099	6422
	NORMAL COOLING DEG. DAYS	30	0	0	0	6	42	145	254	208	75	6	0	0	736

Table 2.7-2 Local Climatological Data Summary for Detroit, Michigan (Sheet 2 of 4)

NORMAL, MEANS, and EXTREMES
DETROIT (KDTW)

LATITUDE: 42° 12'N	LONGITUDE: -83° 20'W	ELEVATION (FT): GRND: 631 BARO: 631	TIME ZONE: EASTERN (UTC-5)	WBAN: 94847

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
RH	NORMAL (PERCENT)	30	76	73	69	65	65	67	69	72	73	72	74	77	71
	HOUR 01 LST	30	79	78	75	73	75	79	81	84	84	80	79	80	79
	HOUR 07 LST	30	81	80	79	77	77	79	83	86	87	84	82	81	81
	HOUR 13 LST	30	70	65	60	53	53	55	55	57	57	58	65	70	60
	HOUR 19 LST	30	74	71	65	57	56	58	59	63	66	67	72	76	65
S	PERCENT POSSIBLE SUNSHINE	31	40	46	52	53	60	65	68	67	61	51	35	31	52
W/O	MEAN NO. DAYS WITH:														
	HEAVY FOG (VISBY <= 1/4 MI)	43	2.3	2.3	2.0	0.9	0.8	0.5	0.5	1.0	1.5	1.6	1.4	2.9	17.7
	THUNDERSTORMS	48	0.2	0.4	1.5	3.0	4.0	6.1	6.3	5.4	3.9	1.2	0.7	0.3	33.0
CLOUDNESS	MEAN:														
	SUNRISE-SUNSET (OKTAS)														
	MIDNIGHT-MIDNIGHT (OKTAS)														
	MEAN NO. DAYS WITH:														
	CLEAR														
	PARTY CLOUDY														
	CLOUDY														
PR	MEAN STATION PRESSURE (IN)	23		29.38	29.32	29.26	29.26	29.26	29.28	29.33	29.34	29.35	29.33	29.35	29.32
	MEAN SEA-LEVEL PRES. (IN)	23		30.11	30.04	29.98	29.97	29.97	29.98	30.03	30.05	30.06	30.06	30.08	30.03

Table 2.7-2 Local Climatological Data Summary for Detroit, Michigan (Sheet 3 of 4)

NORMAL, MEANS, and EXTREMES
DETROIT (KDTW)

LATITUDE: 42° 12'N	LONGITUDE: -83° 20'W	ELEVATION (FT): GRND: 631 BARO: 631	TIME ZONE: EASTERN (UTC-5)	WBAN: 94847

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
WINDS	MEAN SPEED (MPH)	23	11.6	10.9	11.0	10.8	9.8	8.9	8.4	7.8	8.3	9.6	11.0	11.0	9.9
	PREVAIL DIR (TENS OF DEGS)	39	24	24	30	30	30	24	23	23	24	24	24	24	24
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	11	44	51	46	47	61	45	53	44	35	47	47	49	61
	DIR. (TENS OF DEGS)		22	22	23	22	22	30	28	24	27	22	27	29	22
	YEAR OF OCCURRENCE		1996	1997	2004	2001	2004	2005	1998	2003	2001	2004	2003	1998	MAY 2004
	MAXIMUM 5-SECOND														
	SPEED (MPH)	11	53	60	59	57	78	55	67	53	45	56	58	60	78
	DIR. (TENS OF DEGS)		24	24	24	24	22	31	28	23	28	24	25	31	22
	YEAR OF OCCURRENCE		1996	2001	2004	1997	2004	2005	1998	2003	1997	2004	1998	1998	MAY 2004
PRECIPITATION	NORMAL (IN)	30	1.91	1.88	2.52	3.05	3.05	3.55	3.16	3.10	3.27	2.23	2.66	2.51	32.89
	MAXIMUM MONTHLY (IN)	48	3.92	5.02	4.48	5.40	8.46	7.04	6.02	7.83	7.52	6.76	5.68	6.00	8.46
	YEAR OF OCCURRENCE		1993	1990	1973	1961	2004	1987	1969	1975	1986	2001	1982	1965	MAY 2004
	MINIMUM MONTHLY (IN)	48	0.27	0.15	0.74	0.69	0.87	0.97	0.59	0.43	0.43	0.13	0.79	0.46	0.13
	YEAR OF OCCURRENCE		1961	1969	2005	2004	1988	1988	1974	1996	1960	2005	1976	1960	OCT 2005
	MAXIMUM IN 24 HOURS (IN)	48	1.72	2.41	1.82	3.58	2.87	2.84	4.34	3.21	4.08	2.57	2.30	3.71	4.34
	YEAR OF OCCURRENCE		1967	1998	1997	2000	1968	1983	1998	1964	2000	1985	2005	1965	JUL 1998
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	13.4	11.3	12.7	12.6	11.6	10.1	9.6	9.5	9.9	9.8	12.3	13.9	136.7
	PRECIPITATION >= 1.00	30	0.1	0.2	0.2	0.4	0.6	0.9	0.8	0.7	0.6	0.3	0.3	0.2	5.3

Table 2.7-2 Local Climatological Data Summary for Detroit, Michigan (Sheet 4 of 4)

NORMAL, MEANS, and EXTREMES
DETROIT (KDTW)

LATITUDE: 42° 12'N	LONGITUDE: -83° 20'W	ELEVATION (FT): GRND: 631 BARO: 631	TIME ZONE: EASTERN (UTC-5)	WBAN: 94847

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
SNOWFALL	NORMAL (IN)	30	11.9	9.3	7.0	1.7	0.*	0.0	0.0	0.0	0.0	0.3	2.7	11.1	44.0
	MAXIMUM MONTHLY (IN)	47	29.6	20.8	16.1	9.0	0.1	T	0.0	0.0	T	2.9	11.8	34.9	34.9
	YEAR OF OCCURRENCE		1978	1986	1965	1982	2005	2006			1994	1980	1966	1974	DEC 1974
	MAXIMUM IN 24 HOURS (IN)	47	12.2	10.3	9.2	7.4	0.1	T	0.0	0.0	T	2.9	5.6	19.2	19.2
	YEAR OF OCCURRENCE		2005	1965	1973	1982	2005	2006			1994	1980	1977	1974	DEC 1974
	MAXIMUM SNOW DEPTH (IN)	46	24	18	9	6	0	0	0	0	0	1	6	19	24
	YEAR OF OCCURRENCE		1999	1982	1982	1982						1980	1966	1974	JAN 1999
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	3.6	2.9	2.1	0.5	0.0	0.0	0.0	0.0	0.0	0.1	0.9	3.5	13.6

Source: Reference 2.7-1

Table 2.7-3 Local Climatological Data Summary for Flint, Michigan (Sheet 1 of 4)

NORMAL, MEANS, and EXTREMES
FLINT (KFNT)

LATITUDE: 42° 58'N	LONGITUDE: -83° 44'W	ELEVATION (FT): GRND: 770 BARO: 783	TIME ZONE: EASTERN (UTC-5)	WBAN: 14826

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	29.2	32.3	43.1	56.2	69.0	77.7	82.0	79.5	71.9	59.7	46.3	34.2	56.8
	MEAN DAILY MAXIMUM	114	29.1	29.7	41.9	55.5	68.4	76.9	81.5	80.4	71.0	60.7	45.2	32.3	56.1
	HIGHEST DAILY MAXIMUM	50	61	68	80	87	93	101	101	98	94	89	76	70	101
	YEAR OF OCCURRENCE		1997	1999	2000	2004	1988	1988	1995	2001	2002	2002	1978	2001	JUL 1995
	MEAN OF EXTREME MAXS.	114	48.4	50.6	66.1	77.9	84.1	90.4	92.1	90.9	86.7	78.7	66.3	53.9	73.8
	NORMAL DAILY MINIMUM	30	13.3	15.3	24.3	34.6	45.2	54.6	59.1	57.4	49.4	38.6	29.8	19.1	36.7
	MEAN DAILY MINIMUM	114	15.2	14.0	24.2	34.6	45.3	54.0	57.6	57.0	49.6	40.1	29.8	19.8	36.8
	LOWEST DAILY MINIMUM	50	-25	-22	-12	6	22	33	40	37	26	19	6	-13	-25
	YEAR OF OCCURRENCE		1976	1967	1978	1982	1966	1998	2001	1982	1991	1974	1976	2000	JAN 1976
	MEAN OF EXTREME MINS.	114	-6.0	-4.0	4.9	21.1	31.1	40.3	46.4	44.4	34.2	25.1	15.2	0.1	21.1
	NORMAL DRY BULB	30	21.3	23.8	33.7	45.4	57.1	66.2	70.6	68.5	60.7	49.2	38.1	26.7	46.8
	MEAN DRY BULB	114	22.2	21.9	33.0	45.1	56.9	65.5	69.5	68.7	60.3	50.4	37.6	26.1	46.4
	MEAN WET BULB	23	22.1	23.9	30.7	41.3	51.5	60.6	64.6	63.7	56.6	45.8	36.1	26.8	43.6
	MEAN DEW POINT	23	18.4	19.6	25.5	35.1	46.0	56.3	60.8	60.6	53.1	41.8	32.2	23.4	39.4
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.0	0.3	1.7.	3.2	1.5	0.6	0.0	0.0	0.0	7.3
	MAXIMUM <= 32	30	18.5	14.4	5.3	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.2	12.0	52.8
	MINIMUM <= 32	30	29.0	25.3	23.0	11.1	1.6	0.0	0.0	0.0	0.4	5.8	17.1	27.2	140.5
	MINIMUM <= 0	30	4.6	3.6	0.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	10.5
H/C	NORMAL HEATING DEG. DAYS	30	1341	1147	957	577	267	66	13	28	168	478	791	1172	7005
	NORMAL COOLING DEG. DAYS	30	0	0	1	5	33	110	199	151	52	4	0	0	555

Table 2.7-3 Local Climatological Data Summary for Flint, Michigan (Sheet 2 of 4)

NORMAL, MEANS, and EXTREMES
FLINT (KFNT)

LATITUDE: 42° 58'N	LONGITUDE: -83° 44'W	ELEVATION (FT): GRND: 770 BARO: 783	TIME ZONE: EASTERN (UTC-5)	WBAN: 14826

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
RH	NORMAL (PERCENT)	30	77	75	71	66	66	69	71	75	76	74	76	79	73
RH	HOUR 01 LST	30	81	79	77	75	76	80	84	87	87	82	81	82	81
RH	HOUR 07 LST	30	82	81	81	79	78	81	85	90	90	85	83	83	83
RH	HOUR 13 LST	30	72	69	62	55	54	56	55	59	59	60	68	74	62
RH	HOUR 19 LST	30	76	72	66	59	56	58	59	65	69	71	75	79	67
S	PERCENT POSSIBLE SUNSHINE														
W/O	MEAN NO. DAYS WITH:														
W/O	HEAVY FOG (VISBY <= 1/4 MI)	43	1.6	1.6	2.3	0.8	1.2	0.8	1.1	1.6	2.0	1.8	1.1	2.2	18.1
W/O	THUNDERSTORMS	58	0.2	0.2	1.2	2.9	4.2	5.8	6.4	5.7	3.6	1.5	0.8	0.3	32.8
CLOUDNESS	MEAN:														
CLOUDNESS	SUNRISE-SUNSET (OKTAS)							6.4							
CLOUDNESS	MIDNIGHT-MIDNIGHT (OKTAS)							7.2							
CLOUDNESS	MEAN NO. DAYS WITH:														
CLOUDNESS	CLEAR			2.0	3.0		3.0	6.0							
CLOUDNESS	PARTY CLOUDY	1	2.0	3.0	5.0		9.0	2.0							
CLOUDNESS	CLOUDY	1	4.0	6.0	9.0		6.0	13.0							
PR	MEAN STATION PRESSURE (IN)	23	29.21	29.23	29.21	29.15	29.15	29.15	29.18	29.22	29.23	29.23	29.21	29.22	29.20
PR	MEAN SEA-LEVEL PRES. (IN)	23	30.06	30.08	30.05	29.98	29.97	29.97	29.99	30.03	30.05	30.06	30.05	30.07	30.03

Table 2.7-3 Local Climatological Data Summary for Flint, Michigan (Sheet 3 of 4)

NORMAL, MEANS, and EXTREMES
FLINT (KFNT)

LATITUDE: 42° 58'N	LONGITUDE: -83° 44'W	ELEVATION (FT): GRND: 770 BARO: 783	TIME ZONE: EASTERN (UTC-5)	WBAN: 14826

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
WINDS	MEAN SPEED (MPH)	23	10.8	10.4	10.6	10.4	9.5	8.2	7.6	7.2	7.9	9.1	10.2	10.1	9.3
	PREVAIL DIR (TENS OF DEGS)	35	24	28	28	08	19	21	24	21	20	21	24	24	24
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	11	37	41	40	41	40	36	40	35	38	41	41	38	41
	DIR. (TENS OF DEGS)		25	30	25	30	26	28	33	24	30	31	28	27	31
	YEAR OF OCCURRENCE		1996	2006	2002	2002	2004	2000	1998	2003	2005	2006	2003	2003	OCT 2006
	MAXIMUM 5-SECOND														
	SPEED (MPH)	11	52	53	51	52	49	46	51	46	48	53	55	49	55
	DIR. (TENS OF DEGS)		18	32	27	26	27	29	25	27	29	31	22	27	22
	YEAR OF OCCURRENCE		1996	2006	2002	2003	2000	2000	2003	1996	2005	2006	1998	2003	NOV 1998
PRECIPITATION	NORMAL (IN)	30	1.57	1.35	2.22	3.13	2.74	3.07	3.17	3.43	3.76	234	2.65	2.18	31.61
	MAXIMUM MONTHLY (IN)	65	4.02	5.28	4.33	5.90	8.19	6.52	9.35	11.04	10.86	6.59	5.66	4.66	11.04
	YEAR OF OCCURRENCE		2006	1954	1948	1947	2004	1994	1992	1975	1986	2001	2003	1971	AUG 1975
	MINIMUM MONTHLY (IN)	65	0.07	0.17	0.25	0.62	0.34	0.63	0.73	0.45	0.29	0.33	0.66	0.44	0.07
	YEAR OF OCCURRENCE		1945	1969	1958	1942	1988	1988	1978	1969	2002	1944	1980	1969	JAN 1945
	MAXIMUM IN 24 HOURS (IN)	65	1.81	2.85	2.33	2.89	2.25	3.55	3.72	4.45	6.04	3.19	2.30	1.77	6.04
	YEAR OF OCCURRENCE		1967	1954	1948	1976	1974	1943	1957	1968	1950	1981	1995	1971	SEP 1950
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	13.8	10.9	12.2	12.9	10.7	10.5	9.7	10.1	10.5	10.1	12.6	13.8	137.8
	PRECIPITATION >= 1.00	30	0.1	0.1	0.3	0.5	0.4	0.6	0.8	0.5	1.0	0.3	0.4	0.2	5.2

Table 2.7-3 Local Climatological Data Summary for Flint, Michigan (Sheet 4 of 4)

NORMAL, MEANS, and EXTREMES
FLINT (KFNT)

LATITUDE: 42° 58'N	LONGITUDE: -83° 44'W	ELEVATION (FT): GRND: 770 BARO: 783	TIME ZONE: EASTERN (UTC-5)	WBAN: 14826

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
SNOWFALL	NORMAL (IN)	30	13.2	9.4	7.7	2.6	0.*	0.0	0.0	0.0	0.0	0.3	3.5	11.6	48.3
	MAXIMUM MONTHLY (IN)	65	28.5	20.8	19.4	17.3	0.6	T	T	T	T	4.4	16.2	35.3	35.3
	YEAR OF OCCURRENCE		1976	1990	1965	1975	1961	2006	1992	1998	1975	1989	1951	2000	DEC 2000
	MAXIMUM IN 24 HOURS (IN)	65	19.8	11.3	12.6	16.7	0.5	T	T	T	T	3.5	13.4	10.8	19.8
	YEAR OF OCCURRENCE		1967	1965	1973	1975	1961	1992	1992	1998	1975	1989	1951	2000	JAN 1967
	MAXIMUM SNOW DEPTH (IN)	57	23	23	13	17	0	0	0	0	0	2	8	20	23
	YEAR OF OCCURRENCE		1967	1967	1973	1975						1997	1975	2000	FEB 1967
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	4.0	3.1	2.5	0.5	0.0	0.0	0.0	0.0	0.0	0.1	1.2	3.9	15.3

Source: Reference 2.7-2

Table 2.7-4 Local Climatological Data Summary for Toledo, Ohio (Sheet 1 of 4)

NORMAL, MEANS, and EXTREMES
TOLEDO (KTOL)

LATITUDE: 41° 35'N	LONGITUDE: -83° 48'W	ELEVATION (FT): GRND: 674 BARO: 693	TIME ZONE: EASTERN (UTC-5)	WBAN: 94830

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
TEMPERATURE °F	NORMAL DAILY MAXIMUM	30	31.4	35.1	46.5	58.9	70.7	79.5	83.4	81.0	74.0	62.1	48.3	36.0	58.9
	MEAN DAILY MAXIMUM	52	31.1	34.8	45.4	59.4	70.6	79.8	83.9	81.9	74.9	62.8	48.7	36.0	59.1
	HIGHEST DAILY MAXIMUM	51	65	71	81	88	95	104	104	99	98	91	80	70	104
	YEAR OF OCCURRENCE		1995	2000	1998	2002	1962	1988	1995	1993	1978	1963	2003	2001	JUL 1995
	MEAN OF EXTREME MAXS.	52	51.4	55.9	70.4	80.9	87.2	92.8	94.3	91.8	89.4	80.7	68.6	56.9	76.7
	NORMAL DAILY MINIMUM	30	16.4	18.9	27.9	37.7	48.6	58.2	62.6	60.7	52.9	41.6	32.6	23.3	40.0
	MEAN DAILY MINIMUM	52	16.4	18.9	27.0	37.5	47.4	56.7	61.3	59.6	51.9	40.8	32.0	21.8	39.3
	LOWEST DAILY MINIMUM	51	-20	-14	-6	8	25	32	40	34	26	15	2	-19	-20
	YEAR OF OCCURRENCE		1984	1982	1984	1982	2005	1972	1988	1982	1974	1976	1958	1989	JAN 1984
	MEAN OF EXTREME MINS.	52	-4.4	-0.7	9.0	21.6	32.4	42.7	48.9	46.8	35.5	25.1	16.1	1.1	22.8
	NORMAL DRY BULB	30	23.9	27.0	37.2	48.3	59.6	68.8	73.0	70.8	63.5	51.8	40.5	29.2	49.5
	MEAN DRY BULB	52	23.8	26.9	36.3	48.4	59.0	68.4	72.6	70.7	63.4	51.8	40.3	28.9	49.2
	MEAN WET BULB	23	24.2	26.4	33.2	43.4	53.4	62.2	66.5	65.3	58.1	47.3	37.9	28.1	45.5
	MEAN DEW POINT	23	20.1	22.1	27.6	37.0	48.0	57.8	62.6	62.2	54.4	42.9	33.6	24.6	41.1
	NORMAL NO. DAYS WITH:														
	MAXIMUM >= 90	30	0.0	0.0	0.0	0.0	0.9	3.4	5.9	3.2	1.2	0.0	0.0	0.0	14.6
	MAXIMUM <= 32	30	16.7	12.6	4.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	1.7	10.6	45.8
	MINIMUM <= 32	30	28.5	24.6	21.5	9.6	1.0	*	0.0	0.0	0.4	6.1	16.8	26.0	134.5
	MINIMUM <= 0	30	4.3	3.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	8.9
H/C	NORMAL HEATING DEG. DAYS	30	1281	1079	878	517	224	45	6	18	129	431	745	1107	6460
	NORMAL COOLING DEG. DAYS	30	0	0	1	7	42	148	248	190	73	6	0	0	715

Table 2.7-4 Local Climatological Data Summary for Toledo, Ohio (Sheet 2 of 4)

NORMAL, MEANS, and EXTREMES
TOLEDO (KTOL)

LATITUDE: 41° 35’N	LONGITUDE: -83° 48’W	ELEVATION (FT): GRND: 674 BARO: 693	TIME ZONE: EASTERN (UTC-5)	WBAN: 94830

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
RH	NORMAL (PERCENT)	30	77	75	70	66	67	69	71	76	76	74	76	79	73
RH	HOUR 01 LST	30	80	79	77	75	79	83	85	89	88	83	80	82	82
RH	HOUR 07 LST	30	81	81	81	79	80	82	86	91	92	87	83	83	84
RH	HOUR 13 LST	30	71	67	60	53	53	55	56	59	58	58	66	73	61
RH	HOUR 19 LST	30	76	72	65	58	57	59	61	68	71	71	74	78	68
S	PERCENT POSSIBLE SUNSHINE	40	41	46	50	52	60	64	65	63	61	54	37	33	52
W/O	MEAN NO. DAYS WITH:														
W/O	HEAVY FOG (VISBY <= 1/4 MI)	43	1.8	1.6	1.8	0.7	0.7	1.0	0.8	1.6	1.7	1.8	1.4	2.3	17.2
W/O	THUNDERSTORMS	52	0.2	0.5	1.6	3.3	4.5	6.1	6.2	5.2	3.0	1.1	0.8	0.2	32.7
CLOUDNESS	MEAN:														
CLOUDNESS	SUNRISE-SUNSET (OKTAS)														
CLOUDNESS	MIDNIGHT-MIDNIGHT (OKTAS)														
CLOUDNESS	MEAN NO. DAYS WITH:														
CLOUDNESS	CLEAR				2.0		2.0								
CLOUDNESS	PARTY CLOUDY				1.0										
CLOUDNESS	CLOUDY	1	1.0	1.0	2.0										
PR	MEAN STATION PRESSURE (IN)	23	29.32	29.32	29.29	29.23	29.24	29.24	29.26	29.30	29.32	29.32	29.32	29.33	29.29
PR	MEAN SEA-LEVEL PRES. (IN)	23	30.09	30.10	30.05	29.98	29.98	29.97	29.99	30.03	30.05	30.07	30.07	30.10	30.04

Table 2.7-4 Local Climatological Data Summary for Toledo, Ohio (Sheet 3 of 4)

NORMAL, MEANS, and EXTREMES
TOLEDO (KTOL)

LATITUDE: 41° 35'N	LONGITUDE: -83° 48'W	ELEVATION (FT): GRND: 674 BARO: 693	TIME ZONE: EASTERN (UTC-5)	WBAN: 94830

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
WINDS	MEAN SPEED (MPH)	23	10.8	10.3	10.6	10.6	9.2	7.9	7.2	6.6	7.2	8.5	10.1	10.0	9.1
	PREVAIL DIR (TENS OF DEGS)	32	25	25	07	07	24	24	24	25	25	24	25	25	25
	MAXIMUM 2-MINUTE:														
	SPEED (MPH)	11	43	46	46	48	46	44	40	43	38	45	51	48	51
	DIR. (TENS OF DEGS)		24	26	24	25	25	28	26	26	24	24	21	30	21
	YEAR OF OCCURRENCE		1996	2001	2002	1997	2000	2005	2003	1998	2001	1996	2005	1998	NOV 2005
	MAXIMUM 5-SECOND														
	SPEED (MPH)	11	56	56	69	61	68	53	52	54	47	59	66	56	69
	DIR. (TENS OF DEGS)		25	26	23	27	27	28	29	26	23	25	24	31	23
	YEAR OF OCCURRENCE		1996	2001	2002	2003	1999	2005	2005	1998	2001	1996	1998	1998	MAR 2002
PRECIPITATION	NORMAL (IN)	30	1.93	1.88	2.62	3.24	3.14	3.80	2.80	3.19	2.84	2.35	2.78	2.64	33.21
	MAXIMUM MONTHLY (IN)	51	4.61	5.39	5.70	6.10	6.80	8.48	9.19	8.47	8.10	6.26	6.86	6.81	9.19
	YEAR OF OCCURRENCE		1965	1990	1985	1977	2000	1981	2006	1965	1972	2001	1982	1967	JUL 2006
	MINIMUM MONTHLY (IN)	51	0.27	0.27	0.58	0.88	0.96	0.27	0.34	0.40	0.58	0.27	0.55	0.54	0.27
	YEAR OF OCCURRENCE		1961	1969	1958	1962	1964	1988	1995	1976	1963	2005	1976	1958	OCT 2005
	MAXIMUM IN 24 HOURS (IN)	51	1.78	2.59	2.60	3.43	2.34	3.21	4.39	2.42	3.97	3.21	3.17	3.53	4.39
	YEAR OF OCCURRENCE		1959	1990	1985	1977	1991	1978	1969	1972	1972	1988	1982	1967	JUL 1969
	NORMAL NO. DAYS WITH:														
	PRECIPITATION >= 0.01	30	13.6	10.6	12.5	12.7	11.9	10.6	9.4	9.6	9.9	9.9	12.0	13.6	136.3
	PRECIPITATION >= 1.00	30	0.1	0.2	0.2	0.3	0.6	0.7	0.6	0.6	0.6	0.3	0.4	0.3	4.9

Table 2.7-4 Local Climatological Data Summary for Toledo, Ohio (Sheet 4 of 4)

NORMAL, MEANS, and EXTREMES
TOLEDO (KTOL)

LATITUDE: 41° 35'N	LONGITUDE: -83° 48'W	ELEVATION (FT): GRND: 674 BARO: 693	TIME ZONE: EASTERN (UTC-5)	WBAN: 94830

	ELEMENT	POR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
SNOWFALL	NORMAL (IN)	30	10.8	8.5	5.6	1.3	0.1	0.0	0.0	0.0	0.0	0.2	2.6	8.3	37.4
	MAXIMUM MONTHLY (IN)	45	30.8	16.6	17.7	12.0	1.3	T	T	T	T	2.0	17.9	24.2	30.8
	YEAR OF OCCURRENCE		1978	1994	1993	1957	1989	1995	1992	1994	1993	1989	1966	1977	JAN 1978
	MAXIMUM IN 24 HOURS (IN)	45	12.0	7.7	9.7	9.8	1.3	T	T	T	T	1.8	8.3	13.9	13.9
	YEAR OF OCCURRENCE		2005	1981	1993	1957	1989	1995	1992	1994	1993	1989	1966	1974	DEC 1974
	MAXIMUM SNOW DEPTH (IN)	43	17	19	8	10	1	0	0	0	0	1	8	16	19
	YEAR OF OCCURRENCE		1978	1978	2002	1957	1989					1989	1966	1977	FEB 1978
	NORMAL NO. DAYS WITH:														
	SNOWFALL >= 1.0	30	3.3	2.8	1.7	0.4	0.0	0.0	0.0	0.0	0.0	0.1	1.0	2.5	11.8

Source: Reference 2.7-3

Table 2.7-5 Climatological Normals for National Weather Service First-Order and Cooperative Observation Stations in the Region Surrounding the Fermi Site

Station	Normal Annual Temperatures (°F)			Normal Annual Precipitation	
	Daily Maximum	Daily Minimum	Daily Normal	Precipitation (inches)	Snowfall (inches)
Monroe	57.4 (A)	40.4 (A)	49.0 (A)	33.4 (A)	25.3 (A)
Detroit (Detroit Metropolitan Airport)	58.4 (B)	41.0 (B)	49.7 (B)	32.9 (B)	44.0 (B)
Windsor, ON	57.2 (C)	40.8 (C)	48.9 (C)	36.2 (C)	49.8 (C)
Ann Arbor (Univ. of Michigan)	58.1 (D)	39.9 (D)	49.0 (D)	35.4 (D)	52.1 (D)
Toledo, OH	58.9 (E)	40.0 (E)	49.5 (E)	33.2 (E)	37.4 (E)
Adrian 2 NNE	59.1 (F)	37.3 (F)	48.3 (F)	35.2 (F)	29.2 (F)
Flint	56.8 (G)	36.7 (G)	46.8 (G)	31.6 (G)	48.3 (G)

Source A: Reference 2.7-4
Source B: Reference 2.7-1
Source C: Reference 2.7-5
Source D: Reference 2.7-6
Source E: Reference 2.7-3
Source F: Reference 2.7-7
Source G: Reference 2.7-2

Table 2.7-6 Climatological Extremes for National Weather Service First-Order and Cooperative Observation Stations Surrounding the Fermi Site

Parameter	Monroe	Detroit[1]	Windsor, ON	Ann Arbor (Univ. of Michigan)	Toledo, OH	Adrian 2 NNE	Flint
Maximum Temperature	106 (A)	105 (B)	104 (D)	105 (A)	104 (E)	108 (A)	101 (G)
Minimum Temperature	-21 (A)	-24 (B)	-20 (D)	-23 (A)	-20 (F)	-26 (A)	-25 (G)
Max 24-hr Precipitation (inches)[2]	4.22 (A)	4.78 (C)	3.72 (D)	4.54 (A)	4.39 (E)	4.74 (A)	6.04 (G)
Max Monthly Precipitation (inches)	9.03 (A)	8.76 (B)	N/A	10.78 (A)	9.19 (F)	11.17 (A)	11.04 (G)
Max 24-hr Snowfall (inches)	20.0 (A)	24.5 (B)	14.5 (D)	20.0 (A)	13.9 (E)	15.0 (A)	19.8 (G)
Max Monthly Snowfall (inches)	29.0 (A)	38.4 (B)	N/A	58.5 (A)	30.8 (F)	34.5 (A)	35.3 (G)

Notes:
1. Extreme values for Detroit were observed in the vicinity of the meteorological stations at Detroit City Airport and Willow Run Airport.
2. (H) The highest reported 24-hour precipitation amount for COOP stations was reported at Grosse Pointe Farms in July 1976 with a value of 5.13 inches.

Source A: Reference 2.7-10
Source B: Reference 2.7-11
Source C: Reference 2.7-12
Source D: Reference 2.7-5
Source E: Reference 2.7-3
Source F: Reference 2.7-13
Source G: Reference 2.7-2
Source H: Reference 2.7-14
Source I: Reference 2.7-15

Table 2.7-7 Mean Monthly and Annual Mixing Heights (Meters) at White Lake, Michigan (2003 - 2007)

Month	Morning	Afternoon
January	887	796
February	833	913
March	834	1176
April	694	1482
May	670	1561
June	588	1748
July	663	1739
August	662	1530
September	542	1376
October	805	1248
November	809	943
December	853	718
Annual	737	1274

Source: Reference 2.7-24

Table 2.7-8 Annual Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2, 3]

	Annual	
Duration (Hours)	**Number of Observations**	**Probability of Occurrence (%)**
1	222	13.3
2	159	9.5
3	137	8.2
4	101	6.0
5	103	6.1
6	90	5.4
7	66	3.9
8	65	3.9
9	75	4.5
10	89	5.3
11	101	6.0
12	114	6.8
13	91	5.4
14	73	4.4
15	50	3.0
16	35	2.1
17	18	1.1
18	14	0.8
19	10	0.6
20	5	0.3
21	3	0.2
22	5	0.3
23	2	0.1
24	5	0.3
25+	21	1.3

Notes:
1. The longest inversion lasted 76 hours.
2. An inversion was present a total of 13,098 hours of a possible 42,800 hours during the 5-year period.
3. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-9 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

January

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	10	10.1
2	6	6.1
3	11	11.1
4	4	4.0
5	11	11.1
6	7	7.1
7	6	6.1
8	3	3.0
9	4	4.0
10	6	6.1
11	2	2.0
12	2	2.0
13	3	3.0
14	0	0.0
15	5	5.1
16	2	2.0
17	0	0.0
18	1	1.0
19	1	1.0
20	1	1.0
21	0	0.0
22	0	0.0
23	0	0.0
24	2	2.0
25+	6	6.1

Notes:
1. The longest inversion lasted 74 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-10 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

February

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	13	13.5
2	9	9.4
3	8	8.3
4	7	7.3
5	5	5.2
6	7	7.3
7	6	6.3
8	4	4.2
9	5	5.2
10	6	6.3
11	4	4.2
12	4	4.2
13	2	2.1
14	3	3.1
15	4	4.2
16	1	1.0
17	2	2.1
18	1	1.0
19	1	1.0
20	0	0.0
21	0	0.0
22	0	0.0
23	0	0.0
24	0	0.0
25+	2	2.1

Notes:
1. The longest inversion lasted 76 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-11 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

March

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	23	15.2
2	14	9.3
3	14	9.3
4	7	4.6
5	5	3.3
6	12	7.9
7	8	5.3
8	5	3.3
9	5	3.3
10	3	2.0
11	6	4.0
12	3	2.0
13	7	4.6
14	9	6.0
15	5	3.3
16	5	3.3
17	2	1.3
18	3	2.0
19	2	1.3
20	1	0.7
21	0	0.0
22	1	0.7
23	2	1.3
24	1	0.7
25+	4	2.6

Notes:
1. The longest inversion lasted 51 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-12 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

April

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	13	9.9
2	17	13.0
3	12	9.2
4	8	6.1
5	8	6.1
6	6	4.6
7	4	3.1
8	5	3.8
9	1	0.8
10	6	4.6
11	5	3.8
12	13	9.9
13	7	5.3
14	3	2.3
15	0	0.0
16	2	1.5
17	1	0.8
18	2	1.5
19	2	1.5
20	3	2.3
21	1	0.8
22	1	0.8
23	0	0.0
24	1	0.8
25+	5	3.8

Notes:
1. The longest inversion lasted 67 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-13 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

May

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	27	17.5
2	15	9.7
3	8	5.2
4	13	8.4
5	10	6.5
6	9	5.8
7	9	5.8
8	10	6.5
9	6	3.9
10	9	5.8
11	11	7.1
12	15	9.7
13	7	4.5
14	1	0.6
15	1	0.6
16	1	0.6
17	1	0.6
18	0	0.0
19	0	0.0
20	0	0.0
21	0	0.0
22	0	0.0
23	0	0.0
24	1	0.6
25+	0	0.0

Notes:
1. The longest inversion lasted 24 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-14 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

June

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	21	12.2
2	21	12.2
3	14	8.1
4	10	5.8
5	9	5.2
6	9	5.2
7	10	5.8
8	8	4.7
9	8	4.7
10	14	8.1
11	24	14.0
12	13	7.6
13	4	2.3
14	4	2.3
15	1	0.6
16	1	0.6
17	1	0.6
18	0	0.0
19	0	0.0
20	0	0.0
21	0	0.0
22	0	0.0
23	0	0.0
24	0	0.0
25+	0	0.0

Notes:
1. The longest inversion lasted 17 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-15 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

July

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	26	15.1
2	16	9.3
3	16	9.3
4	7	4.1
5	20	11.6
6	11	6.4
7	2	1.2
8	5	2.9
9	10	5.8
10	15	8.7
11	17	9.9
12	19	11.0
13	8	4.7
14	0	0.0
15	0	0.0
16	0	0.0
17	0	0.0
18	0	0.0
19	0	0.0
20	0	0.0
21	0	0.0
22	0	0.0
23	0	0.0
24	0	0.0
25+	0	0.0

Notes:
1. The longest inversion lasted 13 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-16 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

August

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	31	17.2
2	16	8.9
3	14	7.8
4	12	6.7
5	6	3.3
6	7	3.9
7	3	1.7
8	6	3.3
9	9	5.0
10	9	5.0
11	19	10.6
12	18	10.0
13	23	12.8
14	7	3.9
15	0	0.0
16	0	0.0
17	0	0.0
18	0	0.0
19	0	0.0
20	0	0.0
21	0	0.0
22	0	0.0
23	0	0.0
24	0	0.0
25+	0	0.0

Notes:
1. The longest inversion lasted 14 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-17 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

September

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	8	5.6
2	9	6.3
3	9	6.3
4	7	4.9
5	10	7.0
6	8	5.6
7	2	1.4
8	5	3.5
9	7	4.9
10	5	3.5
11	5	3.5
12	17	11.9
13	18	12.6
14	25	17.5
15	7	4.9
16	1	0.7
17	0	0.0
18	0	0.0
19	0	0.0
20	0	0.0
21	0	0.0
22	0	0.0
23	0	0.0
24	0	0.0
25+	0	0.0

Notes:
1. The longest inversion lasted 16 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-18 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

October

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	19	12.3
2	14	9.0
3	11	7.1
4	12	7.7
5	5	3.2
6	5	3.2
7	8	5.2
8	6	3.9
9	8	5.2
10	4	2.6
11	5	3.2
12	3	1.9
13	8	5.2
14	14	9.0
15	18	11.6
16	9	5.8
17	2	1.3
18	2	1.3
19	1	0.6
20	0	0.0
21	0	0.0
22	1	0.6
23	0	0.0
24	0	0.0
25+	0	0.0

Notes:
1. The longest inversion lasted 22 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-19 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

November

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	19	16.0
2	8	6.7
3	6	5.0
4	9	7.6
5	11	9.2
6	3	2.5
7	3	2.5
8	6	5.0
9	10	8.4
10	7	5.9
11	3	2.5
12	5	4.2
13	1	0.8
14	3	2.5
15	5	4.2
16	6	5.0
17	5	4.2
18	3	2.5
19	2	1.7
20	0	0.0
21	2	1.7
22	0	0.0
23	0	0.0
24	0	0.0
25+	1	0.8

Notes:
1. The longest inversion lasted 48 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-20 Monthly Temperature Inversion Frequency and Persistence at the Fermi Site (2003 - 2007)[1, 2]

December

Duration (Hours)	Number of Observations	Probability of Occurrence (%)
1	12	11.7
2	14	13.6
3	14	13.6
4	5	4.9
5	3	2.9
6	6	5.8
7	5	4.9
8	2	1.9
9	2	1.9
10	5	4.9
11	0	0.0
12	2	1.9
13	3	2.9
14	4	3.9
15	4	3.9
16	7	6.8
17	4	3.9
18	2	1.9
19	1	1.0
20	0	0.0
21	0	0.0
22	2	1.9
23	0	0.0
24	0	0.0
25+	3	2.9

Notes:
1. The longest inversion lasted 47 hours.
2. Probability of occurrence represents that, if an inversions occurs, the probability of its duration will be equal to the number of hours specified.

Table 2.7-21 Freezing Rain Events in the Five-County Area Surrounding the Fermi Site (1993-2007)

Date	Reported Accumulation (in)[(2)]
1/21/1993	0.40
3/4/1993(1)	--
1/27/1994	0.25
2/27/1995	0.25
3/6/1995	0.25
4/10/1995	Trace
12/13/1995	0.25
3/13/1997	1.5-2.5
1/13/1998[(1)]	--
1/2/1999[(1)]	--
3/11/2000	Trace
12/11/2000	0.25
12/13/2000	Trace
1/29/2001	0.20
2/24/2001	0.25
1/30/2002	0.50
3/24/2002	Trace
3/26/2002	0.50
1/4/2004	Trace
1/26/2004	0.13
1/5/2005	0.75
1/14/2007	0.50
2/25/2007	0.50
3/1/2007	0.20

Notes:
1. Ice accumulations were not available for selected dates from the NCDC Storm Database.
2. 3 inches of ice accumulation occurred during the ice freezing rain event of January 26-27, 1967 across northern Ohio.

Source: Reference 2.7-29 and Reference 2.7-38

Table 2.7-22 Monthly and Annual Temperature Data for Detroit Metropolitan Airport and Fermi Site (2003 - 2007) (ºF) (Sheet 1 of 2)

Period		Upper Level – 60-Meter Fermi Site	Lower Level – 10-Meter Fermi Site	Single Level–10 m Detroit Metropolitan Airport
January	Mean	25.7	26.2	27.4
	Maximum	57.8	55.6	57.9
	Minimum	-0.6	-3.8	-5.1
February	Mean	25.2	25.8	26.1
	Maximum	53.5	53.3	57.2
	Minimum	-4.1	-3.5	-4.0
March	Mean	35.8	35.9	37.1
	Maximum	76.9	78.5	81.0
	Minimum	-2.9	-2.9	-2.9
April	Mean	48.2	48.4	49.3
	Maximum	86.9	85.5	86.0
	Minimum	19.8	20.5	21.0
May	Mean	57.9	58.4	59.2
	Maximum	85.0	88.0	91.4
	Minimum	34.3	33.6	32.0
June	Mean	68.7	69.2	69.7
	Maximum	91.8	94.2	95.0
	Minimum	44.5	42.3	39.9
July	Mean	72.4	72.9	73.5
	Maximum	91.9	94.3	95.0
	Minimum	52.3	52.2	50.0
August	Mean	71.8	72.2	72.3
	Maximum	92.0	93.7	96.8
	Minimum	51.9	51.7	52.0
September	Mean	65.4	65.6	65.2
	Maximum	83.7	85.8	90.0
	Minimum	41.9	39.1	39.0

Table 2.7-22 Monthly and Annual Temperature Data for Detroit Metropolitan Airport and Fermi Site (2003 - 2007) (ºF) (Sheet 2 of 2)

Period		Upper Level – 60-Meter Fermi Site	Lower Level – 10-Meter Fermi Site	Single Level–10 m Detroit Metropolitan Airport
October	Mean	53.8	53.9	53.5
	Maximum	85.7	87.4	89.6
	Minimum	31.8	32.0	31.5
November	Mean	42.3	42.6	42.3
	Maximum	72.4	72.1	75.0
	Minimum	12.4	13.5	12.2
December	Mean	30.6	31.0	31.2
	Maximum	56.8	57.5	59.0
	Minimum	-2.0	-2.4	-2.9
Annual	Mean	50.0	50.3	50.2
	Maximum	92.0	94.3	96.8
	Minimum	-4.1	-3.8	-5.1

Source: Reference 2.7-41

Table 2.7-23 Monthly and Annual Dew-point Temperature (°F) Summaries for the Fermi Site (2003 - 2007)

	Mean Dew-point	Measured Dew-point Extremes		Mean Dew-point Diurnal Range
		Maximum	Minimum	
January	16.6	50.2	-14.7	11.3
February	15.7	45.4	-14.5	10.8
March	24.5	57.2	-14.8	10.7
April	33.3	56.1	8.9	9.7
May	45.1	69.0	18.0	10.2
June	54.7	71.1	35.8	9.0
July	58.1	72.4	38.8	8.1
August	58.1	74.7	36.7	7.7
September	51.3	68.1	30.0	8.7
October	40.6	66.0	19.9	9.3
November	31.7	58.8	-6.4	10.5
December	21.7	50.2	-21.8	9.4
Annual	37.6	74.7	-21.8	9.6

Table 2.7-24 Hours with Precipitation and Hourly Precipitation Rate Distribution for Detroit Metropolitan Airport (2003-2007)

Month	Trace	0.01-0.09 in	0.10-0.24 in	0.25-0.49 in	0.50-0.99 in	≥1.00 in	Hours with Precipitation	Number of Observations
January	684	287	21	1	0	0	993	3720
February	524	199	11	0	1	0	735	3384
March	463	213	28	1	1	0	706	3720
April	339	176	26	1	0	0	542	3600
May	295	230	45	15	4	0	589	3720
June	176	131	17	6	5	1	336	3600
July	162	142	33	10	4	0	351	3720
August	182	140	27	17	7	0	373	3720
September	145	138	27	5	0	0	315	3600
October	241	210	23	1	0	0	475	3720
November	332	279	41	3	1	0	656	3600
December	576	315	25	3	0	0	919	3720
Annual	4119	2460	324	63	23	1	6990	43824
Percent of Total Hours	9.40%	5.61%	0.74%	0.14%	0.05%	0.002%	15.95%	

Source: Reference 2.7-44

Table 2.7-25 Mean Monthly and Annual Summaries (Hours) of Fog and Heavy Fog for Detroit, Michigan (1961-1995)

	Mean Number of Hours and Frequency of Hours			
Month	**Fog**		**Heavy Fog**	
January	99.4	13.4%	7.9	1.1%
February	93.9	13.9%	8.6	1.3%
March	107.4	14.4%	9.0	1.2%
April	73.6	10.2%	2.3	0.3%
May	73.2	9.8%	1.6	0.2%
June	64.9	9.0%	1.6	0.2%
July	69.1	9.3%	1.3	0.2%
August	96.7	13.0%	3.2	0.4%
September	97.7	13.6%	3.9	0.5%
October	99.8	13.4%	4.9	0.7%
November	106.8	14.8%	5.1	0.7%
December	129.6	17.4%	10.8	1.5%
Annual	1112.0	12.7%	60.2	0.7%

Source: Reference 2.7-39 and Reference 2.7-40

Table 2.7-26 Monthly and Annual Mean Wind Speeds (mph) for Detroit Metropolitan Airport and Fermi Site (2003 - 2007)

Period	Upper Level - 60 m Fermi Site	Lower Level – 10 m Fermi Site	Single Level – 10 m Detroit Metropolitan Airport
January	14.33	7.45	10.30
February	13.61	7.23	9.83
March	14.13	7.47	9.66
April	14.65	8.21	10.25
May	12.36	6.72	8.19
June	10.85	5.70	7.50
July	10.29	5.12	7.56
August	10.10	5.01	6.83
September	11.38	5.68	7.02
October	13.03	6.06	8.49
November	13.86	7.02	9.36
December	14.37	7.28	10.12
Annual	12.74	6.57	8.75

Source: Reference 2.7-41

Table 2.7-27 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
All Wind Speeds

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	222	181	160	180	189	209	203	227	247	292	320	328	309	322	287	225	**44.37%**
3	100	70	74	91	74	100	117	111	125	160	175	166	134	149	133	104	**21.42%**
4	50	46	47	47	49	69	65	51	49	106	99	91	81	79	85	52	**12.13%**
5	30	22	19	24	24	47	41	35	46	58	64	49	27	63	34	40	**7.09%**
6	8	13	26	12	12	31	30	13	20	38	30	41	20	39	27	16	**4.28%**
7	8	10	14	7	10	20	23	11	18	32	30	30	17	23	15	15	**3.22%**
8	8	6	10	7	17	11	10	10	4	34	21	15	7	12	10	11	**2.20%**
9	6	4	5	5	8	5	5	5	6	17	18	7	4	5	7	16	**1.40%**
10	5	2	5	3	4	1	4	1	2	14	17	8	3	5	1	7	**0.93%**
11	0	0	4	4	3	6	1	2	2	17	5	1	5	7	2	5	**0.73%**
12	3	0	3	1	3	4	2	0	1	8	12	3	0	4	2	1	**0.53%**
13	2	0	0	0	4	6	2	0	0	2	2	4	2	2	0	2	**0.32%**
14	0	0	1	0	1	1	0	0	2	3	2	2	2	2	0	3	**0.22%**
15	1	0	2	2	1	0	0	0	1	6	6	0	2	1	1	1	**0.27%**
16	0	1	0	0	3	1	0	0	0	4	0	2	2	1	0	0	**0.16%**
17	0	0	1	0	1	1	0	0	0	4	2	1	1	0	0	2	**0.15%**
18	0	0	1	0	0	0	0	0	0	2	1	1	1	0	0	1	**0.08%**
19	1	0	1	1	0	0	0	0	0	0	4	1	0	1	0	0	**0.10%**
20	1	0	0	2	2	0	0	0	0	1	2	3	0	0	1	0	**0.14%**
21	0	0	0	0	0	0	0	0	0	3	0	0	0	1	1	0	**0.06%**
22	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.01%**
23	0	0	0	0	0	0	0	0	0	0	2	0	0	0	1	0	**0.03%**
24	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.01%**
25	1	0	0	0	0	0	0	0	0	2	1	2	0	0	0	0	**0.07%**
26	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.02%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	2	1	0	0	0	0	0	**0.03%**
31	1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**0.03%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	5.10%	4.04%	4.24%	4.39%	4.61%	5.82%	5.72%	5.30%	5.95%	9.17%	9.30%	8.59%	7.02%	8.14%	6.90%	5.70%	
AVE PERSISTENT HOURS	**3.49**	**3.19**	**3.84**	**3.47**	**3.85**	**3.78**	**3.56**	**3.17**	**3.30**	**4.49**	**4.27**	**3.72**	**3.32**	**3.57**	**3.34**	**3.74**	

THE LONGEST PERSISTENT WIND WAS FROM THE NORTH AND SOUTHWEST AND LASTED 31 HOURS

Table 2.7-28 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
0-5 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	93	87	27	20	35	62	49	84	98	114	169	230	212	217	198	144	**62.74%**
3	28	31	8	7	7	11	19	16	26	40	63	92	73	94	77	41	**21.60%**
4	9	7	3	0	2	8	3	1	14	14	21	41	29	39	29	17	**8.09%**
5	5	4	0	0	1	1	4	3	4	5	15	16	5	31	13	8	**3.92%**
6	1	1	0	0	0	0	1	0	3	4	5	10	2	11	3	1	**1.43%**
7	2	0	0	0	0	2	0	0	1	3	2	9	1	8	4	5	**1.26%**
8	1	0	0	0	0	0	0	0	0	1	0	3	1	3	1	1	**0.38%**
9	0	0	0	0	0	0	0	0	0	0	2	0	0	2	0	0	**0.14%**
10	1	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.10%**
11	0	0	0	0	0	1	0	0	0	0	0	0	0	3	0	0	**0.14%**
12	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.03%**
13	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	**0.10%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.03%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.03%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**4.84%**	**4.44%**	**1.33%**	**0.96%**	**1.54%**	**2.90%**	**2.59%**	**3.55%**	**4.98%**	**6.18%**	**9.45%**	**13.75%**	**11.05%**	**13.92%**	**11.09%**	**7.44%**	

Table 2.7-29 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
5-10 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	92	86	103	132	120	168	167	171	159	208	215	149	102	113	120	121	**47.07%**
3	49	39	58	64	45	73	71	73	68	113	102	70	61	60	51	50	**22.14%**
4	20	14	38	26	28	35	57	36	35	67	44	41	39	31	32	32	**12.16%**
5	20	9	17	16	9	30	31	19	24	44	19	24	19	27	15	26	**7.38%**
6	6	2	18	5	5	14	23	9	9	16	14	16	8	12	14	13	**3.89%**
7	6	2	6	0	3	10	12	9	11	27	11	12	5	6	3	6	**2.73%**
8	4	0	8	2	5	7	3	4	0	21	8	6	4	5	6	6	**1.88%**
9	1	0	4	1	0	3	5	1	2	6	6	3	3	1	4	3	**0.91%**
10	1	1	3	1	2	0	1	1	1	4	5	3	2	3	1	2	**0.66%**
11	0	0	3	1	0	1	1	0	1	3	4	2	1	0	0	0	**0.36%**
12	0	0	2	0	0	3	2	0	0	2	0	1	1	2	1	0	**0.30%**
13	0	0	0	0	1	3	1	0	0	1	0	2	2	0	0	0	**0.21%**
14	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	**0.04%**
15	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	**0.06%**
16	1	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	**0.06%**
17	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	**0.06%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	**0.04%**
20	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0.02%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**4.23%**	**3.24%**	**5.50%**	**5.24%**	**4.61%**	**7.36%**	**7.91%**	**6.83%**	**6.58%**	**10.93%**	**9.07%**	**7.06%**	**5.22%**	**5.50%**	**5.24%**	**5.48%**	

Table 2.7-30 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
10-15 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	27	24	25	43	55	38	14	21	24	66	75	28	14	22	14	16	**43.32%**
3	11	9	7	19	36	24	8	5	11	40	42	8	8	8	7	12	**21.83%**
4	11	10	5	7	12	17	2	2	8	20	19	5	3	11	6	6	**12.33%**
5	6	3	6	4	11	2	2	3	1	21	13	8	3	5	5	6	**8.48%**
6	2	3	4	2	3	5	3	1	0	11	8	1	1	4	1	2	**4.37%**
7	0	3	1	2	6	2	0	0	1	7	8	0	1	0	1	1	**2.83%**
8	1	0	0	4	1	0	0	0	1	2	7	2	3	1	0	2	**2.05%**
9	0	1	0	3	2	0	0	0	1	4	4	0	0	2	0	0	**1.46%**
10	2	0	0	1	0	0	0	0	0	4	1	1	2	1	0	0	**1.03%**
11	0	0	1	0	1	0	0	0	0	3	2	0	0	1	0	0	**0.68%**
12	1	0	0	0	1	1	0	0	1	0	0	0	1	0	1	0	**0.51%**
13	0	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	**0.17%**
14	0	0	1	1	0	0	0	0	0	1	0	0	0	0	0	0	**0.26%**
15	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**0.17%**
16	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0.17%**
17	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	**0.17%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.17%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	5.31%	4.54%	4.37%	7.45%	11.04%	7.62%	2.48%	2.74%	4.20%	15.33%	15.67%	4.54%	3.08%	4.71%	3.08%	3.85%	

Table 2.7-31 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
15-20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	4	3	1	9	17	3	0	3	1	11	15	2	2	1	1	3	**49.03%**
3	3	0	0	2	10	1	0	0	0	7	10	1	0	1	1	2	**24.52%**
4	1	2	0	1	6	1	1	0	0	0	6	0	0	0	0	1	**12.26%**
5	2	2	0	0	1	1	0	0	0	0	3	0	0	0	0	0	**5.81%**
6	0	0	0	0	1	0	0	0	0	1	6	0	0	0	0	0	**5.16%**
7	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0	0	**1.94%**
8	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.65%**
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
12	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.65%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**6.45%**	**5.81%**	**0.65%**	**8.39%**	**22.58%**	**3.87%**	**0.65%**	**1.94%**	**0.65%**	**12.90%**	**26.45%**	**1.94%**	**1.29%**	**1.29%**	**1.29%**	**3.87%**	

Table 2.7-32   Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
>20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	0	0	0	1	2	0	0	0	0	0	3	0	0	0	0	0	**60.00%**
3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**20.00%**
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**10.00%**
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**10.00%**
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**0.00%**	**0.00%**	**0.00%**	**10.00%**	**30.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**60.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	

Table 2.7-33 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
All Wind Speeds

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	125	98	83	118	102	97	84	114	145	151	139	182	187	152	140	130	**20.83%**
3	89	57	65	81	83	79	81	93	105	107	101	110	113	119	87	88	**14.84%**
4	55	39	44	51	39	52	84	77	69	73	78	91	95	96	84	70	**11.16%**
5	46	35	30	35	31	53	56	58	47	53	58	61	62	66	51	49	**8.05%**
6	31	33	32	20	24	37	43	65	44	47	47	57	47	50	39	36	**6.63%**
7	27	18	23	26	19	43	31	34	40	39	41	27	35	41	38	30	**5.21%**
8	22	25	20	25	21	20	38	31	26	29	28	28	29	46	35	24	**4.55%**
9	18	15	11	9	15	20	34	29	13	26	32	32	34	31	24	19	**3.68%**
10	13	17	11	11	15	24	22	17	21	26	21	28	19	19	21	21	**3.11%**
11	18	9	14	9	10	13	23	17	26	20	22	26	22	26	14	8	**2.82%**
12	11	10	17	9	14	20	18	18	18	21	16	10	16	22	21	9	**2.54%**
13	4	6	7	6	8	16	13	15	16	19	9	19	15	14	13	16	**1.99%**
14	6	9	3	7	12	14	16	10	15	12	7	14	9	16	12	7	**1.72%**
15	9	7	9	5	4	15	11	4	6	9	27	13	11	10	10	7	**1.60%**
16	4	6	7	10	6	9	11	3	8	11	10	4	10	10	7	16	**1.34%**
17	1	5	4	3	6	10	7	5	8	11	14	8	5	7	9	5	**1.10%**
18	2	5	3	3	5	5	1	1	11	16	8	5	13	6	10	4	**1.00%**
19	2	3	5	3	1	6	4	2	10	8	7	4	8	4	4	5	**0.77%**
20	4	5	4	6	2	2	2	6	2	8	5	3	6	6	3	7	**0.72%**
21	4	4	4	1	2	1	1	0	3	8	2	8	7	3	4	8	**0.61%**
22	3	0	0	5	7	1	0	1	5	8	2	4	0	5	3	3	**0.48%**
23	5	2	0	1	3	0	1	1	2	8	5	6	1	3	5	1	**0.45%**
24	0	2	5	3	1	1	1	1	3	5	9	2	1	1	4	1	**0.41%**
25	0	1	2	3	3	1	3	0	1	7	4	5	1	1	4	2	**0.39%**
26	0	1	0	2	1	3	0	0	4	7	8	3	2	2	3	3	**0.40%**
27	1	0	1	1	2	1	1	0	3	5	7	5	6	1	3	5	**0.43%**
28	1	2	0	1	4	0	0	0	1	3	5	3	5	1	4	2	**0.33%**
29	0	1	0	2	0	0	0	0	0	3	6	4	4	3	2	5	**0.31%**
30	1	1	3	0	0	1	1	0	2	4	1	5	0	3	4	0	**0.26%**
31	0	0	0	1	0	2	1	0	1	1	6	1	0	2	1	1	**0.17%**
32	1	0	0	0	0	2	0	0	1	2	4	4	2	1	1	1	**0.19%**
33	0	0	2	1	2	0	0	0	0	2	7	2	0	2	2	0	**0.20%**
34	0	0	3	0	0	1	0	0	2	1	4	1	0	2	2	0	**0.16%**
35	0	1	0	1	1	1	0	0	1	0	1	0	0	1	2	0	**0.09%**
36	0	0	1	2	0	1	0	0	0	3	1	3	2	2	0	0	**0.15%**
37	0	0	0	0	1	0	1	0	0	2	0	4	1	3	1	0	**0.13%**
38	0	1	2	1	1	1	1	0	1	0	0	0	0	0	0	0	**0.08%**
39	0	0	0	2	2	0	0	0	0	0	3	2	0	0	2	0	**0.11%**
40	0	0	1	1	1	0	0	0	0	1	3	0	2	1	0	0	**0.10%**
41	0	2	0	1	0	0	0	0	0	0	2	0	1	0	0	0	**0.06%**
42	0	0	0	0	1	0	0	0	0	1	2	1	1	0	1	0	**0.07%**
43	0	0	0	0	0	0	0	0	0	1	2	0	0	0	0	0	**0.03%**
44	0	0	1	0	0	0	0	0	0	0	1	1	1	0	0	0	**0.04%**
45	1	0	0	0	0	0	0	0	0	0	2	2	1	2	0	0	**0.08%**
46	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
47	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.02%**
48+	2	1	3	3	3	0	0	0	2	10	13	9	5	2	1	0	**0.55%**
% of PERSISTENT DIRECTION	**5.16%**	**4.28%**	**4.27%**	**4.77%**	**4.61%**	**5.62%**	**6.00%**	**6.13%**	**6.74%**	**7.82%**	**7.83%**	**8.12%**	**7.93%**	**7.96%**	**6.83%**	**5.93%**	
AVE PERSISTENT HOURS	**6.34**	**7.20**	**7.91**	**7.31**	**7.80**	**7.38**	**6.94**	**5.96**	**7.23**	**8.98**	**9.82**	**8.19**	**7.30**	**7.33**	**7.74**	**7.05**	

THE LONGEST PERSISTENT WIND WAS FROM THE WEST BY SOUTHWEST AND LASTED 158 HOURS

Table 2.7-34 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
0-5 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	105	119	55	36	49	73	75	99	131	145	179	206	197	172	184	151	**39.48%**
3	53	48	32	17	21	28	25	41	55	67	95	119	126	131	96	88	**20.82%**
4	35	27	18	5	3	15	26	23	40	38	59	88	76	83	71	47	**13.07%**
5	19	23	8	3	4	9	6	14	12	17	47	60	49	54	59	36	**8.39%**
6	12	14	3	0	3	5	7	8	11	17	28	26	44	38	29	24	**5.37%**
7	12	6	0	1	3	0	3	2	9	10	16	23	22	26	25	13	**3.42%**
8	6	4	2	2	3	1	4	1	1	7	10	24	14	32	18	4	**2.66%**
9	1	0	0	0	1	3	1	1	2	3	12	19	17	25	13	6	**2.08%**
10	4	2	1	0	0	0	3	1	2	3	7	5	7	12	10	4	**1.22%**
11	2	0	1	2	0	1	0	0	1	1	4	12	6	16	7	2	**1.10%**
12	1	0	0	0	1	0	0	0	1	3	4	6	10	8	10	1	**0.90%**
13	0	0	0	0	0	0	0	0	0	0	1	5	7	7	3	0	**0.46%**
14	2	0	0	0	0	0	1	0	0	0	1	4	4	2	2	0	**0.32%**
15	0	1	0	0	0	1	0	0	0	0	2	1	3	3	0	1	**0.24%**
16	0	0	0	0	0	0	0	0	0	0	0	2	2	1	1	1	**0.14%**
17	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	0	**0.08%**
18	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	**0.06%**
19	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	**0.04%**
20	0	0	0	1	0	1	0	0	0	0	0	0	0	3	0	0	**0.10%**
21	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	**0.04%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0.02%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**5.05%**	**4.88%**	**2.40%**	**1.34%**	**1.76%**	**2.74%**	**3.02%**	**3.80%**	**5.29%**	**6.21%**	**9.31%**	**11.99%**	**11.77%**	**12.27%**	**10.61%**	**7.57%**	

Table 2.7-35 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
5-10 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	80	64	78	116	103	120	102	119	103	152	127	89	67	65	62	88	**25.45%**
3	61	47	54	65	89	70	96	76	82	95	88	59	62	53	44	61	**18.27%**
4	35	24	47	38	48	53	84	58	64	72	74	61	43	51	37	46	**13.84%**
5	22	12	32	26	23	56	46	55	41	54	54	37	36	42	28	30	**9.85%**
6	19	22	19	32	27	25	34	44	27	34	36	27	20	24	25	20	**7.21%**
7	12	9	26	21	17	23	28	26	24	37	34	19	28	27	21	21	**6.18%**
8	12	9	14	10	13	17	26	24	11	30	20	16	13	18	16	18	**4.43%**
9	5	6	8	5	11	7	25	9	19	17	19	17	17	8	14	10	**3.27%**
10	3	6	7	7	5	16	9	6	4	14	20	11	5	6	13	7	**2.30%**
11	5	5	10	5	4	7	16	11	5	17	11	14	7	6	9	8	**2.32%**
12	3	3	8	5	5	8	9	2	8	11	6	8	1	7	4	6	**1.56%**
13	3	0	4	6	1	6	5	6	8	9	5	5	5	2	3	3	**1.18%**
14	0	2	4	3	2	6	3	0	7	5	5	5	0	0	3	3	**0.80%**
15	0	1	3	2	0	6	3	0	2	2	4	3	1	2	1	0	**0.50%**
16	1	1	3	2	0	2	4	1	2	4	4	3	2	2	2	1	**0.56%**
17	0	1	2	1	3	4	1	1	3	3	2	1	4	3	2	0	**0.51%**
18	0	1	1	2	2	3	0	1	3	3	3	1	1	2	0	1	**0.40%**
19	0	0	1	1	0	0	1	0	2	3	1	0	2	0	0	1	**0.20%**
20	0	0	1	0	0	1	0	2	0	0	2	3	0	0	1	0	**0.17%**
21	1	0	2	0	0	0	0	0	3	0	1	1	1	1	1	1	**0.20%**
22	0	0	1	1	0	0	0	0	1	3	1	0	2	0	0	0	**0.15%**
23	0	0	1	0	0	0	0	0	1	0	0	1	1	0	1	0	**0.08%**
24	0	0	0	0	0	0	2	0	0	0	0	1	0	0	0	0	**0.05%**
25	0	0	1	0	0	1	1	0	1	0	1	1	0	0	0	1	**0.12%**
26	0	0	0	0	0	0	0	0	1	0	0	2	2	1	0	0	**0.10%**
27	0	0	0	0	0	0	0	0	0	2	1	0	1	0	0	0	**0.07%**
28	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	**0.05%**
29	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	**0.07%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
34	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	**0.03%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0	0	**0.05%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**4.34%**	**3.55%**	**5.42%**	**5.77%**	**5.87%**	**7.16%**	**8.22%**	**7.31%**	**7.01%**	**9.42%**	**8.62%**	**6.45%**	**5.34%**	**5.32%**	**4.79%**	**5.40%**	

Table 2.7-36 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
10-15 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	19	14	16	26	38	39	20	21	10	51	48	22	14	18	12	17	**27.92%**
3	14	12	13	17	31	26	6	8	17	45	43	16	9	12	8	12	**20.96%**
4	8	7	5	12	27	20	5	3	16	20	28	8	6	8	7	6	**13.49%**
5	5	8	6	9	17	10	3	5	5	29	17	7	8	5	5	7	**10.59%**
6	5	7	1	3	9	9	1	3	5	12	17	6	2	6	3	2	**6.60%**
7	2	2	0	4	10	6	2	1	4	10	12	3	1	1	3	3	**4.64%**
8	2	1	1	9	2	0	1	0	2	5	7	4	1	2	1	2	**2.90%**
9	0	2	2	1	3	2	0	0	1	6	10	3	1	4	1	1	**2.68%**
10	4	1	0	1	2	3	0	0	1	7	4	1	4	2	0	0	**2.18%**
11	1	1	0	4	2	0	0	0	1	4	0	2	2	0	0	0	**1.23%**
12	1	3	3	3	2	0	0	0	2	2	5	0	1	2	1	0	**1.81%**
13	1	2	3	2	2	0	0	0	0	2	0	0	2	0	0	1	**1.09%**
14	1	2	3	1	2	0	0	0	0	3	2	0	0	1	1	0	**1.16%**
15	0	0	1	2	1	1	0	0	0	0	1	1	0	0	0	0	**0.51%**
16	1	1	0	0	1	0	0	0	1	3	0	0	0	0	0	0	**0.51%**
17	1	0	2	2	0	1	0	0	1	1	1	1	0	0	1	0	**0.80%**
18	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	**0.15%**
19	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.07%**
20	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**0.15%**
21	0	0	1	0	0	0	1	0	0	1	2	0	0	0	0	0	**0.36%**
22	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.07%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.07%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.07%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**4.71%**	**4.57%**	**4.21%**	**7.11%**	**10.80%**	**8.48%**	**2.83%**	**2.97%**	**4.79%**	**14.65%**	**14.36%**	**5.37%**	**3.84%**	**4.50%**	**3.12%**	**3.70%**	

Table 2.7-37 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
15-20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	4	3	1	7	17	7	0	2	2	10	12	2	2	3	1	3	**40.21%**
3	2	0	0	2	12	3	0	1	0	5	11	2	1	1	1	2	**22.75%**
4	1	0	0	1	6	1	1	0	0	6	8	0	0	0	0	2	**13.76%**
5	3	4	1	3	2	0	0	0	0	1	3	1	0	0	0	0	**9.52%**
6	0	1	0	0	2	1	0	0	0	1	6	0	0	0	0	0	**5.82%**
7	0	2	0	1	0	0	0	0	0	3	1	0	0	0	0	0	**3.70%**
8	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**1.06%**
9	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**1.06%**
10	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.53%**
11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**0.53%**
12	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	**1.06%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**5.29%**	**5.82%**	**1.06%**	**8.47%**	**21.16%**	**6.35%**	**0.53%**	**1.59%**	**1.06%**	**14.29%**	**23.28%**	**2.65%**	**1.59%**	**2.12%**	**1.06%**	**3.70%**	

Table 2.7-38 Wind Direction Persistence Summaries - Fermi Site 10-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
>20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	0	0	0	1	2	0	0	0	0	1	3	0	1	0	0	0	**61.54%**
3	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	**15.38%**
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**7.69%**
6	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**7.69%**
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
9	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	**7.69%**
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**0.00%**	**0.00%**	**0.00%**	**7.69%**	**23.08%**	**0.00%**	**0.00%**	**0.00%**	**0.00%**	**15.38%**	**46.15%**	**0.00%**	**7.69%**	**0.00%**	**0.00%**	**0.00%**	

Table 2.7-39 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
All Wind Speeds

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	145	146	179	199	193	199	202	213	234	263	304	279	291	297	226	195	**40.38%**
3	66	80	99	97	101	106	116	117	130	133	173	173	165	135	135	96	**21.77%**
4	37	39	59	63	40	50	49	59	71	121	87	89	106	93	60	56	**12.22%**
5	29	28	36	32	32	44	39	33	50	64	69	66	51	63	51	48	**8.33%**
6	6	12	20	22	24	34	26	12	19	40	46	42	33	39	24	25	**4.80%**
7	10	16	20	17	18	25	20	12	19	21	30	27	35	27	22	16	**3.79%**
8	11	7	13	10	18	14	7	4	9	26	26	29	19	19	16	13	**2.73%**
9	4	3	7	7	4	15	5	4	6	19	11	13	9	10	10	8	**1.53%**
10	1	3	8	3	7	4	3	6	2	16	12	15	5	10	6	3	**1.18%**
11	1	0	5	4	2	1	3	3	1	8	8	13	8	5	3	2	**0.76%**
12	3	1	2	3	7	2	1	1	1	9	5	5	2	3	3	6	**0.61%**
13	2	0	1	2	4	1	0	1	0	2	1	6	5	6	1	2	**0.39%**
14	1	0	2	1	1	3	2	0	1	3	3	2	1	4	1	2	**0.31%**
15	0	0	4	1	1	0	0	0	1	6	0	2	3	2	2	1	**0.26%**
16	0	0	2	1	0	0	0	0	0	2	2	2	3	2	1	2	**0.19%**
17	0	0	0	0	1	0	0	0	0	3	4	2	1	2	1	2	**0.18%**
18	0	0	1	0	0	2	0	0	0	1	3	1	0	0	0	0	**0.09%**
19	0	0	2	1	2	0	0	0	1	0	1	5	2	0	2	0	**0.18%**
20	0	0	0	0	0	0	0	0	0	1	0	3	1	0	0	0	**0.06%**
21	0	0	0	0	3	0	0	0	0	0	0	2	0	1	0	0	**0.07%**
22	0	0	0	0	0	0	0	0	0	1	2	1	0	0	0	0	**0.05%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.01%**
24	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.02%**
25	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	**0.02%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.01%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
32	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.01%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.01%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.01%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**3.58%**	**3.79%**	**5.22%**	**5.24%**	**5.20%**	**5.66%**	**5.36%**	**5.27%**	**6.17%**	**8.38%**	**8.93%**	**8.85%**	**8.39%**	**8.16%**	**6.39%**	**5.40%**	
AVE PERSISTENT HOURS	**3.51**	**3.39**	**4.06**	**3.66**	**4.06**	**3.86**	**3.47**	**3.27**	**3.41**	**4.29**	**4.03**	**4.45**	**3.87**	**3.95**	**3.77**	**3.86**	

THE LONGEST PERSISTENT WIND WAS FROM THE WEST BY SOUTHWEST AND LASTED 41 HOURS

Table 2.7-40 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
0-5 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	10	22	20	13	12	15	10	18	16	10	15	12	5	21	5	16	**81.48%**
3	2	1	3	3	2	3	1	6	2	1	1	1	0	1	4	3	**12.59%**
4	0	0	1	0	1	0	0	0	0	1	0	0	0	1	0	1	**1.85%**
5	1	0	2	0	0	0	0	0	1	1	0	0	0	1	0	0	**2.22%**
6	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	**1.11%**
7	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	**0.37%**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
10	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.37%**
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**4.81%**	**8.52%**	**10.37%**	**6.67%**	**5.56%**	**7.04%**	**4.07%**	**8.89%**	**7.04%**	**4.81%**	**5.93%**	**4.81%**	**1.85%**	**8.89%**	**3.33%**	**7.41%**	

Table 2.7-41 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
5-10 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	61	54	110	89	87	104	135	118	108	105	97	83	107	102	94	106	**62.42%**
3	13	24	52	31	21	39	48	55	50	27	30	29	40	36	27	39	**22.45%**
4	5	9	20	14	4	21	18	22	21	17	12	10	6	18	11	9	**8.68%**
5	4	6	11	8	5	11	13	12	5	3	4	2	5	0	5	6	**4.00%**
6	1	0	5	1	0	2	8	3	1	2	1	2	0	0	1	2	**1.16%**
7	0	0	0	0	0	4	2	1	1	2	1	0	1	0	2	1	**0.60%**
8	0	0	2	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.12%**
9	1	0	0	1	0	1	0	0	0	1	0	1	0	1	1	1	**0.32%**
10	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	**0.12%**
11	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	**0.08%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
13	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	**0.04%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	3.40%	3.76%	8.00%	5.76%	4.68%	7.28%	9.00%	8.48%	7.48%	6.28%	5.80%	5.12%	6.36%	6.32%	5.64%	6.60%	

Table 2.7-42 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
10-15 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	75	58	93	92	95	99	98	77	104	159	172	185	160	180	142	117	**52.02%**
3	33	32	40	34	36	41	30	32	35	69	92	104	82	67	66	61	**23.31%**
4	18	9	22	21	13	14	22	12	19	37	32	52	45	34	34	22	**11.08%**
5	6	7	15	13	7	6	6	9	10	20	28	20	20	31	18	24	**6.55%**
6	2	1	10	7	2	8	6	3	11	11	8	14	13	7	5	5	**3.08%**
7	2	2	3	1	2	7	3	2	0	7	4	9	5	3	6	5	**1.66%**
8	2	2	6	2	1	1	1	1	0	7	4	5	1	5	3	6	**1.28%**
9	0	0	1	0	0	0	0	0	1	1	2	1	2	1	2	0	**0.30%**
10	0	0	0	1	0	0	0	1	0	1	3	1	2	0	1	1	**0.30%**
11	0	0	1	0	0	0	0	0	0	0	1	2	1	1	0	0	**0.16%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	**0.08%**
13	0	0	1	0	0	0	0	0	0	1	0	0	0	1	0	0	**0.08%**
14	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.03%**
15	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	**0.05%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**3.77%**	**3.03%**	**5.24%**	**4.67%**	**4.26%**	**4.80%**	**4.53%**	**3.74%**	**4.91%**	**8.54%**	**9.44%**	**10.78%**	**9.06%**	**9.03%**	**7.59%**	**6.60%**	

Table 2.7-43 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
15-20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	33	30	31	44	67	55	36	31	45	117	116	96	81	70	61	32	**49.68%**
3	11	18	17	18	26	26	15	17	29	53	53	63	44	39	24	5	**24.08%**
4	5	7	10	15	14	14	5	2	9	29	18	30	22	15	10	8	**11.20%**
5	1	6	8	1	9	9	4	2	7	18	16	22	9	18	5	4	**7.31%**
6	1	1	2	0	3	4	1	2	4	5	5	8	11	3	5	4	**3.10%**
7	2	0	3	2	3	2	0	0	1	6	6	8	1	2	2	1	**2.05%**
8	1	1	1	1	0	1	0	1	0	4	1	3	1	2	1	1	**1.00%**
9	0	0	0	0	0	0	0	0	0	2	1	1	3	3	0	2	**0.63%**
10	0	0	1	0	3	0	0	0	0	2	0	2	1	0	0	0	**0.47%**
11	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	**0.11%**
12	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.05%**
13	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.05%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	**0.11%**
16	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	**0.16%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**2.84%**	**3.31%**	**3.84%**	**4.26%**	**6.57%**	**5.84%**	**3.21%**	**2.89%**	**4.99%**	**12.46%**	**11.41%**	**12.51%**	**9.20%**	**7.99%**	**5.68%**	**3.00%**	

Table 2.7-44 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
>20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	7	7	9	14	37	20	9	9	16	47	48	36	34	33	14	10	**49.86%**
3	5	3	1	9	14	10	3	3	8	27	17	26	13	23	8	5	**24.93%**
4	2	2	2	2	9	1	3	0	6	12	11	5	10	3	6	5	**11.25%**
5	2	1	0	5	6	1	0	0	1	3	7	7	5	4	3	0	**6.41%**
6	1	0	0	0	3	1	0	0	0	3	5	2	1	0	2	1	**2.71%**
7	0	0	0	1	0	1	0	0	0	2	1	2	0	0	0	1	**1.14%**
8	0	0	0	1	1	0	0	0	0	3	2	2	0	3	1	1	**1.99%**
9	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	**0.28%**
10	0	0	0	0	0	0	0	0	0	0	2	0	0	1	1	0	**0.57%**
11	0	0	1	0	0	0	0	0	0	0	0	2	0	0	0	0	**0.43%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	**0.28%**
15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.14%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**2.42%**	**1.85%**	**1.85%**	**4.56%**	**9.97%**	**4.84%**	**2.14%**	**1.71%**	**4.56%**	**13.82%**	**13.53%**	**11.97%**	**8.97%**	**9.54%**	**4.99%**	**3.28%**	

Table 2.7-45 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
All Wind Speeds

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	87	85	76	96	104	114	99	108	103	134	99	114	127	102	74	97	**17.75%**
3	59	54	59	83	73	75	86	89	94	90	77	106	82	68	73	70	**13.58%**
4	34	24	31	64	45	45	61	80	83	72	71	70	65	62	58	52	**10.06%**
5	39	39	40	43	33	43	47	57	59	67	59	60	50	65	40	38	**8.54%**
6	33	23	39	27	18	27	34	48	44	62	45	41	42	40	45	34	**6.60%**
7	24	25	23	26	27	30	26	33	37	37	43	40	41	29	38	30	**5.58%**
8	13	17	19	24	18	28	26	24	30	34	34	35	29	31	35	16	**4.53%**
9	13	16	24	14	25	34	24	32	21	22	22	23	26	28	25	19	**4.04%**
10	11	14	12	13	12	23	25	19	18	28	28	31	14	17	23	14	**3.31%**
11	21	12	20	18	17	10	18	16	21	19	20	17	25	18	15	9	**3.03%**
12	14	8	11	7	8	19	11	21	15	25	18	21	15	22	18	3	**2.59%**
13	10	6	13	12	13	11	11	11	19	16	12	26	17	16	11	15	**2.40%**
14	3	13	10	5	15	12	21	12	12	14	12	19	17	13	7	12	**2.16%**
15	4	4	3	6	8	7	13	9	8	11	16	11	9	13	11	12	**1.59%**
16	0	6	10	8	4	13	9	6	9	11	11	11	6	9	5	12	**1.43%**
17	3	9	5	9	8	10	5	6	5	12	6	10	12	14	11	3	**1.40%**
18	5	6	8	4	3	6	5	4	12	10	10	10	15	9	10	6	**1.35%**
19	0	5	3	8	3	4	3	2	9	7	6	4	8	9	6	11	**0.97%**
20	1	3	4	7	3	2	6	2	3	3	7	8	10	7	5	7	**0.86%**
21	1	3	2	1	6	2	3	2	3	8	8	9	10	1	4	5	**0.75%**
22	1	3	3	3	10	2	0	2	4	6	10	6	3	8	5	1	**0.73%**
23	0	2	0	2	4	1	1	2	5	11	4	6	7	3	4	5	**0.63%**
24	2	1	4	1	4	2	2	1	5	5	8	3	1	5	3	1	**0.53%**
25	0	0	2	2	1	1	1	1	2	3	6	3	9	2	4	3	**0.44%**
26	3	1	2	2	2	1	0	2	5	6	4	8	4	5	7	3	**0.60%**
27	0	1	2	1	3	1	0	1	0	1	6	5	7	4	7	3	**0.46%**
28	0	1	2	1	3	4	3	1	1	4	2	5	6	3	3	1	**0.44%**
29	0	2	3	2	2	1	0	0	1	1	2	2	1	4	2	2	**0.27%**
30	2	1	2	0	1	1	0	0	0	0	3	5	4	2	4	1	**0.29%**
31	1	0	1	3	3	0	0	1	0	2	5	2	3	3	2	1	**0.30%**
32	1	1	2	1	1	1	0	0	2	2	6	1	7	5	1	0	**0.34%**
33	0	0	0	1	1	1	0	0	1	3	3	4	2	6	2	0	**0.26%**
34	0	1	1	0	0	0	0	0	2	3	6	3	1	2	1	0	**0.22%**
35	0	0	0	0	0	1	0	0	1	1	0	0	1	2	0	0	**0.07%**
36	0	0	1	1	1	0	0	0	1	0	2	2	1	2	3	1	**0.16%**
37	0	0	0	1	0	2	0	0	1	1	0	3	2	2	0	0	**0.13%**
38	0	0	1	1	2	2	0	0	1	2	2	0	0	0	0	1	**0.13%**
39	0	0	0	3	0	0	0	0	0	1	2	3	1	2	1	1	**0.15%**
40	1	1	1	0	1	2	0	0	0	0	2	3	1	1	0	0	**0.14%**
41	0	1	1	2	0	0	0	0	0	1	2	0	0	1	0	0	**0.09%**
42	0	0	0	0	1	0	0	0	0	0	1	0	3	0	0	1	**0.07%**
43	0	0	1	1	1	0	0	0	0	0	1	4	0	0	0	0	**0.09%**
44	0	0	0	0	0	1	0	0	1	1	1	0	0	0	0	0	**0.04%**
45	0	0	0	1	0	0	0	0	0	0	1	3	1	0	1	0	**0.08%**
46	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0	0	**0.04%**
47	0	0	0	1	1	0	0	0	0	1	0	0	1	0	0	0	**0.04%**
48+	3	2	5	4	3	0	1	0	1	7	15	12	11	3	2	0	**0.76%**
% of PERSISTENT DIRECTION	**4.27%**	**4.28%**	**4.90%**	**5.58%**	**5.35%**	**5.91%**	**5.93%**	**6.49%**	**7.01%**	**8.16%**	**7.65%**	**8.21%**	**7.64%**	**7.03%**	**6.21%**	**5.37%**	
AVE PERSISTENT HOURS	**6.80**	**7.76**	**8.82**	**8.08**	**8.53**	**7.64**	**6.92**	**6.45**	**7.66**	**8.64**	**10.41**	**9.81**	**9.77**	**9.53**	**8.99**	**7.83**	

THE LONGEST PERSISTENT WIND WAS FROM THE WEST BY SOUTHWEST AND LASTED 158 HOURS

Table 2.7-46 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
0-5 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	20	26	25	23	20	23	18	28	24	14	21	25	20	25	15	25	**65.31%**
3	7	12	12	5	3	6	6	7	9	5	7	4	4	5	10	10	**20.78%**
4	2	2	2	0	2	0	6	3	1	1	2	1	0	2	1	4	**5.38%**
5	1	2	3	2	0	1	1	1	1	2	2	1	2	3	2	0	**4.45%**
6	0	0	2	3	0	2	2	1	0	1	0	0	0	0	1	0	**2.23%**
7	0	0	2	1	1	1	0	0	0	0	0	0	0	0	1	0	**1.11%**
8	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	**0.19%**
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
10	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.37%**
11	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.19%**
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**5.57%**	**8.16%**	**8.72%**	**6.31%**	**4.82%**	**6.12%**	**6.12%**	**7.42%**	**6.49%**	**4.27%**	**5.94%**	**5.75%**	**4.82%**	**6.68%**	**5.57%**	**7.24%**	

Table 2.7-47 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
5-10 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	61	89	94	101	98	111	112	123	99	136	99	107	127	107	110	101	**43.84%**
3	37	45	72	51	51	53	80	65	77	55	68	49	55	57	49	65	**24.31%**
4	19	23	32	30	21	41	31	49	54	29	23	29	23	23	33	23	**12.64%**
5	9	13	30	16	23	21	21	23	18	19	18	23	14	14	18	14	**7.69%**
6	7	8	15	6	5	12	29	20	4	5	10	10	5	11	7	9	**4.27%**
7	0	1	6	6	2	12	10	10	10	5	4	3	7	9	5	6	**2.51%**
8	1	4	5	6	3	3	7	7	5	2	4	2	4	4	3	3	**1.65%**
9	2	1	3	2	0	5	5	4	1	1	1	2	2	1	3	2	**0.92%**
10	1	0	1	6	1	3	4	6	1	2	0	0	2	3	2	2	**0.89%**
11	0	1	3	0	1	2	3	0	1	0	0	1	1	1	1	3	**0.47%**
12	0	1	2	0	0	2	5	2	2	0	0	0	2	0	0	0	**0.42%**
13	0	0	0	0	0	1	1	0	1	0	0	0	0	2	1	0	**0.16%**
14	0	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	**0.08%**
15	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	**0.03%**
16	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	**0.05%**
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
18	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	**0.05%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.03%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	3.59%	4.89%	6.94%	5.86%	5.37%	6.96%	8.09%	8.11%	7.17%	6.67%	5.94%	5.94%	6.36%	6.07%	6.07%	5.97%	

Table 2.7-48 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
10-15 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	44	51	80	92	90	91	79	78	99	146	150	154	147	140	112	99	**35.80%**
3	34	33	50	48	54	70	44	48	44	81	92	115	87	73	67	52	**21.50%**
4	22	22	31	34	29	24	33	25	45	47	63	67	56	63	41	33	**13.76%**
5	17	15	22	22	11	15	19	20	17	32	42	45	43	52	40	33	**9.64%**
6	10	6	14	8	8	10	11	11	17	25	22	25	30	28	32	16	**5.92%**
7	5	5	14	5	5	7	6	5	7	10	13	26	19	18	19	11	**3.79%**
8	7	2	6	6	3	5	6	5	7	15	15	17	10	16	10	12	**3.08%**
9	3	7	2	3	2	3	1	1	2	9	2	10	9	7	9	9	**1.71%**
10	0	0	4	3	1	2	2	2	5	6	18	9	11	11	4	6	**1.82%**
11	2	1	5	2	2	1	0	2	1	5	3	2	7	6	2	0	**0.89%**
12	0	1	0	0	0	3	1	1	3	3	1	3	4	2	2	5	**0.63%**
13	1	0	2	1	0	0	0	0	0	3	3	1	2	3	3	2	**0.46%**
14	1	0	0	1	0	0	0	0	1	1	0	1	0	0	1	2	**0.17%**
15	0	0	0	0	1	0	0	0	0	0	3	2	1	0	0	0	**0.15%**
16	0	0	0	0	0	0	0	0	1	1	2	0	1	0	1	0	**0.13%**
17	0	0	1	1	0	0	0	0	2	0	1	2	0	1	1	0	**0.20%**
18	0	1	0	0	0	0	0	0	0	0	0	2	0	0	1	0	**0.09%**
19	0	0	1	0	0	0	0	0	0	0	1	0	1	0	1	0	**0.09%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	**0.02%**
21	0	0	1	0	0	0	0	0	1	1	0	0	0	0	0	0	**0.07%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	2	**0.07%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.02%**
32	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.02%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**3.16%**	**3.12%**	**5.05%**	**4.90%**	**4.46%**	**5.01%**	**4.38%**	**4.29%**	**5.46%**	**8.34%**	**9.38%**	**10.44%**	**9.27%**	**9.10%**	**7.52%**	**6.11%**	

Table 2.7-49 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
15-20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	23	27	37	34	69	53	31	31	51	106	100	96	80	67	53	33	**39.16%**
3	15	16	20	32	30	28	21	22	26	62	53	57	50	42	27	9	**22.42%**
4	7	6	10	16	22	21	13	6	18	36	33	40	27	24	18	14	**13.67%**
5	3	7	9	5	14	14	7	4	12	26	26	19	16	19	9	9	**8.75%**
6	3	9	4	4	6	7	2	4	6	16	13	16	11	10	7	6	**5.45%**
7	3	2	3	6	4	5	0	0	5	11	11	12	10	2	6	0	**3.52%**
8	1	3	2	1	2	2	1	2	1	5	7	6	6	4	3	2	**2.11%**
9	5	0	0	0	2	1	0	0	4	1	2	3	4	3	1	2	**1.23%**
10	1	0	2	0	4	0	1	0	2	5	3	5	4	2	0	0	**1.27%**
11	0	1	0	0	0	1	0	0	1	3	1	4	0	2	1	0	**0.62%**
12	1	0	0	0	0	0	0	1	1	1	3	1	2	1	0	0	**0.48%**
13	0	0	0	0	0	0	0	0	1	0	3	1	0	0	0	0	**0.22%**
14	0	0	1	0	1	0	0	0	0	1	1	2	1	0	0	0	**0.31%**
15	0	0	0	1	0	0	0	0	0	1	1	3	0	0	0	1	**0.31%**
16	1	0	0	0	0	0	0	0	0	1	0	1	2	0	0	0	**0.22%**
17	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	**0.13%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.09%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.04%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**2.77%**	**3.16%**	**3.87%**	**4.35%**	**6.77%**	**5.80%**	**3.34%**	**3.08%**	**5.63%**	**12.13%**	**11.30%**	**11.82%**	**9.41%**	**7.74%**	**5.49%**	**3.34%**	

Table 2.7-50 Wind Direction Persistence Summaries - Fermi Site 60-Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
>20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	5	8	8	15	34	20	7	10	21	48	43	34	36	33	18	8	**41.28%**
3	5	3	2	9	17	16	3	3	8	32	28	29	25	27	8	5	**26.10%**
4	2	2	2	4	17	4	6	1	3	15	13	10	15	4	7	4	**12.93%**
5	3	1	0	5	8	2	0	2	3	6	16	6	5	5	3	3	**8.07%**
6	1	1	1	2	3	1	0	0	4	5	4	7	3	0	2	1	**4.15%**
7	1	0	0	1	2	0	0	1	1	1	3	4	0	1	1	2	**2.14%**
8	0	0	0	1	1	0	1	0	1	4	2	3	0	1	2	2	**2.14%**
9	0	0	0	0	0	0	0	0	0	0	2	2	1	0	0	0	**0.59%**
10	0	0	0	0	0	0	0	0	1	1	2	0	0	1	1	0	**0.71%**
11	0	0	1	0	0	0	0	0	0	1	0	2	0	0	0	0	**0.47%**
12	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	1	**0.47%**
13	0	0	0	0	0	1	0	0	1	0	1	0	0	0	0	0	**0.36%**
14	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	**0.24%**
15	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	**0.12%**
16	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	**0.12%**
17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	**0.12%**
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	**0.00%**
% of PERSISTENT DIRECTION	**2.02%**	**1.78%**	**1.66%**	**4.39%**	**9.73%**	**5.22%**	**2.02%**	**2.02%**	**5.22%**	**13.64%**	**13.64%**	**11.63%**	**10.20%**	**8.78%**	**4.98%**	**3.08%**	

Table 2.7-51 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
All Wind Speeds (A)

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	275	210	169	162	254	105	155	190	372	360	353	329	331	352	241	235	51.26%
3	146	111	55	75	93	26	44	93	206	138	154	139	179	129	117	94	22.53%
4	81	61	23	20	56	13	29	48	107	66	89	61	107	74	31	32	11.25%
5	30	39	21	18	37	5	10	18	59	34	31	52	43	19	21	27	5.81%
6	26	16	6	8	27	0	6	4	27	26	24	15	35	19	10	5	3.18%
7	15	12	5	4	15	0	1	1	25	14	19	9	12	14	8	4	1.98%
8	9	7	2	2	10	0	0	2	4	13	7	7	14	11	2	1	1.14%
9	13	6	1	0	4	0	0	0	8	10	14	5	5	2	0	4	0.90%
10	4	1	3	1	1	2	2	0	0	3	3	2	9	0	1	4	0.45%
11	5	2	0	1	1	2	0	0	6	2	3	1	5	1	2	0	0.39%
12	6	2	1	0	0	0	0	0	5	0	5	4	4	3	0	0	0.38%
13	1	0	1	0	3	0	0	0	1	3	1	1	3	0	1	0	0.19%
14	2	4	1	0	2	0	0	0	2	0	0	0	2	0	0	0	0.16%
15	2	0	0	0	2	0	0	0	1	0	1	0	1	0	0	2	0.11%
16	0	0	0	0	2	0	0	0	2	0	0	1	0	0	2	0	0.09%
17	1	2	0	0	1	0	0	0	3	0	0	0	0	0	0	0	0.09%
18	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03%
19	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03%
20	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01%
21	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.01%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	7.79%	5.95%	3.61%	3.64%	6.36%	1.92%	3.09%	4.46%	10.37%	8.38%	8.82%	7.84%	9.39%	7.81%	5.46%	5.11%	
AVE PERSISTENT HOURS	3.67	3.52	3.00	2.86	3.44	2.66	2.72	2.78	3.37	3.15	3.25	3.10	3.42	2.96	2.92	2.91	

* THE LONGEST PERSISTENT WIND WAS FROM THE SOUTH BY SOUTHWEST AND LASTED 24 HOURS
(A) Hourly wind speeds of 3 knots or less (3.45) are reported as calm hours.
Source: Reference 2.7-41

Table 2.7-52 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
0-5 MPH [(A)]

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	51	45	24	36	87	22	25	39	104	33	3	10	33	31	19	26	78.82%
3	24	16	2	7	13	4	2	3	29	4	2	0	5	3	3	2	15.95%
4	0	2	0	1	7	0	3	1	7	2	0	0	0	1	0	2	3.49%
5	0	3	0	1	2	0	0	0	2	1	0	1	0	0	0	0	1.34%
6	0	0	0	0	1	0	0	0	2	0	0	0	0	0	0	0	0.40%
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	10.05%	8.85%	3.49%	6.03%	14.75%	3.49%	4.02%	5.76%	19.30%	5.36%	0.67%	1.47%	5.09%	4.69%	2.95%	4.02%	

(A) Hourly wind speeds of 3 knots or less (3.45) are reported as calm hours.
Source: Reference 2.7-41

Table 2.7-53 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
5-10 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	175	138	87	75	179	46	78	118	230	153	83	103	160	139	99	121	66.27%
3	74	42	31	25	53	9	22	31	77	46	26	24	65	35	30	25	20.54%
4	19	27	4	6	23	3	11	16	34	21	4	12	16	11	3	6	7.21%
5	9	8	4	3	17	5	3	2	10	5	3	5	11	3	0	4	3.07%
6	7	6	2	2	4	0	2	1	8	3	0	2	2	3	2	0	1.47%
7	4	6	1	0	3	0	0	0	1	1	0	0	0	0	0	0	0.53%
8	2	1	0	1	2	0	0	0	1	0	0	0	0	1	0	0	0.27%
9	1	1	0	0	0	0	0	0	5	0	0	1	0	0	0	0	0.27%
10	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03%
11	2	1	0	0	1	0	0	0	0	0	0	0	0	3	0	0	0.23%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.03%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.03%
16	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	9.79%	7.75%	4.31%	3.74%	9.45%	2.10%	3.87%	5.61%	12.22%	7.68%	3.87%	4.91%	8.48%	6.51%	4.48%	5.21%	

Source: Reference 2.7-41

Table 2.7-54 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
10-15 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	88	56	48	43	33	8	26	47	121	127	174	137	134	132	103	80	60.99%
3	29	27	19	15	23	4	6	11	52	45	60	36	55	42	24	24	21.21%
4	20	13	2	7	7	4	2	8	20	30	21	20	26	11	9	11	9.48%
5	8	8	5	6	10	0	2	0	6	8	15	14	6	5	8	7	4.85%
6	4	1	1	0	2	0	0	0	5	7	7	2	7	1	2	1	1.80%
7	0	4	2	0	0	2	0	0	1	0	1	1	1	2	0	0	0.63%
8	1	0	2	0	0	0	0	0	1	1	1	2	2	0	0	0	0.45%
9	2	2	1	0	0	0	0	0	0	2	0	0	0	0	0	0	0.31%
10	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04%
11	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0.04%
12	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.09%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	7.06%	4.99%	3.60%	3.19%	3.42%	0.81%	1.62%	2.97%	9.26%	9.89%	12.54%	9.53%	10.38%	8.67%	6.56%	5.53%	

Source: Reference 2.7-41

Table 2.7-55 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
15-20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	16	18	2	6	3	0	5	3	24	41	82	55	65	44	29	20	65.97%
3	12	5	1	0	0	0	0	0	11	3	25	13	31	7	5	7	19.17%
4	7	1	1	0	0	0	0	0	4	9	17	9	3	0	5	1	9.11%
5	1	0	0	0	0	0	0	0	2	2	8	5	4	1	1	4	4.47%
6	0	0	0	0	0	0	0	0	2	0	0	2	1	0	0	0	0.80%
7	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0.32%
8	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.16%
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	5.75%	3.83%	0.64%	0.96%	0.48%	0.00%	0.80%	0.48%	6.87%	8.79%	21.41%	13.58%	16.61%	8.31%	6.39%	5.11%	

Source: Reference 2.7-41

Table 2.7-56 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 22.5° Direction
2003-2007
>20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	6	2	0	0	0	0	0	0	4	10	25	9	26	9	9	7	69.48%
3	1	0	0	0	0	0	0	0	6	1	10	9	3	2	3	0	22.73%
4	0	0	0	0	0	0	0	0	0	3	4	2	1	0	0	0	6.49%
5	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.65%
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
7	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.65%
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	4.55%	1.30%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	6.49%	9.09%	26.62%	12.99%	19.48%	7.14%	7.79%	4.55%	

Source: Reference 2.7-41

Table 2.7-57 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
All Wind Speeds [(A)]

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	156	107	110	86	166	107	160	164	240	175	133	161	204	136	145	126	24.23%
3	99	75	79	104	103	44	78	91	197	128	125	119	111	94	106	78	16.63%
4	61	43	41	49	43	41	54	89	125	84	58	75	96	66	65	49	10.59%
5	42	40	44	45	50	26	33	66	90	51	57	81	77	62	60	41	8.82%
6	49	19	28	31	25	18	35	57	54	48	46	59	58	54	24	38	6.56%
7	32	24	22	24	15	16	13	30	64	38	44	46	37	51	47	27	5.40%
8	33	22	14	13	30	16	12	40	40	36	40	35	36	46	29	21	4.72%
9	27	13	16	14	16	12	8	21	38	26	38	25	30	22	22	25	3.60%
10	29	13	14	12	7	9	8	13	19	26	24	31	23	33	23	18	3.08%
11	14	16	7	6	14	4	8	10	26	24	18	12	24	19	15	5	2.26%
12	7	13	11	6	8	1	5	12	17	17	9	15	22	13	13	23	1.96%
13	12	3	11	7	8	1	3	12	11	16	20	5	20	6	19	3	1.60%
14	12	22	4	1	3	4	0	3	7	13	6	16	16	12	4	4	1.29%
15	6	10	4	2	3	6	2	6	14	7	13	11	16	6	6	6	1.20%
16	8	8	2	7	7	4	3	4	9	7	12	10	15	10	5	3	1.16%
17	2	4	4	3	3	1	0	2	11	7	3	5	12	9	1	5	0.73%
18	9	14	5	1	4	0	1	2	5	12	14	4	6	5	5	8	0.97%
19	6	2	2	5	3	1	2	2	4	10	3	3	5	8	1	1	0.59%
20	5	8	3	4	3	0	0	3	5	4	3	8	8	9	1	2	0.67%
21	3	4	1	0	3	0	0	3	4	10	8	4	0	2	1	2	0.46%
22	3	2	1	1	2	0	0	1	2	2	2	3	2	1	3	6	0.32%
23	4	2	1	4	2	0	0	2	0	4	6	1	3	2	4	2	0.38%
24	2	1	3	2	4	1	0	0	3	5	4	5	0	1	2	3	0.37%
25	0	3	0	3	1	0	0	0	1	3	4	3	3	2	2	3	0.29%
26	3	0	2	1	1	1	0	0	0	2	1	3	1	0	1	2	0.18%
27	0	5	0	0	1	0	0	0	0	0	2	0	0	2	0	1	0.11%
28	6	4	1	0	0	0	0	0	1	1	4	3	2	4	0	1	0.28%
29	1	1	0	3	0	0	0	0	3	2	5	0	1	2	2	0	0.20%
30	1	0	0	1	0	0	0	0	1	2	2	0	2	2	0	0	0.11%
31	0	0	0	1	1	0	0	0	0	2	2	1	1	2	1	0	0.11%
32	0	0	1	0	1	0	0	0	1	0	0	0	3	0	0	0	0.06%
33	0	4	0	0	0	0	0	0	0	2	0	4	0	2	0	2	0.14%
34	3	3	1	0	1	0	0	0	0	1	0	1	0	1	0	1	0.12%
35	0	2	2	0	0	0	0	1	0	1	4	0	0	0	1	0	0.11%
36	0	1	0	0	0	0	0	1	2	2	0	0	0	1	0	1	0.08%
37	1	1	1	0	1	0	0	0	0	2	0	3	0	0	2	0	0.11%
38	0	0	0	0	0	0	0	0	0	2	0	2	1	1	0	1	0.07%
39	0	1	0	0	0	0	0	0	0	1	0	3	0	0	0	1	0.06%
40	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0.02%
41	0	0	0	1	0	0	0	0	0	0	1	0	2	0	0	0	0.04%
42	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0.02%
43	0	0	0	1	0	0	0	0	0	0	0	2	0	0	0	0	0.03%
44	0	0	0	0	0	2	0	0	0	0	0	0	1	0	0	0	0.03%
45	0	2	0	0	0	0	0	0	0	1	2	0	0	0	0	0	0.05%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	2	2	0	0	0	0	0	0	0	3	4	0	1	3	1	0	0.16%
% of PERSISTENT DIRECTION	6.50%	5.04%	4.44%	4.48%	5.39%	3.21%	4.33%	6.47%	10.14%	7.93%	7.31%	7.74%	8.55%	7.04%	6.23%	5.19%	
AVE PERSISTENT HOURS	6.86	8.38	6.22	6.32	5.72	5.20	4.25	5.44	5.73	7.41	7.77	6.97	6.75	7.29	6.20	6.71	

* THE LONGEST PERSISTENT WIND WAS FROM THE SOUTHWEST AND LASTED 67 HOURS
(A)Hourly wind speeds of 3 knots or less (3.45) are reported as calm hours.
Source: Reference 2.7-41

Table 2.7-58 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction

2003-2007

0-5 MPH [(A)]

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	84	64	42	58	122	50	53	83	147	60	14	22	49	59	41	47	63.05%
3	34	32	23	33	43	15	19	22	61	22	4	6	15	17	14	18	23.95%
4	15	8	3	6	15	6	7	9	26	7	1	2	11	3	1	9	8.17%
5	5	2	2	6	6	2	2	5	4	3	0	2	1	3	0	0	2.72%
6	0	3	3	2	2	3	2	0	2	1	0	0	1	1	0	1	1.33%
7	1	1	1	2	2	1	0	0	0	1	0	0	0	0	0	0	0.57%
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.13%
9	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0.06%
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	8.81%	6.97%	4.69%	6.78%	12.04%	4.88%	5.26%	7.54%	15.27%	5.96%	1.20%	2.03%	4.88%	5.26%	3.55%	4.88%	

[(A)]Hourly wind speeds of 3 knots or less (3.45) are reported as calm hours.

Source: Reference 2.7-41

Table 2.7-59 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
5-10 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	161	127	116	98	164	75	126	148	263	168	128	150	207	155	122	133	45.77%
3	100	73	52	53	88	24	48	95	130	94	60	80	86	90	58	52	23.13%
4	42	59	22	28	34	26	27	45	64	52	28	37	45	52	34	46	12.53%
5	28	22	11	16	28	15	15	27	32	25	11	25	30	31	18	15	6.82%
6	27	15	7	13	5	7	11	15	27	23	14	12	28	19	10	8	4.71%
7	16	16	10	9	9	4	3	8	17	8	6	3	11	4	12	10	2.85%
8	4	10	8	7	5	2	2	6	6	8	2	3	2	6	3	4	1.52%
9	2	5	2	3	1	3	2	4	6	4	1	0	2	3	0	1	0.76%
10	4	9	1	0	6	0	0	1	4	0	0	1	2	3	0	2	0.65%
11	4	2	3	0	2	0	0	0	5	1	1	1	0	3	0	0	0.43%
12	3	2	4	0	2	2	0	0	3	1	0	0	0	0	1	0	0.35%
13	0	0	0	1	3	0	0	0	0	1	0	0	1	0	0	0	0.12%
14	0	1	0	0	1	0	2	0	0	0	0	0	0	0	0	1	0.10%
15	0	0	0	0	2	0	0	0	0	2	0	0	0	1	0	0	0.10%
16	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0.06%
17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.02%
18	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0.04%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.04%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	7.68%	6.73%	4.61%	4.50%	6.84%	3.09%	4.61%	6.82%	10.89%	7.59%	4.91%	6.10%	8.09%	7.17%	5.04%	5.32%	

Source: Reference 2.7-41

Table 2.7-60 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
10-15 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	109	69	58	35	38	12	29	67	115	147	139	154	152	130	123	93	40.82%
3	51	32	38	28	33	4	6	28	86	84	91	81	73	79	63	53	23.05%
4	28	30	11	17	13	3	8	20	35	51	70	49	59	52	39	25	14.16%
5	13	21	9	14	16	5	6	3	16	27	39	33	25	30	29	22	8.55%
6	16	12	4	8	6	1	4	3	14	21	22	16	16	10	14	7	4.83%
7	8	6	4	3	2	0	0	3	10	9	15	14	17	9	6	5	3.08%
8	4	3	5	0	0	0	0	2	5	15	10	11	9	6	3	0	2.03%
9	6	2	1	0	0	0	0	1	2	9	11	0	2	4	1	3	1.17%
10	2	2	0	2	0	2	0	0	2	2	1	5	0	1	2	0	0.58%
11	0	0	3	0	3	0	0	0	2	0	4	2	1	3	1	1	0.56%
12	2	0	2	0	0	0	0	0	1	2	3	1	1	1	0	0	0.36%
13	0	4	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0.17%
14	0	0	1	0	0	0	0	0	0	0	0	4	1	0	1	0	0.19%
15	2	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0.14%
16	0	2	0	2	0	0	0	0	0	0	3	0	1	0	0	0	0.22%
17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.03%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0.06%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	6.72%	5.08%	3.83%	3.05%	3.08%	0.75%	1.47%	3.53%	8.00%	10.19%	11.36%	10.27%	9.91%	9.03%	7.83%	5.89%	

Source: Reference 2.7-41

Table 2.7-61 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
15-20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	18	22	6	4	4	0	4	3	26	58	79	68	69	47	33	27	49.32%
3	16	9	0	2	0	1	0	1	10	18	53	29	42	26	29	8	25.71%
4	5	1	3	0	0	0	1	1	10	15	26	14	20	10	8	3	12.33%
5	5	2	0	0	0	0	0	1	4	4	13	7	5	7	1	4	5.58%
6	2	0	1	1	0	0	0	2	2	3	2	8	10	2	1	4	4.00%
7	0	0	0	0	0	0	0	0	0	0	6	3	0	2	2	2	1.58%
8	0	0	0	0	0	0	0	0	0	0	3	1	3	0	1	0	0.84%
9	0	0	0	0	0	0	0	0	0	0	3	1	0	0	0	0	0.42%
10	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.11%
11	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0.11%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	4.85%	3.58%	1.05%	0.74%	0.42%	0.11%	0.53%	0.84%	5.48%	10.43%	19.49%	13.91%	15.70%	9.91%	7.90%	5.06%	

Source: Reference 2.7-41

Table 2.7-62 Wind Direction Persistence Summaries - Detroit Metropolitan Airport 10 Meter Level

Number of Occurrences for Winds Blowing from the Same 67.5° Direction
2003-2007
>20 MPH

HOURS	N	NNE	NE	ENE	E	ESE	SE	SSE	S	SSW	SW	WSW	W	WNW	NW	NNW	% of PERSISTENT WINDS
2	5	4	0	0	0	0	0	0	4	9	29	24	30	13	14	10	62.01%
3	3	0	0	0	0	0	0	0	8	3	12	9	9	6	5	1	24.45%
4	0	0	0	0	0	0	0	0	1	4	6	4	3	0	0	0	7.86%
5	0	0	0	0	0	0	0	0	0	3	3	1	0	0	2	0	3.93%
6	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0.87%
7	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0.44%
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
10	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.44%
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
47	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
48	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00%
% of PERSISTENT DIRECTION	3.49%	1.75%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	5.68%	8.73%	22.27%	17.03%	18.78%	8.30%	9.17%	4.80%	

Table 2.7-63 Monthly and Annual Vertical Stability Class and Mean 60-Meter Wind Speed Distributions for Fermi Site (2003 - 2007) (Sheet 1 of 2)

	Vertical Stability Categories						
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**
January							
Wind Speed (mph)	13.49	14.28	14.39	15.21	13.28	13.22	11.75
Frequency (%)	10.09	5.38	6.33	46.28	23.88	6.14	1.89
February							
Wind Speed (mph)	13.13	14.44	14.61	14.80	12.45	10.84	10.37
Frequency (%)	17.13	5.53	5.36	41.95	21.09	6.27	2.66
March							
Wind Speed (mph)	12.43	13.10	13.20	15.49	13.47	14.48	14.66
Frequency (%)	16.99	5.33	3.71	34.09	23.73	10.15	6.01
April							
Wind Speed (mph)	14.56	14.92	16.39	16.56	14.50	13.17	12.61
Frequency (%)	20.91	4.86	4.89	25.74	26.11	11.62	5.87
May							
Wind Speed (mph)	12.41	12.53	12.62	13.65	11.65	10.88	9.90
Frequency (%)	23.10	6.53	6.26	28.65	22.12	8.71	4.65
June							
Wind Speed (mph)	9.98	10.80	11.16	11.99	11.36	10.28	8.43
Frequency (%)	26.93	5.88	4.43	23.17	24.87	10.03	4.71
July							
Wind Speed (mph)	10.03	10.43	10.80	12.04	10.34	8.59	8.05
Frequency (%)	31.05	5.46	4.18	19.94	23.01	9.89	6.47
August							
Wind Speed (mph)	9.56	9.57	9.60	11.12	10.75	9.37	8.91
Frequency (%)	26.83	5.69	4.69	18.82	25.07	12.64	6.26
September							
Wind Speed (mph)	10.06	11.90	11.75	13.21	12.29	10.37	8.37
Frequency (%)	25.25	4.61	3.78	21.19	26.83	10.50	7.83
October							
Wind Speed (mph)	11.69	12.81	14.65	14.55	13.03	12.70	9.93
Frequency (%)	17.20	4.45	3.47	28.38	28.52	11.46	6.53
November							
Wind Speed (mph)	13.13	14.69	15.81	14.86	12.89	12.17	12.10
Frequency (%)	10.76	4.06	4.68	42.16	25.70	9.31	3.32

Table 2.7-63 Monthly and Annual Vertical Stability Class and Mean 60-Meter Wind Speed Distributions for Fermi Site (2003 - 2007) (Sheet 2 of 2)

	Vertical Stability Categories						
Period	**A**	**B**	**C**	**D**	**E**	**F**	**G**
December							
Wind Speed (mph)	12.45	14.39	16.21	15.12	13.69	12.86	12.80
Frequency (%)	8.90	5.05	5.56	48.55	22.26	8.12	1.56
Annual							
Wind Speed (mph)	11.48	12.70	13.49	14.37	12.47	11.51	10.32
Frequency (%)	19.63	5.25	4.78	31.54	24.41	9.57	4.82

Table 2.7-64 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

All Pasquill Stability Classes

			Wind Speed (Miles/Hour)													
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	6	3	32	60	115	128	309	549	350	250	133	82	5	0	0	2022
NNE	3	5	16	47	76	106	313	474	243	183	104	67	18	0	0	1655
NE	6	3	10	29	40	51	148	609	601	288	110	28	2	0	0	1925
ENE	4	1	8	15	21	35	94	415	525	407	159	122	12	0	0	1818
E	8	3	10	14	16	21	118	419	487	383	273	220	37	7	0	2016
ESE	3	2	12	17	25	55	198	751	695	390	161	98	3	0	0	2410
SE	10	2	4	30	21	53	201	898	739	241	52	24	3	0	0	2278
SSE	7	3	19	33	49	54	207	728	596	199	53	11	3	0	0	1962
S	4	3	29	68	93	94	282	779	601	259	88	32	0	0	0	2332
SSW	8	9	50	78	127	114	346	1089	1122	753	341	223	9	0	0	4269
SW	12	14	78	120	179	226	523	950	837	632	426	289	59	3	0	4348
WSW	19	15	108	216	324	339	627	944	687	318	96	46	2	0	0	3741
W	22	15	178	290	273	212	454	734	490	243	95	26	3	1	0	3036
WNW	10	3	43	106	163	155	434	808	436	216	96	47	0	0	0	2517
NW	15	9	91	207	253	272	516	710	455	206	69	29	0	0	0	2832
NNW	10	21	183	335	415	361	480	750	479	236	126	59	1	1	0	3457
TOTAL	147	111	871	1665	2190	2276	5250	11607	9343	5204	2382	1403	157	12	0	42618

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-65 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class A Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	0	0	1	0	3	6	18	56	69	45	5	10	0	0	0	213
NNE	0	0	0	0	3	4	25	61	38	31	9	10	0	0	0	181
NE	0	0	0	1	5	8	28	100	115	46	13	6	0	0	0	322
ENE	0	0	1	1	4	5	21	107	129	78	27	20	0	0	0	393
E	1	0	1	0	2	2	27	113	130	118	81	51	2	2	0	530
ESE	0	0	0	2	3	6	35	275	260	137	53	19	0	0	0	790
SE	5	0	0	0	0	5	39	376	349	73	5	0	0	0	0	852
SSE	1	0	0	2	5	6	40	251	275	61	8	1	0	0	0	650
S	0	0	0	1	5	3	44	226	181	36	7	2	0	0	0	505
SSW	1	0	1	0	4	4	54	214	294	157	53	16	4	0	0	802
SW	0	1	1	0	3	5	41	126	144	103	52	19	1	0	0	496
WSW	1	0	0	3	8	13	51	148	178	80	17	1	0	0	0	500
W	3	0	1	9	3	15	62	173	143	77	23	6	0	0	0	515
WNW	0	0	0	2	1	11	31	143	127	74	28	13	0	0	0	430
NW	0	1	1	1	8	19	66	199	171	70	22	10	0	0	0	568
NNW	0	0	3	4	10	20	67	216	197	70	26	14	0	0	0	627
TOTAL	12	2	10	26	67	132	649	2784	2800	1256	429	198	7	2	0	8374

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-66 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class B Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	0	0	0	1	6	6	14	41	27	10	8	8	0	0	0	121
NNE	0	0	0	0	1	5	14	22	17	14	6	5	0	0	0	84
NE	0	0	0	1	0	0	9	27	14	10	3	1	0	0	0	65
ENE	0	0	0	0	1	4	9	16	24	18	11	7	0	0	0	90
E	0	0	0	0	0	1	5	16	24	26	16	9	0	0	0	97
ESE	0	0	0	0	2	2	9	38	25	17	6	8	0	0	0	107
SE	0	0	0	1	0	3	23	69	40	8	3	2	0	0	0	149
SSE	1	0	0	2	3	2	8	46	23	4	1	1	0	0	0	91
S	0	0	1	1	2	2	17	40	21	9	3	0	0	0	0	96
SSW	0	0	1	0	1	4	10	44	78	37	31	17	0	0	0	223
SW	0	0	1	1	1	5	16	50	54	42	42	29	8	1	0	250
WSW	0	0	0	1	3	7	19	48	77	17	12	4	0	0	0	188
W	0	0	0	2	7	4	22	77	49	23	6	1	0	0	0	191
WNW	0	0	0	1	2	5	21	55	40	22	7	3	0	0	0	156
NW	0	0	1	3	3	10	19	47	39	19	7	4	0	0	0	152
NNW	0	1	0	5	3	9	22	63	38	13	11	7	0	0	0	172
TOTAL	1	1	4	19	35	69	237	699	590	289	173	106	8	1	0	2232

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-67 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class C Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	0	0	0	0	3	6	16	44	21	12	9	8	0	0	0	119
NNE	0	0	0	1	0	2	14	32	14	14	17	1	0	0	0	95
NE	0	0	0	2	3	3	6	25	27	18	6	1	0	0	0	91
ENE	0	0	2	2	0	1	3	9	24	35	14	9	3	0	0	102
E	0	0	0	1	1	1	2	18	13	18	9	13	2	0	0	78
ESE	0	0	0	0	0	2	9	33	23	19	8	4	0	0	0	98
SE	0	0	0	0	1	2	9	37	24	9	3	1	0	0	0	86
SSE	0	0	0	0	1	1	10	28	20	3	6	1	0	0	0	70
S	0	0	0	2	4	5	9	32	20	15	3	1	0	0	0	91
SSW	0	0	1	3	3	3	13	41	50	34	20	13	0	0	0	181
SW	0	0	0	2	2	11	20	48	56	44	21	43	10	1	0	258
WSW	0	0	0	2	2	7	22	52	44	28	15	10	0	0	0	182
W	0	0	1	3	8	7	29	49	35	15	16	2	0	0	0	165
WNW	0	0	2	3	4	5	12	55	31	8	6	4	0	0	0	130
NW	0	0	0	4	5	9	17	44	25	10	11	5	0	0	0	130
NNW	0	0	3	2	7	10	25	50	21	16	14	6	0	0	0	154
TOTAL	0	0	9	27	44	75	216	597	448	298	178	122	15	1	0	2030

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-68 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class D Pasquill Stability Class

	Wind Speed (Miles/Hour)															
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	1	1	9	11	18	34	63	137	138	149	96	48	4	0	0	709
NNE	0	0	2	11	23	32	91	173	118	100	69	47	18	0	0	684
NE	0	0	2	9	6	13	56	256	357	194	78	20	2	0	0	993
ENE	0	0	2	3	8	6	28	141	231	216	97	82	5	0	0	819
E	1	0	2	1	5	3	29	96	181	146	121	101	23	2	0	711
ESE	0	1	1	3	6	15	42	151	186	142	55	47	1	0	0	650
SE	1	1	0	9	6	10	32	163	141	62	20	14	3	0	0	462
SSE	0	0	1	2	6	13	38	102	88	45	18	4	2	0	0	319
S	1	0	2	10	7	17	47	142	132	87	28	13	0	0	0	486
SSW	1	1	4	13	12	7	50	196	241	217	138	112	2	0	0	994
SW	0	1	10	12	18	29	97	356	441	361	278	178	37	1	0	1819
WSW	1	2	9	22	36	61	200	456	339	170	48	25	0	0	0	1369
W	4	2	17	23	42	45	165	278	209	116	46	14	1	0	0	962
WNW	0	0	5	15	28	39	114	279	187	91	47	24	0	0	0	829
NW	0	0	8	19	31	34	123	261	166	78	24	7	0	0	0	751
NNW	1	2	15	30	42	57	107	265	166	109	67	28	0	0	0	889
TOTAL	11	11	89	193	294	415	1282	3452	3321	2283	1230	764	98	3	0	13446

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-69 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class E Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	3	0	9	20	36	40	87	160	80	28	14	8	1	0	0	486
NNE	1	2	5	20	28	39	130	146	47	22	3	4	0	0	0	447
NE	4	1	2	10	16	17	40	188	83	20	10	0	0	0	0	391
ENE	3	0	2	6	3	10	25	130	103	53	8	4	4	0	0	351
E	5	2	4	8	5	6	37	132	108	59	38	36	8	3	0	451
ESE	1	1	4	5	4	20	54	176	157	54	36	16	2	0	0	530
SE	2	1	2	8	7	18	46	153	130	59	9	5	0	0	0	440
SSE	2	1	8	10	17	15	62	179	112	64	12	0	1	0	0	483
S	1	1	13	24	34	33	110	254	197	82	31	11	0	0	0	791
SSW	3	5	11	31	38	34	129	421	357	258	87	56	2	0	0	1432
SW	5	5	21	37	77	95	234	327	123	71	31	19	3	0	0	1048
WSW	7	1	39	65	136	133	245	232	42	17	1	0	0	0	0	918
W	9	6	38	69	103	73	133	148	45	11	4	2	1	0	0	642
WNW	4	0	10	28	35	44	150	206	47	15	8	3	0	0	0	550
NW	6	3	15	60	80	101	218	141	48	27	5	3	0	0	0	707
NNW	2	3	31	72	125	103	161	137	53	23	7	4	1	1	0	723
TOTAL	58	32	214	473	744	781	1861	3130	1732	863	304	171	23	4	0	10390

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-70 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class F Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	2	2	10	15	36	24	83	93	12	5	1	0	0	0	0	283
NNE	1	3	6	12	14	19	35	30	9	2	0	0	0	0	0	131
NE	1	2	2	6	8	7	9	11	5	0	0	0	0	0	0	51
ENE	1	1	1	3	5	7	6	9	13	7	2	0	0	0	0	55
E	1	1	3	3	2	6	11	33	21	9	7	9	1	0	0	107
ESE	2	0	2	5	6	7	30	50	28	13	2	3	0	0	0	148
SE	1	0	2	8	2	5	29	61	32	17	7	1	0	0	0	165
SSE	2	1	5	16	15	12	36	90	52	13	7	3	0	0	0	252
S	2	1	8	21	34	32	46	66	43	26	15	5	0	0	0	299
SSW	2	2	27	26	48	46	67	142	88	42	9	9	1	0	0	509
SW	5	6	26	52	62	63	98	30	15	4	1	1	0	0	0	363
WSW	6	6	22	79	100	83	68	6	6	2	2	6	2	0	0	388
W	3	4	54	89	71	46	35	7	9	1	0	1	1	1	0	322
WNW	5	3	17	29	52	32	66	51	4	6	0	0	0	0	0	265
NW	3	3	27	63	64	63	61	16	6	2	0	0	0	0	0	308
NNW	6	8	64	92	99	83	71	16	3	5	1	0	0	0	0	448
TOTAL	43	43	276	519	618	535	751	711	346	154	54	38	5	1	0	4094

Notes:
Data from 10 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-71 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

10-m Level

Class G Pasquill Stability Class

	Wind Speed (Miles/Hour)															
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	0	0	3	13	13	12	28	18	3	1	0	0	0	0	0	91
NNE	1	0	3	3	7	5	4	10	0	0	0	0	0	0	0	33
NE	1	0	4	0	2	3	0	2	0	0	0	0	0	0	0	12
ENE	0	0	0	0	0	2	2	3	1	0	0	0	0	0	0	8
E	0	0	0	1	1	2	7	11	10	7	1	1	1	0	0	42
ESE	0	0	5	2	4	3	19	28	16	8	1	1	0	0	0	87
SE	1	0	0	4	5	10	23	39	23	13	5	1	0	0	0	124
SSE	1	1	5	1	2	5	13	32	26	9	1	1	0	0	0	97
S	0	1	5	9	7	2	9	19	7	4	1	0	0	0	0	64
SSW	1	1	5	5	21	16	23	31	14	8	3	0	0	0	0	128
SW	2	1	19	16	16	18	17	13	4	7	1	0	0	0	0	114
WSW	4	6	38	44	39	35	22	2	1	4	1	0	0	0	0	196
W	3	3	67	95	39	22	8	2	0	0	0	0	0	0	0	239
WNW	1	0	9	28	41	19	40	19	0	0	0	0	0	0	0	157
NW	6	2	39	57	62	36	12	2	0	0	0	0	0	0	0	216
NNW	1	7	67	130	129	79	27	3	1	0	0	0	0	0	0	444
TOTAL	22	22	269	408	388	269	254	234	106	61	14	4	1	0	0	2052

Notes:

Data from 10 meter level

Data from 2003-2007

Calm is defined as a wind speed less than 1mph

Table 2.7-72 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

60-m Level

All Pasquill Stability Classes

	Wind Speed (Miles/Hour)														
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	0	1	2	7	12	25	79	196	203	268	281	317	111	34	5	1541
NNE	0	0	2	8	11	23	77	217	255	247	230	324	122	34	19	1569
NE	0	0	1	14	15	21	80	273	420	462	408	449	155	9	3	2310
ENE	3	0	2	4	17	17	58	205	329	389	392	469	200	72	15	2172
E	3	0	4	6	11	10	56	180	298	288	317	543	369	166	86	2337
ESE	6	3	3	3	13	12	60	281	433	364	312	541	228	76	30	2365
SE	6	3	0	6	9	15	53	298	493	403	310	340	96	34	19	2085
SSE	8	1	2	9	14	17	72	283	482	382	289	302	103	22	10	1996
S	2	0	2	5	16	18	51	279	393	464	355	509	206	83	26	2409
SSW	1	0	1	5	9	20	57	222	386	573	606	1042	576	209	59	3766
SW	2	1	2	5	11	18	50	205	350	529	667	1058	581	267	124	3870
WSW	3	2	5	8	20	22	50	187	326	591	776	1297	550	211	123	4171
W	3	1	2	8	21	21	45	182	380	580	690	956	450	159	92	3590
WNW	2	0	4	5	19	23	88	226	343	445	497	455	144	52	10	2313
NW	1	0	4	5	21	27	48	203	312	526	574	569	266	100	44	2700
NNW	1	1	3	11	20	29	80	187	334	535	671	917	369	181	135	3474
TOTAL	41	13	39	109	239	318	1004	3624	5737	7046	7375	10088	4526	1709	800	42668

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-73 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003-2007

60-m Level

Class A Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	0	0	0	0	0	3	7	33	25	33	24	24	1	7	0	157
NNE	0	0	0	0	1	2	8	27	28	28	22	31	10	7	0	164
NE	0	0	1	2	2	2	11	46	61	61	84	60	18	1	0	349
ENE	1	0	0	1	3	5	16	47	94	79	65	72	26	10	0	419
E	0	0	1	0	0	2	10	67	122	85	102	107	99	25	4	624
ESE	1	0	1	1	2	2	14	131	228	148	91	116	30	7	0	772
SE	2	0	0	0	1	3	16	127	260	154	70	20	3	0	0	656
SSE	2	0	0	2	0	2	16	104	232	156	65	16	5	0	0	600
S	0	0	1	1	2	5	6	90	177	173	64	47	10	0	0	576
SSW	0	0	0	1	0	3	12	68	125	167	135	171	45	7	1	735
SW	0	0	0	0	1	3	9	51	56	80	82	108	30	14	5	439
WSW	1	0	1	1	3	2	3	35	52	71	86	188	71	27	3	544
W	0	0	1	0	2	2	6	45	86	102	92	166	118	38	16	674
WNW	0	0	0	1	2	3	6	36	49	63	62	47	26	4	2	301
NW	0	0	1	0	2	3	9	38	83	102	112	123	73	22	14	582
NNW	0	0	0	1	2	2	11	49	91	121	113	205	118	40	26	779
TOTAL	7	0	7	11	23	44	160	994	1769	1623	1269	1501	683	209	71	8371

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-74 Annual JFD of Wind Sirection, Wind Speed, and Stability Class

Fermi Site

2003 - 2007

60-m Level

Class B Pasquill Stability Class

Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
	Wind Speed (Miles/Hour)															
N	0	0	0	0	0	2	9	17	11	10	10	8	4	3	0	74
NNE	0	0	0	0	1	1	2	15	10	6	12	16	7	0	0	70
NE	0	0	0	0	0	1	5	3	16	18	10	14	5	1	0	73
ENE	0	0	0	0	1	2	4	10	9	13	11	20	10	5	0	85
E	0	0	0	1	0	0	5	11	16	11	13	27	19	7	0	110
ESE	1	0	0	0	0	0	7	18	14	16	16	19	13	4	1	109
SE	0	0	0	0	2	1	4	24	26	16	17	8	2	1	0	101
SSE	0	0	0	1	1	2	6	21	33	16	13	5	1	0	0	99
S	0	0	0	1	2	0	3	16	27	28	8	18	5	0	0	108
SSW	0	0	0	1	0	0	5	25	23	25	36	49	29	7	1	201
SW	0	0	0	0	0	0	5	13	24	22	37	48	37	17	12	215
WSW	0	0	0	1	1	2	1	12	18	30	26	74	34	17	16	232
W	0	0	0	0	3	0	3	7	30	41	33	70	43	9	9	248
WNW	0	0	1	0	1	1	5	20	33	29	18	27	10	4	0	149
NW	0	0	1	0	1	4	4	10	19	35	26	33	31	8	3	175
NNW	0	0	0	0	2	4	8	8	21	28	30	45	23	14	10	193
TOTAL	1	0	2	5	15	20	76	230	330	344	316	481	273	97	52	2242

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-75 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003 - 2007

60-m Level

Class C Pasquill Stability Class

	Wind Speed (Miles/Hour)															
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	0	0	0	0	2	1	6	18	13	14	14	12	10	5	1	96
NNE	0	0	0	1	0	1	5	9	13	17	3	22	8	1	0	80
NE	0	0	0	1	0	0	2	12	12	20	15	24	9	0	0	95
ENE	0	0	0	1	1	0	4	5	9	13	21	40	12	7	2	115
E	0	0	0	0	0	2	2	6	9	9	7	22	15	8	5	85
ESE	0	0	0	0	0	1	2	10	17	8	10	25	11	2	0	86
SE	0	0	0	0	0	0	1	18	16	13	11	11	3	0	0	73
SSE	0	0	0	1	0	1	5	16	18	12	8	10	7	1	0	79
S	0	0	0	0	0	1	4	18	17	13	16	18	5	0	0	92
SSW	0	0	0	0	1	1	4	5	17	32	24	38	25	7	1	155
SW	0	0	0	0	2	2	3	19	14	20	28	42	26	18	25	199
WSW	0	0	1	0	0	0	3	10	23	22	30	67	41	21	25	243
W	0	0	1	1	1	3	2	12	22	26	27	52	34	12	13	206
WNW	0	0	0	0	2	1	7	10	22	27	23	25	9	3	0	129
NW	0	0	0	0	2	2	2	14	14	24	16	22	19	4	9	128
NNW	0	0	0	0	2	3	3	10	17	24	28	38	25	15	18	183
TOTAL	0	0	2	5	13	19	55	192	253	294	281	468	259	104	99	2044

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-76 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003 - 2007

60-m Level

Class D Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	0	1	0	3	4	5	21	54	64	60	76	142	78	16	3	527
NNE	0	0	1	3	3	8	22	77	96	84	78	150	91	25	19	657
NE	0	0	0	3	4	5	12	71	98	200	209	298	110	7	2	1019
ENE	1	0	1	0	1	1	6	43	74	131	191	269	124	47	12	901
E	2	0	3	1	0	4	14	31	48	75	95	220	158	85	45	781
ESE	3	1	1	0	2	1	17	37	77	105	99	187	75	30	6	641
SE	1	1	0	0	2	2	8	43	62	85	84	94	23	3	3	411
SSE	0	0	0	0	3	5	13	46	61	55	55	58	16	2	1	315
S	1	0	0	1	2	3	12	42	48	64	82	126	51	19	1	452
SSW	0	0	0	1	3	6	5	33	53	104	141	254	164	70	19	853
SW	1	0	0	1	2	3	9	22	74	117	180	455	352	162	67	1445
WSW	0	1	1	3	10	8	9	41	110	209	268	576	351	132	78	1797
W	1	1	0	0	8	6	9	38	87	163	190	321	197	88	42	1151
WNW	0	0	0	2	4	2	23	46	95	144	160	191	82	37	7	793
NW	0	0	1	1	5	6	12	41	68	129	151	193	105	41	14	767
NNW	1	0	2	6	4	9	19	39	72	104	162	267	139	81	72	977
TOTAL	11	5	10	25	57	74	211	704	1187	1829	2221	3801	2116	845	391	13487

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-77 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003 - 2007

60-m Level

Class E Pasquill Stability Class

	Wind Speed (Miles/Hour)														
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	0	0	1	1	2	9	20	38	46	96	84	91	16	3	1	408
NNE	0	0	0	1	3	5	18	48	74	80	64	80	4	1	0	378
NE	0	0	0	4	3	3	19	78	145	121	72	41	13	0	1	500
ENE	1	0	1	0	4	4	13	48	71	119	92	59	25	3	1	441
E	0	0	0	2	4	1	9	34	79	89	83	136	66	34	20	557
ESE	1	1	0	0	1	4	9	36	75	73	80	137	58	18	11	504
SE	2	1	0	2	1	2	13	43	91	101	98	125	25	8	2	514
SSE	4	1	1	2	8	5	14	60	84	82	99	112	28	5	1	506
S	1	0	1	0	3	1	11	56	64	115	116	204	74	40	12	698
SSW	0	0	0	1	3	6	11	28	75	155	202	398	221	79	23	1202
SW	1	1	1	0	1	6	13	46	86	165	228	299	107	50	15	1019
WSW	0	0	0	2	4	5	12	41	76	170	258	315	41	11	0	935
W	0	0	0	3	3	3	11	35	95	153	213	233	52	10	4	815
WNW	0	0	1	1	6	7	21	54	79	111	146	109	17	4	1	557
NW	0	0	0	2	5	5	12	42	70	142	160	126	38	23	4	629
NNW	0	1	0	1	5	3	17	44	73	142	150	221	60	28	8	753
TOTAL	10	5	6	22	56	69	223	731	1283	1914	2145	2686	845	317	104	10416

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-78 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003 - 2007

60-m Level

Class F Pasquill Stability Class

								Wind Speed (Miles/Hour)								
Direction	**<1.0**	**1.0-1.12**	**1.121 -1.68**	**1.681 -2.24**	**2.241 -2.80**	**2.801 -3.36**	**3.361 -4.47**	**4.471 -6.71**	**6.711 -8.95**	**8.951 -11.18**	**11.181 -13.42**	**13.421 -17.9**	**17.91 -22.37**	**22.371 -26.84**	**>26.84**	**Total**
N	0	0	0	3	3	2	10	16	26	39	50	30	1	0	0	180
NNE	0	0	0	1	2	2	6	25	21	24	38	18	1	0	0	138
NE	0	0	0	3	1	2	16	41	68	32	14	11	0	0	0	188
ENE	0	0	0	1	1	4	9	36	53	24	9	8	3	0	0	148
E	1	0	0	2	4	0	10	17	17	14	14	22	9	5	9	124
ESE	0	0	0	1	2	4	7	30	19	11	13	45	25	6	8	171
SE	0	1	0	4	2	4	7	27	34	23	15	56	23	10	3	209
SSE	0	0	1	2	0	2	8	24	47	51	39	65	25	11	4	279
S	0	0	0	1	5	6	6	34	40	55	45	65	41	19	10	327
SSW	1	0	0	1	1	1	4	29	56	65	47	102	79	31	14	431
SW	0	0	0	1	1	2	4	28	65	98	79	75	19	1	0	373
WSW	1	1	2	1	2	2	10	23	29	55	77	66	5	1	0	275
W	1	0	0	2	4	4	6	19	30	59	84	89	6	2	8	314
WNW	2	0	2	0	3	4	10	36	42	40	60	44	0	0	0	243
NW	1	0	1	2	3	2	4	36	33	54	75	52	0	2	0	265
NNW	0	0	1	1	3	2	12	20	41	80	132	111	4	3	1	411
TOTAL	7	2	7	26	37	43	129	441	621	724	791	859	241	91	57	4076

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-79 Annual JFD of Wind Direction, Wind Speed, and Stability Class

Fermi Site

2003 - 2007

60-m Level

Class G Pasquill Stability Class

	Wind Speed (Miles/Hour)															
Direction	<1.0	1.0-1.12	1.121 -1.68	1.681 -2.24	2.241 -2.80	2.801 -3.36	3.361 -4.47	4.471 -6.71	6.711 -8.95	8.951 -11.18	11.181 -13.42	13.421 -17.9	17.91 -22.37	22.371 -26.84	>26.84	Total
N	0	0	1	0	1	3	6	20	18	16	23	10	1	0	0	99
NNE	0	0	1	2	1	4	16	16	13	8	13	7	1	0	0	82
NE	0	0	0	1	5	8	15	22	20	10	4	1	0	0	0	86
ENE	0	0	0	1	6	1	6	16	19	10	3	1	0	0	0	63
E	0	0	0	0	3	1	6	14	7	5	3	9	3	2	3	56
ESE	0	1	1	1	6	0	4	19	3	3	3	12	16	9	4	82
SE	1	0	0	0	1	3	4	16	4	11	15	26	17	12	11	121
SSE	2	0	0	1	2	0	10	12	7	10	10	36	21	3	4	118
S	0	0	0	1	2	2	9	23	20	16	24	31	20	5	3	156
SSW	0	0	1	0	1	3	16	34	37	25	21	30	13	8	0	189
SW	0	0	1	3	4	2	7	26	31	27	33	31	10	5	0	180
WSW	1	0	0	0	0	3	12	25	18	34	31	11	7	2	1	145
W	1	0	0	2	0	3	8	26	30	36	51	25	0	0	0	182
WNW	0	0	0	1	1	5	16	24	23	31	28	12	0	0	0	141
NW	0	0	0	0	3	5	5	22	25	40	34	20	0	0	0	154
NNW	0	0	0	2	2	6	10	17	19	36	56	30	0	0	0	178
TOTAL	5	1	5	15	38	49	150	332	294	318	352	292	109	46	26	2032

Notes:
Data from 60 meter level
Data from 2003-2007
Calm is defined as a wind speed less than 1mph

Table 2.7-80 Distances to Site Boundary

Sector	Distance to Site Boundary (meters)
N	909
NNE	1381
NE	1904
ENE	N/A
E	N/A
ESE	N/A
SE	N/A
SSE	981
S	981
SSW	1006
SW	1297
WSW	1131
W	793
WNW	769
NW	769
NNW	769

Note: There are no site boundary distances listed for the ENE, E, ESE, and SE sectors since they are directly towards Lake Erie.

Table 2.7-81 Distances to Nearest Residence

Sector	Distance to Nearest Residence (meters)
NNE	1959
NE	2032
SSE	1328
SSW	1292
SW	1456
WSW	1671
W	1421
NW	957
NNW	1770

Note: Sectors are included with noted residences from Fermi site annual land use survey.

Table 2.7-82 Distances to Nearest Vegetable Garden

Sector	Distance to Nearest Vegetable Garden (meters)
N	3566
NNE	3327
NE	3452
S	1917
WSW	3295
W	2272
NW	960
NNW	1607

Note: Sectors are included with noted vegetable gardens from Fermi site annual land use survey.

Table 2.7-83 Distances to Nearest Sheep

Sector	Distance to Nearest Sheep (meters)
NNE	7088
NNW	7023

Note: Sectors are included with noted sheep from Fermi site annual land use survey.

Table 2.7-84 Distances to Nearest Goat

Sector	Distance to Nearest Goat (meters)
WNW	3554
NNW	4811

Note: Sectors are included with noted goats from Fermi site annual land use survey.

Table 2.7-85 Distances to Nearest Meat Cow

Sector	Distance to Nearest Meat Cow (meters)
NNE	7089
NNW	4754

Note: Sectors are included with noted meat cows from Fermi site annual land use survey.

Table 2.7-86 Distances to Nearest Milk Cow

Sector	Distance to Nearest Milk Cow (meters)
WNW	3363
NW	5719

Note: Sectors are included with noted milk cows from Fermi site annual land use survey.

Table 2.7-87 Site Boundary X/Q and D/Q Factors for Ground-Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
N	9.6E-06	9.5E-06	8.7E-06	3.5E-08
NNE	6.8E-06	6.8E-06	6.0E-06	2.9E-08
NE	3.5E-06	3.4E-06	3.0E-06	1.3E-08
SSE	1.1E-05	1.1E-05	1.0E-05	3.3E-08
S	8.2E-06	8.2E-06	7.4E-06	2.6E-08
SSW	5.8E-06	5.8E-06	5.2E-06	2.1E-08
SW	2.7E-06	2.7E-06	2.4E-06	1.5E-08
WSW	2.6E-06	2.6E-06	2.3E-06	1.9E-08
W	5.5E-06	5.5E-06	5.1E-06	3.7E-08
WNW	8.1E-06	8.1E-06	7.4E-06	4.6E-08
NW	7.9E-06	7.9E-06	7.2E-06	4.4E-08
NNW	9.2E-06	9.2E-06	8.4E-06	3.9E-08

Note: There are no values listed for the ENE, E, ESE and SE sectors because these sectors are directly towards Lake Erie.

Table 2.7-88 Site Boundary Χ/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted Χ/Q (sec/m^3)	2.26 Day Decay, Undepleted Χ/Q (sec/m^3)	8.0 Day Decay, Depleted Χ/Q (sec/m^3)	D/Q (m^{-2})
N	5.3E-07	5.3E-07	4.9E-07	1.0E-08
NNE	6.0E-07	6.0E-07	5.5E-07	1.1E-08
NE	3.3E-07	3.3E-07	3.1E-07	5.8E-09
SSE	3.8E-07	3.8E-07	3.5E-07	9.2E-09
S	3.8E-07	3.8E-07	3.5E-07	7.4E-09
SSW	2.8E-07	2.8E-07	2.6E-07	5.8E-09
SW	2.9E-07	2.9E-07	2.7E-07	6.0E-09
WSW	3.2E-07	3.2E-07	2.9E-07	8.1E-09
W	5.7E-07	5.7E-07	5.3E-07	1.5E-08
WNW	6.6E-07	6.6E-07	6.2E-07	1.7E-08
NW	6.4E-07	6.4E-07	6.1E-07	1.6E-08
NNW	6.0E-07	6.0E-07	5.6E-07	1.3E-08

Note: There are no values listed for the ENE, E, ESE and SE sectors because these sectors are directly towards Lake Erie.

Table 2.7-89 Site Boundary χ/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted χ/Q (sec/m^3)	2.26 Day Decay, Undepleted χ/Q (sec/m^3)	8.0 Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
N	6.1E-07	6.1E-07	5.6E-07	9.6E-09
NNE	6.3E-07	6.3E-07	5.7E-07	1.0E-08
NE	2.9E-07	2.9E-07	2.7E-07	4.8E-09
SSE	4.3E-07	4.3E-07	3.9E-07	8.1E-09
S	4.2E-07	4.2E-07	3.9E-07	6.3E-09
SSW	3.0E-07	3.0E-07	2.8E-07	5.1E-09
SW	2.6E-07	2.6E-07	2.3E-07	5.0E-09
WSW	3.0E-07	3.0E-07	2.7E-07	7.0E-09
W	6.2E-07	6.2E-07	5.7E-07	1.4E-08
WNW	7.2E-07	7.2E-07	6.7E-07	1.5E-08
NW	7.1E-07	7.1E-07	6.6E-07	1.5E-08
NNW	6.8E-07	6.8E-07	6.3E-07	1.2E-08

Note: There are no values listed for the ENE, E, ESE and SE sectors because these sectors are directly towards Lake Erie.

Table 2.7-90 Nearest Goat X/Q and D/Q Factors for Ground-Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	2.7E-07	2.7E-07	2.2E-07	1.5E-09
NNW	1.7E-07	1.7E-07	1.3E-07	6.2E-10

Table 2.7-91 Nearest Goat X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	6.6E-08	6.5E-08	6.0E-08	8.4E-10
NNW	3.5E-08	3.5E-08	3.2E-08	3.0E-10

Table 2.7-92 Nearest Goat X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	Distance (miles)	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	2.21	5.7E-08	5.7E-08	5.1E-08	7.9E-10
NNW	2.99	3.0E-08	3.0E-08	2.7E-08	3.0E-10

Table 2.7-93 Nearest Milk Cow X/Q and D/Q Factors for Ground-Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	3.1E-07	3.1E-07	2.5E-07	1.7E-09
NW	1.0E-07	1.0E-07	7.9E-08	4.7E-10

Table 2.7-94 Nearest Milk Cow X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	7.2E-08	7.2E-08	6.6E-08	9.5E-10
NW	2.8E-08	2.7E-08	2.5E-08	2.8E-10

Table 2.7-95 Nearest Milk Cow X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	6.2E-08	6.2E-08	5.6E-08	8.9E-10
NW	2.4E-08	2.4E-08	2.1E-08	2.7E-10

Table 2.7-96 Annual Average X/Q Values (No Decay, Undepleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)											
Distance in Miles from the Site											
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	4.096E-05	1.188E-05	5.798E-06	2.761E-06	1.040E-06	5.456E-07	3.395E-07	2.341E-07	1.728E-07	1.339E-07	1.076E-07
NNE	6.801E-05	1.974E-05	9.639E-06	4.591E-06	1.728E-06	9.064E-07	5.639E-07	3.888E-07	2.870E-07	2.224E-07	1.786E-07
NE	1.148E-04	3.343E-05	1.621E-05	7.747E-06	2.938E-06	1.555E-06	9.749E-07	6.768E-07	5.027E-07	3.917E-07	3.162E-07
ENE	1.347E-04	3.915E-05	1.893E-05	9.055E-06	3.442E-06	1.825E-06	1.147E-06	7.972E-07	5.930E-07	4.627E-07	3.740E-07
E	1.255E-04	3.635E-05	1.753E-05	8.383E-06	3.190E-06	1.693E-06	1.065E-06	7.409E-07	5.516E-07	4.307E-07	3.484E-07
ESE	1.615E-04	4.668E-05	2.245E-05	1.075E-05	4.100E-06	2.182E-06	1.375E-06	9.584E-07	7.146E-07	5.587E-07	4.525E-07
SE	1.071E-04	3.100E-05	1.495E-05	7.149E-06	2.719E-06	1.443E-06	9.071E-07	6.313E-07	4.699E-07	3.669E-07	2.967E-07
SSE	7.788E-05	2.259E-05	1.092E-05	5.220E-06	1.982E-06	1.051E-06	6.596E-07	4.585E-07	3.410E-07	2.660E-07	2.149E-07
S	5.836E-05	1.696E-05	8.205E-06	3.923E-06	1.491E-06	7.900E-07	4.960E-07	3.448E-07	2.564E-07	2.000E-07	1.616E-07
SSW	4.414E-05	1.288E-05	6.263E-06	2.992E-06	1.133E-06	5.985E-07	3.747E-07	2.598E-07	1.928E-07	1.501E-07	1.210E-07
SW	2.330E-05	6.709E-06	3.284E-06	1.561E-06	5.814E-07	3.017E-07	1.858E-07	1.270E-07	9.297E-08	7.150E-08	5.705E-08
WSW	1.680E-05	4.797E-06	2.340E-06	1.110E-06	4.131E-07	2.143E-07	1.319E-07	9.013E-08	6.598E-08	5.075E-08	4.049E-08
W	1.891E-05	5.406E-06	2.634E-06	1.251E-06	4.682E-07	2.441E-07	1.510E-07	1.036E-07	7.614E-08	5.876E-08	4.703E-08
WNW	2.642E-05	7.499E-06	3.633E-06	1.725E-06	6.486E-07	3.398E-07	2.111E-07	1.454E-07	1.072E-07	8.298E-08	6.661E-08
NW	2.587E-05	7.292E-06	3.515E-06	1.668E-06	6.280E-07	3.296E-07	2.051E-07	1.415E-07	1.045E-07	8.100E-08	6.510E-08
NNW	2.956E-05	8.461E-06	4.103E-06	1.952E-06	7.363E-07	3.872E-07	2.414E-07	1.667E-07	1.233E-07	9.567E-08	7.696E-08

Table 2.7-96 Annual Average X/Q Values (No Decay, Undepleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5.0**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	8.888E-08	4.550E-08	2.948E-08	1.695E-08	1.151E-08	8.550E-09	6.715E-09	5.480E-09	4.599E-09	3.943E-09	3.437E-09
NNE	1.476E-07	7.553E-08	4.894E-08	2.813E-08	1.911E-08	1.419E-08	1.115E-08	9.099E-09	7.636E-09	6.546E-09	5.706E-09
NE	2.625E-07	1.369E-07	8.997E-08	5.276E-08	3.634E-08	2.729E-08	2.162E-08	1.778E-08	1.502E-08	1.295E-08	1.135E-08
ENE	3.107E-07	1.628E-07	1.073E-07	6.319E-08	4.365E-08	3.285E-08	2.609E-08	2.149E-08	1.818E-08	1.569E-08	1.376E-08
E	2.897E-07	1.522E-07	1.005E-07	5.943E-08	4.116E-08	3.104E-08	2.469E-08	2.037E-08	1.725E-08	1.491E-08	1.309E-08
ESE	3.766E-07	1.988E-07	1.317E-07	7.817E-08	5.430E-08	4.104E-08	3.271E-08	2.702E-08	2.292E-08	1.983E-08	1.743E-08
SE	2.467E-07	1.297E-07	8.565E-08	5.062E-08	3.506E-08	2.644E-08	2.103E-08	1.734E-08	1.469E-08	1.270E-08	1.115E-08
SSE	1.786E-07	9.355E-08	6.166E-08	3.633E-08	2.511E-08	1.890E-08	1.501E-08	1.237E-08	1.047E-08	9.038E-09	7.930E-09
S	1.342E-07	7.026E-08	4.628E-08	2.724E-08	1.881E-08	1.415E-08	1.124E-08	9.253E-09	7.827E-09	6.756E-09	5.926E-09
SSW	1.004E-07	5.218E-08	3.420E-08	1.998E-08	1.372E-08	1.028E-08	8.132E-09	6.677E-09	5.633E-09	4.851E-09	4.245E-09
SW	4.684E-08	2.340E-08	1.488E-08	8.335E-09	5.559E-09	4.071E-09	3.160E-09	2.554E-09	2.126E-09	1.809E-09	1.567E-09
WSW	3.325E-08	1.663E-08	1.059E-08	5.943E-09	3.971E-09	2.912E-09	2.264E-09	1.832E-09	1.527E-09	1.300E-09	1.127E-09
W	3.872E-08	1.957E-08	1.257E-08	7.132E-09	4.803E-09	3.544E-09	2.769E-09	2.251E-09	1.882E-09	1.608E-09	1.398E-09
WNW	5.499E-08	2.810E-08	1.819E-08	1.045E-08	7.101E-09	5.277E-09	4.148E-09	3.387E-09	2.845E-09	2.441E-09	2.129E-09
NW	5.383E-08	2.768E-08	1.800E-08	1.041E-08	7.111E-09	5.305E-09	4.183E-09	3.426E-09	2.884E-09	2.480E-09	2.167E-09
NNW	6.366E-08	3.278E-08	2.134E-08	1.235E-08	8.427E-09	6.283E-09	4.952E-09	4.053E-09	3.410E-09	2.930E-09	2.559E-09

Table 2.7-96 Annual Average X/Q Values (No Decay, Undepleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment

	Segment Boundaries in Miles from the Site									
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	5.799E-06	1.203E-06	3.523E-07	1.755E-07	1.085E-07	4.802E-08	1.732E-08	8.606E-09	5.497E-09	3.950E-09
NNE	9.640E-06	1.999E-06	5.852E-07	2.914E-07	1.801E-07	7.972E-08	2.875E-08	1.429E-08	9.127E-09	6.558E-09
NE	1.628E-05	3.392E-06	1.010E-06	5.101E-07	3.187E-07	1.440E-07	5.373E-08	2.744E-08	1.783E-08	1.297E-08
ENE	1.903E-05	3.971E-06	1.188E-06	6.017E-07	3.768E-07	1.710E-07	6.431E-08	3.303E-08	2.154E-08	1.571E-08
E	1.765E-05	3.679E-06	1.103E-06	5.596E-07	3.510E-07	1.598E-07	6.045E-08	3.120E-08	2.042E-08	1.493E-08
ESE	2.263E-05	4.725E-06	1.423E-06	7.249E-07	4.559E-07	2.085E-07	7.945E-08	4.124E-08	2.708E-08	1.986E-08
SE	1.505E-05	3.136E-06	9.397E-07	4.768E-07	2.990E-07	1.361E-07	5.149E-08	2.657E-08	1.739E-08	1.271E-08
SSE	1.098E-05	2.288E-06	6.834E-07	3.460E-07	2.166E-07	9.827E-08	3.697E-08	1.900E-08	1.240E-08	9.051E-09
S	8.247E-06	1.720E-06	5.139E-07	2.602E-07	1.628E-07	7.382E-08	2.772E-08	1.423E-08	9.276E-09	6.766E-09
SSW	6.280E-06	1.308E-06	3.884E-07	1.957E-07	1.220E-07	5.490E-08	2.036E-08	1.034E-08	6.695E-09	4.858E-09
SW	3.279E-06	6.747E-07	1.932E-07	9.451E-08	5.755E-08	2.482E-08	8.557E-09	4.103E-09	2.564E-09	1.813E-09
WSW	2.339E-06	4.796E-07	1.372E-07	6.708E-08	4.085E-08	1.764E-08	6.099E-09	2.936E-09	1.839E-09	1.303E-09
W	2.635E-06	5.426E-07	1.569E-07	7.737E-08	4.743E-08	2.071E-08	7.305E-09	3.570E-09	2.258E-09	1.612E-09
WNW	3.644E-06	7.507E-07	2.191E-07	1.089E-07	6.716E-08	2.967E-08	1.068E-08	5.312E-09	3.398E-09	2.445E-09
NW	3.533E-06	7.265E-07	2.128E-07	1.061E-07	6.564E-08	2.919E-08	1.063E-08	5.338E-09	3.436E-09	2.484E-09
NNW	4.115E-06	8.513E-07	2.504E-07	1.252E-07	7.758E-08	3.456E-08	1.260E-08	6.322E-09	4.065E-09	2.934E-09

Table 2.7-97 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	4.091E-05	1.185E-05	5.777E-06	2.748E-06	1.032E-06	5.403E-07	3.354E-07	2.307E-07	1.699E-07	1.313E-07	1.052E-07
NNE	6.794E-05	1.970E-05	9.608E-06	4.571E-06	1.716E-06	8.985E-07	5.578E-07	3.837E-07	2.826E-07	2.185E-07	1.751E-07
NE	1.147E-04	3.334E-05	1.615E-05	7.708E-06	2.916E-06	1.539E-06	9.624E-07	6.664E-07	4.937E-07	3.836E-07	3.089E-07
ENE	1.345E-04	3.902E-05	1.885E-05	8.999E-06	3.410E-06	1.803E-06	1.129E-06	7.824E-07	5.801E-07	4.512E-07	3.635E-07
E	1.253E-04	3.622E-05	1.744E-05	8.325E-06	3.156E-06	1.669E-06	1.046E-06	7.254E-07	5.381E-07	4.186E-07	3.374E-07
ESE	1.612E-04	4.652E-05	2.233E-05	1.067E-05	4.057E-06	2.151E-06	1.350E-06	9.382E-07	6.971E-07	5.431E-07	4.383E-07
SE	1.069E-04	3.090E-05	1.488E-05	7.103E-06	2.693E-06	1.424E-06	8.926E-07	6.191E-07	4.594E-07	3.575E-07	2.882E-07
SSE	7.777E-05	2.253E-05	1.088E-05	5.192E-06	1.966E-06	1.039E-06	6.507E-07	4.511E-07	3.345E-07	2.602E-07	2.097E-07
S	5.828E-05	1.692E-05	8.175E-06	3.904E-06	1.480E-06	7.824E-07	4.900E-07	3.398E-07	2.520E-07	1.961E-07	1.581E-07
SSW	4.409E-05	1.285E-05	6.240E-06	2.977E-06	1.124E-06	5.926E-07	3.701E-07	2.559E-07	1.894E-07	1.471E-07	1.183E-07
SW	2.328E-05	6.696E-06	3.275E-06	1.555E-06	5.781E-07	2.994E-07	1.841E-07	1.255E-07	9.172E-08	7.040E-08	5.606E-08
WSW	1.679E-05	4.789E-06	2.335E-06	1.107E-06	4.113E-07	2.130E-07	1.310E-07	8.932E-08	6.529E-08	5.014E-08	3.994E-08
W	1.890E-05	5.398E-06	2.628E-06	1.247E-06	4.661E-07	2.427E-07	1.499E-07	1.027E-07	7.533E-08	5.805E-08	4.639E-08
WNW	2.639E-05	7.486E-06	3.623E-06	1.720E-06	6.453E-07	3.375E-07	2.093E-07	1.439E-07	1.059E-07	8.184E-08	6.558E-08
NW	2.585E-05	7.280E-06	3.507E-06	1.663E-06	6.250E-07	3.275E-07	2.035E-07	1.402E-07	1.034E-07	8.001E-08	6.420E-08
NNW	2.953E-05	8.443E-06	4.090E-06	1.944E-06	7.316E-07	3.840E-07	2.389E-07	1.646E-07	1.215E-07	9.408E-08	7.552E-08

Table 2.7-97 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 2 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**5.0**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	8.674E-08	4.387E-08	2.808E-08	1.576E-08	1.046E-08	7.590E-09	5.828E-09	4.652E-09	3.820E-09	3.205E-09	2.735E-09
NNE	1.443E-07	7.308E-08	4.683E-08	2.635E-08	1.752E-08	1.274E-08	9.806E-09	7.843E-09	6.453E-09	5.425E-09	4.639E-09
NE	2.557E-07	1.317E-07	8.540E-08	4.881E-08	3.278E-08	2.400E-08	1.856E-08	1.490E-08	1.229E-08	1.035E-08	8.860E-09
ENE	3.011E-07	1.553E-07	1.008E-07	5.754E-08	3.856E-08	2.816E-08	2.171E-08	1.737E-08	1.428E-08	1.199E-08	1.023E-08
E	2.796E-07	1.443E-07	9.366E-08	5.346E-08	3.578E-08	2.608E-08	2.006E-08	1.601E-08	1.313E-08	1.099E-08	9.348E-09
ESE	3.635E-07	1.885E-07	1.227E-07	7.034E-08	4.722E-08	3.451E-08	2.661E-08	2.128E-08	1.748E-08	1.465E-08	1.248E-08
SE	2.388E-07	1.235E-07	8.028E-08	4.596E-08	3.085E-08	2.256E-08	1.741E-08	1.394E-08	1.146E-08	9.624E-09	8.211E-09
SSE	1.738E-07	8.981E-08	5.839E-08	3.349E-08	2.254E-08	1.654E-08	1.280E-08	1.029E-08	8.491E-09	7.154E-09	6.126E-09
S	1.310E-07	6.773E-08	4.407E-08	2.533E-08	1.709E-08	1.256E-08	9.751E-09	7.854E-09	6.499E-09	5.490E-09	4.714E-09
SSW	9.788E-08	5.025E-08	3.252E-08	1.854E-08	1.243E-08	9.091E-09	7.026E-09	5.638E-09	4.650E-09	3.916E-09	3.353E-09
SW	4.594E-08	2.272E-08	1.431E-08	7.857E-09	5.138E-09	3.690E-09	2.810E-09	2.229E-09	1.820E-09	1.521E-09	1.293E-09
WSW	3.275E-08	1.625E-08	1.027E-08	5.678E-09	3.737E-09	2.700E-09	2.068E-09	1.649E-09	1.354E-09	1.137E-09	9.713E-10
W	3.814E-08	1.913E-08	1.219E-08	6.815E-09	4.521E-09	3.288E-09	2.532E-09	2.028E-09	1.672E-09	1.409E-09	1.208E-09
WNW	5.404E-08	2.738E-08	1.757E-08	9.924E-09	6.630E-09	4.846E-09	3.747E-09	3.011E-09	2.489E-09	2.101E-09	1.805E-09
NW	5.300E-08	2.705E-08	1.746E-08	9.947E-09	6.691E-09	4.918E-09	3.822E-09	3.085E-09	2.560E-09	2.169E-09	1.869E-09
NNW	6.234E-08	3.177E-08	2.046E-08	1.160E-08	7.763E-09	5.676E-09	4.388E-09	3.524E-09	2.910E-09	2.455E-09	2.106E-09

Table 2.7-97 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	5.780E-06	1.195E-06	3.481E-07	1.726E-07	1.061E-07	4.638E-08	1.614E-08	7.650E-09	4.671E-09	3.213E-09
NNE	9.611E-06	1.987E-06	5.790E-07	2.871E-07	1.766E-07	7.725E-08	2.698E-08	1.284E-08	7.875E-09	5.439E-09
NE	1.622E-05	3.369E-06	9.977E-07	5.011E-07	3.114E-07	1.387E-07	4.982E-08	2.416E-08	1.495E-08	1.037E-08
ENE	1.895E-05	3.938E-06	1.170E-06	5.888E-07	3.664E-07	1.635E-07	5.871E-08	2.835E-08	1.744E-08	1.201E-08
E	1.756E-05	3.644E-06	1.084E-06	5.461E-07	3.401E-07	1.519E-07	5.453E-08	2.626E-08	1.607E-08	1.102E-08
ESE	2.252E-05	4.680E-06	1.399E-06	7.073E-07	4.416E-07	1.981E-07	7.170E-08	3.474E-08	2.135E-08	1.469E-08
SE	1.498E-05	3.109E-06	9.250E-07	4.662E-07	2.904E-07	1.299E-07	4.687E-08	2.271E-08	1.399E-08	9.646E-09
SSE	1.094E-05	2.271E-06	6.745E-07	3.395E-07	2.114E-07	9.450E-08	3.416E-08	1.665E-08	1.032E-08	7.169E-09
S	8.219E-06	1.709E-06	5.079E-07	2.558E-07	1.593E-07	7.128E-08	2.583E-08	1.264E-08	7.880E-09	5.502E-09
SSW	6.258E-06	1.300E-06	3.838E-07	1.923E-07	1.193E-07	5.295E-08	1.893E-08	9.154E-09	5.658E-09	3.925E-09
SW	3.270E-06	6.713E-07	1.914E-07	9.325E-08	5.656E-08	2.414E-08	8.082E-09	3.724E-09	2.239E-09	1.525E-09
WSW	2.335E-06	4.777E-07	1.362E-07	6.639E-08	4.030E-08	1.726E-08	5.836E-09	2.724E-09	1.656E-09	1.140E-09
W	2.630E-06	5.404E-07	1.557E-07	7.656E-08	4.678E-08	2.027E-08	6.990E-09	3.314E-09	2.036E-09	1.412E-09
WNW	3.636E-06	7.472E-07	2.173E-07	1.076E-07	6.612E-08	2.894E-08	1.016E-08	4.882E-09	3.022E-09	2.106E-09
NW	3.526E-06	7.235E-07	2.113E-07	1.050E-07	6.474E-08	2.855E-08	1.017E-08	4.952E-09	3.095E-09	2.174E-09
NNW	4.103E-06	8.465E-07	2.479E-07	1.234E-07	7.614E-08	3.354E-08	1.186E-08	5.717E-09	3.537E-09	2.461E-09

Table 2.7-98 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 1 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	3.875E-05	1.084E-05	5.162E-06	2.414E-06	8.810E-07	4.505E-07	2.740E-07	1.852E-07	1.342E-07	1.022E-07	8.084E-08
NNE	6.435E-05	1.802E-05	8.582E-06	4.014E-06	1.464E-06	7.487E-07	4.554E-07	3.077E-07	2.230E-07	1.698E-07	1.343E-07
NE	1.086E-04	3.050E-05	1.443E-05	6.772E-06	2.490E-06	1.284E-06	7.868E-07	5.352E-07	3.902E-07	2.989E-07	2.375E-07
ENE	1.275E-04	3.572E-05	1.685E-05	7.912E-06	2.916E-06	1.506E-06	9.246E-07	6.299E-07	4.599E-07	3.526E-07	2.805E-07
E	1.187E-04	3.316E-05	1.560E-05	7.324E-06	2.701E-06	1.396E-06	8.580E-07	5.850E-07	4.274E-07	3.280E-07	2.610E-07
ESE	1.528E-04	4.259E-05	1.998E-05	9.390E-06	3.472E-06	1.799E-06	1.108E-06	7.567E-07	5.537E-07	4.255E-07	3.390E-07
SE	1.013E-04	2.829E-05	1.330E-05	6.246E-06	2.303E-06	1.190E-06	7.314E-07	4.987E-07	3.643E-07	2.796E-07	2.225E-07
SSE	7.367E-05	2.062E-05	9.720E-06	4.562E-06	1.680E-06	8.673E-07	5.323E-07	3.625E-07	2.646E-07	2.029E-07	1.614E-07
S	5.521E-05	1.547E-05	7.304E-06	3.429E-06	1.263E-06	6.524E-07	4.004E-07	2.727E-07	1.991E-07	1.527E-07	1.214E-07
SSW	4.176E-05	1.175E-05	5.575E-06	2.615E-06	9.601E-07	4.942E-07	3.025E-07	2.055E-07	1.497E-07	1.145E-07	9.092E-08
SW	2.205E-05	6.123E-06	2.924E-06	1.365E-06	4.930E-07	2.493E-07	1.501E-07	1.005E-07	7.226E-08	5.465E-08	4.292E-08
WSW	1.590E-05	4.378E-06	2.084E-06	9.708E-07	3.504E-07	1.772E-07	1.067E-07	7.141E-08	5.133E-08	3.882E-08	3.050E-08
W	1.789E-05	4.935E-06	2.346E-06	1.094E-06	3.971E-07	2.018E-07	1.221E-07	8.208E-08	5.923E-08	4.495E-08	3.542E-08
WNW	2.500E-05	6.845E-06	3.235E-06	1.509E-06	5.500E-07	2.808E-07	1.706E-07	1.151E-07	8.336E-08	6.345E-08	5.014E-08
NW	2.448E-05	6.656E-06	3.130E-06	1.459E-06	5.326E-07	2.724E-07	1.658E-07	1.121E-07	8.128E-08	6.196E-08	4.903E-08
NNW	2.797E-05	7.722E-06	3.653E-06	1.707E-06	6.242E-07	3.199E-07	1.949E-07	1.320E-07	9.580E-08	7.309E-08	5.788E-08

Table 2.7-98 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	5.0	7.5	10	15	20	25	30	35	40	45	50
N	6.579E-08	3.174E-08	1.953E-08	1.032E-08	6.537E-09	4.568E-09	3.396E-09	2.635E-09	2.109E-09	1.729E-09	1.445E-09
NNE	1.093E-07	5.275E-08	3.246E-08	1.716E-08	1.088E-08	7.608E-09	5.660E-09	4.395E-09	3.521E-09	2.888E-09	2.415E-09
NE	1.942E-07	9.546E-08	5.955E-08	3.208E-08	2.059E-08	1.454E-08	1.090E-08	8.516E-09	6.857E-09	5.651E-09	4.742E-09
ENE	2.296E-07	1.132E-07	7.079E-08	3.824E-08	2.459E-08	1.738E-08	1.303E-08	1.018E-08	8.201E-09	6.757E-09	5.669E-09
E	2.137E-07	1.057E-07	6.619E-08	3.584E-08	2.308E-08	1.633E-08	1.225E-08	9.578E-09	7.715E-09	6.357E-09	5.333E-09
ESE	2.779E-07	1.380E-07	8.669E-08	4.715E-08	3.045E-08	2.159E-08	1.623E-08	1.271E-08	1.025E-08	8.459E-09	7.104E-09
SE	1.822E-07	9.014E-08	5.648E-08	3.061E-08	1.973E-08	1.396E-08	1.049E-08	8.206E-09	6.615E-09	5.455E-09	4.580E-09
SSE	1.321E-07	6.519E-08	4.078E-08	2.207E-08	1.421E-08	1.006E-08	7.555E-09	5.913E-09	4.768E-09	3.935E-09	3.306E-09
S	9.937E-08	4.902E-08	3.066E-08	1.658E-08	1.068E-08	7.562E-09	5.682E-09	4.449E-09	3.590E-09	2.963E-09	2.491E-09
SSW	7.428E-08	3.639E-08	2.264E-08	1.216E-08	7.785E-09	5.486E-09	4.106E-09	3.204E-09	2.578E-09	2.123E-09	1.780E-09
SW	3.472E-08	1.635E-08	9.887E-09	5.095E-09	3.173E-09	2.189E-09	1.610E-09	1.239E-09	9.843E-10	8.019E-10	6.662E-10
WSW	2.468E-08	1.165E-08	7.053E-09	3.647E-09	2.279E-09	1.577E-09	1.163E-09	8.971E-10	7.147E-10	5.837E-10	4.861E-10
W	2.874E-08	1.371E-08	8.369E-09	4.378E-09	2.757E-09	1.919E-09	1.423E-09	1.102E-09	8.816E-10	7.224E-10	6.034E-10
WNW	4.079E-08	1.966E-08	1.210E-08	6.403E-09	4.065E-09	2.848E-09	2.123E-09	1.652E-09	1.326E-09	1.090E-09	9.134E-10
NW	3.995E-08	1.938E-08	1.199E-08	6.391E-09	4.081E-09	2.872E-09	2.150E-09	1.678E-09	1.351E-09	1.114E-09	9.355E-10
NNW	4.717E-08	2.290E-08	1.416E-08	7.541E-09	4.805E-09	3.375E-09	2.520E-09	1.963E-09	1.577E-09	1.297E-09	1.087E-09

Table 2.7-98 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Ground Level Release (Based on 2001-2007 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment

	Segment Boundaries in Miles from the Site									
Sector	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	5.202E-06	1.030E-06	2.855E-07	1.366E-07	8.161E-08	3.388E-08	1.069E-08	4.624E-09	2.652E-09	1.736E-09
NNE	8.648E-06	1.713E-06	4.745E-07	2.269E-07	1.356E-07	5.630E-08	1.777E-08	7.702E-09	4.423E-09	2.900E-09
NE	1.460E-05	2.905E-06	8.187E-07	3.969E-07	2.397E-07	1.014E-07	3.308E-08	1.470E-08	8.565E-09	5.672E-09
ENE	1.707E-05	3.400E-06	9.618E-07	4.676E-07	2.830E-07	1.202E-07	3.941E-08	1.756E-08	1.024E-08	6.782E-09
E	1.582E-05	3.148E-06	8.924E-07	4.345E-07	2.633E-07	1.121E-07	3.691E-08	1.650E-08	9.632E-09	6.380E-09
ESE	2.030E-05	4.044E-06	1.152E-06	5.628E-07	3.420E-07	1.463E-07	4.851E-08	2.181E-08	1.278E-08	8.489E-09
SE	1.350E-05	2.685E-06	7.607E-07	3.704E-07	2.245E-07	9.564E-08	3.152E-08	1.411E-08	8.252E-09	5.475E-09
SSE	9.849E-06	1.959E-06	5.537E-07	2.691E-07	1.628E-07	6.920E-08	2.273E-08	1.016E-08	5.946E-09	3.949E-09
S	7.398E-06	1.473E-06	4.165E-07	2.025E-07	1.225E-07	5.205E-08	1.709E-08	7.642E-09	4.474E-09	2.974E-09
SSW	5.633E-06	1.121E-06	3.148E-07	1.522E-07	9.175E-08	3.870E-08	1.254E-08	5.547E-09	3.223E-09	2.131E-09
SW	2.942E-06	5.784E-07	1.567E-07	7.363E-08	4.336E-08	1.756E-08	5.306E-09	2.220E-09	1.248E-09	8.057E-10
WSW	2.099E-06	4.113E-07	1.114E-07	5.230E-08	3.081E-08	1.250E-08	3.796E-09	1.599E-09	9.037E-10	5.864E-10
W	2.365E-06	4.652E-07	1.273E-07	6.032E-08	3.577E-08	1.468E-08	4.544E-09	1.944E-09	1.110E-09	7.255E-10
WNW	3.270E-06	6.435E-07	1.778E-07	8.485E-08	5.062E-08	2.100E-08	6.630E-09	2.883E-09	1.663E-09	1.095E-09
NW	3.171E-06	6.228E-07	1.727E-07	8.272E-08	4.950E-08	2.067E-08	6.608E-09	2.906E-09	1.688E-09	1.118E-09
NNW	3.692E-06	7.295E-07	2.031E-07	9.748E-08	5.842E-08	2.441E-08	7.797E-09	3.414E-09	1.975E-09	1.302E-09

Table 2.7-99 Annual Average D/Q Values for Ground Level Release (Based on 2001-2007 met data) (Sheet 1 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	1.265E-07	4.279E-08	2.197E-08	1.045E-08	3.752E-09	1.861E-09	1.096E-09	7.174E-10	5.048E-10	3.741E-10	2.883E-10
NNE	2.385E-07	8.064E-08	4.141E-08	1.969E-08	7.071E-09	3.507E-09	2.065E-09	1.352E-09	9.513E-10	7.050E-10	5.433E-10
NE	2.472E-07	8.360E-08	4.292E-08	2.041E-08	7.330E-09	3.635E-09	2.140E-09	1.402E-09	9.862E-10	7.308E-10	5.632E-10
ENE	2.009E-07	6.795E-08	3.489E-08	1.659E-08	5.958E-09	2.954E-09	1.740E-09	1.139E-09	8.015E-10	5.940E-10	4.578E-10
E	1.646E-07	5.566E-08	2.858E-08	1.359E-08	4.880E-09	2.420E-09	1.425E-09	9.331E-10	6.566E-10	4.866E-10	3.750E-10
ESE	1.879E-07	6.354E-08	3.262E-08	1.551E-08	5.571E-09	2.763E-09	1.627E-09	1.065E-09	7.495E-10	5.555E-10	4.281E-10
SE	1.508E-07	5.099E-08	2.618E-08	1.245E-08	4.471E-09	2.217E-09	1.306E-09	8.549E-10	6.016E-10	4.458E-10	3.435E-10
SSE	1.345E-07	4.549E-08	2.335E-08	1.110E-08	3.988E-09	1.978E-09	1.165E-09	7.626E-10	5.366E-10	3.977E-10	3.064E-10
S	1.077E-07	3.641E-08	1.870E-08	8.888E-09	3.193E-09	1.583E-09	9.323E-10	6.105E-10	4.296E-10	3.183E-10	2.453E-10
SSW	8.994E-08	3.042E-08	1.562E-08	7.424E-09	2.667E-09	1.323E-09	7.787E-10	5.099E-10	3.588E-10	2.659E-10	2.049E-10
SW	1.059E-07	3.580E-08	1.838E-08	8.739E-09	3.139E-09	1.557E-09	9.166E-10	6.002E-10	4.223E-10	3.130E-10	2.412E-10
WSW	9.700E-08	3.280E-08	1.684E-08	8.007E-09	2.876E-09	1.426E-09	8.399E-10	5.499E-10	3.870E-10	2.868E-10	2.210E-10
W	1.075E-07	3.637E-08	1.867E-08	8.877E-09	3.189E-09	1.581E-09	9.311E-10	6.097E-10	4.290E-10	3.179E-10	2.450E-10
WNW	1.274E-07	4.308E-08	2.212E-08	1.052E-08	3.778E-09	1.873E-09	1.103E-09	7.223E-10	5.082E-10	3.767E-10	2.903E-10
NW	1.214E-07	4.105E-08	2.108E-08	1.002E-08	3.599E-09	1.785E-09	1.051E-09	6.882E-10	4.842E-10	3.589E-10	2.765E-10
NNW	1.082E-07	3.660E-08	1.879E-08	8.933E-09	3.209E-09	1.591E-09	9.370E-10	6.135E-10	4.317E-10	3.199E-10	2.466E-10

Table 2.7-99 Annual Average D/Q Values for Ground Level Release (Based on 2001-2007 met data) (Sheet 2 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	5.0	7.5	10	15	20	25	30	35	40	45	50
N	2.290E-10	1.017E-10	6.163E-11	3.115E-11	1.886E-11	1.264E-11	9.059E-12	6.802E-12	5.289E-12	4.225E-12	3.448E-12
NNE	4.316E-10	1.917E-10	1.161E-10	5.871E-11	3.553E-11	2.382E-11	1.707E-11	1.282E-11	9.967E-12	7.961E-12	6.498E-12
NE	4.474E-10	1.988E-10	1.204E-10	6.086E-11	3.683E-11	2.470E-11	1.770E-11	1.329E-11	1.033E-11	8.253E-12	6.736E-12
ENE	3.637E-10	1.616E-10	9.786E-11	4.946E-11	2.994E-11	2.007E-11	1.438E-11	1.080E-11	8.397E-12	6.708E-12	5.475E-12
E	2.979E-10	1.323E-10	8.017E-11	4.052E-11	2.452E-11	1.644E-11	1.178E-11	8.847E-12	6.879E-12	5.495E-12	4.485E-12
ESE	3.401E-10	1.511E-10	9.151E-11	4.626E-11	2.800E-11	1.877E-11	1.345E-11	1.010E-11	7.853E-12	6.273E-12	5.120E-12
SE	2.729E-10	1.212E-10	7.344E-11	3.712E-11	2.247E-11	1.506E-11	1.079E-11	8.106E-12	6.302E-12	5.034E-12	4.109E-12
SSE	2.434E-10	1.081E-10	6.551E-11	3.311E-11	2.004E-11	1.344E-11	9.629E-12	7.230E-12	5.622E-12	4.491E-12	3.665E-12
S	1.949E-10	8.658E-11	5.244E-11	2.651E-11	1.604E-11	1.076E-11	7.708E-12	5.788E-12	4.500E-12	3.595E-12	2.934E-12
SSW	1.628E-10	7.232E-11	4.381E-11	2.214E-11	1.340E-11	8.985E-12	6.438E-12	4.835E-12	3.759E-12	3.003E-12	2.451E-12
SW	1.916E-10	8.512E-11	5.156E-11	2.606E-11	1.577E-11	1.058E-11	7.578E-12	5.691E-12	4.425E-12	3.534E-12	2.885E-12
WSW	1.756E-10	7.799E-11	4.724E-11	2.388E-11	1.445E-11	9.690E-12	6.944E-12	5.214E-12	4.054E-12	3.238E-12	2.643E-12
W	1.946E-10	8.647E-11	5.238E-11	2.647E-11	1.602E-11	1.074E-11	7.698E-12	5.781E-12	4.495E-12	3.590E-12	2.930E-12
WNW	2.306E-10	1.024E-10	6.205E-11	3.136E-11	1.898E-11	1.273E-11	9.120E-12	6.848E-12	5.325E-12	4.253E-12	3.472E-12
NW	2.197E-10	9.760E-11	5.912E-11	2.988E-11	1.809E-11	1.213E-11	8.689E-12	6.525E-12	5.073E-12	4.052E-12	3.308E-12
NNW	1.959E-10	8.701E-11	5.271E-11	2.664E-11	1.612E-11	1.081E-11	7.747E-12	5.817E-12	4.523E-12	3.613E-12	2.949E-12

Table 2.7-99 Annual Average D/Q Values for Ground Level Release (Based on 2001-2007 met data) (Sheet 3 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors										
Segment Boundaries in Miles from the Site										
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	2.148E-08	4.399E-09	1.148E-09	5.158E-10	2.918E-10	1.122E-10	3.246E-11	1.287E-11	6.870E-12	4.252E-12
NNE	4.047E-08	8.290E-09	2.164E-09	9.720E-10	5.499E-10	2.115E-10	6.117E-11	2.425E-11	1.295E-11	8.014E-12
NE	4.195E-08	8.594E-09	2.243E-09	1.008E-09	5.700E-10	2.192E-10	6.341E-11	2.513E-11	1.342E-11	8.307E-12
ENE	3.410E-08	6.985E-09	1.823E-09	8.189E-10	4.633E-10	1.782E-10	5.154E-11	2.043E-11	1.091E-11	6.752E-12
E	2.793E-08	5.722E-09	1.494E-09	6.708E-10	3.795E-10	1.459E-10	4.222E-11	1.673E-11	8.936E-12	5.531E-12
ESE	3.189E-08	6.532E-09	1.705E-09	7.658E-10	4.332E-10	1.666E-10	4.820E-11	1.910E-11	1.020E-11	6.314E-12
SE	2.559E-08	5.242E-09	1.368E-09	6.146E-10	3.477E-10	1.337E-10	3.868E-11	1.533E-11	8.187E-12	5.067E-12
SSE	2.283E-08	4.676E-09	1.221E-09	5.482E-10	3.101E-10	1.193E-10	3.450E-11	1.367E-11	7.303E-12	4.520E-12
S	1.827E-08	3.743E-09	9.772E-10	4.389E-10	2.483E-10	9.548E-11	2.762E-11	1.095E-11	5.846E-12	3.618E-12
SSW	1.526E-08	3.127E-09	8.162E-10	3.666E-10	2.074E-10	7.975E-11	2.307E-11	9.144E-12	4.883E-12	3.022E-12
SW	1.797E-08	3.680E-09	9.608E-10	4.315E-10	2.441E-10	9.387E-11	2.716E-11	1.076E-11	5.748E-12	3.558E-12
WSW	1.646E-08	3.372E-09	8.803E-10	3.954E-10	2.237E-10	8.601E-11	2.488E-11	9.862E-12	5.266E-12	3.260E-12
W	1.825E-08	3.738E-09	9.759E-10	4.383E-10	2.480E-10	9.536E-11	2.759E-11	1.093E-11	5.839E-12	3.614E-12
WNW	2.162E-08	4.429E-09	1.156E-09	5.193E-10	2.938E-10	1.130E-10	3.268E-11	1.295E-11	6.917E-12	4.281E-12
NW	2.060E-08	4.220E-09	1.102E-09	4.947E-10	2.799E-10	1.076E-10	3.114E-11	1.234E-11	6.590E-12	4.079E-12
NNW	1.837E-08	3.762E-09	9.821E-10	4.411E-10	2.495E-10	9.596E-11	2.776E-11	1.100E-11	5.875E-12	3.637E-12

Table 2.7-100 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	1.847E-06	6.419E-07	3.901E-07	2.390E-07	1.300E-07	8.553E-08	6.176E-08	4.731E-08	3.778E-08	3.111E-08	2.641E-08
NNE	3.700E-06	1.308E-06	7.853E-07	4.572E-07	2.338E-07	1.489E-07	1.057E-07	8.007E-08	6.514E-08	5.466E-08	4.612E-08
NE	4.753E-06	1.755E-06	1.028E-06	5.637E-07	2.628E-07	1.612E-07	1.128E-07	8.531E-08	6.785E-08	5.593E-08	4.733E-08
ENE	2.592E-06	1.040E-06	6.226E-07	3.489E-07	1.723E-07	1.114E-07	8.133E-08	6.357E-08	5.192E-08	4.374E-08	3.770E-08
E	1.792E-06	7.851E-07	4.809E-07	2.708E-07	1.335E-07	8.608E-08	6.270E-08	4.893E-08	3.994E-08	3.364E-08	2.900E-08
ESE	1.930E-06	8.467E-07	5.110E-07	2.833E-07	1.366E-07	8.712E-08	6.322E-08	4.935E-08	4.037E-08	3.412E-08	2.954E-08
SE	1.709E-06	7.440E-07	4.472E-07	2.474E-07	1.190E-07	7.593E-08	5.511E-08	4.300E-08	3.512E-08	2.961E-08	2.556E-08
SSE	2.063E-06	8.025E-07	4.717E-07	2.605E-07	1.251E-07	7.882E-08	5.630E-08	4.323E-08	3.479E-08	2.895E-08	2.470E-08
S	2.096E-06	7.468E-07	4.308E-07	2.364E-07	1.123E-07	6.997E-08	4.951E-08	3.774E-08	3.020E-08	2.502E-08	2.128E-08
SSW	1.650E-06	6.059E-07	3.574E-07	2.007E-07	9.800E-08	6.227E-08	4.466E-08	3.434E-08	2.764E-08	2.298E-08	1.957E-08
SW	1.167E-06	4.527E-07	3.182E-07	2.117E-07	1.177E-07	7.587E-08	5.335E-08	3.984E-08	3.110E-08	2.509E-08	2.078E-08
WSW	1.208E-06	4.555E-07	3.026E-07	1.913E-07	1.001E-07	6.246E-08	4.309E-08	3.178E-08	2.458E-08	1.971E-08	1.643E-08
W	1.618E-06	5.700E-07	3.591E-07	2.192E-07	1.106E-07	6.814E-08	4.679E-08	3.446E-08	2.667E-08	2.141E-08	1.768E-08
WNW	1.899E-06	6.393E-07	3.869E-07	2.372E-07	1.231E-07	7.735E-08	5.386E-08	4.011E-08	3.131E-08	2.532E-08	2.104E-08
NW	1.889E-06	6.269E-07	3.596E-07	2.129E-07	1.094E-07	6.886E-08	4.813E-08	3.599E-08	2.822E-08	2.290E-08	1.919E-08
NNW	1.757E-06	5.793E-07	3.291E-07	1.924E-07	1.002E-07	6.445E-08	4.598E-08	3.497E-08	2.780E-08	2.284E-08	1.947E-08

Table 2.7-100 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	5	7.5	10	15	20	25	30	35	40	45	50
N	2.285E-08	1.424E-08	1.043E-08	7.007E-09	5.237E-09	4.107E-09	3.296E-09	2.698E-09	2.264E-09	1.941E-09	1.691E-09
NNE	3.972E-08	2.303E-08	1.602E-08	1.002E-08	7.161E-09	5.515E-09	4.455E-09	3.719E-09	3.182E-09	2.774E-09	2.454E-09
NE	4.094E-08	2.508E-08	1.825E-08	1.225E-08	9.247E-09	7.451E-09	6.258E-09	5.408E-09	4.773E-09	4.279E-09	3.884E-09
ENE	3.314E-08	2.158E-08	1.633E-08	1.151E-08	8.984E-09	7.421E-09	6.358E-09	5.588E-09	5.002E-09	4.542E-09	4.169E-09
E	2.553E-08	1.641E-08	1.227E-08	8.460E-09	6.457E-09	5.213E-09	4.366E-09	3.751E-09	3.286E-09	2.921E-09	2.627E-09
ESE	2.612E-08	1.735E-08	1.334E-08	9.618E-09	7.600E-09	6.316E-09	5.423E-09	4.765E-09	4.259E-09	3.857E-09	3.530E-09
SE	2.253E-08	1.480E-08	1.126E-08	7.987E-09	6.248E-09	5.161E-09	4.416E-09	3.874E-09	3.460E-09	3.134E-09	2.871E-09
SSE	2.153E-08	1.419E-08	1.101E-08	8.274E-09	6.887E-09	6.012E-09	5.373E-09	4.855E-09	4.401E-09	3.987E-09	3.599E-09
S	1.847E-08	1.173E-08	8.812E-09	6.256E-09	4.962E-09	4.171E-09	3.632E-09	3.234E-09	2.924E-09	2.669E-09	2.454E-09
SSW	1.701E-08	1.064E-08	7.833E-09	5.315E-09	4.040E-09	3.270E-09	2.756E-09	2.387E-09	2.108E-09	1.890E-09	1.713E-09
SW	1.758E-08	9.725E-09	6.525E-09	3.872E-09	2.670E-09	2.000E-09	1.580E-09	1.295E-09	1.090E-09	9.369E-10	8.183E-10
WSW	1.398E-08	7.668E-09	5.130E-09	3.040E-09	2.097E-09	1.570E-09	1.239E-09	1.014E-09	8.510E-10	7.284E-10	6.330E-10
W	1.493E-08	8.573E-09	5.942E-09	3.703E-09	2.619E-09	1.965E-09	1.537E-09	1.248E-09	1.043E-09	8.912E-10	7.744E-10
WNW	1.787E-08	1.072E-08	7.716E-09	5.098E-09	3.706E-09	2.786E-09	2.190E-09	1.788E-09	1.501E-09	1.288E-09	1.123E-09
NW	1.643E-08	9.815E-09	7.039E-09	4.658E-09	3.470E-09	2.722E-09	2.186E-09	1.793E-09	1.510E-09	1.299E-09	1.135E-09
NNW	1.693E-08	1.073E-08	7.992E-09	5.499E-09	4.109E-09	3.152E-09	2.489E-09	2.038E-09	1.715E-09	1.474E-09	1.288E-09

Table 2.7-100 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment										
Segment Boundaries in Miles from the Site										
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	3.789E-07	1.345E-07	6.232E-08	3.796E-08	2.648E-08	1.446E-08	6.980E-09	4.084E-09	2.703E-09	1.944E-09
NNE	7.557E-07	2.457E-07	1.070E-07	6.541E-08	4.628E-08	2.363E-08	1.008E-08	5.530E-09	3.725E-09	2.777E-09
NE	9.831E-07	2.845E-07	1.147E-07	6.830E-08	4.751E-08	2.557E-08	1.225E-08	7.453E-09	5.409E-09	4.279E-09
ENE	5.938E-07	1.845E-07	8.224E-08	5.213E-08	3.780E-08	2.181E-08	1.146E-08	7.413E-09	5.585E-09	4.540E-09
E	4.551E-07	1.429E-07	6.343E-08	4.011E-08	2.909E-08	1.660E-08	8.417E-09	5.206E-09	3.749E-09	2.920E-09
ESE	4.844E-07	1.472E-07	6.405E-08	4.055E-08	2.963E-08	1.752E-08	9.548E-09	6.301E-09	4.760E-09	3.855E-09
SE	4.243E-07	1.284E-07	5.582E-08	3.527E-08	2.564E-08	1.495E-08	7.941E-09	5.153E-09	3.871E-09	3.133E-09
SSE	4.513E-07	1.346E-07	5.708E-08	3.498E-08	2.479E-08	1.441E-08	8.265E-09	5.990E-09	4.830E-09	3.966E-09
S	4.146E-07	1.211E-07	5.025E-08	3.038E-08	2.135E-08	1.193E-08	6.249E-09	4.166E-09	3.230E-09	2.665E-09
SSW	3.430E-07	1.049E-07	4.523E-08	2.778E-08	1.963E-08	1.081E-08	5.308E-09	3.270E-09	2.386E-09	1.889E-09
SW	3.007E-07	1.200E-07	5.395E-08	3.131E-08	2.088E-08	1.005E-08	3.928E-09	2.011E-09	1.298E-09	9.384E-10
WSW	2.871E-07	1.036E-07	4.373E-08	2.478E-08	1.649E-08	7.943E-09	3.085E-09	1.578E-09	1.016E-09	7.294E-10
W	3.438E-07	1.159E-07	4.755E-08	2.690E-08	1.777E-08	8.816E-09	3.719E-09	1.968E-09	1.253E-09	8.930E-10
WNW	3.764E-07	1.281E-07	5.462E-08	3.154E-08	2.113E-08	1.097E-08	5.061E-09	2.793E-09	1.793E-09	1.290E-09
NW	3.538E-07	1.144E-07	4.880E-08	2.841E-08	1.927E-08	1.005E-08	4.659E-09	2.707E-09	1.798E-09	1.301E-09
NNW	3.240E-07	1.048E-07	4.650E-08	2.796E-08	1.952E-08	1.089E-08	5.435E-09	3.142E-09	2.044E-09	1.476E-09

Table 2.7-101 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)											
Distance in Miles from the Site											
Sector	**0.25**	**0.5**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	1.846E-06	6.414E-07	3.896E-07	2.386E-07	1.297E-07	8.525E-08	6.150E-08	4.707E-08	3.755E-08	3.089E-08	2.620E-08
NNE	3.699E-06	1.307E-06	7.844E-07	4.565E-07	2.333E-07	1.485E-07	1.053E-07	7.970E-08	6.479E-08	5.431E-08	4.579E-08
NE	4.751E-06	1.753E-06	1.026E-06	5.628E-07	2.622E-07	1.607E-07	1.124E-07	8.494E-08	6.750E-08	5.559E-08	4.701E-08
ENE	2.591E-06	1.039E-06	6.218E-07	3.483E-07	1.718E-07	1.110E-07	8.097E-08	6.323E-08	5.160E-08	4.342E-08	3.739E-08
E	1.791E-06	7.844E-07	4.803E-07	2.703E-07	1.331E-07	8.576E-08	6.240E-08	4.866E-08	3.967E-08	3.337E-08	2.874E-08
ESE	1.929E-06	8.459E-07	5.103E-07	2.828E-07	1.362E-07	8.680E-08	6.293E-08	4.907E-08	4.010E-08	3.385E-08	2.928E-08
SE	1.709E-06	7.432E-07	4.465E-07	2.470E-07	1.187E-07	7.565E-08	5.486E-08	4.276E-08	3.489E-08	2.939E-08	2.534E-08
SSE	2.062E-06	8.018E-07	4.710E-07	2.600E-07	1.248E-07	7.855E-08	5.606E-08	4.300E-08	3.458E-08	2.875E-08	2.451E-08
S	2.095E-06	7.461E-07	4.302E-07	2.360E-07	1.120E-07	6.973E-08	4.930E-08	3.754E-08	3.002E-08	2.485E-08	2.111E-08
SSW	1.650E-06	6.053E-07	3.569E-07	2.003E-07	9.776E-08	6.206E-08	4.447E-08	3.417E-08	2.748E-08	2.282E-08	1.942E-08
SW	1.166E-06	4.523E-07	3.178E-07	2.113E-07	1.175E-07	7.564E-08	5.315E-08	3.966E-08	3.093E-08	2.493E-08	2.063E-08
WSW	1.208E-06	4.552E-07	3.023E-07	1.910E-07	9.987E-08	6.229E-08	4.294E-08	3.165E-08	2.446E-08	1.960E-08	1.632E-08
W	1.617E-06	5.696E-07	3.588E-07	2.189E-07	1.104E-07	6.796E-08	4.663E-08	3.432E-08	2.655E-08	2.129E-08	1.757E-08
WNW	1.898E-06	6.387E-07	3.864E-07	2.369E-07	1.229E-07	7.712E-08	5.366E-08	3.993E-08	3.115E-08	2.517E-08	2.089E-08
NW	1.888E-06	6.263E-07	3.591E-07	2.126E-07	1.092E-07	6.864E-08	4.795E-08	3.583E-08	2.806E-08	2.276E-08	1.905E-08
NNW	1.757E-06	5.788E-07	3.286E-07	1.921E-07	9.994E-08	6.424E-08	4.579E-08	3.480E-08	2.764E-08	2.268E-08	1.932E-08

Table 2.7-101 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	2.264E-08	1.404E-08	1.023E-08	6.797E-09	5.021E-09	3.891E-09	3.086E-09	2.497E-09	2.073E-09	1.758E-09	1.516E-09
NNE	3.940E-08	2.274E-08	1.575E-08	9.752E-09	6.906E-09	5.268E-09	4.214E-09	3.485E-09	2.953E-09	2.550E-09	2.234E-09
NE	4.063E-08	2.478E-08	1.796E-08	1.193E-08	8.924E-09	7.118E-09	5.916E-09	5.058E-09	4.416E-09	3.916E-09	3.516E-09
ENE	3.283E-08	2.127E-08	1.600E-08	1.115E-08	8.598E-09	7.015E-09	5.935E-09	5.149E-09	4.550E-09	4.078E-09	3.694E-09
E	2.527E-08	1.615E-08	1.200E-08	8.171E-09	6.156E-09	4.905E-09	4.054E-09	3.437E-09	2.971E-09	2.606E-09	2.313E-09
ESE	2.586E-08	1.707E-08	1.305E-08	9.285E-09	7.241E-09	5.937E-09	5.029E-09	4.359E-09	3.843E-09	3.433E-09	3.099E-09
SE	2.232E-08	1.458E-08	1.103E-08	7.731E-09	5.975E-09	4.874E-09	4.118E-09	3.566E-09	3.145E-09	2.812E-09	2.542E-09
SSE	2.134E-08	1.400E-08	1.080E-08	8.031E-09	6.607E-09	5.697E-09	5.028E-09	4.485E-09	4.014E-09	3.589E-09	3.198E-09
S	1.832E-08	1.157E-08	8.655E-09	6.084E-09	4.777E-09	3.975E-09	3.424E-09	3.017E-09	2.698E-09	2.437E-09	2.215E-09
SSW	1.686E-08	1.051E-08	7.696E-09	5.171E-09	3.891E-09	3.117E-09	2.599E-09	2.227E-09	1.946E-09	1.725E-09	1.546E-09
SW	1.744E-08	9.604E-09	6.415E-09	3.771E-09	2.576E-09	1.911E-09	1.495E-09	1.213E-09	1.011E-09	8.604E-10	7.440E-10
WSW	1.388E-08	7.584E-09	5.053E-09	2.971E-09	2.033E-09	1.511E-09	1.183E-09	9.598E-10	7.993E-10	6.788E-10	5.852E-10
W	1.483E-08	8.480E-09	5.854E-09	3.620E-09	2.541E-09	1.892E-09	1.468E-09	1.183E-09	9.817E-10	8.323E-10	7.178E-10
WNW	1.773E-08	1.059E-08	7.592E-09	4.973E-09	3.583E-09	2.669E-09	2.080E-09	1.685E-09	1.403E-09	1.193E-09	1.032E-09
NW	1.630E-08	9.699E-09	6.929E-09	4.549E-09	3.363E-09	2.617E-09	2.086E-09	1.698E-09	1.419E-09	1.211E-09	1.050E-09
NNW	1.678E-08	1.058E-08	7.847E-09	5.345E-09	3.954E-09	3.002E-09	2.348E-09	1.904E-09	1.588E-09	1.352E-09	1.170E-09

Table 2.7-101 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	3.784E-07	1.341E-07	6.206E-08	3.773E-08	2.627E-08	1.426E-08	6.770E-09	3.870E-09	2.504E-09	1.762E-09
NNE	7.549E-07	2.452E-07	1.066E-07	6.506E-08	4.595E-08	2.334E-08	9.820E-09	5.283E-09	3.491E-09	2.552E-09
NE	9.820E-07	2.839E-07	1.143E-07	6.795E-08	4.719E-08	2.527E-08	1.194E-08	7.118E-09	5.059E-09	3.916E-09
ENE	5.930E-07	1.840E-07	8.188E-08	5.181E-08	3.749E-08	2.150E-08	1.109E-08	7.005E-09	5.145E-09	4.075E-09
E	4.545E-07	1.426E-07	6.313E-08	3.984E-08	2.883E-08	1.634E-08	8.127E-09	4.898E-09	3.436E-09	2.606E-09
ESE	4.838E-07	1.468E-07	6.375E-08	4.028E-08	2.937E-08	1.724E-08	9.213E-09	5.921E-09	4.354E-09	3.431E-09
SE	4.238E-07	1.281E-07	5.556E-08	3.504E-08	2.542E-08	1.472E-08	7.683E-09	4.866E-09	3.564E-09	2.811E-09
SSE	4.507E-07	1.343E-07	5.683E-08	3.476E-08	2.459E-08	1.421E-08	8.014E-09	5.672E-09	4.461E-09	3.570E-09
S	4.141E-07	1.208E-07	5.004E-08	3.020E-08	2.118E-08	1.177E-08	6.075E-09	3.969E-09	3.012E-09	2.432E-09
SSW	3.425E-07	1.047E-07	4.504E-08	2.762E-08	1.948E-08	1.067E-08	5.163E-09	3.116E-09	2.226E-09	1.724E-09
SW	3.004E-07	1.197E-07	5.375E-08	3.114E-08	2.073E-08	9.929E-09	3.828E-09	1.922E-09	1.217E-09	8.620E-10
WSW	2.868E-07	1.034E-07	4.358E-08	2.466E-08	1.639E-08	7.859E-09	3.017E-09	1.519E-09	9.624E-10	6.798E-10
W	3.434E-07	1.156E-07	4.740E-08	2.677E-08	1.766E-08	8.723E-09	3.637E-09	1.895E-09	1.188E-09	8.341E-10
WNW	3.760E-07	1.279E-07	5.442E-08	3.138E-08	2.099E-08	1.085E-08	4.937E-09	2.677E-09	1.690E-09	1.196E-09
NW	3.534E-07	1.141E-07	4.862E-08	2.826E-08	1.913E-08	9.936E-09	4.551E-09	2.604E-09	1.702E-09	1.213E-09
NNW	3.236E-07	1.046E-07	4.631E-08	2.780E-08	1.937E-08	1.074E-08	5.283E-09	2.994E-09	1.910E-09	1.354E-09

Table 2.7-102 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)

	Distance in Miles from the Site										
Sector	0.25	0.5	0.75	1	1.5	2	2.5	3	3.5	4	4.5
N	1.768E-06	5.978E-07	3.589E-07	2.202E-07	1.203E-07	7.917E-08	5.711E-08	4.367E-08	3.479E-08	2.859E-08	2.423E-08
NNE	3.529E-06	1.213E-06	7.185E-07	4.174E-07	2.134E-07	1.358E-07	9.611E-08	7.266E-08	5.909E-08	4.957E-08	4.174E-08
NE	4.506E-06	1.619E-06	9.319E-07	5.069E-07	2.347E-07	1.436E-07	1.004E-07	7.588E-08	6.031E-08	4.968E-08	4.202E-08
ENE	2.461E-06	9.670E-07	5.702E-07	3.176E-07	1.567E-07	1.016E-07	7.441E-08	5.830E-08	4.770E-08	4.023E-08	3.471E-08
E	1.704E-06	7.351E-07	4.442E-07	2.486E-07	1.224E-07	7.906E-08	5.772E-08	4.514E-08	3.690E-08	3.111E-08	2.685E-08
ESE	1.836E-06	7.937E-07	4.724E-07	2.600E-07	1.249E-07	7.974E-08	5.799E-08	4.536E-08	3.717E-08	3.146E-08	2.727E-08
SE	1.626E-06	6.973E-07	4.132E-07	2.269E-07	1.087E-07	6.945E-08	5.053E-08	3.950E-08	3.232E-08	2.729E-08	2.358E-08
SSE	1.958E-06	7.457E-07	4.316E-07	2.366E-07	1.131E-07	7.130E-08	5.096E-08	3.915E-08	3.152E-08	2.623E-08	2.238E-08
S	1.987E-06	6.891E-07	3.910E-07	2.129E-07	1.005E-07	6.247E-08	4.416E-08	3.364E-08	2.690E-08	2.227E-08	1.892E-08
SSW	1.565E-06	5.595E-07	3.247E-07	1.812E-07	8.830E-08	5.616E-08	4.032E-08	3.103E-08	2.498E-08	2.077E-08	1.768E-08
SW	1.117E-06	4.232E-07	2.971E-07	1.987E-07	1.105E-07	7.085E-08	4.952E-08	3.676E-08	2.852E-08	2.288E-08	1.885E-08
WSW	1.158E-06	4.260E-07	2.818E-07	1.785E-07	9.316E-08	5.780E-08	3.962E-08	2.903E-08	2.231E-08	1.778E-08	1.475E-08
W	1.548E-06	5.309E-07	3.320E-07	2.026E-07	1.018E-07	6.229E-08	4.248E-08	3.109E-08	2.392E-08	1.909E-08	1.567E-08
WNW	1.826E-06	5.991E-07	3.590E-07	2.200E-07	1.139E-07	7.116E-08	4.928E-08	3.649E-08	2.834E-08	2.281E-08	1.886E-08
NW	1.821E-06	5.900E-07	3.340E-07	1.971E-07	1.009E-07	6.319E-08	4.393E-08	3.268E-08	2.549E-08	2.059E-08	1.719E-08
NNW	1.687E-06	5.420E-07	3.033E-07	1.771E-07	9.217E-08	5.921E-08	4.214E-08	3.196E-08	2.534E-08	2.075E-08	1.766E-08

Table 2.7-102 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	2.092E-08	1.299E-08	9.471E-09	6.236E-09	4.388E-09	3.255E-09	2.514E-09	1.991E-09	1.621E-09	1.351E-09	1.147E-09
NNE	3.587E-08	2.060E-08	1.420E-08	8.752E-09	6.184E-09	4.715E-09	3.775E-09	3.124E-09	2.640E-09	2.275E-09	1.986E-09
NE	3.632E-08	2.223E-08	1.615E-08	1.080E-08	8.127E-09	6.530E-09	5.470E-09	4.713E-09	4.126E-09	3.672E-09	3.303E-09
ENE	3.053E-08	1.994E-08	1.509E-08	1.063E-08	8.276E-09	6.820E-09	5.829E-09	5.106E-09	4.533E-09	4.084E-09	3.714E-09
E	2.364E-08	1.521E-08	1.136E-08	7.803E-09	5.926E-09	4.761E-09	3.967E-09	3.391E-09	2.942E-09	2.593E-09	2.310E-09
ESE	2.414E-08	1.607E-08	1.237E-08	8.905E-09	7.018E-09	5.814E-09	4.975E-09	4.355E-09	3.857E-09	3.465E-09	3.141E-09
SE	2.080E-08	1.370E-08	1.042E-08	7.378E-09	5.755E-09	4.739E-09	4.042E-09	3.532E-09	3.127E-09	2.810E-09	2.550E-09
SSE	1.950E-08	1.291E-08	1.004E-08	7.581E-09	6.324E-09	5.474E-09	4.729E-09	4.112E-09	3.595E-09	3.151E-09	2.775E-09
S	1.642E-08	1.044E-08	7.850E-09	5.579E-09	4.429E-09	3.725E-09	3.235E-09	2.845E-09	2.506E-09	2.225E-09	1.989E-09
SSW	1.536E-08	9.620E-09	7.069E-09	4.782E-09	3.623E-09	2.924E-09	2.455E-09	2.115E-09	1.840E-09	1.613E-09	1.426E-09
SW	1.587E-08	8.593E-09	5.667E-09	3.273E-09	2.209E-09	1.625E-09	1.264E-09	1.018E-09	8.400E-10	7.055E-10	6.010E-10
WSW	1.250E-08	6.708E-09	4.408E-09	2.540E-09	1.702E-09	1.228E-09	9.312E-10	7.328E-10	5.934E-10	4.920E-10	4.158E-10
W	1.317E-08	7.447E-09	5.094E-09	3.042E-09	2.026E-09	1.454E-09	1.095E-09	8.596E-10	6.962E-10	5.776E-10	4.883E-10
WNW	1.595E-08	9.470E-09	6.750E-09	4.259E-09	2.918E-09	2.104E-09	1.593E-09	1.258E-09	1.024E-09	8.530E-10	7.240E-10
NW	1.466E-08	8.657E-09	6.151E-09	3.941E-09	2.763E-09	2.054E-09	1.588E-09	1.259E-09	1.028E-09	8.582E-10	7.300E-10
NNW	1.532E-08	9.679E-09	7.182E-09	4.747E-09	3.318E-09	2.434E-09	1.853E-09	1.467E-09	1.197E-09	9.993E-10	8.497E-10

Table 2.7-102 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	3.504E-07	1.242E-07	5.761E-08	3.497E-08	2.430E-08	1.319E-08	6.134E-09	3.261E-09	2.000E-09	1.355E-09
NNE	6.946E-07	2.242E-07	9.731E-08	5.934E-08	4.189E-08	2.115E-08	8.822E-09	4.731E-09	3.126E-09	2.276E-09
NE	8.957E-07	2.547E-07	1.021E-07	6.071E-08	4.218E-08	2.266E-08	1.080E-08	6.532E-09	4.706E-09	3.670E-09
ENE	5.461E-07	1.680E-07	7.522E-08	4.788E-08	3.480E-08	2.014E-08	1.057E-08	6.812E-09	5.094E-09	4.080E-09
E	4.219E-07	1.312E-07	5.838E-08	3.705E-08	2.692E-08	1.538E-08	7.760E-09	4.754E-09	3.384E-09	2.592E-09
ESE	4.494E-07	1.348E-07	5.874E-08	3.733E-08	2.735E-08	1.622E-08	8.836E-09	5.800E-09	4.342E-09	3.461E-09
SE	3.935E-07	1.175E-07	5.117E-08	3.246E-08	2.365E-08	1.382E-08	7.333E-09	4.731E-09	3.523E-09	2.808E-09
SSE	4.147E-07	1.220E-07	5.166E-08	3.168E-08	2.246E-08	1.310E-08	7.569E-09	5.403E-09	4.091E-09	3.143E-09
S	3.781E-07	1.086E-07	4.483E-08	2.706E-08	1.899E-08	1.062E-08	5.573E-09	3.717E-09	2.828E-09	2.221E-09
SSW	3.131E-07	9.467E-08	4.083E-08	2.510E-08	1.774E-08	9.762E-09	4.775E-09	2.923E-09	2.107E-09	1.611E-09
SW	2.814E-07	1.125E-07	5.011E-08	2.873E-08	1.894E-08	8.909E-09	3.332E-09	1.636E-09	1.020E-09	7.066E-10
WSW	2.680E-07	9.642E-08	4.023E-08	2.250E-08	1.481E-08	6.973E-09	2.583E-09	1.236E-09	7.364E-10	4.939E-10
W	3.186E-07	1.066E-07	4.321E-08	2.413E-08	1.576E-08	7.673E-09	3.047E-09	1.463E-09	8.646E-10	5.796E-10
WNW	3.506E-07	1.185E-07	5.000E-08	2.856E-08	1.895E-08	9.701E-09	4.217E-09	2.117E-09	1.264E-09	8.558E-10
NW	3.301E-07	1.055E-07	4.457E-08	2.568E-08	1.726E-08	8.878E-09	3.909E-09	2.057E-09	1.265E-09	8.609E-10
NNW	3.003E-07	9.639E-08	4.262E-08	2.548E-08	1.771E-08	9.824E-09	4.653E-09	2.437E-09	1.474E-09	1.002E-09

Table 2.7-103 Annual Average D/Q Values for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distances in Miles										
Sector	**0.25**	**0.50**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	2.364E-08	1.178E-08	7.038E-09	3.670E-09	1.420E-09	7.470E-10	4.586E-10	3.104E-10	2.242E-10	1.697E-10	1.331E-10
NNE	5.332E-08	2.515E-08	1.463E-08	7.556E-09	2.945E-09	1.539E-09	9.392E-10	6.324E-10	4.550E-10	3.433E-10	2.685E-10
NE	5.519E-08	2.258E-08	1.225E-08	6.026E-09	2.233E-09	1.138E-09	6.832E-10	4.548E-10	3.246E-10	2.434E-10	1.896E-10
ENE	2.995E-08	1.358E-08	7.554E-09	3.752E-09	1.387E-09	7.122E-10	4.308E-10	2.887E-10	2.072E-10	1.562E-10	1.222E-10
E	2.453E-08	1.184E-08	6.741E-09	3.378E-09	1.245E-09	6.416E-10	3.893E-10	2.615E-10	1.882E-10	1.422E-10	1.115E-10
ESE	2.692E-08	1.302E-08	7.401E-09	3.704E-09	1.363E-09	7.023E-10	4.260E-10	2.862E-10	2.059E-10	1.556E-10	1.220E-10
SE	2.234E-08	1.093E-08	6.220E-09	3.107E-09	1.139E-09	5.857E-10	3.549E-10	2.383E-10	1.714E-10	1.295E-10	1.016E-10
SSE	2.249E-08	1.025E-08	5.700E-09	2.830E-09	1.044E-09	5.368E-10	3.250E-10	2.179E-10	1.565E-10	1.180E-10	9.236E-11
S	1.938E-08	8.156E-09	4.484E-09	2.222E-09	8.237E-10	4.219E-10	2.546E-10	1.701E-10	1.217E-10	9.153E-11	7.141E-11
SSW	1.621E-08	6.780E-09	3.746E-09	1.860E-09	6.893E-10	3.530E-10	2.129E-10	1.423E-10	1.018E-10	7.653E-11	5.970E-11
SW	1.930E-08	1.057E-08	6.902E-09	3.844E-09	1.607E-09	8.673E-10	5.395E-10	3.679E-10	2.668E-10	2.023E-10	1.586E-10
WSW	2.338E-08	1.207E-08	7.420E-09	3.971E-09	1.605E-09	8.498E-10	5.221E-10	3.531E-10	2.547E-10	1.925E-10	1.507E-10
W	3.030E-08	1.463E-08	8.627E-09	4.628E-09	1.832E-09	9.540E-10	5.795E-10	3.888E-10	2.789E-10	2.100E-10	1.640E-10
WNW	3.191E-08	1.623E-08	9.548E-09	5.154E-09	2.009E-09	1.044E-09	6.345E-10	4.261E-10	3.061E-10	2.308E-10	1.805E-10
NW	2.936E-08	1.541E-08	9.074E-09	4.877E-09	1.875E-09	9.712E-10	5.896E-10	3.959E-10	2.844E-10	2.146E-10	1.680E-10
NNW	2.469E-08	1.246E-08	7.217E-09	3.674E-09	1.387E-09	7.224E-10	4.410E-10	2.975E-10	2.146E-10	1.624E-10	1.274E-10

Table 2.7-103 Annual Average D/Q Values for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distances in Miles										
Sector	**5**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	1.073E-10	5.070E-11	3.196E-11	3.925E-11	2.843E-11	1.732E-11	1.203E-11	9.077E-12	7.072E-12	5.648E-12	4.611E-12
NNE	2.160E-10	9.930E-11	6.062E-11	3.165E-11	2.024E-11	1.455E-11	1.137E-11	9.229E-12	8.176E-12	6.981E-12	6.995E-12
NE	1.520E-10	6.948E-11	4.242E-11	2.232E-11	1.432E-11	1.039E-11	8.218E-12	7.131E-12	6.185E-12	6.383E-12	6.951E-12
ENE	9.834E-11	4.567E-11	2.812E-11	1.510E-11	9.901E-12	7.379E-12	6.003E-12	5.204E-12	4.635E-12	4.323E-12	4.469E-12
E	8.991E-11	4.210E-11	2.601E-11	1.406E-11	9.159E-12	6.919E-12	5.595E-12	4.733E-12	4.136E-12	3.664E-12	3.325E-12
ESE	9.842E-11	4.611E-11	2.850E-11	1.542E-11	1.007E-11	7.645E-12	6.232E-12	5.323E-12	4.699E-12	4.206E-12	3.833E-12
SE	8.197E-11	3.845E-11	2.380E-11	1.291E-11	8.444E-12	6.421E-12	5.171E-12	4.403E-12	3.887E-12	3.475E-12	3.183E-12
SSE	7.438E-11	3.460E-11	2.147E-11	1.163E-11	9.941E-12	2.015E-11	1.913E-11	1.418E-11	1.073E-11	7.424E-12	5.631E-12
S	5.735E-11	2.640E-11	1.617E-11	8.597E-12	5.701E-12	5.069E-12	7.181E-12	9.852E-12	9.158E-12	7.359E-12	5.944E-12
SSW	4.793E-11	2.206E-11	1.351E-11	7.166E-12	4.757E-12	4.190E-12	4.211E-12	4.727E-12	6.495E-12	5.983E-12	5.108E-12
SW	1.277E-10	5.875E-11	3.573E-11	1.821E-11	1.147E-11	8.171E-12	6.310E-12	5.609E-12	5.635E-12	4.878E-12	4.113E-12
WSW	1.239E-10	5.634E-11	3.370E-11	1.868E-11	1.395E-11	1.193E-11	8.926E-12	6.830E-12	5.323E-12	4.255E-12	3.504E-12
W	1.318E-10	6.028E-11	3.950E-11	3.013E-11	1.939E-11	1.321E-11	9.685E-12	7.286E-12	5.670E-12	4.530E-12	3.698E-12
WNW	1.453E-10	6.670E-11	5.189E-11	3.731E-11	2.311E-11	1.601E-11	1.157E-11	8.703E-12	6.771E-12	5.409E-12	4.416E-12
NW	1.353E-10	6.230E-11	4.100E-11	3.548E-11	2.398E-11	1.572E-11	1.102E-11	8.303E-12	6.449E-12	5.155E-12	4.211E-12
NNW	1.056E-10	4.865E-11	3.939E-11	3.506E-11	2.147E-11	1.393E-11	1.005E-11	7.564E-12	5.886E-12	4.701E-12	3.837E-12

Table 2.7-103 Annual Average D/Q Values for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Segment Boundaries in Miles									
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	6.596E-09	1.621E-09	4.762E-10	2.281E-10	1.344E-10	5.494E-11	3.282E-11	1.817E-11	9.158E-12	5.686E-12
NNE	1.382E-08	3.345E-09	9.764E-10	4.631E-10	2.712E-10	1.080E-10	3.302E-11	1.479E-11	9.440E-12	7.340E-12
NE	1.178E-08	2.589E-09	7.130E-10	3.309E-10	1.916E-10	7.580E-11	2.323E-11	1.057E-11	7.081E-12	6.535E-12
ENE	7.203E-09	1.613E-09	4.490E-10	2.110E-10	1.234E-10	4.958E-11	1.568E-11	7.501E-12	5.215E-12	4.469E-12
E	6.379E-09	1.451E-09	4.055E-10	1.916E-10	1.126E-10	4.557E-11	1.454E-11	6.986E-12	4.752E-12	3.678E-12
ESE	7.006E-09	1.590E-09	4.438E-10	2.097E-10	1.232E-10	4.991E-11	1.595E-11	7.728E-12	5.345E-12	4.214E-12
SE	5.884E-09	1.330E-09	3.698E-10	1.745E-10	1.026E-10	4.161E-11	1.334E-11	6.461E-12	4.426E-12	3.489E-12
SSE	5.435E-09	1.216E-09	3.387E-10	1.594E-10	9.330E-11	3.760E-11	1.307E-11	1.702E-11	1.428E-11	7.740E-12
S	4.295E-09	9.558E-10	2.654E-10	1.241E-10	7.216E-11	2.873E-11	8.994E-12	6.082E-12	8.824E-12	7.368E-12
SSW	3.582E-09	8.000E-10	2.220E-10	1.037E-10	6.033E-11	2.401E-11	7.506E-12	4.350E-12	5.253E-12	5.811E-12
SW	6.359E-09	1.775E-09	5.583E-10	2.711E-10	1.601E-10	6.383E-11	1.911E-11	8.305E-12	5.819E-12	4.819E-12
WSW	6.920E-09	1.795E-09	5.419E-10	2.591E-10	1.532E-10	6.128E-11	1.991E-11	1.127E-11	6.855E-12	4.294E-12
W	8.185E-09	2.063E-09	6.031E-10	2.841E-10	1.657E-10	6.694E-11	2.744E-11	1.345E-11	7.356E-12	4.560E-12
WNW	9.080E-09	2.279E-09	6.603E-10	3.117E-10	1.824E-10	7.758E-11	3.424E-11	1.613E-11	8.787E-12	5.445E-12
NW	8.617E-09	2.140E-09	6.139E-10	2.897E-10	1.697E-10	6.905E-11	3.159E-11	1.604E-11	8.373E-12	5.189E-12
NNW	6.809E-09	1.600E-09	4.587E-10	2.184E-10	1.297E-10	5.719E-11	2.998E-11	1.438E-11	7.634E-12	4.732E-12

Table 2.7-104 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m³)											
Distance in Miles from the Site											
Sector	**0.25**	**0.5**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	2.201E-06	7.406E-07	4.177E-07	2.335E-07	1.153E-07	7.323E-08	5.214E-08	3.971E-08	3.164E-08	2.604E-08	2.209E-08
NNE	4.384E-06	1.491E-06	8.431E-07	4.603E-07	2.169E-07	1.335E-07	9.317E-08	6.999E-08	5.630E-08	4.687E-08	3.947E-08
NE	6.279E-06	2.172E-06	1.227E-06	6.467E-07	2.789E-07	1.622E-07	1.094E-07	8.056E-08	6.285E-08	5.106E-08	4.273E-08
ENE	3.470E-06	1.266E-06	7.259E-07	3.856E-07	1.707E-07	1.026E-07	7.140E-08	5.407E-08	4.321E-08	3.583E-08	3.053E-08
E	2.338E-06	9.151E-07	5.385E-07	2.882E-07	1.281E-07	7.707E-08	5.369E-08	4.068E-08	3.252E-08	2.697E-08	2.299E-08
ESE	2.623E-06	1.018E-06	5.898E-07	3.125E-07	1.366E-07	8.125E-08	5.613E-08	4.230E-08	3.370E-08	2.790E-08	2.376E-08
SE	2.306E-06	8.907E-07	5.144E-07	2.726E-07	1.189E-07	7.060E-08	4.875E-08	3.674E-08	2.928E-08	2.424E-08	2.064E-08
SSE	2.739E-06	9.777E-07	5.517E-07	2.912E-07	1.274E-07	7.564E-08	5.197E-08	3.887E-08	3.071E-08	2.520E-08	2.127E-08
S	2.821E-06	9.464E-07	5.235E-07	2.752E-07	1.197E-07	7.059E-08	4.811E-08	3.571E-08	2.803E-08	2.288E-08	1.923E-08
SSW	2.205E-06	7.580E-07	4.273E-07	2.272E-07	1.003E-07	5.973E-08	4.112E-08	3.079E-08	2.434E-08	1.998E-08	1.686E-08
SW	1.297E-06	4.751E-07	2.927E-07	1.795E-07	9.708E-08	6.307E-08	4.485E-08	3.382E-08	2.659E-08	2.159E-08	1.797E-08
WSW	1.299E-06	4.660E-07	2.781E-07	1.644E-07	8.402E-08	5.278E-08	3.675E-08	2.733E-08	2.128E-08	1.716E-08	1.435E-08
W	1.811E-06	6.138E-07	3.526E-07	2.011E-07	9.778E-08	5.999E-08	4.129E-08	3.052E-08	2.370E-08	1.908E-08	1.579E-08
WNW	2.106E-06	6.937E-07	3.857E-07	2.186E-07	1.080E-07	6.724E-08	4.682E-08	3.493E-08	2.733E-08	2.214E-08	1.843E-08
NW	2.088E-06	6.839E-07	3.671E-07	2.023E-07	9.803E-08	6.078E-08	4.232E-08	3.162E-08	2.479E-08	2.013E-08	1.686E-08
NNW	2.006E-06	6.514E-07	3.496E-07	1.901E-07	9.111E-08	5.674E-08	3.987E-08	3.010E-08	2.383E-08	1.953E-08	1.658E-08

Table 2.7-104 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	1.910E-08	1.187E-08	8.698E-09	5.886E-09	4.463E-09	3.575E-09	2.941E-09	2.446E-09	2.058E-09	1.764E-09	1.537E-09
NNE	3.395E-08	1.970E-08	1.373E-08	8.609E-09	6.170E-09	4.760E-09	3.850E-09	3.219E-09	2.757E-09	2.406E-09	2.131E-09
NE	3.663E-08	2.175E-08	1.556E-08	1.024E-08	7.650E-09	6.119E-09	5.114E-09	4.406E-09	3.881E-09	3.476E-09	3.156E-09
ENE	2.661E-08	1.686E-08	1.258E-08	8.741E-09	6.775E-09	5.576E-09	4.771E-09	4.193E-09	3.758E-09	3.419E-09	3.148E-09
E	2.006E-08	1.258E-08	9.287E-09	6.322E-09	4.800E-09	3.866E-09	3.234E-09	2.778E-09	2.434E-09	2.164E-09	1.948E-09
ESE	2.074E-08	1.318E-08	9.878E-09	6.930E-09	5.408E-09	4.465E-09	3.822E-09	3.354E-09	2.998E-09	2.717E-09	2.489E-09
SE	1.801E-08	1.145E-08	8.561E-09	5.968E-09	4.631E-09	3.809E-09	3.253E-09	2.851E-09	2.547E-09	2.310E-09	2.119E-09
SSE	1.838E-08	1.158E-08	8.712E-09	6.301E-09	5.162E-09	4.508E-09	4.077E-09	3.757E-09	3.492E-09	3.252E-09	3.023E-09
S	1.654E-08	1.006E-08	7.361E-09	5.053E-09	3.934E-09	3.277E-09	2.846E-09	2.541E-09	2.311E-09	2.129E-09	1.980E-09
SSW	1.456E-08	8.902E-09	6.482E-09	4.355E-09	3.295E-09	2.662E-09	2.243E-09	1.945E-09	1.723E-09	1.551E-09	1.413E-09
SW	1.527E-08	8.546E-09	5.769E-09	3.444E-09	2.382E-09	1.787E-09	1.413E-09	1.159E-09	9.769E-10	8.403E-10	7.346E-10
WSW	1.226E-08	6.802E-09	4.579E-09	2.732E-09	1.892E-09	1.422E-09	1.126E-09	9.239E-10	7.781E-10	6.684E-10	5.829E-10
W	1.336E-08	7.676E-09	5.319E-09	3.327E-09	2.383E-09	1.821E-09	1.439E-09	1.170E-09	9.776E-10	8.350E-10	7.256E-10
WNW	1.568E-08	9.327E-09	6.666E-09	4.417E-09	3.300E-09	2.561E-09	2.022E-09	1.651E-09	1.386E-09	1.189E-09	1.037E-09
NW	1.443E-08	8.538E-09	6.074E-09	3.992E-09	2.999E-09	2.400E-09	1.979E-09	1.653E-09	1.394E-09	1.199E-09	1.048E-09
NNW	1.438E-08	8.993E-09	6.673E-09	4.634E-09	3.562E-09	2.835E-09	2.275E-09	1.864E-09	1.569E-09	1.349E-09	1.178E-09

Table 2.7-104 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	4.076E-07	1.229E-07	5.279E-08	3.181E-08	2.215E-08	1.207E-08	5.879E-09	3.558E-09	2.439E-09	1.767E-09
NNE	8.168E-07	2.339E-07	9.466E-08	5.662E-08	3.962E-08	2.021E-08	8.663E-09	4.772E-09	3.223E-09	2.408E-09
NE	1.179E-06	3.088E-07	1.119E-07	6.342E-08	4.294E-08	2.231E-08	1.027E-08	6.126E-09	4.408E-09	3.477E-09
ENE	6.947E-07	1.882E-07	7.278E-08	4.350E-08	3.065E-08	1.712E-08	8.720E-09	5.574E-09	4.192E-09	3.419E-09
E	5.110E-07	1.410E-07	5.472E-08	3.274E-08	2.308E-08	1.278E-08	6.304E-09	3.862E-09	2.777E-09	2.164E-09
ESE	5.617E-07	1.511E-07	5.730E-08	3.395E-08	2.387E-08	1.339E-08	6.909E-09	4.459E-09	3.352E-09	2.716E-09
SE	4.905E-07	1.316E-07	4.977E-08	2.949E-08	2.073E-08	1.162E-08	5.950E-09	3.806E-09	2.850E-09	2.309E-09
SSE	5.306E-07	1.408E-07	5.304E-08	3.094E-08	2.137E-08	1.182E-08	6.331E-09	4.510E-09	3.748E-09	3.238E-09
S	5.071E-07	1.324E-07	4.914E-08	2.826E-08	1.931E-08	1.030E-08	5.068E-09	3.280E-09	2.540E-09	2.128E-09
SSW	4.119E-07	1.105E-07	4.195E-08	2.452E-08	1.693E-08	9.083E-09	4.357E-09	2.663E-09	1.946E-09	1.551E-09
SW	2.829E-07	1.003E-07	4.530E-08	2.675E-08	1.804E-08	8.805E-09	3.489E-09	1.796E-09	1.162E-09	8.416E-10
WSW	2.693E-07	8.799E-08	3.726E-08	2.144E-08	1.441E-08	7.026E-09	2.769E-09	1.429E-09	9.261E-10	6.692E-10
W	3.433E-07	1.039E-07	4.197E-08	2.388E-08	1.586E-08	7.892E-09	3.350E-09	1.818E-09	1.173E-09	8.367E-10
WNW	3.799E-07	1.144E-07	4.751E-08	2.752E-08	1.851E-08	9.556E-09	4.420E-09	2.543E-09	1.656E-09	1.191E-09
NW	3.642E-07	1.046E-07	4.296E-08	2.497E-08	1.693E-08	8.752E-09	4.013E-09	2.391E-09	1.647E-09	1.201E-09
NNW	3.458E-07	9.784E-08	4.046E-08	2.398E-08	1.664E-08	9.158E-09	4.611E-09	2.805E-09	1.869E-09	1.351E-09

Table 2.7-105 Annual Average χ/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

Annual Average χ/Q (sec/m^3)											
Distance in Miles from the Site											
Sector	**0.25**	**0.5**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	2.200E-06	7.400E-07	4.172E-07	2.331E-07	1.150E-07	7.299E-08	5.193E-08	3.951E-08	3.145E-08	2.587E-08	2.192E-08
NNE	4.382E-06	1.489E-06	8.420E-07	4.595E-07	2.164E-07	1.331E-07	9.282E-08	6.967E-08	5.600E-08	4.659E-08	3.920E-08
NE	6.277E-06	2.170E-06	1.225E-06	6.457E-07	2.782E-07	1.616E-07	1.089E-07	8.018E-08	6.251E-08	5.075E-08	4.244E-08
ENE	3.468E-06	1.265E-06	7.248E-07	3.848E-07	1.702E-07	1.022E-07	7.106E-08	5.377E-08	4.293E-08	3.557E-08	3.028E-08
E	2.337E-06	9.142E-07	5.377E-07	2.876E-07	1.277E-07	7.677E-08	5.343E-08	4.044E-08	3.230E-08	2.677E-08	2.279E-08
ESE	2.622E-06	1.017E-06	5.890E-07	3.118E-07	1.362E-07	8.093E-08	5.586E-08	4.205E-08	3.347E-08	2.769E-08	2.356E-08
SE	2.305E-06	8.898E-07	5.136E-07	2.720E-07	1.185E-07	7.031E-08	4.851E-08	3.652E-08	2.908E-08	2.406E-08	2.046E-08
SSE	2.737E-06	9.767E-07	5.509E-07	2.906E-07	1.270E-07	7.535E-08	5.173E-08	3.865E-08	3.051E-08	2.502E-08	2.110E-08
S	2.820E-06	9.455E-07	5.228E-07	2.747E-07	1.194E-07	7.033E-08	4.789E-08	3.552E-08	2.786E-08	2.272E-08	1.907E-08
SSW	2.204E-06	7.573E-07	4.267E-07	2.268E-07	1.000E-07	5.952E-08	4.094E-08	3.062E-08	2.419E-08	1.984E-08	1.673E-08
SW	1.296E-06	4.747E-07	2.923E-07	1.792E-07	9.686E-08	6.288E-08	4.468E-08	3.367E-08	2.645E-08	2.146E-08	1.785E-08
WSW	1.298E-06	4.656E-07	2.777E-07	1.641E-07	8.385E-08	5.263E-08	3.663E-08	2.722E-08	2.118E-08	1.706E-08	1.427E-08
W	1.810E-06	6.134E-07	3.522E-07	2.008E-07	9.759E-08	5.983E-08	4.115E-08	3.039E-08	2.358E-08	1.897E-08	1.569E-08
WNW	2.105E-06	6.931E-07	3.853E-07	2.182E-07	1.077E-07	6.704E-08	4.664E-08	3.477E-08	2.718E-08	2.201E-08	1.830E-08
NW	2.087E-06	6.833E-07	3.666E-07	2.019E-07	9.779E-08	6.059E-08	4.215E-08	3.147E-08	2.465E-08	2.001E-08	1.674E-08
NNW	2.005E-06	6.508E-07	3.491E-07	1.898E-07	9.088E-08	5.655E-08	3.970E-08	2.995E-08	2.369E-08	1.940E-08	1.646E-08

Table 2.7-105 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

	Annual Average X/Q (sec/m³)										
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	1.894E-08	1.172E-08	8.547E-09	5.728E-09	4.299E-09	3.408E-09	2.774E-09	2.283E-09	1.901E-09	1.614E-09	1.393E-09
NNE	3.369E-08	1.947E-08	1.351E-08	8.401E-09	5.969E-09	4.565E-09	3.661E-09	3.034E-09	2.576E-09	2.229E-09	1.957E-09
NE	3.635E-08	2.150E-08	1.532E-08	1.000E-08	7.406E-09	5.873E-09	4.865E-09	4.153E-09	3.624E-09	3.216E-09	2.891E-09
ENE	2.637E-08	1.663E-08	1.235E-08	8.495E-09	6.517E-09	5.307E-09	4.492E-09	3.904E-09	3.461E-09	3.114E-09	2.834E-09
E	1.987E-08	1.240E-08	9.105E-09	6.131E-09	4.605E-09	3.667E-09	3.033E-09	2.576E-09	2.232E-09	1.962E-09	1.746E-09
ESE	2.054E-08	1.298E-08	9.682E-09	6.719E-09	5.184E-09	4.232E-09	3.581E-09	3.106E-09	2.743E-09	2.457E-09	2.225E-09
SE	1.784E-08	1.128E-08	8.398E-09	5.795E-09	4.450E-09	3.621E-09	3.059E-09	2.652E-09	2.343E-09	2.101E-09	1.906E-09
SSE	1.822E-08	1.142E-08	8.557E-09	6.131E-09	4.973E-09	4.298E-09	3.846E-09	3.505E-09	3.221E-09	2.966E-09	2.725E-09
S	1.639E-08	9.931E-09	7.233E-09	4.921E-09	3.797E-09	3.134E-09	2.697E-09	2.385E-09	2.149E-09	1.961E-09	1.806E-09
SSW	1.443E-08	8.789E-09	6.373E-09	4.244E-09	3.183E-09	2.548E-09	2.127E-09	1.828E-09	1.604E-09	1.429E-09	1.289E-09
SW	1.515E-08	8.446E-09	5.678E-09	3.361E-09	2.304E-09	1.714E-09	1.343E-09	1.092E-09	9.120E-10	7.774E-10	6.736E-10
WSW	1.217E-08	6.731E-09	4.514E-09	2.674E-09	1.839E-09	1.372E-09	1.078E-09	8.781E-10	7.342E-10	6.260E-10	5.419E-10
W	1.327E-08	7.596E-09	5.245E-09	3.258E-09	2.316E-09	1.757E-09	1.379E-09	1.113E-09	9.236E-10	7.835E-10	6.760E-10
WNW	1.556E-08	9.221E-09	6.565E-09	4.316E-09	3.198E-09	2.462E-09	1.929E-09	1.563E-09	1.302E-09	1.108E-09	9.590E-10
NW	1.432E-08	8.438E-09	5.980E-09	3.902E-09	2.910E-09	2.312E-09	1.893E-09	1.570E-09	1.315E-09	1.123E-09	9.745E-10
NNW	1.426E-08	8.880E-09	6.560E-09	4.515E-09	3.440E-09	2.713E-09	2.158E-09	1.752E-09	1.462E-09	1.246E-09	1.080E-09

Table 2.7-105 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	4.071E-07	1.226E-07	5.258E-08	3.163E-08	2.199E-08	1.191E-08	5.719E-09	3.392E-09	2.278E-09	1.617E-09
NNE	8.159E-07	2.334E-07	9.431E-08	5.632E-08	3.935E-08	1.998E-08	8.456E-09	4.578E-09	3.039E-09	2.231E-09
NE	1.178E-06	3.081E-07	1.115E-07	6.308E-08	4.264E-08	2.205E-08	1.003E-08	5.879E-09	4.155E-09	3.217E-09
ENE	6.937E-07	1.877E-07	7.244E-08	4.322E-08	3.040E-08	1.689E-08	8.472E-09	5.304E-09	3.903E-09	3.113E-09
E	5.102E-07	1.406E-07	5.446E-08	3.252E-08	2.289E-08	1.259E-08	6.114E-09	3.664E-09	2.576E-09	1.962E-09
ESE	5.609E-07	1.507E-07	5.702E-08	3.372E-08	2.366E-08	1.320E-08	6.695E-09	4.226E-09	3.104E-09	2.456E-09
SE	4.898E-07	1.312E-07	4.953E-08	2.929E-08	2.055E-08	1.146E-08	5.776E-09	3.617E-09	2.651E-09	2.101E-09
SSE	5.298E-07	1.404E-07	5.280E-08	3.074E-08	2.119E-08	1.166E-08	6.156E-09	4.297E-09	3.494E-09	2.952E-09
S	5.064E-07	1.321E-07	4.893E-08	2.809E-08	1.916E-08	1.017E-08	4.935E-09	3.136E-09	2.384E-09	1.959E-09
SSW	4.113E-07	1.102E-07	4.177E-08	2.437E-08	1.680E-08	8.969E-09	4.246E-09	2.549E-09	1.828E-09	1.429E-09
SW	2.826E-07	1.001E-07	4.513E-08	2.661E-08	1.792E-08	8.706E-09	3.406E-09	1.723E-09	1.095E-09	7.788E-10
WSW	2.690E-07	8.782E-08	3.713E-08	2.134E-08	1.432E-08	6.955E-09	2.712E-09	1.379E-09	8.804E-10	6.269E-10
W	3.430E-07	1.037E-07	4.183E-08	2.377E-08	1.577E-08	7.813E-09	3.281E-09	1.755E-09	1.117E-09	7.852E-10
WNW	3.794E-07	1.142E-07	4.733E-08	2.738E-08	1.839E-08	9.449E-09	4.319E-09	2.445E-09	1.568E-09	1.110E-09
NW	3.638E-07	1.044E-07	4.279E-08	2.483E-08	1.681E-08	8.653E-09	3.923E-09	2.304E-09	1.565E-09	1.125E-09
NNW	3.453E-07	9.760E-08	4.029E-08	2.384E-08	1.651E-08	9.044E-09	4.492E-09	2.685E-09	1.758E-09	1.249E-09

Table 2.7-106 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

	Annual Average X/Q (sec/m³)										
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	2.100E-06	6.859E-07	3.794E-07	2.108E-07	1.038E-07	6.583E-08	4.678E-08	3.555E-08	2.824E-08	2.318E-08	1.962E-08
NNE	4.171E-06	1.376E-06	7.631E-07	4.131E-07	1.934E-07	1.185E-07	8.241E-08	6.168E-08	4.956E-08	4.121E-08	3.460E-08
NE	5.946E-06	1.996E-06	1.105E-06	5.742E-07	2.430E-07	1.397E-07	9.347E-08	6.845E-08	5.317E-08	4.303E-08	3.590E-08
ENE	3.288E-06	1.170E-06	6.586E-07	3.453E-07	1.507E-07	9.000E-08	6.249E-08	4.727E-08	3.776E-08	3.132E-08	2.668E-08
E	2.217E-06	8.506E-07	4.923E-07	2.603E-07	1.141E-07	6.828E-08	4.747E-08	3.594E-08	2.872E-08	2.382E-08	2.030E-08
ESE	2.488E-06	9.466E-07	5.394E-07	2.821E-07	1.215E-07	7.168E-08	4.934E-08	3.711E-08	2.954E-08	2.445E-08	2.081E-08
SE	2.187E-06	8.283E-07	4.703E-07	2.460E-07	1.056E-07	6.221E-08	4.280E-08	3.220E-08	2.564E-08	2.122E-08	1.807E-08
SSE	2.595E-06	9.033E-07	5.004E-07	2.606E-07	1.121E-07	6.601E-08	4.513E-08	3.363E-08	2.650E-08	2.170E-08	1.828E-08
S	2.672E-06	8.699E-07	4.717E-07	2.446E-07	1.045E-07	6.091E-08	4.119E-08	3.040E-08	2.376E-08	1.932E-08	1.618E-08
SSW	2.088E-06	6.971E-07	3.851E-07	2.021E-07	8.778E-08	5.185E-08	3.552E-08	2.651E-08	2.090E-08	1.713E-08	1.443E-08
SW	1.238E-06	4.410E-07	2.686E-07	1.653E-07	8.976E-08	5.821E-08	4.122E-08	3.091E-08	2.417E-08	1.951E-08	1.615E-08
WSW	1.241E-06	4.331E-07	2.549E-07	1.508E-07	7.707E-08	4.823E-08	3.341E-08	2.469E-08	1.911E-08	1.531E-08	1.275E-08
W	1.727E-06	5.682E-07	3.211E-07	1.824E-07	8.826E-08	5.383E-08	3.680E-08	2.702E-08	2.084E-08	1.667E-08	1.372E-08
WNW	2.017E-06	6.461E-07	3.527E-07	1.991E-07	9.796E-08	6.072E-08	4.204E-08	3.118E-08	2.426E-08	1.955E-08	1.618E-08
NW	2.004E-06	6.395E-07	3.367E-07	1.843E-07	8.878E-08	5.474E-08	3.789E-08	2.815E-08	2.194E-08	1.772E-08	1.477E-08
NNW	1.919E-06	6.061E-07	3.185E-07	1.718E-07	8.178E-08	5.071E-08	3.549E-08	2.668E-08	2.104E-08	1.718E-08	1.455E-08

Table 2.7-106 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15**	**20**	**25**	**30**	**35**	**40**	**45**	**50**
N	1.694E-08	1.048E-08	7.645E-09	5.142E-09	3.843E-09	2.946E-09	2.319E-09	1.867E-09	1.526E-09	1.273E-09	1.082E-09
NNE	2.968E-08	1.701E-08	1.172E-08	7.221E-09	5.101E-09	3.888E-09	3.112E-09	2.576E-09	2.178E-09	1.879E-09	1.644E-09
NE	3.069E-08	1.810E-08	1.288E-08	8.413E-09	6.250E-09	4.981E-09	4.151E-09	3.567E-09	3.122E-09	2.781E-09	2.508E-09
ENE	2.325E-08	1.477E-08	1.102E-08	7.657E-09	5.928E-09	4.874E-09	4.165E-09	3.655E-09	3.256E-09	2.947E-09	2.694E-09
E	1.771E-08	1.111E-08	8.190E-09	5.551E-09	4.193E-09	3.360E-09	2.797E-09	2.391E-09	2.084E-09	1.844E-09	1.651E-09
ESE	1.816E-08	1.155E-08	8.657E-09	6.066E-09	4.724E-09	3.893E-09	3.324E-09	2.910E-09	2.593E-09	2.343E-09	2.140E-09
SE	1.576E-08	1.003E-08	7.502E-09	5.221E-09	4.042E-09	3.317E-09	2.826E-09	2.471E-09	2.198E-09	1.983E-09	1.806E-09
SSE	1.577E-08	9.948E-09	7.494E-09	5.448E-09	4.493E-09	3.949E-09	3.590E-09	3.296E-09	2.991E-09	2.712E-09	2.454E-09
S	1.388E-08	8.403E-09	6.126E-09	4.196E-09	3.269E-09	2.730E-09	2.378E-09	2.128E-09	1.931E-09	1.773E-09	1.632E-09
SSW	1.243E-08	7.588E-09	5.510E-09	3.685E-09	2.779E-09	2.240E-09	1.884E-09	1.631E-09	1.435E-09	1.285E-09	1.162E-09
SW	1.365E-08	7.475E-09	4.954E-09	2.871E-09	1.938E-09	1.426E-09	1.109E-09	8.945E-10	7.408E-10	6.274E-10	5.398E-10
WSW	1.084E-08	5.877E-09	3.881E-09	2.246E-09	1.519E-09	1.119E-09	8.678E-10	6.921E-10	5.650E-10	4.707E-10	3.987E-10
W	1.154E-08	6.511E-09	4.445E-09	2.717E-09	1.866E-09	1.360E-09	1.035E-09	8.132E-10	6.589E-10	5.467E-10	4.623E-10
WNW	1.370E-08	8.038E-09	5.683E-09	3.692E-09	2.622E-09	1.946E-09	1.481E-09	1.169E-09	9.520E-10	7.934E-10	6.736E-10
NW	1.258E-08	7.330E-09	5.149E-09	3.330E-09	2.449E-09	1.878E-09	1.484E-09	1.200E-09	9.822E-10	8.212E-10	6.992E-10
NNW	1.258E-08	7.832E-09	5.786E-09	3.990E-09	2.935E-09	2.221E-09	1.719E-09	1.363E-09	1.113E-09	9.296E-10	7.910E-10

Table 2.7-106 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	**0.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	3.725E-07	1.107E-07	4.737E-08	2.840E-08	1.968E-08	1.065E-08	5.121E-09	2.935E-09	1.866E-09	1.277E-09
NNE	7.437E-07	2.089E-07	8.376E-08	4.984E-08	3.474E-08	1.748E-08	7.279E-09	3.901E-09	2.578E-09	1.881E-09
NE	1.067E-06	2.707E-07	9.578E-08	5.367E-08	3.608E-08	1.858E-08	8.445E-09	4.987E-09	3.564E-09	2.781E-09
ENE	6.331E-07	1.670E-07	6.374E-08	3.802E-08	2.679E-08	1.499E-08	7.637E-09	4.872E-09	3.649E-09	2.945E-09
E	4.688E-07	1.262E-07	4.841E-08	2.892E-08	2.039E-08	1.128E-08	5.534E-09	3.357E-09	2.390E-09	1.843E-09
ESE	5.155E-07	1.350E-07	5.041E-08	2.976E-08	2.091E-08	1.173E-08	6.046E-09	3.887E-09	2.908E-09	2.342E-09
SE	4.502E-07	1.175E-07	4.374E-08	2.583E-08	1.815E-08	1.018E-08	5.204E-09	3.314E-09	2.468E-09	1.981E-09
SSE	4.833E-07	1.246E-07	4.610E-08	2.671E-08	1.837E-08	1.015E-08	5.478E-09	3.950E-09	3.264E-09	2.699E-09
S	4.592E-07	1.162E-07	4.213E-08	2.397E-08	1.626E-08	8.608E-09	4.213E-09	2.733E-09	2.124E-09	1.767E-09
SSW	3.731E-07	9.722E-08	3.627E-08	2.107E-08	1.449E-08	7.741E-09	3.688E-09	2.241E-09	1.629E-09	1.284E-09
SW	2.610E-07	9.252E-08	4.163E-08	2.432E-08	1.622E-08	7.726E-09	2.919E-09	1.436E-09	8.971E-10	6.286E-10
WSW	2.482E-07	8.063E-08	3.388E-08	1.926E-08	1.280E-08	6.092E-09	2.286E-09	1.125E-09	6.939E-10	4.719E-10
W	3.144E-07	9.387E-08	3.743E-08	2.102E-08	1.379E-08	6.711E-09	2.723E-09	1.365E-09	8.178E-10	5.487E-10
WNW	3.496E-07	1.039E-07	4.268E-08	2.444E-08	1.626E-08	8.249E-09	3.659E-09	1.940E-09	1.175E-09	7.960E-10
NW	3.362E-07	9.487E-08	3.849E-08	2.211E-08	1.483E-08	7.528E-09	3.343E-09	1.873E-09	1.198E-09	8.237E-10
NNW	3.172E-07	8.797E-08	3.602E-08	2.118E-08	1.460E-08	7.978E-09	3.920E-09	2.211E-09	1.369E-09	9.325E-10

Table 2.7-107 Annual Average D/Q Values for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 1 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distances in Miles										
Sector	**0.25**	**0.50**	**0.75**	**1**	**1.5**	**2**	**2.5**	**3**	**3.5**	**4**	**4.5**
N	2.322E-08	1.111E-08	6.853E-09	3.611E-09	1.379E-09	7.339E-10	4.555E-10	3.107E-10	2.257E-10	1.714E-10	1.347E-10
NNE	5.010E-08	2.258E-08	1.354E-08	7.118E-09	2.730E-09	1.457E-09	9.061E-10	6.186E-10	4.530E-10	3.476E-10	2.725E-10
NE	6.121E-08	2.429E-08	1.354E-08	6.723E-09	2.451E-09	1.251E-09	7.538E-10	5.032E-10	3.598E-10	2.703E-10	2.107E-10
ENE	3.019E-08	1.357E-08	7.927E-09	4.002E-09	1.453E-09	7.468E-10	4.525E-10	3.038E-10	2.184E-10	1.649E-10	1.291E-10
E	2.414E-08	1.163E-08	6.950E-09	3.538E-09	1.283E-09	6.618E-10	4.022E-10	2.707E-10	1.951E-10	1.476E-10	1.159E-10
ESE	2.671E-08	1.288E-08	7.696E-09	3.914E-09	1.417E-09	7.300E-10	4.433E-10	2.983E-10	2.149E-10	1.626E-10	1.276E-10
SE	2.176E-08	1.069E-08	6.415E-09	3.260E-09	1.175E-09	6.045E-10	3.666E-10	2.465E-10	1.776E-10	1.344E-10	1.055E-10
SSE	2.277E-08	1.030E-08	6.030E-09	3.044E-09	1.103E-09	5.668E-10	3.433E-10	2.304E-10	1.657E-10	1.251E-10	9.798E-11
S	2.165E-08	8.836E-09	4.987E-09	2.491E-09	9.095E-10	4.660E-10	2.815E-10	1.884E-10	1.350E-10	1.015E-10	7.926E-11
SSW	1.841E-08	7.440E-09	4.173E-09	2.081E-09	7.613E-10	3.901E-10	2.357E-10	1.577E-10	1.129E-10	8.493E-11	6.627E-11
SW	1.715E-08	8.392E-09	5.677E-09	3.243E-09	1.365E-09	7.678E-10	4.932E-10	3.435E-10	2.525E-10	1.930E-10	1.520E-10
WSW	2.025E-08	9.844E-09	6.443E-09	3.517E-09	1.416E-09	7.714E-10	4.853E-10	3.336E-10	2.434E-10	1.852E-10	1.498E-10
W	2.787E-08	1.351E-08	8.102E-09	4.448E-09	1.741E-09	9.184E-10	5.645E-10	3.820E-10	2.758E-10	2.085E-10	1.632E-10
WNW	2.820E-08	1.463E-08	9.352E-09	4.883E-09	1.865E-09	9.836E-10	6.058E-10	4.111E-10	2.976E-10	2.257E-10	1.772E-10
NW	2.596E-08	1.394E-08	8.683E-09	4.622E-09	1.725E-09	9.056E-10	5.569E-10	3.779E-10	2.738E-10	2.080E-10	1.636E-10
NNW	2.224E-08	1.136E-08	7.031E-09	3.653E-09	1.354E-09	7.097E-10	4.361E-10	2.958E-10	2.143E-10	1.627E-10	1.292E-10

Table 2.7-107 Annual Average D/Q Values for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 2 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distances in Miles										
Sector	5	7.5	10	15	20	25	30	35	40	45	50
N	1.086E-10	5.232E-11	3.223E-11	1.741E-11	2.664E-11	2.025E-11	1.314E-11	9.403E-12	7.323E-12	5.855E-12	4.783E-12
NNE	2.194E-10	1.037E-10	6.323E-11	3.323E-11	2.124E-11	1.531E-11	1.184E-11	9.588E-12	7.997E-12	6.846E-12	5.991E-12
NE	1.690E-10	7.830E-11	4.806E-11	2.525E-11	1.598E-11	1.153E-11	9.038E-12	7.483E-12	6.416E-12	5.628E-12	5.068E-12
ENE	1.041E-10	4.895E-11	3.029E-11	1.621E-11	1.040E-11	7.738E-12	6.287E-12	5.387E-12	4.752E-12	4.262E-12	3.922E-12
E	9.359E-11	4.431E-11	2.751E-11	1.482E-11	9.493E-12	7.090E-12	5.515E-12	4.418E-12	3.620E-12	3.018E-12	2.554E-12
ESE	1.031E-10	4.880E-11	3.031E-11	1.633E-11	1.047E-11	7.835E-12	6.117E-12	4.929E-12	4.067E-12	3.416E-12	3.104E-12
SE	8.528E-11	4.047E-11	2.515E-11	1.360E-11	8.742E-12	6.551E-12	5.220E-12	4.369E-12	3.836E-12	3.472E-12	3.186E-12
SSE	7.899E-11	3.719E-11	2.302E-11	1.238E-11	8.078E-12	5.937E-12	7.790E-12	1.267E-11	1.174E-11	9.306E-12	7.244E-12
S	6.367E-11	2.958E-11	1.822E-11	9.658E-12	6.160E-12	4.495E-12	3.559E-12	2.976E-12	3.582E-12	3.866E-12	5.308E-12
SSW	5.320E-11	2.473E-11	1.522E-11	8.024E-12	5.105E-12	3.722E-12	2.944E-12	2.467E-12	2.148E-12	2.029E-12	2.158E-12
SW	1.225E-10	5.866E-11	3.567E-11	1.871E-11	1.177E-11	8.328E-12	6.301E-12	4.985E-12	4.081E-12	3.432E-12	2.980E-12
WSW	1.206E-10	5.709E-11	3.432E-11	1.783E-11	1.131E-11	8.048E-12	7.466E-12	7.044E-12	5.680E-12	4.603E-12	3.747E-12
W	1.313E-10	6.159E-11	3.735E-11	2.432E-11	1.986E-11	1.381E-11	9.800E-12	7.404E-12	5.763E-12	4.604E-12	3.758E-12
WNW	1.430E-10	6.886E-11	4.172E-11	3.502E-11	2.473E-11	1.628E-11	1.173E-11	8.833E-12	6.872E-12	5.490E-12	4.482E-12
NW	1.323E-10	6.351E-11	3.934E-11	2.124E-11	2.325E-11	1.739E-11	1.235E-11	8.593E-12	6.668E-12	5.329E-12	4.354E-12
NNW	1.044E-10	4.982E-11	3.078E-11	2.296E-11	2.358E-11	1.464E-11	1.021E-11	7.713E-12	6.001E-12	4.793E-12	3.913E-12

Table 2.7-107 Annual Average D/Q Values for Mixed-Mode Release from the Turbine Building Stack (Based on 2001-2007 met data) (Sheet 3 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Segment Boundaries in Miles									
Sector	0.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	6.359E-09	1.588E-09	4.718E-10	2.293E-10	1.359E-10	5.591E-11	2.481E-11	1.911E-11	9.679E-12	5.893E-12
NNE	1.270E-08	3.140E-09	9.381E-10	4.601E-10	2.751E-10	1.114E-10	3.457E-11	1.550E-11	9.624E-12	6.870E-12
NE	1.290E-08	2.867E-09	7.862E-10	3.667E-10	2.129E-10	8.502E-11	2.620E-11	1.172E-11	7.521E-12	5.654E-12
ENE	7.437E-09	1.706E-09	4.715E-10	2.224E-10	1.304E-10	5.291E-11	1.676E-11	7.868E-12	5.402E-12	4.281E-12
E	6.473E-09	1.508E-09	4.188E-10	1.986E-10	1.170E-10	4.779E-11	1.527E-11	7.101E-12	4.428E-12	3.024E-12
ESE	7.167E-09	1.667E-09	4.617E-10	2.188E-10	1.289E-10	5.264E-11	1.683E-11	7.851E-12	4.940E-12	3.494E-12
SE	5.963E-09	1.385E-09	3.820E-10	1.808E-10	1.066E-10	4.362E-11	1.401E-11	6.603E-12	4.409E-12	3.474E-12
SSE	5.653E-09	1.296E-09	3.578E-10	1.687E-10	9.898E-11	4.018E-11	1.283E-11	7.249E-12	1.092E-11	9.262E-12
S	4.733E-09	1.064E-09	2.934E-10	1.375E-10	8.009E-11	3.211E-11	1.000E-11	4.564E-12	3.373E-12	4.316E-12
SSW	3.969E-09	8.896E-10	2.457E-10	1.150E-10	6.696E-11	2.683E-11	8.325E-12	3.780E-12	2.482E-12	2.112E-12
SW	5.198E-09	1.517E-09	5.065E-10	2.558E-10	1.532E-10	6.263E-11	1.939E-11	8.435E-12	5.017E-12	3.457E-12
WSW	5.899E-09	1.596E-09	5.009E-10	2.470E-10	1.495E-10	6.109E-11	1.860E-11	8.684E-12	6.645E-12	4.605E-12
W	7.679E-09	1.977E-09	5.859E-10	2.805E-10	1.648E-10	6.631E-11	2.523E-11	1.382E-11	7.464E-12	4.634E-12
WNW	8.539E-09	2.144E-09	6.287E-10	3.026E-10	1.789E-10	7.327E-11	3.193E-11	1.671E-11	8.913E-12	5.526E-12
NW	8.045E-09	2.005E-09	5.783E-10	2.785E-10	1.651E-10	6.805E-11	2.616E-11	1.694E-11	8.933E-12	5.365E-12
NNW	6.492E-09	1.578E-09	4.529E-10	2.179E-10	1.300E-10	5.349E-11	2.497E-11	1.525E-11	7.775E-12	4.825E-12

Table 2.7-108 Nearest Residence X/Q and D/Q Factors for Ground-Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	2.8E-06	2.8E-06	2.4E-06	1.2E-08
NE	3.0E-06	2.9E-06	2.5E-06	1.1E-08
SSE	6.1E-06	6.1E-06	5.4E-06	1.8E-08
SSW	3.5E-06	3.5E-06	3.1E-06	1.3E-08
SW	2.0E-06	2.0E-06	1.8E-06	1.1E-08
WSW	1.0E-06	1.0E-06	8.8E-07	7.3E-09
W	1.7E-06	1.7E-06	1.5E-06	1.2E-08
NW	5.3E-06	5.3E-06	4.8E-06	3.1E-08
NNW	1.5E-06	1.5E-06	1.3E-06	7.0E-09

Table 2.7-109 Nearest Residence X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	3.3E-07	3.3E-07	3.0E-07	4.8E-09
NE	3.0E-07	3.0E-07	2.8E-07	5.0E-09
SSE	2.7E-07	2.7E-07	2.5E-07	5.9E-09
SSW	2.2E-07	2.2E-07	2.0E-07	4.1E-09
SW	2.4E-07	2.4E-07	2.3E-07	4.7E-09
WSW	1.8E-07	1.8E-07	1.7E-07	3.7E-09
W	2.7E-07	2.7E-07	2.5E-07	6.0E-09
NW	4.7E-07	4.7E-07	4.4E-07	1.2E-08
NNW	1.6E-07	1.6E-07	1.5E-07	2.9E-09

Table 2.7-110 Nearest Residence X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	3.1E-07	3.1E-07	2.8E-07	4.5E-09
NE	2.6E-07	2.6E-07	2.4E-07	4.2E-09
SSE	2.7E-07	2.7E-07	2.5E-07	5.3E-09
SSW	2.2E-07	2.2E-07	2.0E-07	3.7E-09
SW	2.1E-07	2.1E-07	1.9E-07	4.0E-09
WSW	1.5E-07	1.5E-07	1.4E-07	3.2E-09
W	2.5E-07	2.5E-07	2.3E-07	5.9E-09
NW	5.1E-07	5.1E-07	4.7E-07	1.2E-08
NNW	1.6E-07	1.6E-07	1.4E-07	2.9E-09

Table 2.7-111 Nearest Garden X/Q and D/Q Factors for Ground-Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
N	4.4E-07	4.3E-07	3.6E-07	1.5E-09
NNE	8.4E-07	8.4E-07	6.9E-07	3.2E-09
NE	8.9E-07	8.8E-07	7.3E-07	3.1E-09
S	1.8E-06	1.8E-06	1.5E-06	5.7E-09
WSW	2.0E-07	2.0E-07	1.7E-07	1.3E-09
W	5.4E-07	5.4E-07	4.6E-07	3.7E-09
NW	5.3E-06	5.3E-06	4.8E-06	3.1E-08
NNW	2.0E-06	2.0E-06	1.7E-06	9.0E-09

Table 2.7-112 Nearest Garden χ/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted χ/Q (sec/m^3)	2.26 Day Decay, Undepleted χ/Q (sec/m^3)	8.0 Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
N	7.4E-08	7.3E-08	6.8E-08	6.0E-10
NNE	1.4E-07	1.4E-07	1.3E-07	1.4E-09
NE	1.4E-07	1.4E-07	1.3E-07	1.6E-09
S	1.4E-07	1.4E-07	1.3E-07	2.1E-09
WSW	6.0E-08	6.0E-08	5.5E-08	8.1E-10
W	1.2E-07	1.2E-07	1.1E-07	2.1E-09
NW	4.7E-07	4.7E-07	4.4E-07	1.2E-08
NNW	1.9E-07	1.9E-07	1.8E-07	3.7E-09

Table 2.7-113 Nearest Garden Χ/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted Χ/Q (sec/m^3)	2.26 Day Decay, Undepleted Χ/Q (sec/m^3)	8.0 Day Decay, Depleted Χ/Q (sec/m^3)	D/Q (m^{-2})
N	6.2E-08	6.2E-08	5.6E-08	5.9E-10
NNE	1.3E-07	1.3E-07	1.1E-07	1.4E-09
NE	1.2E-07	1.2E-07	1.1E-07	1.4E-09
S	1.4E-07	1.3E-07	1.2E-07	1.9E-09
WSW	5.1E-08	5.1E-08	4.6E-08	7.3E-10
W	1.1E-07	1.1E-07	9.8E-08	2.0E-09
NW	5.0E-07	5.0E-07	4.7E-07	1.1E-08
NNW	1.9E-07	1.9E-07	1.7E-07	3.7E-09

Table 2.7-114 Nearest Sheep X/Q and D/Q Factors for Ground Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	1.9E-07	1.8E-07	1.4E-07	5.7E-10
NNW	8.1E-08	8.0E-08	6.1E-08	2.6E-10

Table 2.7-115 Nearest Sheep X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.8E-08	4.7E-08	4.3E-08	2.8E-10
NNW	2.0E-08	2.0E-08	1.8E-08	1.4E-10

Table 2.7-116 Nearest Sheep X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.1E-08	4.0E-08	3.6E-08	2.8E-10
NNW	1.7E-08	1.7E-08	1.5E-08	1.4E-10

Table 2.7-117 Nearest Meat Cow X/Q and D/Q Factors for Ground Level Release (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	1.9E-07	1.8E-07	1.4E-07	5.7E-10
NNW	1.7E-07	1.7E-07	1.4E-07	6.4E-10

Table 2.7-118 Nearest Meat Cow χ/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted χ/Q (sec/m^3)	2.26 Day Decay, Undepleted χ/Q (sec/m^3)	8.0 Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.8E-08	4.7E-08	4.3E-08	2.8E-10
NNW	3.6E-08	3.6E-08	3.3E-08	3.1E-10

Table 2.7-119 Nearest Meat Cow X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 2002-2007 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.1E-08	4.0E-08	3.6E-08	2.8E-10
NNW	3.1E-08	3.1E-08	2.7E-08	3.1E-10

Table 2.7-120 Site Boundary X/Q and D/Q Factors for Ground-Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
N	9.50E-06	9.50E-06	8.60E-06	4.00E-08
NNE	6.10E-06	6.00E-06	5.40E-06	2.70E-08
NE	2.60E-06	2.60E-06	2.20E-06	1.20E-08
SSE	1.10E-05	1.10E-05	9.90E-06	3.50E-08
S	7.20E-06	7.20E-06	6.50E-06	2.40E-08
SSW	4.00E-06	4.00E-06	3.60E-06	1.70E-08
SW	2.40E-06	2.30E-06	2.10E-06	1.80E-08
WSW	2.40E-06	2.40E-06	2.10E-06	1.60E-08
W	5.50E-06	5.50E-06	5.00E-06	3.20E-08
WNW	8.90E-06	8.90E-06	8.10E-06	4.40E-08
NW	1.00E-05	1.00E-05	9.50E-06	4.90E-08
NNW	9.60E-06	9.60E-06	8.80E-06	4.00E-08

Table 2.7-121 Site Boundary X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
N	7.20E-07	7.20E-07	6.60E-07	1.10E-08
NNE	6.70E-07	6.70E-07	6.10E-07	9.80E-09
NE	3.50E-07	3.50E-07	3.20E-07	5.40E-09
SSE	5.20E-07	5.20E-07	4.80E-07	1.00E-08
S	4.20E-07	4.20E-07	3.80E-07	7.00E-09
SSW	2.80E-07	2.80E-07	2.60E-07	5.60E-09
SW	3.80E-07	3.80E-07	3.60E-07	8.40E-09
WSW	3.30E-07	3.30E-07	3.00E-07	6.90E-09
W	5.60E-07	5.60E-07	5.20E-07	1.20E-08
WNW	7.80E-07	7.80E-07	7.30E-07	1.50E-08
NW	8.70E-07	8.70E-07	8.10E-07	1.50E-08
NNW	7.10E-07	7.10E-07	6.60E-07	1.00E-08

Table 2.7-122 Site Boundary χ/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted χ/Q (sec/m^3)	2.26 Day Decay, Undepleted χ/Q (sec/m^3)	8.0 Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
N	8.10E-07	8.10E-07	7.40E-07	9.90E-09
NNE	7.20E-07	7.10E-07	6.40E-07	9.20E-09
NE	3.30E-07	3.30E-07	3.00E-07	4.70E-09
SSE	5.80E-07	5.80E-07	5.30E-07	8.50E-09
S	4.80E-07	4.80E-07	4.40E-07	6.00E-09
SSW	2.90E-07	2.90E-07	2.60E-07	4.70E-09
SW	3.40E-07	3.40E-07	3.10E-07	7.50E-09
WSW	3.10E-07	3.10E-07	2.80E-07	5.90E-09
W	6.20E-07	6.20E-07	5.70E-07	1.10E-08
WNW	8.60E-07	8.60E-07	8.00E-07	1.40E-08
NW	9.60E-07	9.60E-07	8.90E-07	1.40E-08
NNW	8.30E-07	8.30E-07	7.60E-07	9.40E-09

Table 2.7-123 Nearest Residence X/Q and D/Q Factors for Ground-Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	2.50E-06	2.50E-06	2.20E-06	1.10E-08
NE	2.20E-06	2.20E-06	1.90E-06	1.00E-08
SSE	6.00E-06	5.90E-06	5.30E-06	1.90E-08
SSW	2.40E-06	2.40E-06	2.20E-06	1.10E-08
SW	1.70E-06	1.70E-06	1.50E-06	1.30E-08
WSW	9.10E-07	9.10E-07	8.00E-07	6.10E-09
W	1.70E-06	1.70E-06	1.50E-06	1.10E-08
NW	7.00E-06	7.00E-06	6.30E-06	3.40E-08
NNW	1.60E-06	1.60E-06	1.40E-06	7.00E-09

Table 2.7-124 Nearest Residence X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	3.60E-07	3.60E-07	3.30E-07	4.50E-09
NE	3.20E-07	3.20E-07	2.90E-07	4.60E-09
SSE	3.60E-07	3.60E-07	3.30E-07	6.50E-09
SSW	2.10E-07	2.10E-07	2.00E-07	3.90E-09
SW	3.20E-07	3.20E-07	3.00E-07	6.60E-09
WSW	1.80E-07	1.80E-07	1.70E-07	3.20E-09
W	2.80E-07	2.80E-07	2.60E-07	4.90E-09
NW	6.80E-07	6.80E-07	6.30E-07	1.20E-08
NNW	2.40E-07	2.40E-07	2.20E-07	2.80E-09

Table 2.7-125 Nearest Residence X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	3.60E-07	3.60E-07	3.20E-07	4.10E-09
NE	2.90E-07	2.90E-07	2.60E-07	4.10E-09
SSE	3.70E-07	3.70E-07	3.40E-07	5.60E-09
SSW	2.00E-07	2.00E-07	1.90E-07	3.40E-09
SW	2.80E-07	2.80E-07	2.50E-07	5.90E-09
WSW	1.60E-07	1.60E-07	1.40E-07	2.80E-09
W	2.70E-07	2.70E-07	2.40E-07	4.90E-09
NW	7.20E-07	7.20E-07	6.60E-07	1.10E-08
NNW	2.20E-07	2.20E-07	2.00E-07	2.50E-09

Table 2.7-126 Nearest Garden χ/Q and D/Q Factors for Ground-Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted χ/Q (sec/m^3)	2.26 Day Decay, Undepleted χ/Q (sec/m^3)	8.0 Day Decay, Depleted χ/Q (sec/m^3)	D/Q (m^{-2})
N	4.30E-07	4.30E-07	3.50E-07	1.70E-09
NNE	7.50E-07	7.40E-07	6.20E-07	3.00E-09
NE	6.60E-07	6.50E-07	5.40E-07	2.80E-09
S	1.50E-06	1.50E-06	1.30E-06	5.30E-09
WSW	1.80E-07	1.80E-07	1.50E-07	1.10E-09
W	5.40E-07	5.30E-07	4.60E-07	3.20E-09
NW	7.00E-06	7.00E-06	6.30E-06	3.40E-08
NNW	2.10E-06	2.10E-06	1.80E-06	9.00E-09

Table 2.7-127 Nearest Garden Χ/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted Χ/Q (sec/m^3)	2.26 Day Decay, Undepleted Χ/Q (sec/m^3)	8.0 Day Decay, Depleted Χ/Q (sec/m^3)	D/Q (m^{-2})
N	9.80E-08	9.80E-08	9.00E-08	7.50E-10
NNE	1.50E-07	1.50E-07	1.40E-07	1.40E-09
NE	1.40E-07	1.40E-07	1.30E-07	1.40E-09
S	1.50E-07	1.50E-07	1.40E-07	2.00E-09
WSW	5.60E-08	5.60E-08	5.10E-08	7.20E-10
W	1.30E-07	1.20E-07	1.20E-07	1.80E-09
NW	6.80E-07	6.80E-07	6.30E-07	1.20E-08
NNW	2.80E-07	2.80E-07	2.60E-07	3.50E-09

Table 2.7-128 Nearest Garden X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
N	8.60E-08	8.60E-08	7.70E-08	7.20E-10
NNE	1.40E-07	1.40E-07	1.20E-07	1.30E-09
NE	1.20E-07	1.20E-07	1.10E-07	1.30E-09
S	1.50E-07	1.50E-07	1.30E-07	1.70E-09
WSW	4.90E-08	4.90E-08	4.40E-08	6.50E-10
W	1.10E-07	1.10E-07	1.00E-07	1.70E-09
NW	7.10E-07	7.10E-07	6.50E-07	1.10E-08
NNW	2.70E-07	2.60E-07	2.40E-07	3.10E-09

Table 2.7-129 Nearest Sheep Χ/Q and D/Q Factors for Ground Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted Χ/Q (sec/m^3)	2.26 Day Decay, Undepleted Χ/Q (sec/m^3)	8.0 Day Decay, Depleted Χ/Q (sec/m^3)	D/Q (m^{-2})
NNE	1.60E-07	1.60E-07	1.20E-07	5.30E-10
NNW	8.40E-08	8.20E-08	6.30E-08	2.70E-10

Table 2.7-130 Nearest Sheep X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.80E-08	4.80E-08	4.30E-08	2.70E-10
NNW	2.60E-08	2.50E-08	2.30E-08	1.50E-10

Table 2.7-131 Nearest Sheep X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.30E-08	4.30E-08	3.80E-08	2.70E-10
NNW	2.30E-08	2.30E-08	2.00E-08	1.50E-10

Table 2.7-132 Nearest Goat X/Q and D/Q Factors for Ground Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	3.00E-07	3.00E-07	2.40E-07	1.40E-09
NNW	1.70E-07	1.70E-07	1.40E-07	6.20E-10

Table 2.7-133 Nearest Goat X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	7.70E-08	7.70E-08	7.00E-08	8.10E-10
NNW	4.70E-08	4.60E-08	4.20E-08	3.30E-10

Table 2.7-134 Nearest Goat X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	6.90E-08	6.90E-08	6.10E-08	7.70E-10
NNW	4.20E-08	4.20E-08	3.70E-08	3.20E-10

Table 2.7-135 Nearest Meat Cow X/Q and D/Q Factors for Ground Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	1.60E-07	1.60E-07	1.20E-07	5.30E-10
NNW	1.80E-07	1.80E-07	1.40E-07	6.40E-10

Table 2.7-136 Nearest Meat Cow X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.80E-08	4.80E-08	4.30E-08	2.70E-10
NNW	4.80E-08	4.70E-08	4.30E-08	3.40E-10

Table 2.7-137 Nearest Meat Cow X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
NNE	4.30E-08	4.30E-08	3.80E-08	2.70E-10
NNW	4.30E-08	4.20E-08	3.80E-08	3.30E-10

Table 2.7-138 Nearest Milk Cow X/Q and D/Q Factors for Ground Level Release (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	3.40E-07	3.30E-07	2.80E-07	1.60E-09
NW	1.30E-07	1.30E-07	1.00E-07	5.20E-10

Table 2.7-139 Nearest Milk Cow X/Q and D/Q Factors for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	8.40E-08	8.40E-08	7.70E-08	9.10E-10
NW	3.90E-08	3.90E-08	3.50E-08	3.20E-10

Table 2.7-140 Nearest Milk Cow X/Q and D/Q Factors for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data)

Sector	No Decay, Undepleted X/Q (sec/m^3)	2.26 Day Decay, Undepleted X/Q (sec/m^3)	8.0 Day Decay, Depleted X/Q (sec/m^3)	D/Q (m^{-2})
WNW	7.60E-08	7.50E-08	6.80E-08	8.70E-10
NW	3.50E-08	3.50E-08	3.10E-08	3.10E-10

Table 2.7-141 Annual Average Χ/Q Values (no Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 1 of 3)

Annual Average Χ/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	4.021E-05	1.175E-05	5.764E-06	2.745E-06	1.028E-06	5.364E-07	3.321E-07	2.280E-07	1.677E-07	1.295E-07	1.037E-07
NNE	6.006E-05	1.753E-05	8.587E-06	4.091E-06	1.535E-06	8.031E-07	4.984E-07	3.429E-07	2.527E-07	1.954E-07	1.568E-07
NE	8.615E-05	2.517E-05	1.225E-05	5.855E-06	2.217E-06	1.171E-06	7.330E-07	5.081E-07	3.768E-07	2.932E-07	2.365E-07
ENE	9.240E-05	2.698E-05	1.312E-05	6.270E-06	2.378E-06	1.257E-06	7.879E-07	5.466E-07	4.058E-07	3.160E-07	2.550E-07
E	9.619E-05	2.802E-05	1.359E-05	6.498E-06	2.467E-06	1.306E-06	8.192E-07	5.689E-07	4.227E-07	3.294E-07	2.660E-07
ESE	9.470E-05	2.751E-05	1.330E-05	6.365E-06	2.420E-06	1.284E-06	8.065E-07	5.609E-07	4.172E-07	3.255E-07	2.631E-07
SE	7.865E-05	2.288E-05	1.108E-05	5.299E-06	2.014E-06	1.067E-06	6.699E-07	4.656E-07	3.462E-07	2.699E-07	2.181E-07
SSE	7.415E-05	2.158E-05	1.044E-05	4.999E-06	1.902E-06	1.009E-06	6.339E-07	4.409E-07	3.280E-07	2.559E-07	2.069E-07
S	5.040E-05	1.469E-05	7.117E-06	3.407E-06	1.297E-06	6.879E-07	4.322E-07	3.006E-07	2.236E-07	1.745E-07	1.410E-07
SSW	2.980E-05	8.719E-06	4.249E-06	2.030E-06	7.686E-07	4.059E-07	2.540E-07	1.760E-07	1.305E-07	1.016E-07	8.188E-08
SW	2.008E-05	5.786E-06	2.832E-06	1.344E-06	4.978E-07	2.570E-07	1.576E-07	1.073E-07	7.830E-08	6.005E-08	4.779E-08
WSW	1.497E-05	4.322E-06	2.112E-06	1.003E-06	3.728E-07	1.932E-07	1.188E-07	8.113E-08	5.936E-08	4.564E-08	3.640E-08
W	1.858E-05	5.364E-06	2.619E-06	1.245E-06	4.642E-07	2.415E-07	1.491E-07	1.021E-07	7.493E-08	5.776E-08	4.618E-08
WNW	2.835E-05	8.196E-06	3.995E-06	1.901E-06	7.111E-07	3.711E-07	2.298E-07	1.578E-07	1.161E-07	8.969E-08	7.186E-08
NW	3.307E-05	9.562E-06	4.656E-06	2.216E-06	8.295E-07	4.331E-07	2.684E-07	1.844E-07	1.357E-07	1.049E-07	8.405E-08
NNW	3.047E-05	8.888E-06	4.350E-06	2.074E-06	7.779E-07	4.067E-07	2.522E-07	1.734E-07	1.276E-07	9.867E-08	7.909E-08

Table 2.7-141 Annual Average X/Q Values (no Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	8.544E-08	4.325E-08	2.779E-08	1.579E-08	1.064E-08	7.853E-09	6.137E-09	4.987E-09	4.170E-09	3.563E-09	3.097E-09
NNE	1.293E-07	6.584E-08	4.248E-08	2.429E-08	1.644E-08	1.218E-08	9.542E-09	7.773E-09	6.513E-09	5.576E-09	4.854E-09
NE	1.960E-07	1.017E-07	6.658E-08	3.882E-08	2.663E-08	1.993E-08	1.575E-08	1.292E-08	1.089E-08	9.375E-09	8.200E-09
ENE	2.115E-07	1.100E-07	7.212E-08	4.216E-08	2.897E-08	2.171E-08	1.718E-08	1.411E-08	1.190E-08	1.025E-08	8.973E-09
E	2.208E-07	1.152E-07	7.566E-08	4.437E-08	3.056E-08	2.295E-08	1.818E-08	1.495E-08	1.263E-08	1.089E-08	9.542E-09
ESE	2.186E-07	1.145E-07	7.544E-08	4.443E-08	3.070E-08	2.311E-08	1.835E-08	1.512E-08	1.279E-08	1.104E-08	9.686E-09
SE	1.811E-07	9.470E-08	6.231E-08	3.663E-08	2.527E-08	1.900E-08	1.507E-08	1.241E-08	1.049E-08	9.051E-09	7.935E-09
SSE	1.719E-07	8.999E-08	5.928E-08	3.489E-08	2.410E-08	1.813E-08	1.439E-08	1.185E-08	1.003E-08	8.655E-09	7.591E-09
S	1.172E-07	6.129E-08	4.035E-08	2.373E-08	1.637E-08	1.231E-08	9.763E-09	8.036E-09	6.794E-09	5.862E-09	5.139E-09
SSW	6.787E-08	3.520E-08	2.302E-08	1.341E-08	9.193E-09	6.877E-09	5.433E-09	4.455E-09	3.755E-09	3.231E-09	2.825E-09
SW	3.915E-08	1.941E-08	1.228E-08	6.823E-09	4.531E-09	3.307E-09	2.561E-09	2.065E-09	1.715E-09	1.457E-09	1.260E-09
WSW	2.989E-08	1.493E-08	9.506E-09	5.335E-09	3.569E-09	2.620E-09	2.039E-09	1.651E-09	1.376E-09	1.173E-09	1.017E-09
W	3.799E-08	1.915E-08	1.227E-08	6.948E-09	4.678E-09	3.451E-09	2.697E-09	2.191E-09	1.832E-09	1.566E-09	1.361E-09
WNW	5.923E-08	3.006E-08	1.937E-08	1.106E-08	7.487E-09	5.549E-09	4.351E-09	3.547E-09	2.974E-09	2.548E-09	2.220E-09
NW	6.930E-08	3.522E-08	2.271E-08	1.299E-08	8.807E-09	6.534E-09	5.128E-09	4.184E-09	3.510E-09	3.009E-09	2.622E-09
NNW	6.520E-08	3.310E-08	2.132E-08	1.216E-08	8.217E-09	6.079E-09	4.760E-09	3.875E-09	3.245E-09	2.777E-09	2.416E-09

Table 2.7-141 Annual Average X/Q Values (no Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment										
Segment Boundaries in Miles from the Site										
Sector	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	5.752E-06	1.191E-06	3.449E-07	1.704E-07	1.046E-07	4.575E-08	1.617E-08	7.910E-09	5.004E-09	3.570E-09
NNE	8.576E-06	1.778E-06	5.175E-07	2.567E-07	1.581E-07	6.957E-08	2.484E-08	1.226E-08	7.799E-09	5.586E-09
NE	1.228E-05	2.561E-06	7.599E-07	3.825E-07	2.383E-07	1.071E-07	3.957E-08	2.004E-08	1.296E-08	9.390E-09
ENE	1.315E-05	2.745E-06	8.166E-07	4.118E-07	2.569E-07	1.157E-07	4.295E-08	2.183E-08	1.414E-08	1.027E-08
E	1.364E-05	2.847E-06	8.489E-07	4.289E-07	2.680E-07	1.211E-07	4.519E-08	2.307E-08	1.499E-08	1.091E-08
ESE	1.338E-05	2.792E-06	8.355E-07	4.233E-07	2.651E-07	1.203E-07	4.522E-08	2.323E-08	1.515E-08	1.106E-08
SE	1.113E-05	2.323E-06	6.941E-07	3.513E-07	2.198E-07	9.951E-08	3.729E-08	1.910E-08	1.244E-08	9.064E-09
SSE	1.050E-05	2.193E-06	6.567E-07	3.328E-07	2.085E-07	9.454E-08	3.551E-08	1.823E-08	1.188E-08	8.668E-09
S	7.150E-06	1.495E-06	4.478E-07	2.269E-07	1.421E-07	6.440E-08	2.415E-08	1.237E-08	8.057E-09	5.870E-09
SSW	4.256E-06	8.877E-07	2.633E-07	1.325E-07	8.252E-08	3.704E-08	1.367E-08	6.917E-09	4.468E-09	3.236E-09
SW	2.827E-06	5.788E-07	1.640E-07	7.963E-08	4.823E-08	2.063E-08	7.016E-09	3.335E-09	2.073E-09	1.460E-09
WSW	2.110E-06	4.331E-07	1.236E-07	6.035E-08	3.673E-08	1.584E-08	5.477E-09	2.640E-09	1.657E-09	1.175E-09
W	2.618E-06	5.386E-07	1.549E-07	7.615E-08	4.658E-08	2.028E-08	7.121E-09	3.477E-09	2.199E-09	1.569E-09
WNW	3.998E-06	8.243E-07	2.387E-07	1.180E-07	7.246E-08	3.179E-08	1.132E-08	5.587E-09	3.559E-09	2.553E-09
NW	4.662E-06	9.615E-07	2.787E-07	1.379E-07	8.476E-08	3.724E-08	1.329E-08	6.578E-09	4.197E-09	3.014E-09
NNW	4.347E-06	9.010E-07	2.619E-07	1.297E-07	7.975E-08	3.500E-08	1.244E-08	6.122E-09	3.888E-09	2.782E-09

Table 2.7-142 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 1 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	4.017E-05	1.172E-05	5.746E-06	2.734E-06	1.021E-06	5.319E-07	3.286E-07	2.252E-07	1.652E-07	1.273E-07	1.018E-07
NNE	6.000E-05	1.750E-05	8.564E-06	4.076E-06	1.527E-06	7.974E-07	4.940E-07	3.393E-07	2.495E-07	1.927E-07	1.543E-07
NE	8.607E-05	2.513E-05	1.222E-05	5.833E-06	2.205E-06	1.163E-06	7.263E-07	5.025E-07	3.721E-07	2.890E-07	2.326E-07
ENE	9.231E-05	2.692E-05	1.308E-05	6.246E-06	2.364E-06	1.248E-06	7.803E-07	5.403E-07	4.003E-07	3.111E-07	2.505E-07
E	9.608E-05	2.796E-05	1.354E-05	6.468E-06	2.450E-06	1.294E-06	8.097E-07	5.610E-07	4.158E-07	3.233E-07	2.605E-07
ESE	9.460E-05	2.745E-05	1.326E-05	6.337E-06	2.405E-06	1.272E-06	7.976E-07	5.535E-07	4.108E-07	3.198E-07	2.579E-07
SE	7.855E-05	2.282E-05	1.104E-05	5.274E-06	1.999E-06	1.057E-06	6.618E-07	4.589E-07	3.403E-07	2.647E-07	2.134E-07
SSE	7.407E-05	2.153E-05	1.041E-05	4.976E-06	1.889E-06	9.999E-07	6.268E-07	4.350E-07	3.229E-07	2.513E-07	2.027E-07
S	5.034E-05	1.465E-05	7.093E-06	3.391E-06	1.288E-06	6.817E-07	4.273E-07	2.965E-07	2.201E-07	1.713E-07	1.382E-07
SSW	2.977E-05	8.700E-06	4.235E-06	2.021E-06	7.636E-07	4.024E-07	2.512E-07	1.737E-07	1.285E-07	9.979E-08	8.028E-08
SW	2.006E-05	5.776E-06	2.825E-06	1.340E-06	4.953E-07	2.553E-07	1.563E-07	1.062E-07	7.738E-08	5.924E-08	4.706E-08
WSW	1.496E-05	4.314E-06	2.107E-06	1.000E-06	3.709E-07	1.918E-07	1.178E-07	8.029E-08	5.864E-08	4.500E-08	3.583E-08
W	1.856E-05	5.354E-06	2.611E-06	1.240E-06	4.616E-07	2.396E-07	1.477E-07	1.009E-07	7.393E-08	5.687E-08	4.538E-08
WNW	2.832E-05	8.181E-06	3.983E-06	1.893E-06	7.071E-07	3.683E-07	2.276E-07	1.560E-07	1.146E-07	8.834E-08	7.064E-08
NW	3.304E-05	9.546E-06	4.644E-06	2.209E-06	8.253E-07	4.302E-07	2.661E-07	1.825E-07	1.341E-07	1.034E-07	8.276E-08
NNW	3.044E-05	8.871E-06	4.337E-06	2.066E-06	7.733E-07	4.035E-07	2.497E-07	1.713E-07	1.259E-07	9.709E-08	7.767E-08

Table 2.7-142 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	8.365E-08	4.190E-08	2.664E-08	1.483E-08	9.793E-09	7.088E-09	5.434E-09	4.334E-09	3.558E-09	2.986E-09	2.550E-09
NNE	1.270E-07	6.410E-08	4.100E-08	2.303E-08	1.532E-08	1.115E-08	8.596E-09	6.886E-09	5.676E-09	4.780E-09	4.095E-09
NE	1.925E-07	9.899E-08	6.420E-08	3.677E-08	2.478E-08	1.823E-08	1.416E-08	1.142E-08	9.470E-09	8.017E-09	6.899E-09
ENE	2.074E-07	1.068E-07	6.936E-08	3.977E-08	2.681E-08	1.971E-08	1.531E-08	1.234E-08	1.022E-08	8.646E-09	7.433E-09
E	2.157E-07	1.112E-07	7.223E-08	4.140E-08	2.789E-08	2.048E-08	1.589E-08	1.279E-08	1.058E-08	8.935E-09	7.671E-09
ESE	2.138E-07	1.108E-07	7.219E-08	4.161E-08	2.815E-08	2.075E-08	1.614E-08	1.303E-08	1.081E-08	9.147E-09	7.869E-09
SE	1.768E-07	9.130E-08	5.936E-08	3.407E-08	2.297E-08	1.688E-08	1.309E-08	1.054E-08	8.724E-09	7.369E-09	6.327E-09
SSE	1.680E-07	8.698E-08	5.665E-08	3.261E-08	2.202E-08	1.621E-08	1.260E-08	1.016E-08	8.411E-09	7.111E-09	6.109E-09
S	1.145E-07	5.923E-08	3.855E-08	2.217E-08	1.497E-08	1.101E-08	8.557E-09	6.900E-09	5.717E-09	4.836E-09	4.158E-09
SSW	6.639E-08	3.405E-08	2.203E-08	1.256E-08	8.423E-09	6.168E-09	4.772E-09	3.834E-09	3.166E-09	2.670E-09	2.290E-09
SW	3.849E-08	1.890E-08	1.185E-08	6.471E-09	4.223E-09	3.029E-09	2.306E-09	1.829E-09	1.494E-09	1.249E-09	1.063E-09
WSW	2.936E-08	1.454E-08	9.169E-09	5.052E-09	3.318E-09	2.392E-09	1.828E-09	1.455E-09	1.192E-09	9.985E-10	8.514E-10
W	3.726E-08	1.859E-08	1.179E-08	6.549E-09	4.325E-09	3.132E-09	2.402E-09	1.918E-09	1.576E-09	1.324E-09	1.132E-09
WNW	5.811E-08	2.922E-08	1.864E-08	1.045E-08	6.947E-09	5.058E-09	3.898E-09	3.124E-09	2.576E-09	2.171E-09	1.861E-09
NW	6.811E-08	3.432E-08	2.194E-08	1.233E-08	8.220E-09	5.997E-09	4.630E-09	3.717E-09	3.070E-09	2.590E-09	2.223E-09
NNW	6.390E-08	3.212E-08	2.048E-08	1.145E-08	7.589E-09	5.509E-09	4.234E-09	3.385E-09	2.785E-09	2.342E-09	2.003E-09

Table 2.7-142 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment										
	Segment Boundaries in Miles from the Site									
Sector	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	5.735E-06	1.184E-06	3.414E-07	1.679E-07	1.026E-07	4.440E-08	1.522E-08	7.147E-09	4.352E-09	2.994E-09
NNE	8.555E-06	1.769E-06	5.130E-07	2.535E-07	1.556E-07	6.782E-08	2.360E-08	1.124E-08	6.914E-09	4.792E-09
NE	1.225E-05	2.548E-06	7.531E-07	3.777E-07	2.344E-07	1.043E-07	3.754E-08	1.835E-08	1.146E-08	8.033E-09
ENE	1.312E-05	2.730E-06	8.089E-07	4.063E-07	2.525E-07	1.125E-07	4.058E-08	1.984E-08	1.238E-08	8.664E-09
E	1.360E-05	2.829E-06	8.394E-07	4.221E-07	2.625E-07	1.171E-07	4.224E-08	2.062E-08	1.283E-08	8.954E-09
ESE	1.334E-05	2.775E-06	8.266E-07	4.169E-07	2.599E-07	1.165E-07	4.242E-08	2.088E-08	1.307E-08	9.165E-09
SE	1.110E-05	2.308E-06	6.860E-07	3.454E-07	2.150E-07	9.610E-08	3.476E-08	1.699E-08	1.058E-08	7.385E-09
SSE	1.047E-05	2.180E-06	6.496E-07	3.276E-07	2.043E-07	9.151E-08	3.325E-08	1.632E-08	1.019E-08	7.125E-09
S	7.128E-06	1.486E-06	4.428E-07	2.234E-07	1.392E-07	6.232E-08	2.261E-08	1.109E-08	6.923E-09	4.846E-09
SSW	4.243E-06	8.825E-07	2.605E-07	1.305E-07	8.091E-08	3.589E-08	1.282E-08	6.211E-09	3.848E-09	2.676E-09
SW	2.821E-06	5.763E-07	1.627E-07	7.870E-08	4.749E-08	2.012E-08	6.667E-09	3.058E-09	1.838E-09	1.253E-09
WSW	2.106E-06	4.311E-07	1.225E-07	5.963E-08	3.615E-08	1.545E-08	5.196E-09	2.413E-09	1.461E-09	1.001E-09
W	2.611E-06	5.359E-07	1.535E-07	7.515E-08	4.578E-08	1.972E-08	6.726E-09	3.158E-09	1.926E-09	1.328E-09
WNW	3.987E-06	8.201E-07	2.365E-07	1.164E-07	7.125E-08	3.094E-08	1.071E-08	5.097E-09	3.136E-09	2.176E-09
NW	4.651E-06	9.571E-07	2.764E-07	1.362E-07	8.346E-08	3.633E-08	1.264E-08	6.043E-09	3.731E-09	2.597E-09
NNW	4.335E-06	8.962E-07	2.593E-07	1.279E-07	7.832E-08	3.401E-08	1.174E-08	5.554E-09	3.399E-09	2.348E-09

Table 2.7-143 Annual Average X/Q Values (8.0 Day Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m³)											
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	3.805E-05	1.072E-05	5.132E-06	2.400E-06	8.712E-07	4.431E-07	2.682E-07	1.805E-07	1.303E-07	9.894E-08	7.799E-08
NNE	5.682E-05	1.600E-05	7.646E-06	3.577E-06	1.302E-06	6.637E-07	4.027E-07	2.716E-07	1.965E-07	1.494E-07	1.180E-07
NE	8.151E-05	2.298E-05	1.091E-05	5.119E-06	1.880E-06	9.677E-07	5.922E-07	4.023E-07	2.930E-07	2.242E-07	1.780E-07
ENE	8.742E-05	2.462E-05	1.168E-05	5.482E-06	2.016E-06	1.039E-06	6.364E-07	4.328E-07	3.154E-07	2.415E-07	1.918E-07
E	9.100E-05	2.557E-05	1.210E-05	5.681E-06	2.091E-06	1.079E-06	6.614E-07	4.501E-07	3.283E-07	2.515E-07	1.999E-07
ESE	8.960E-05	2.511E-05	1.185E-05	5.565E-06	2.052E-06	1.060E-06	6.512E-07	4.438E-07	3.241E-07	2.486E-07	1.978E-07
SE	7.441E-05	2.088E-05	9.863E-06	4.632E-06	1.707E-06	8.812E-07	5.408E-07	3.683E-07	2.688E-07	2.061E-07	1.639E-07
SSE	7.016E-05	1.969E-05	9.299E-06	4.370E-06	1.612E-06	8.333E-07	5.119E-07	3.489E-07	2.548E-07	1.955E-07	1.555E-07
S	4.768E-05	1.340E-05	6.336E-06	2.978E-06	1.099E-06	5.682E-07	3.490E-07	2.379E-07	1.737E-07	1.332E-07	1.060E-07
SSW	2.819E-05	7.957E-06	3.783E-06	1.775E-06	6.516E-07	3.353E-07	2.051E-07	1.393E-07	1.014E-07	7.757E-08	6.156E-08
SW	1.900E-05	5.281E-06	2.522E-06	1.175E-06	4.222E-07	2.124E-07	1.274E-07	8.498E-08	6.089E-08	4.592E-08	3.597E-08
WSW	1.417E-05	3.945E-06	1.881E-06	8.775E-07	3.162E-07	1.596E-07	9.602E-08	6.425E-08	4.616E-08	3.490E-08	2.740E-08
W	1.758E-05	4.896E-06	2.332E-06	1.088E-06	3.936E-07	1.995E-07	1.204E-07	8.084E-08	5.824E-08	4.414E-08	3.474E-08
WNW	2.682E-05	7.481E-06	3.557E-06	1.662E-06	6.029E-07	3.066E-07	1.856E-07	1.249E-07	9.025E-08	6.856E-08	5.407E-08
NW	3.129E-05	8.728E-06	4.146E-06	1.938E-06	7.035E-07	3.580E-07	2.169E-07	1.460E-07	1.055E-07	8.019E-08	6.327E-08
NNW	2.883E-05	8.112E-06	3.873E-06	1.814E-06	6.595E-07	3.360E-07	2.037E-07	1.372E-07	9.920E-08	7.539E-08	5.949E-08

Table 2.7-143 Annual Average X/Q Values (8.0 Day Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	6.330E-08	3.021E-08	1.844E-08	9.640E-09	6.063E-09	4.214E-09	3.120E-09	2.413E-09	1.926E-09	1.575E-09	1.313E-09
NNE	9.591E-08	4.606E-08	2.825E-08	1.487E-08	9.406E-09	6.567E-09	4.881E-09	3.787E-09	3.032E-09	2.487E-09	2.079E-09
NE	1.454E-07	7.116E-08	4.427E-08	2.377E-08	1.523E-08	1.074E-08	8.052E-09	6.291E-09	5.068E-09	4.179E-09	3.509E-09
ENE	1.568E-07	7.691E-08	4.791E-08	2.578E-08	1.654E-08	1.168E-08	8.760E-09	6.849E-09	5.520E-09	4.553E-09	3.825E-09
E	1.635E-07	8.039E-08	5.016E-08	2.704E-08	1.738E-08	1.228E-08	9.215E-09	7.206E-09	5.809E-09	4.791E-09	4.025E-09
ESE	1.619E-07	7.996E-08	5.005E-08	2.711E-08	1.748E-08	1.239E-08	9.320E-09	7.305E-09	5.899E-09	4.875E-09	4.102E-09
SE	1.341E-07	6.606E-08	4.128E-08	2.230E-08	1.435E-08	1.015E-08	7.624E-09	5.966E-09	4.812E-09	3.971E-09	3.337E-09
SSE	1.273E-07	6.283E-08	3.931E-08	2.128E-08	1.371E-08	9.711E-09	7.300E-09	5.718E-09	4.616E-09	3.812E-09	3.206E-09
S	8.676E-08	4.279E-08	2.675E-08	1.447E-08	9.312E-09	6.590E-09	4.951E-09	3.876E-09	3.127E-09	2.581E-09	2.170E-09
SSW	5.027E-08	2.458E-08	1.527E-08	8.182E-09	5.234E-09	3.686E-09	2.757E-09	2.151E-09	1.730E-09	1.424E-09	1.195E-09
SW	2.904E-08	1.358E-08	8.164E-09	4.178E-09	2.592E-09	1.783E-09	1.308E-09	1.005E-09	7.972E-10	6.486E-10	5.383E-10
WSW	2.216E-08	1.045E-08	6.320E-09	3.265E-09	2.040E-09	1.411E-09	1.041E-09	8.025E-10	6.390E-10	5.215E-10	4.340E-10
W	2.816E-08	1.338E-08	8.147E-09	4.246E-09	2.669E-09	1.854E-09	1.373E-09	1.062E-09	8.476E-10	6.935E-10	5.783E-10
WNW	4.391E-08	2.102E-08	1.287E-08	6.763E-09	4.277E-09	2.987E-09	2.220E-09	1.723E-09	1.380E-09	1.133E-09	9.471E-10
NW	5.140E-08	2.465E-08	1.511E-08	7.957E-09	5.041E-09	3.525E-09	2.624E-09	2.039E-09	1.635E-09	1.342E-09	1.123E-09
NNW	4.832E-08	2.314E-08	1.416E-08	7.431E-09	4.688E-09	3.267E-09	2.424E-09	1.878E-09	1.502E-09	1.230E-09	1.027E-09

Table 2.7-143 Annual Average X/Q Values (8.0 Day Decay, Undepleted) for Ground Level Release (Based on 1985-1989 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	5.160E-06	1.021E-06	2.798E-07	1.327E-07	7.876E-08	3.233E-08	1.001E-08	4.270E-09	2.429E-09	1.582E-09
NNE	7.695E-06	1.524E-06	4.198E-07	2.000E-07	1.191E-07	4.922E-08	1.542E-08	6.650E-09	3.812E-09	2.497E-09
NE	1.102E-05	2.194E-06	6.164E-07	2.980E-07	1.796E-07	7.570E-08	2.453E-08	1.086E-08	6.328E-09	4.194E-09
ENE	1.180E-05	2.352E-06	6.623E-07	3.208E-07	1.936E-07	8.177E-08	2.659E-08	1.181E-08	6.889E-09	4.570E-09
E	1.224E-05	2.439E-06	6.881E-07	3.338E-07	2.017E-07	8.542E-08	2.788E-08	1.241E-08	7.248E-09	4.809E-09
ESE	1.200E-05	2.392E-06	6.774E-07	3.296E-07	1.996E-07	8.488E-08	2.793E-08	1.252E-08	7.345E-09	4.892E-09
SE	9.986E-06	1.990E-06	5.626E-07	2.733E-07	1.653E-07	7.016E-08	2.299E-08	1.026E-08	6.000E-09	3.985E-09
SSE	9.417E-06	1.879E-06	5.324E-07	2.591E-07	1.569E-07	6.670E-08	2.192E-08	9.813E-09	5.750E-09	3.826E-09
S	6.414E-06	1.281E-06	3.630E-07	1.766E-07	1.070E-07	4.543E-08	1.491E-08	6.660E-09	3.898E-09	2.591E-09
SSW	3.818E-06	7.606E-07	2.135E-07	1.032E-07	6.212E-08	2.615E-08	8.447E-09	3.727E-09	2.164E-09	1.430E-09
SW	2.537E-06	4.963E-07	1.331E-07	6.207E-08	3.635E-08	1.461E-08	4.359E-09	1.809E-09	1.012E-09	6.518E-10
WSW	1.894E-06	3.713E-07	1.003E-07	4.704E-08	2.768E-08	1.122E-08	3.400E-09	1.431E-09	8.083E-10	5.239E-10
W	2.349E-06	4.617E-07	1.257E-07	5.933E-08	3.509E-08	1.434E-08	4.412E-09	1.879E-09	1.069E-09	6.965E-10
WNW	3.587E-06	7.065E-07	1.936E-07	9.190E-08	5.460E-08	2.248E-08	7.015E-09	3.024E-09	1.735E-09	1.137E-09
NW	4.183E-06	8.242E-07	2.262E-07	1.074E-07	6.389E-08	2.635E-08	8.250E-09	3.569E-09	2.052E-09	1.348E-09
NNW	3.900E-06	7.722E-07	2.124E-07	1.010E-07	6.007E-08	2.474E-08	7.707E-09	3.308E-09	1.891E-09	1.236E-09

Table 2.7-144 Annual Average D/Q Values for Ground Level Release (Based on 1985-1989 met data) (Sheet 1 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	1.437E-07	4.859E-08	2.495E-08	1.186E-08	4.261E-09	2.113E-09	1.244E-09	8.146E-10	5.732E-10	4.248E-10	3.274E-10
NNE	2.233E-07	7.550E-08	3.877E-08	1.843E-08	6.620E-09	3.283E-09	1.933E-09	1.266E-09	8.907E-10	6.601E-10	5.087E-10
NE	2.287E-07	7.732E-08	3.970E-08	1.887E-08	6.779E-09	3.362E-09	1.980E-09	1.296E-09	9.121E-10	6.760E-10	5.209E-10
ENE	2.089E-07	7.064E-08	3.627E-08	1.724E-08	6.194E-09	3.072E-09	1.809E-09	1.184E-09	8.333E-10	6.175E-10	4.759E-10
E	1.918E-07	6.487E-08	3.331E-08	1.584E-08	5.688E-09	2.821E-09	1.661E-09	1.088E-09	7.653E-10	5.672E-10	4.371E-10
ESE	1.839E-07	6.218E-08	3.192E-08	1.518E-08	5.452E-09	2.704E-09	1.592E-09	1.042E-09	7.335E-10	5.436E-10	4.189E-10
SE	1.554E-07	5.256E-08	2.698E-08	1.283E-08	4.608E-09	2.285E-09	1.346E-09	8.811E-10	6.200E-10	4.595E-10	3.541E-10
SSE	1.428E-07	4.828E-08	2.479E-08	1.178E-08	4.233E-09	2.099E-09	1.236E-09	8.094E-10	5.695E-10	4.221E-10	3.253E-10
S	1.002E-07	3.387E-08	1.739E-08	8.267E-09	2.970E-09	1.473E-09	8.672E-10	5.678E-10	3.995E-10	2.961E-10	2.282E-10
SSW	7.383E-08	2.497E-08	1.282E-08	6.094E-09	2.189E-09	1.086E-09	6.392E-10	4.185E-10	2.945E-10	2.183E-10	1.682E-10
SW	1.228E-07	4.152E-08	2.132E-08	1.014E-08	3.641E-09	1.806E-09	1.063E-09	6.961E-10	4.898E-10	3.630E-10	2.797E-10
WSW	8.181E-08	2.766E-08	1.420E-08	6.753E-09	2.426E-09	1.203E-09	7.083E-10	4.638E-10	3.263E-10	2.419E-10	1.864E-10
W	9.348E-08	3.161E-08	1.623E-08	7.716E-09	2.772E-09	1.375E-09	8.093E-10	5.300E-10	3.729E-10	2.764E-10	2.130E-10
WNW	1.214E-07	4.106E-08	2.108E-08	1.002E-08	3.601E-09	1.786E-09	1.051E-09	6.884E-10	4.844E-10	3.590E-10	2.767E-10
NW	1.354E-07	4.578E-08	2.351E-08	1.118E-08	4.014E-09	1.991E-09	1.172E-09	7.675E-10	5.401E-10	4.002E-10	3.084E-10
NNW	1.087E-07	3.677E-08	1.888E-08	8.975E-09	3.224E-09	1.599E-09	9.414E-10	6.164E-10	4.338E-10	3.215E-10	2.477E-10

Table 2.7-144 Annual Average D/Q Values for Ground Level Release (Based on 1985-1989 met data) (Sheet 2 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.601E-10	1.155E-10	6.998E-11	3.537E-11	2.141E-11	1.435E-11	1.029E-11	7.724E-12	6.005E-12	4.797E-12	3.916E-12
NNE	4.041E-10	1.795E-10	1.087E-10	5.496E-11	3.327E-11	2.230E-11	1.598E-11	1.200E-11	9.331E-12	7.454E-12	6.084E-12
NE	4.138E-10	1.838E-10	1.114E-10	5.629E-11	3.407E-11	2.284E-11	1.637E-11	1.229E-11	9.556E-12	7.633E-12	6.230E-12
ENE	3.781E-10	1.680E-10	1.017E-10	5.142E-11	3.112E-11	2.087E-11	1.495E-11	1.123E-11	8.730E-12	6.974E-12	5.692E-12
E	3.472E-10	1.542E-10	9.344E-11	4.723E-11	2.858E-11	1.917E-11	1.373E-11	1.031E-11	8.018E-12	6.405E-12	5.228E-12
ESE	3.328E-10	1.478E-10	8.955E-11	4.526E-11	2.740E-11	1.837E-11	1.316E-11	9.883E-12	7.684E-12	6.138E-12	5.010E-12
SE	2.813E-10	1.250E-10	7.570E-11	3.826E-11	2.316E-11	1.553E-11	1.113E-11	8.354E-12	6.495E-12	5.189E-12	4.235E-12
SSE	2.584E-10	1.148E-10	6.953E-11	3.515E-11	2.127E-11	1.426E-11	1.022E-11	7.674E-12	5.967E-12	4.766E-12	3.890E-12
S	1.813E-10	8.053E-11	4.878E-11	2.466E-11	1.492E-11	1.001E-11	7.169E-12	5.383E-12	4.186E-12	3.344E-12	2.729E-12
SSW	1.336E-10	5.936E-11	3.596E-11	1.817E-11	1.100E-11	7.375E-12	5.285E-12	3.968E-12	3.085E-12	2.465E-12	2.012E-12
SW	2.222E-10	9.873E-11	5.981E-11	3.023E-11	1.830E-11	1.227E-11	8.790E-12	6.600E-12	5.132E-12	4.099E-12	3.346E-12
WSW	1.481E-10	6.578E-11	3.984E-11	2.014E-11	1.219E-11	8.173E-12	5.856E-12	4.397E-12	3.419E-12	2.731E-12	2.229E-12
W	1.692E-10	7.516E-11	4.553E-11	2.301E-11	1.393E-11	9.338E-12	6.691E-12	5.025E-12	3.907E-12	3.121E-12	2.547E-12
WNW	2.198E-10	9.764E-11	5.914E-11	2.989E-11	1.809E-11	1.213E-11	8.693E-12	6.527E-12	5.075E-12	4.054E-12	3.309E-12
NW	2.450E-10	1.089E-10	6.594E-11	3.333E-11	2.017E-11	1.353E-11	9.691E-12	7.277E-12	5.658E-12	4.520E-12	3.689E-12
NNW	1.968E-10	8.742E-11	5.296E-11	2.677E-11	1.620E-11	1.086E-11	7.783E-12	5.845E-12	4.544E-12	3.630E-12	2.963E-12

Table 2.7-144 Annual Average D/Q Values for Ground Level Release (Based on 1985-1989 met data) (Sheet 3 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	2.439E-08	4.995E-09	1.304E-09	5.857E-10	3.313E-10	1.274E-10	3.686E-11	1.461E-11	7.801E-12	4.829E-12
NNE	3.789E-08	7.761E-09	2.026E-09	9.100E-10	5.148E-10	1.980E-10	5.727E-11	2.270E-11	1.212E-11	7.503E-12
NE	3.880E-08	7.948E-09	2.075E-09	9.319E-10	5.272E-10	2.027E-10	5.865E-11	2.325E-11	1.241E-11	7.683E-12
ENE	3.545E-08	7.261E-09	1.896E-09	8.514E-10	4.816E-10	1.852E-10	5.358E-11	2.124E-11	1.134E-11	7.019E-12
E	3.256E-08	6.669E-09	1.741E-09	7.819E-10	4.423E-10	1.701E-10	4.921E-11	1.950E-11	1.042E-11	6.447E-12
ESE	3.120E-08	6.391E-09	1.669E-09	7.494E-10	4.239E-10	1.630E-10	4.716E-11	1.869E-11	9.982E-12	6.178E-12
SE	2.638E-08	5.403E-09	1.410E-09	6.334E-10	3.583E-10	1.378E-10	3.987E-11	1.580E-11	8.438E-12	5.223E-12
SSE	2.423E-08	4.963E-09	1.296E-09	5.819E-10	3.292E-10	1.266E-10	3.662E-11	1.451E-11	7.751E-12	4.798E-12
S	1.700E-08	3.482E-09	9.089E-10	4.082E-10	2.309E-10	8.881E-11	2.569E-11	1.018E-11	5.438E-12	3.366E-12
SSW	1.253E-08	2.566E-09	6.700E-10	3.009E-10	1.702E-10	6.546E-11	1.894E-11	7.506E-12	4.008E-12	2.481E-12
SW	2.084E-08	4.269E-09	1.114E-09	5.005E-10	2.831E-10	1.089E-10	3.150E-11	1.248E-11	6.666E-12	4.126E-12
WSW	1.388E-08	2.844E-09	7.424E-10	3.334E-10	1.886E-10	7.254E-11	2.098E-11	8.317E-12	4.441E-12	2.749E-12
W	1.586E-08	3.250E-09	8.483E-10	3.810E-10	2.155E-10	8.289E-11	2.398E-11	9.504E-12	5.075E-12	3.141E-12
WNW	2.061E-08	4.221E-09	1.102E-09	4.949E-10	2.800E-10	1.077E-10	3.115E-11	1.235E-11	6.593E-12	4.081E-12
NW	2.298E-08	4.706E-09	1.229E-09	5.518E-10	3.122E-10	1.200E-10	3.473E-11	1.376E-11	7.350E-12	4.549E-12
NNW	1.845E-08	3.780E-09	9.867E-10	4.432E-10	2.507E-10	9.641E-11	2.789E-11	1.105E-11	5.903E-12	3.654E-12

Table 2.7-145 Annual Average X/Q Values (no Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.181E-06	8.309E-07	5.494E-07	3.436E-07	1.817E-07	1.156E-07	8.120E-08	6.078E-08	4.761E-08	3.857E-08	3.224E-08
NNE	3.826E-06	1.402E-06	8.670E-07	5.074E-07	2.560E-07	1.608E-07	1.125E-07	8.426E-08	6.758E-08	5.596E-08	4.680E-08
NE	5.537E-06	1.893E-06	1.089E-06	5.947E-07	2.742E-07	1.665E-07	1.157E-07	8.693E-08	6.878E-08	5.643E-08	4.757E-08
ENE	4.315E-06	1.509E-06	8.787E-07	4.863E-07	2.308E-07	1.432E-07	1.010E-07	7.676E-08	6.125E-08	5.059E-08	4.287E-08
E	3.637E-06	1.284E-06	7.471E-07	4.131E-07	1.966E-07	1.228E-07	8.720E-08	6.671E-08	5.356E-08	4.450E-08	3.791E-08
ESE	3.687E-06	1.289E-06	7.375E-07	4.022E-07	1.882E-07	1.158E-07	8.131E-08	6.165E-08	4.917E-08	4.065E-08	3.450E-08
SE	3.068E-06	1.082E-06	6.246E-07	3.430E-07	1.617E-07	1.001E-07	7.049E-08	5.357E-08	4.280E-08	3.541E-08	3.007E-08
SSE	3.002E-06	1.038E-06	5.959E-07	3.271E-07	1.549E-07	9.586E-08	6.738E-08	5.104E-08	4.063E-08	3.351E-08	2.838E-08
S	2.535E-06	8.430E-07	4.731E-07	2.552E-07	1.180E-07	7.221E-08	5.049E-08	3.817E-08	3.038E-08	2.506E-08	2.124E-08
SSW	1.685E-06	5.886E-07	3.439E-07	1.908E-07	9.013E-08	5.559E-08	3.897E-08	2.944E-08	2.337E-08	1.921E-08	1.620E-08
SW	1.485E-06	6.187E-07	4.325E-07	2.710E-07	1.370E-07	8.347E-08	5.662E-08	4.123E-08	3.157E-08	2.510E-08	2.055E-08
WSW	1.095E-06	4.500E-07	3.107E-07	1.929E-07	9.623E-08	5.838E-08	3.956E-08	2.881E-08	2.209E-08	1.758E-08	1.456E-08
W	1.419E-06	5.546E-07	3.699E-07	2.275E-07	1.128E-07	6.845E-08	4.646E-08	3.391E-08	2.605E-08	2.078E-08	1.706E-08
WNW	1.957E-06	7.444E-07	4.875E-07	2.986E-07	1.487E-07	9.108E-08	6.237E-08	4.588E-08	3.549E-08	2.849E-08	2.353E-08
NW	2.141E-06	8.304E-07	5.508E-07	3.389E-07	1.696E-07	1.040E-07	7.118E-08	5.235E-08	4.048E-08	3.248E-08	2.693E-08
NNW	1.815E-06	6.758E-07	4.463E-07	2.772E-07	1.432E-07	8.973E-08	6.235E-08	4.635E-08	3.613E-08	2.918E-08	2.444E-08

Table 2.7-145 Annual Average X/Q Values (no Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.752E-08	1.614E-08	1.135E-08	7.253E-09	5.258E-09	4.042E-09	3.201E-09	2.603E-09	2.175E-09	1.856E-09	1.612E-09
NNE	3.997E-08	2.253E-08	1.539E-08	9.406E-09	6.634E-09	5.060E-09	4.057E-09	3.368E-09	2.868E-09	2.490E-09	2.195E-09
NE	4.097E-08	2.458E-08	1.761E-08	1.152E-08	8.522E-09	6.745E-09	5.575E-09	4.749E-09	4.136E-09	3.663E-09	3.288E-09
ENE	3.709E-08	2.265E-08	1.641E-08	1.091E-08	8.171E-09	6.533E-09	5.448E-09	4.677E-09	4.102E-09	3.657E-09	3.301E-09
E	3.296E-08	2.019E-08	1.461E-08	9.626E-09	7.119E-09	5.613E-09	4.613E-09	3.903E-09	3.374E-09	2.966E-09	2.641E-09
ESE	2.992E-08	1.836E-08	1.338E-08	8.965E-09	6.741E-09	5.398E-09	4.499E-09	3.857E-09	3.376E-09	3.002E-09	2.704E-09
SE	2.608E-08	1.605E-08	1.172E-08	7.876E-09	5.944E-09	4.779E-09	4.002E-09	3.448E-09	3.032E-09	2.710E-09	2.452E-09
SSE	2.454E-08	1.561E-08	1.185E-08	8.679E-09	7.102E-09	6.124E-09	5.421E-09	4.860E-09	4.377E-09	3.943E-09	3.543E-09
S	1.838E-08	1.148E-08	8.534E-09	5.961E-09	4.665E-09	3.879E-09	3.347E-09	2.957E-09	2.655E-09	2.411E-09	2.205E-09
SSW	1.396E-08	8.444E-09	6.082E-09	4.016E-09	2.998E-09	2.394E-09	1.995E-09	1.712E-09	1.501E-09	1.337E-09	1.205E-09
SW	1.722E-08	9.213E-09	6.062E-09	3.516E-09	2.393E-09	1.775E-09	1.392E-09	1.134E-09	9.500E-10	8.129E-10	7.074E-10
WSW	1.233E-08	6.668E-09	4.436E-09	2.628E-09	1.824E-09	1.377E-09	1.096E-09	9.032E-10	7.633E-10	6.569E-10	5.729E-10
W	1.435E-08	8.097E-09	5.579E-09	3.499E-09	2.513E-09	1.908E-09	1.498E-09	1.217E-09	1.017E-09	8.681E-10	7.540E-10
WNW	1.988E-08	1.168E-08	8.323E-09	5.467E-09	3.973E-09	2.987E-09	2.343E-09	1.909E-09	1.600E-09	1.370E-09	1.192E-09
NW	2.285E-08	1.314E-08	9.218E-09	5.953E-09	4.387E-09	3.421E-09	2.736E-09	2.238E-09	1.877E-09	1.607E-09	1.400E-09
NNW	2.091E-08	1.238E-08	8.847E-09	5.815E-09	4.248E-09	3.216E-09	2.520E-09	2.049E-09	1.714E-09	1.465E-09	1.274E-09

Table 2.7-145 Annual Average X/Q Values (no Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

X/Q (sec/m³) for Each Segment

	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	5.205E-07	1.883E-07	8.222E-08	4.793E-08	3.237E-08	1.654E-08	7.277E-09	4.030E-09	2.611E-09	1.860E-09
NNE	8.261E-07	2.695E-07	1.141E-07	6.792E-08	4.699E-08	2.323E-08	9.504E-09	5.078E-09	3.374E-09	2.493E-09
NE	1.048E-06	2.976E-07	1.177E-07	6.926E-08	4.775E-08	2.513E-08	1.154E-08	6.751E-09	4.752E-09	3.664E-09
ENE	8.444E-07	2.487E-07	1.026E-07	6.162E-08	4.302E-08	2.309E-08	1.092E-08	6.536E-09	4.678E-09	3.657E-09
E	7.181E-07	2.119E-07	8.849E-08	5.387E-08	3.803E-08	2.055E-08	9.619E-09	5.615E-09	3.904E-09	2.967E-09
ESE	7.112E-07	2.036E-07	8.266E-08	4.949E-08	3.463E-08	1.871E-08	8.957E-09	5.397E-09	3.857E-09	3.003E-09
SE	6.011E-07	1.746E-07	7.161E-08	4.306E-08	3.017E-08	1.635E-08	7.871E-09	4.779E-09	3.448E-09	2.710E-09
SSE	5.747E-07	1.669E-07	6.844E-08	4.089E-08	2.848E-08	1.592E-08	8.684E-09	6.104E-09	4.836E-09	3.924E-09
S	4.585E-07	1.282E-07	5.135E-08	3.058E-08	2.131E-08	1.170E-08	5.957E-09	3.876E-09	2.954E-09	2.407E-09
SSW	3.302E-07	9.716E-08	3.959E-08	2.352E-08	1.626E-08	8.620E-09	4.023E-09	2.395E-09	1.712E-09	1.336E-09
SW	4.021E-07	1.430E-07	5.762E-08	3.187E-08	2.066E-08	9.592E-09	3.582E-09	1.787E-09	1.138E-09	8.144E-10
WSW	2.893E-07	1.009E-07	4.028E-08	2.229E-08	1.463E-08	6.933E-09	2.672E-09	1.383E-09	9.049E-10	6.573E-10
W	3.476E-07	1.186E-07	4.730E-08	2.629E-08	1.716E-08	8.366E-09	3.523E-09	1.905E-09	1.221E-09	8.699E-10
WNW	4.606E-07	1.564E-07	6.343E-08	3.579E-08	2.365E-08	1.201E-08	5.438E-09	2.992E-09	1.915E-09	1.372E-09
NW	5.188E-07	1.781E-07	7.240E-08	4.082E-08	2.706E-08	1.356E-08	5.983E-09	3.405E-09	2.243E-09	1.610E-09
NNW	4.222E-07	1.492E-07	6.325E-08	3.640E-08	2.454E-08	1.270E-08	5.793E-09	3.213E-09	2.056E-09	1.468E-09

Table 2.7-146 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m³)											
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.181E-06	8.302E-07	5.488E-07	3.431E-07	1.813E-07	1.153E-07	8.090E-08	6.050E-08	4.735E-08	3.833E-08	3.201E-08
NNE	3.824E-06	1.401E-06	8.660E-07	5.066E-07	2.555E-07	1.603E-07	1.121E-07	8.390E-08	6.724E-08	5.564E-08	4.649E-08
NE	5.535E-06	1.892E-06	1.088E-06	5.939E-07	2.736E-07	1.661E-07	1.153E-07	8.656E-08	6.844E-08	5.611E-08	4.726E-08
ENE	4.313E-06	1.508E-06	8.776E-07	4.855E-07	2.303E-07	1.428E-07	1.006E-07	7.641E-08	6.092E-08	5.028E-08	4.258E-08
E	3.636E-06	1.283E-06	7.461E-07	4.124E-07	1.962E-07	1.224E-07	8.685E-08	6.638E-08	5.326E-08	4.421E-08	3.763E-08
ESE	3.686E-06	1.288E-06	7.366E-07	4.015E-07	1.877E-07	1.155E-07	8.098E-08	6.135E-08	4.889E-08	4.038E-08	3.425E-08
SE	3.066E-06	1.081E-06	6.238E-07	3.425E-07	1.613E-07	9.973E-08	7.020E-08	5.331E-08	4.255E-08	3.518E-08	2.985E-08
SSE	3.000E-06	1.037E-06	5.951E-07	3.266E-07	1.545E-07	9.556E-08	6.711E-08	5.080E-08	4.041E-08	3.330E-08	2.817E-08
S	2.534E-06	8.423E-07	4.726E-07	2.548E-07	1.178E-07	7.199E-08	5.030E-08	3.800E-08	3.022E-08	2.491E-08	2.109E-08
SSW	1.684E-06	5.882E-07	3.435E-07	1.906E-07	8.994E-08	5.543E-08	3.883E-08	2.931E-08	2.325E-08	1.909E-08	1.610E-08
SW	1.484E-06	6.183E-07	4.321E-07	2.707E-07	1.367E-07	8.327E-08	5.645E-08	4.108E-08	3.144E-08	2.498E-08	2.043E-08
WSW	1.094E-06	4.497E-07	3.104E-07	1.927E-07	9.606E-08	5.824E-08	3.944E-08	2.871E-08	2.199E-08	1.749E-08	1.447E-08
W	1.418E-06	5.542E-07	3.695E-07	2.272E-07	1.126E-07	6.828E-08	4.631E-08	3.378E-08	2.593E-08	2.067E-08	1.696E-08
WNW	1.957E-06	7.438E-07	4.870E-07	2.982E-07	1.484E-07	9.083E-08	6.215E-08	4.569E-08	3.531E-08	2.832E-08	2.337E-08
NW	2.140E-06	8.298E-07	5.502E-07	3.385E-07	1.693E-07	1.037E-07	7.094E-08	5.213E-08	4.028E-08	3.230E-08	2.676E-08
NNW	1.814E-06	6.753E-07	4.458E-07	2.768E-07	1.429E-07	8.948E-08	6.213E-08	4.615E-08	3.595E-08	2.901E-08	2.428E-08

Table 2.7-146 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.729E-08	1.593E-08	1.115E-08	7.054E-09	5.061E-09	3.850E-09	3.018E-09	2.430E-09	2.011E-09	1.701E-09	1.463E-09
NNE	3.968E-08	2.228E-08	1.516E-08	9.189E-09	6.428E-09	4.862E-09	3.867E-09	3.183E-09	2.689E-09	2.315E-09	2.025E-09
NE	4.067E-08	2.431E-08	1.735E-08	1.126E-08	8.260E-09	6.485E-09	5.317E-09	4.493E-09	3.882E-09	3.410E-09	3.036E-09
ENE	3.681E-08	2.238E-08	1.616E-08	1.066E-08	7.912E-09	6.273E-09	5.186E-09	4.415E-09	3.839E-09	3.393E-09	3.036E-09
E	3.269E-08	1.993E-08	1.436E-08	9.372E-09	6.867E-09	5.364E-09	4.367E-09	3.660E-09	3.134E-09	2.729E-09	2.408E-09
ESE	2.968E-08	1.813E-08	1.315E-08	8.729E-09	6.503E-09	5.158E-09	4.259E-09	3.617E-09	3.137E-09	2.763E-09	2.466E-09
SE	2.586E-08	1.585E-08	1.151E-08	7.668E-09	5.732E-09	4.564E-09	3.785E-09	3.229E-09	2.812E-09	2.488E-09	2.229E-09
SSE	2.435E-08	1.541E-08	1.166E-08	8.454E-09	6.851E-09	5.847E-09	5.122E-09	4.542E-09	4.047E-09	3.607E-09	3.206E-09
S	1.824E-08	1.134E-08	8.397E-09	5.812E-09	4.507E-09	3.711E-09	3.171E-09	2.774E-09	2.465E-09	2.215E-09	2.005E-09
SSW	1.386E-08	8.347E-09	5.988E-09	3.920E-09	2.899E-09	2.294E-09	1.894E-09	1.610E-09	1.397E-09	1.232E-09	1.099E-09
SW	1.711E-08	9.119E-09	5.977E-09	3.439E-09	2.321E-09	1.708E-09	1.328E-09	1.072E-09	8.904E-10	7.553E-10	6.515E-10
WSW	1.224E-08	6.599E-09	4.373E-09	2.569E-09	1.767E-09	1.323E-09	1.043E-09	8.518E-10	7.131E-10	6.080E-10	5.254E-10
W	1.425E-08	8.014E-09	5.499E-09	3.416E-09	2.428E-09	1.823E-09	1.417E-09	1.140E-09	9.434E-10	7.981E-10	6.869E-10
WNW	1.973E-08	1.154E-08	8.192E-09	5.331E-09	3.836E-09	2.855E-09	2.219E-09	1.792E-09	1.488E-09	1.263E-09	1.090E-09
NW	2.268E-08	1.300E-08	9.080E-09	5.816E-09	4.249E-09	3.283E-09	2.602E-09	2.109E-09	1.754E-09	1.490E-09	1.287E-09
NNW	2.075E-08	1.223E-08	8.698E-09	5.661E-09	4.094E-09	3.068E-09	2.381E-09	1.919E-09	1.590E-09	1.347E-09	1.161E-09

Table 2.7-146 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment										
	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	5.199E-07	1.879E-07	8.191E-08	4.767E-08	3.214E-08	1.633E-08	7.079E-09	3.841E-09	2.439E-09	1.705E-09
NNE	8.253E-07	2.690E-07	1.137E-07	6.758E-08	4.668E-08	2.298E-08	9.289E-09	4.881E-09	3.190E-09	2.318E-09
NE	1.047E-06	2.970E-07	1.173E-07	6.892E-08	4.744E-08	2.485E-08	1.128E-08	6.492E-09	4.496E-09	3.411E-09
ENE	8.434E-07	2.481E-07	1.022E-07	6.129E-08	4.272E-08	2.282E-08	1.066E-08	6.275E-09	4.416E-09	3.393E-09
E	7.172E-07	2.114E-07	8.814E-08	5.356E-08	3.775E-08	2.029E-08	9.367E-09	5.366E-09	3.662E-09	2.731E-09
ESE	7.103E-07	2.031E-07	8.233E-08	4.921E-08	3.437E-08	1.848E-08	8.721E-09	5.157E-09	3.617E-09	2.764E-09
SE	6.003E-07	1.742E-07	7.132E-08	4.282E-08	2.995E-08	1.615E-08	7.662E-09	4.564E-09	3.229E-09	2.488E-09
SSE	5.740E-07	1.666E-07	6.817E-08	4.067E-08	2.827E-08	1.573E-08	8.453E-09	5.825E-09	4.519E-09	3.589E-09
S	4.579E-07	1.279E-07	5.116E-08	3.042E-08	2.117E-08	1.157E-08	5.806E-09	3.707E-09	2.770E-09	2.212E-09
SSW	3.299E-07	9.696E-08	3.945E-08	2.340E-08	1.616E-08	8.523E-09	3.926E-09	2.295E-09	1.610E-09	1.232E-09
SW	4.017E-07	1.427E-07	5.745E-08	3.173E-08	2.055E-08	9.498E-09	3.506E-09	1.719E-09	1.076E-09	7.569E-10
WSW	2.890E-07	1.007E-07	4.016E-08	2.219E-08	1.454E-08	6.864E-09	2.614E-09	1.329E-09	8.535E-10	6.085E-10
W	3.473E-07	1.184E-07	4.716E-08	2.617E-08	1.706E-08	8.282E-09	3.440E-09	1.822E-09	1.144E-09	7.999E-10
WNW	4.602E-07	1.561E-07	6.321E-08	3.561E-08	2.349E-08	1.187E-08	5.302E-09	2.862E-09	1.798E-09	1.266E-09
NW	5.182E-07	1.777E-07	7.215E-08	4.062E-08	2.689E-08	1.341E-08	5.845E-09	3.268E-09	2.115E-09	1.493E-09
NNW	4.217E-07	1.489E-07	6.303E-08	3.622E-08	2.437E-08	1.255E-08	5.640E-09	3.067E-09	1.926E-09	1.350E-09

Table 2.7-147 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.070E-06	7.678E-07	5.048E-07	3.168E-07	1.677E-07	1.065E-07	7.445E-08	5.548E-08	4.326E-08	3.491E-08	2.907E-08
NNE	3.630E-06	1.294E-06	7.908E-07	4.620E-07	2.328E-07	1.458E-07	1.017E-07	7.584E-08	6.072E-08	5.019E-08	4.183E-08
NE	5.244E-06	1.739E-06	9.819E-07	5.312E-07	2.425E-07	1.465E-07	1.015E-07	7.605E-08	6.005E-08	4.917E-08	4.137E-08
ENE	4.087E-06	1.387E-06	7.940E-07	4.361E-07	2.057E-07	1.274E-07	8.978E-08	6.816E-08	5.433E-08	4.484E-08	3.797E-08
E	3.447E-06	1.183E-06	6.770E-07	3.716E-07	1.758E-07	1.096E-07	7.779E-08	5.950E-08	4.777E-08	3.967E-08	3.379E-08
ESE	3.495E-06	1.188E-06	6.682E-07	3.614E-07	1.677E-07	1.028E-07	7.203E-08	5.453E-08	4.343E-08	3.586E-08	3.041E-08
SE	2.907E-06	9.967E-07	5.659E-07	3.084E-07	1.444E-07	8.907E-08	6.265E-08	4.757E-08	3.796E-08	3.138E-08	2.663E-08
SSE	2.843E-06	9.541E-07	5.382E-07	2.932E-07	1.379E-07	8.513E-08	5.972E-08	4.517E-08	3.591E-08	2.958E-08	2.502E-08
S	2.400E-06	7.726E-07	4.252E-07	2.271E-07	1.040E-07	6.332E-08	4.415E-08	3.332E-08	2.647E-08	2.181E-08	1.845E-08
SSW	1.596E-06	5.404E-07	3.101E-07	1.709E-07	8.022E-08	4.938E-08	3.457E-08	2.609E-08	2.068E-08	1.698E-08	1.431E-08
SW	1.413E-06	5.763E-07	4.023E-07	2.525E-07	1.270E-07	7.680E-08	5.168E-08	3.733E-08	2.838E-08	2.240E-08	1.821E-08
WSW	1.041E-06	4.188E-07	2.886E-07	1.794E-07	8.895E-08	5.354E-08	3.598E-08	2.600E-08	1.979E-08	1.564E-08	1.288E-08
W	1.349E-06	5.151E-07	3.420E-07	2.103E-07	1.036E-07	6.242E-08	4.203E-08	3.045E-08	2.323E-08	1.841E-08	1.502E-08
WNW	1.861E-06	6.910E-07	4.504E-07	2.758E-07	1.366E-07	8.306E-08	5.647E-08	4.127E-08	3.173E-08	2.532E-08	2.079E-08
NW	2.034E-06	7.713E-07	5.096E-07	3.134E-07	1.559E-07	9.487E-08	6.445E-08	4.706E-08	3.615E-08	2.883E-08	2.379E-08
NNW	1.720E-06	6.237E-07	4.101E-07	2.554E-07	1.317E-07	8.212E-08	5.674E-08	4.193E-08	3.251E-08	2.612E-08	2.179E-08

Table 2.7-147 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.472E-08	1.433E-08	9.997E-09	6.219E-09	4.263E-09	3.115E-09	2.377E-09	1.870E-09	1.515E-09	1.257E-09	1.063E-09
NNE	3.562E-08	1.980E-08	1.337E-08	8.024E-09	5.578E-09	4.205E-09	3.337E-09	2.744E-09	2.306E-09	1.979E-09	1.721E-09
NE	3.557E-08	2.126E-08	1.516E-08	9.839E-09	7.232E-09	5.695E-09	4.687E-09	3.976E-09	3.433E-09	3.016E-09	2.679E-09
ENE	3.281E-08	2.001E-08	1.446E-08	9.573E-09	7.140E-09	5.691E-09	4.732E-09	4.051E-09	3.526E-09	3.121E-09	2.794E-09
E	2.936E-08	1.795E-08	1.295E-08	8.477E-09	6.230E-09	4.883E-09	3.991E-09	3.358E-09	2.874E-09	2.505E-09	2.209E-09
ESE	2.635E-08	1.613E-08	1.172E-08	7.811E-09	5.845E-09	4.659E-09	3.868E-09	3.302E-09	2.865E-09	2.529E-09	2.258E-09
SE	2.308E-08	1.418E-08	1.033E-08	6.912E-09	5.195E-09	4.163E-09	3.475E-09	2.983E-09	2.603E-09	2.310E-09	2.073E-09
SSE	2.161E-08	1.378E-08	1.049E-08	7.730E-09	6.349E-09	5.419E-09	4.638E-09	4.009E-09	3.487E-09	3.047E-09	2.674E-09
S	1.594E-08	9.967E-09	7.411E-09	5.182E-09	4.061E-09	3.379E-09	2.908E-09	2.533E-09	2.216E-09	1.957E-09	1.743E-09
SSW	1.231E-08	7.428E-09	5.334E-09	3.504E-09	2.604E-09	2.072E-09	1.718E-09	1.463E-09	1.261E-09	1.098E-09	9.656E-10
SW	1.517E-08	7.907E-09	5.093E-09	2.856E-09	1.892E-09	1.373E-09	1.055E-09	8.406E-10	6.880E-10	5.748E-10	4.879E-10
WSW	1.085E-08	5.727E-09	3.739E-09	2.150E-09	1.450E-09	1.059E-09	8.133E-10	6.474E-10	5.293E-10	4.420E-10	3.753E-10
W	1.256E-08	6.962E-09	4.728E-09	2.848E-09	1.936E-09	1.409E-09	1.066E-09	8.366E-10	6.771E-10	5.614E-10	4.742E-10
WNW	1.748E-08	1.014E-08	7.153E-09	4.502E-09	3.096E-09	2.232E-09	1.687E-09	1.329E-09	1.079E-09	8.976E-10	7.604E-10
NW	2.008E-08	1.138E-08	7.897E-09	4.949E-09	3.456E-09	2.565E-09	1.978E-09	1.565E-09	1.272E-09	1.059E-09	8.972E-10
NNW	1.857E-08	1.087E-08	7.702E-09	4.877E-09	3.360E-09	2.437E-09	1.840E-09	1.447E-09	1.174E-09	9.753E-10	8.254E-10

Table 2.7-147 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment										
Segment Boundaries in Miles from the Site										
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	4.797E-07	1.736E-07	7.539E-08	4.357E-08	2.919E-08	1.471E-08	6.189E-09	3.126E-09	1.880E-09	1.262E-09
NNE	7.564E-07	2.451E-07	1.031E-07	6.103E-08	4.201E-08	2.046E-08	8.125E-09	4.224E-09	2.746E-09	1.980E-09
NE	9.498E-07	2.640E-07	1.033E-07	6.048E-08	4.153E-08	2.173E-08	9.862E-09	5.702E-09	3.972E-09	3.015E-09
ENE	7.667E-07	2.221E-07	9.117E-08	5.467E-08	3.809E-08	2.039E-08	9.578E-09	5.694E-09	4.045E-09	3.120E-09
E	6.537E-07	1.899E-07	7.896E-08	4.803E-08	3.389E-08	1.826E-08	8.472E-09	4.885E-09	3.354E-09	2.505E-09
ESE	6.474E-07	1.819E-07	7.325E-08	4.372E-08	3.052E-08	1.644E-08	7.805E-09	4.659E-09	3.297E-09	2.528E-09
SE	5.472E-07	1.562E-07	6.366E-08	3.820E-08	2.672E-08	1.444E-08	6.908E-09	4.163E-09	2.979E-09	2.309E-09
SSE	5.217E-07	1.490E-07	6.068E-08	3.615E-08	2.511E-08	1.406E-08	7.731E-09	5.355E-09	3.990E-09	3.039E-09
S	4.144E-07	1.133E-07	4.493E-08	2.665E-08	1.852E-08	1.016E-08	5.179E-09	3.372E-09	2.519E-09	1.955E-09
SSW	2.994E-07	8.666E-08	3.513E-08	2.081E-08	1.436E-08	7.582E-09	3.511E-09	2.072E-09	1.459E-09	1.097E-09
SW	3.744E-07	1.326E-07	5.264E-08	2.866E-08	1.833E-08	8.269E-09	2.925E-09	1.384E-09	8.436E-10	5.762E-10
WSW	2.690E-07	9.331E-08	3.667E-08	1.998E-08	1.294E-08	5.981E-09	2.192E-09	1.065E-09	6.498E-10	4.432E-10
W	3.219E-07	1.090E-07	4.284E-08	2.345E-08	1.511E-08	7.213E-09	2.861E-09	1.412E-09	8.414E-10	5.634E-10
WNW	4.263E-07	1.437E-07	5.748E-08	3.201E-08	2.091E-08	1.044E-08	4.466E-09	2.245E-09	1.336E-09	9.007E-10
NW	4.806E-07	1.638E-07	6.561E-08	3.648E-08	2.391E-08	1.176E-08	4.941E-09	2.568E-09	1.571E-09	1.062E-09
NNW	3.888E-07	1.372E-07	5.758E-08	3.277E-08	2.188E-08	1.117E-08	4.830E-09	2.444E-09	1.456E-09	9.787E-10

Table 2.7-148 Annual Average D/Q Values for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.669E-08	1.250E-08	7.768E-09	4.236E-09	1.748E-09	9.373E-10	5.808E-10	3.948E-10	2.855E-10	2.159E-10	1.689E-10
NNE	4.999E-08	2.240E-08	1.322E-08	6.947E-09	2.776E-09	1.460E-09	8.932E-10	6.019E-10	4.329E-10	3.263E-10	2.548E-10
NE	5.748E-08	2.242E-08	1.213E-08	5.990E-09	2.246E-09	1.145E-09	6.876E-10	4.572E-10	3.257E-10	2.439E-10	1.895E-10
ENE	4.317E-08	1.732E-08	9.486E-09	4.725E-09	1.786E-09	9.153E-10	5.514E-10	3.676E-10	2.624E-10	1.968E-10	1.531E-10
E	3.717E-08	1.551E-08	8.514E-09	4.241E-09	1.601E-09	8.225E-10	4.967E-10	3.319E-10	2.374E-10	1.783E-10	1.390E-10
ESE	3.642E-08	1.529E-08	8.365E-09	4.155E-09	1.564E-09	8.025E-10	4.841E-10	3.232E-10	2.311E-10	1.736E-10	1.353E-10
SE	3.065E-08	1.282E-08	7.013E-09	3.489E-09	1.318E-09	6.771E-10	4.089E-10	2.732E-10	1.954E-10	1.468E-10	1.144E-10
SSE	2.763E-08	1.114E-08	6.084E-09	3.023E-09	1.140E-09	5.839E-10	3.517E-10	2.345E-10	1.674E-10	1.255E-10	9.771E-11
S	2.188E-08	8.274E-09	4.447E-09	2.185E-09	8.135E-10	4.128E-10	2.470E-10	1.638E-10	1.164E-10	8.701E-11	6.752E-11
SSW	1.761E-08	6.746E-09	3.618E-09	1.775E-09	6.588E-10	3.350E-10	2.008E-10	1.334E-10	9.501E-11	7.109E-11	5.522E-11
SW	3.097E-08	1.552E-08	9.773E-09	5.325E-09	2.202E-09	1.170E-09	7.187E-10	4.857E-10	3.500E-10	2.642E-10	2.065E-10
WSW	2.014E-08	1.011E-08	6.374E-09	3.467E-09	1.429E-09	7.570E-10	4.643E-10	3.134E-10	2.256E-10	1.702E-10	1.331E-10
W	2.469E-08	1.160E-08	6.975E-09	3.895E-09	1.570E-09	8.213E-10	4.998E-10	3.356E-10	2.408E-10	1.813E-10	1.415E-10
WNW	3.070E-08	1.451E-08	8.634E-09	4.794E-09	1.924E-09	1.006E-09	6.126E-10	4.114E-10	2.953E-10	2.224E-10	1.736E-10
NW	2.965E-08	1.457E-08	8.994E-09	5.157E-09	2.103E-09	1.105E-09	6.742E-10	4.534E-10	3.257E-10	2.454E-10	1.916E-10
NNW	2.115E-08	9.980E-09	6.314E-09	3.473E-09	1.448E-09	7.750E-10	4.790E-10	3.248E-10	2.346E-10	1.772E-10	1.385E-10

Table 2.7-148 Annual Average D/Q Values for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	1.357E-10	6.352E-11	4.010E-11	4.356E-11	2.986E-11	1.816E-11	1.357E-11	1.028E-11	8.012E-12	6.410E-12	5.233E-12
NNE	2.045E-10	9.317E-11	5.640E-11	2.884E-11	1.814E-11	1.283E-11	1.001E-11	8.053E-12	7.489E-12	6.328E-12	6.459E-12
NE	1.516E-10	6.868E-11	4.164E-11	2.157E-11	1.362E-11	9.711E-12	7.568E-12	6.599E-12	5.657E-12	5.805E-12	6.680E-12
ENE	1.226E-10	5.569E-11	3.376E-11	1.753E-11	1.113E-11	8.002E-12	6.312E-12	5.473E-12	4.768E-12	4.790E-12	5.176E-12
E	1.115E-10	5.092E-11	3.098E-11	1.625E-11	1.038E-11	7.565E-12	6.007E-12	5.051E-12	4.419E-12	3.931E-12	3.596E-12
ESE	1.085E-10	4.959E-11	3.019E-11	1.587E-11	1.016E-11	7.413E-12	5.895E-12	4.959E-12	4.342E-12	3.865E-12	3.525E-12
SE	9.179E-11	4.192E-11	2.551E-11	1.339E-11	8.563E-12	6.240E-12	4.931E-12	4.145E-12	3.632E-12	3.236E-12	3.012E-12
SSE	7.827E-11	3.559E-11	2.169E-11	1.173E-11	1.270E-11	2.390E-11	1.990E-11	1.464E-11	1.080E-11	7.381E-12	5.786E-12
S	5.396E-11	2.435E-11	1.475E-11	7.612E-12	5.163E-12	4.527E-12	7.056E-12	9.753E-12	8.461E-12	6.698E-12	5.353E-12
SSW	4.417E-11	2.003E-11	1.218E-11	6.334E-12	4.298E-12	3.942E-12	4.383E-12	4.907E-12	5.502E-12	4.801E-12	3.977E-12
SW	1.659E-10	7.547E-11	4.529E-11	2.292E-11	1.442E-11	1.040E-11	8.230E-12	7.013E-12	6.102E-12	5.171E-12	4.325E-12
WSW	1.085E-10	4.906E-11	2.921E-11	1.642E-11	1.185E-11	9.409E-12	7.045E-12	5.357E-12	4.267E-12	3.488E-12	2.918E-12
W	1.136E-10	5.180E-11	3.578E-11	2.629E-11	1.642E-11	1.135E-11	8.465E-12	6.365E-12	4.954E-12	3.961E-12	3.233E-12
WNW	1.395E-10	6.369E-11	5.202E-11	3.526E-11	2.220E-11	1.527E-11	1.104E-11	8.315E-12	6.471E-12	5.169E-12	4.221E-12
NW	1.539E-10	7.006E-11	4.687E-11	3.841E-11	2.552E-11	1.693E-11	1.209E-11	9.336E-12	7.304E-12	5.850E-12	4.780E-12
NNW	1.143E-10	5.192E-11	4.356E-11	3.328E-11	2.045E-11	1.405E-11	1.014E-11	7.637E-12	5.951E-12	4.760E-12	3.885E-12

Table 2.7-148 Annual Average D/Q Values for Mixed-Mode Release from the Reactor Building/Fuel Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors										
Segment Boundaries in Miles from the Site										
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	7.250E-09	1.941E-09	6.015E-10	2.902E-10	1.705E-10	6.915E-11	3.670E-11	1.945E-11	1.036E-11	6.449E-12
NNE	1.247E-08	3.118E-09	9.278E-10	4.406E-10	2.573E-10	1.016E-10	3.021E-11	1.312E-11	8.398E-12	6.720E-12
NE	1.169E-08	2.589E-09	7.174E-10	3.321E-10	1.916E-10	7.509E-11	2.249E-11	9.896E-12	6.517E-12	6.085E-12
ENE	9.110E-09	2.052E-09	5.749E-10	2.674E-10	1.547E-10	6.082E-11	1.829E-11	8.160E-12	5.444E-12	4.927E-12
E	8.170E-09	1.842E-09	5.176E-10	2.419E-10	1.404E-10	5.551E-11	1.692E-11	7.693E-12	5.083E-12	3.952E-12
ESE	8.032E-09	1.801E-09	5.047E-10	2.355E-10	1.367E-10	5.407E-11	1.651E-11	7.538E-12	4.991E-12	3.880E-12
SE	6.736E-09	1.515E-09	4.262E-10	1.991E-10	1.156E-10	4.571E-11	1.394E-11	6.336E-12	4.174E-12	3.270E-12
SSE	5.847E-09	1.311E-09	3.667E-10	1.706E-10	9.876E-11	3.890E-11	1.437E-11	1.931E-11	1.468E-11	7.804E-12
S	4.292E-09	9.401E-10	2.579E-10	1.187E-10	6.827E-11	2.666E-11	8.110E-12	5.708E-12	8.490E-12	6.722E-12
SSW	3.494E-09	7.628E-10	2.096E-10	9.688E-11	5.583E-11	2.190E-11	6.728E-12	4.214E-12	4.984E-12	4.703E-12
SW	9.074E-09	2.437E-09	7.457E-10	3.561E-10	2.086E-10	8.216E-11	2.412E-11	1.061E-11	7.014E-12	5.134E-12
WSW	5.913E-09	1.583E-09	4.819E-10	2.296E-10	1.350E-10	5.346E-11	1.723E-11	9.115E-12	5.424E-12	3.508E-12
W	6.635E-09	1.754E-09	5.199E-10	2.452E-10	1.429E-10	5.841E-11	2.401E-11	1.155E-11	6.427E-12	3.986E-12
WNW	8.233E-09	2.154E-09	6.371E-10	3.007E-10	1.754E-10	7.534E-11	3.318E-11	1.543E-11	8.393E-12	5.204E-12
NW	8.527E-09	2.338E-09	7.008E-10	3.316E-10	1.936E-10	7.839E-11	3.456E-11	1.729E-11	9.349E-12	5.885E-12
NNW	5.866E-09	1.599E-09	4.963E-10	2.385E-10	1.410E-10	6.206E-11	2.986E-11	1.419E-11	7.710E-12	4.789E-12

Table 2.7-149 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)

	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.685E-06	9.507E-07	5.689E-07	3.271E-07	1.618E-07	1.014E-07	7.097E-08	5.315E-08	4.169E-08	3.384E-08	2.831E-08
NNE	4.793E-06	1.652E-06	9.517E-07	5.226E-07	2.445E-07	1.492E-07	1.031E-07	7.675E-08	6.104E-08	5.025E-08	4.197E-08
NE	7.155E-06	2.341E-06	1.292E-06	6.831E-07	2.952E-07	1.713E-07	1.152E-07	8.451E-08	6.571E-08	5.321E-08	4.441E-08
ENE	5.722E-06	1.895E-06	1.053E-06	5.581E-07	2.443E-07	1.438E-07	9.777E-08	7.243E-08	5.675E-08	4.624E-08	3.879E-08
E	4.888E-06	1.623E-06	8.990E-07	4.765E-07	2.088E-07	1.232E-07	8.406E-08	6.249E-08	4.913E-08	4.018E-08	3.382E-08
ESE	4.934E-06	1.629E-06	8.913E-07	4.674E-07	2.026E-07	1.189E-07	8.059E-08	5.956E-08	4.658E-08	3.792E-08	3.179E-08
SE	4.034E-06	1.343E-06	7.417E-07	3.911E-07	1.705E-07	1.003E-07	6.817E-08	5.049E-08	3.957E-08	3.226E-08	2.708E-08
SSE	3.980E-06	1.309E-06	7.195E-07	3.778E-07	1.647E-07	9.712E-08	6.607E-08	4.892E-08	3.829E-08	3.116E-08	2.611E-08
S	3.320E-06	1.063E-06	5.754E-07	2.999E-07	1.290E-07	7.528E-08	5.086E-08	3.749E-08	2.927E-08	2.379E-08	1.991E-08
SSW	2.171E-06	7.236E-07	4.060E-07	2.154E-07	9.393E-08	5.500E-08	3.727E-08	2.752E-08	2.150E-08	1.747E-08	1.462E-08
SW	1.645E-06	6.291E-07	3.935E-07	2.337E-07	1.167E-07	7.188E-08	4.931E-08	3.624E-08	2.795E-08	2.235E-08	1.838E-08
WSW	1.237E-06	4.642E-07	2.869E-07	1.689E-07	8.304E-08	5.082E-08	3.476E-08	2.552E-08	1.968E-08	1.574E-08	1.307E-08
W	1.691E-06	6.100E-07	3.685E-07	2.124E-07	1.019E-07	6.171E-08	4.200E-08	3.076E-08	2.369E-08	1.895E-08	1.559E-08
WNW	2.317E-06	8.164E-07	4.858E-07	2.788E-07	1.337E-07	8.149E-08	5.583E-08	4.114E-08	3.188E-08	2.563E-08	2.119E-08
NW	2.543E-06	9.051E-07	5.422E-07	3.134E-07	1.515E-07	9.261E-08	6.349E-08	4.678E-08	3.623E-08	2.911E-08	2.414E-08
NNW	2.247E-06	7.769E-07	4.599E-07	2.644E-07	1.295E-07	8.037E-08	5.577E-08	4.149E-08	3.238E-08	2.618E-08	2.191E-08

Table 2.7-149 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.418E-08	1.415E-08	9.930E-09	6.340E-09	4.633E-09	3.619E-09	2.925E-09	2.405E-09	2.012E-09	1.717E-09	1.491E-09
NNE	3.581E-08	2.020E-08	1.381E-08	8.440E-09	5.952E-09	4.538E-09	3.637E-09	3.018E-09	2.570E-09	2.231E-09	1.967E-09
NE	3.794E-08	2.216E-08	1.567E-08	1.012E-08	7.432E-09	5.858E-09	4.829E-09	4.107E-09	3.573E-09	3.163E-09	2.839E-09
ENE	3.329E-08	1.977E-08	1.413E-08	9.259E-09	6.878E-09	5.471E-09	4.547E-09	3.896E-09	3.413E-09	3.041E-09	2.746E-09
E	2.913E-08	1.737E-08	1.241E-08	8.090E-09	5.957E-09	4.687E-09	3.848E-09	3.254E-09	2.812E-09	2.472E-09	2.202E-09
ESE	2.728E-08	1.616E-08	1.154E-08	7.559E-09	5.614E-09	4.461E-09	3.699E-09	3.159E-09	2.757E-09	2.447E-09	2.200E-09
SE	2.327E-08	1.386E-08	9.941E-09	6.551E-09	4.890E-09	3.904E-09	3.254E-09	2.794E-09	2.452E-09	2.188E-09	1.978E-09
SSE	2.238E-08	1.355E-08	9.934E-09	6.941E-09	5.552E-09	4.762E-09	4.248E-09	3.870E-09	3.564E-09	3.294E-09	3.043E-09
S	1.706E-08	1.020E-08	7.383E-09	4.988E-09	3.832E-09	3.154E-09	2.711E-09	2.397E-09	2.162E-09	1.977E-09	1.825E-09
SSW	1.252E-08	7.394E-09	5.266E-09	3.435E-09	2.548E-09	2.027E-09	1.687E-09	1.447E-09	1.270E-09	1.133E-09	1.025E-09
SW	1.546E-08	8.361E-09	5.530E-09	3.221E-09	2.196E-09	1.631E-09	1.279E-09	1.043E-09	8.738E-10	7.480E-10	6.513E-10
WSW	1.109E-08	6.041E-09	4.027E-09	2.384E-09	1.653E-09	1.247E-09	9.934E-10	8.208E-10	6.962E-10	6.020E-10	5.281E-10
W	1.313E-08	7.383E-09	5.059E-09	3.153E-09	2.282E-09	1.767E-09	1.409E-09	1.148E-09	9.586E-10	8.183E-10	7.107E-10
WNW	1.792E-08	1.039E-08	7.324E-09	4.794E-09	3.574E-09	2.773E-09	2.188E-09	1.782E-09	1.494E-09	1.279E-09	1.113E-09
NW	2.047E-08	1.166E-08	8.092E-09	5.169E-09	3.828E-09	3.038E-09	2.492E-09	2.074E-09	1.745E-09	1.495E-09	1.302E-09
NNW	1.872E-08	1.095E-08	7.744E-09	5.068E-09	3.775E-09	2.952E-09	2.344E-09	1.907E-09	1.596E-09	1.364E-09	1.186E-09

Table 2.7-149 Annual Average X/Q Values (No Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

X/Q (sec/m^3) for Each Segment										
	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	5.463E-07	1.717E-07	7.195E-08	4.198E-08	2.842E-08	1.450E-08	6.379E-09	3.612E-09	2.404E-09	1.721E-09
NNE	9.165E-07	2.639E-07	1.049E-07	6.142E-08	4.214E-08	2.083E-08	8.527E-09	4.555E-09	3.024E-09	2.234E-09
NE	1.255E-06	3.263E-07	1.179E-07	6.632E-08	4.462E-08	2.278E-08	1.016E-08	5.866E-09	4.110E-09	3.165E-09
ENE	1.020E-06	2.693E-07	9.990E-08	5.723E-08	3.896E-08	2.027E-08	9.284E-09	5.476E-09	3.898E-09	3.042E-09
E	8.722E-07	2.303E-07	8.588E-08	4.954E-08	3.397E-08	1.778E-08	8.103E-09	4.690E-09	3.255E-09	2.473E-09
ESE	8.667E-07	2.242E-07	8.238E-08	4.699E-08	3.194E-08	1.658E-08	7.579E-09	4.463E-09	3.160E-09	2.448E-09
SE	7.195E-07	1.883E-07	6.966E-08	3.990E-08	2.720E-08	1.421E-08	6.566E-09	3.907E-09	2.795E-09	2.188E-09
SSE	6.986E-07	1.820E-07	6.749E-08	3.861E-08	2.623E-08	1.391E-08	6.989E-09	4.767E-09	3.861E-09	3.281E-09
S	5.613E-07	1.431E-07	5.202E-08	2.953E-08	2.001E-08	1.047E-08	5.006E-09	3.157E-09	2.397E-09	1.975E-09
SSW	3.919E-07	1.036E-07	3.810E-08	2.169E-08	1.469E-08	7.586E-09	3.448E-09	2.030E-09	1.448E-09	1.134E-09
SW	3.749E-07	1.228E-07	5.010E-08	2.819E-08	1.847E-08	8.680E-09	3.279E-09	1.641E-09	1.046E-09	7.495E-10
WSW	2.739E-07	8.781E-08	3.535E-08	1.985E-08	1.313E-08	6.268E-09	2.424E-09	1.254E-09	8.227E-10	6.025E-10
W	3.528E-07	1.086E-07	4.276E-08	2.390E-08	1.568E-08	7.628E-09	3.189E-09	1.761E-09	1.150E-09	8.200E-10
WNW	4.673E-07	1.428E-07	5.680E-08	3.215E-08	2.129E-08	1.070E-08	4.814E-09	2.752E-09	1.788E-09	1.281E-09
NW	5.211E-07	1.613E-07	6.457E-08	3.653E-08	2.425E-08	1.203E-08	5.222E-09	3.030E-09	2.068E-09	1.497E-09
NNW	4.435E-07	1.377E-07	5.662E-08	3.262E-08	2.199E-08	1.125E-08	5.088E-09	2.928E-09	1.913E-09	1.367E-09

Table 2.7-150 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

	Annual Average X/Q (sec/m^3)										
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.684E-06	9.499E-07	5.682E-07	3.265E-07	1.614E-07	1.011E-07	7.071E-08	5.291E-08	4.147E-08	3.364E-08	2.812E-08
NNE	4.791E-06	1.650E-06	9.507E-07	5.218E-07	2.440E-07	1.488E-07	1.028E-07	7.643E-08	6.074E-08	4.997E-08	4.170E-08
NE	7.152E-06	2.340E-06	1.291E-06	6.821E-07	2.946E-07	1.708E-07	1.147E-07	8.414E-08	6.537E-08	5.290E-08	4.411E-08
ENE	5.719E-06	1.894E-06	1.052E-06	5.571E-07	2.436E-07	1.433E-07	9.737E-08	7.208E-08	5.643E-08	4.595E-08	3.851E-08
E	4.885E-06	1.622E-06	8.978E-07	4.756E-07	2.082E-07	1.228E-07	8.369E-08	6.216E-08	4.883E-08	3.990E-08	3.356E-08
ESE	4.932E-06	1.627E-06	8.900E-07	4.666E-07	2.021E-07	1.184E-07	8.023E-08	5.924E-08	4.630E-08	3.765E-08	3.154E-08
SE	4.032E-06	1.342E-06	7.407E-07	3.904E-07	1.701E-07	9.993E-08	6.787E-08	5.023E-08	3.933E-08	3.204E-08	2.687E-08
SSE	3.978E-06	1.308E-06	7.186E-07	3.772E-07	1.643E-07	9.679E-08	6.580E-08	4.867E-08	3.807E-08	3.096E-08	2.591E-08
S	3.319E-06	1.062E-06	5.746E-07	2.994E-07	1.287E-07	7.503E-08	5.065E-08	3.731E-08	2.910E-08	2.364E-08	1.977E-08
SSW	2.171E-06	7.230E-07	4.055E-07	2.151E-07	9.372E-08	5.484E-08	3.713E-08	2.740E-08	2.139E-08	1.737E-08	1.452E-08
SW	1.644E-06	6.287E-07	3.932E-07	2.334E-07	1.165E-07	7.171E-08	4.916E-08	3.611E-08	2.783E-08	2.224E-08	1.828E-08
WSW	1.237E-06	4.639E-07	2.866E-07	1.687E-07	8.289E-08	5.070E-08	3.466E-08	2.543E-08	1.960E-08	1.566E-08	1.300E-08
W	1.690E-06	6.096E-07	3.681E-07	2.122E-07	1.017E-07	6.156E-08	4.187E-08	3.064E-08	2.359E-08	1.885E-08	1.550E-08
WNW	2.316E-06	8.158E-07	4.852E-07	2.785E-07	1.334E-07	8.127E-08	5.564E-08	4.097E-08	3.172E-08	2.548E-08	2.105E-08
NW	2.542E-06	9.044E-07	5.416E-07	3.129E-07	1.512E-07	9.235E-08	6.327E-08	4.658E-08	3.605E-08	2.895E-08	2.399E-08
NNW	2.246E-06	7.764E-07	4.594E-07	2.640E-07	1.292E-07	8.014E-08	5.558E-08	4.132E-08	3.222E-08	2.603E-08	2.177E-08

Table 2.7-150 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m³)											
Distance in Miles from the Site											
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.400E-08	1.398E-08	9.770E-09	6.182E-09	4.476E-09	3.464E-09	2.774E-09	2.261E-09	1.874E-09	1.586E-09	1.365E-09
NNE	3.556E-08	1.998E-08	1.361E-08	8.256E-09	5.778E-09	4.372E-09	3.477E-09	2.864E-09	2.420E-09	2.085E-09	1.824E-09
NE	3.766E-08	2.192E-08	1.544E-08	9.894E-09	7.215E-09	5.644E-09	4.618E-09	3.898E-09	3.366E-09	2.958E-09	2.635E-09
ENE	3.302E-08	1.954E-08	1.391E-08	9.043E-09	6.664E-09	5.260E-09	4.337E-09	3.687E-09	3.204E-09	2.833E-09	2.538E-09
E	2.887E-08	1.714E-08	1.220E-08	7.883E-09	5.754E-09	4.487E-09	3.652E-09	3.061E-09	2.622E-09	2.285E-09	2.017E-09
ESE	2.705E-08	1.595E-08	1.134E-08	7.362E-09	5.420E-09	4.268E-09	3.507E-09	2.969E-09	2.569E-09	2.260E-09	2.015E-09
SE	2.307E-08	1.369E-08	9.772E-09	6.384E-09	4.723E-09	3.738E-09	3.088E-09	2.628E-09	2.286E-09	2.021E-09	1.811E-09
SSE	2.220E-08	1.338E-08	9.771E-09	6.771E-09	5.370E-09	4.566E-09	4.035E-09	3.643E-09	3.323E-09	3.042E-09	2.783E-09
S	1.693E-08	1.008E-08	7.266E-09	4.869E-09	3.709E-09	3.027E-09	2.579E-09	2.261E-09	2.021E-09	1.831E-09	1.675E-09
SSW	1.242E-08	7.312E-09	5.187E-09	3.358E-09	2.471E-09	1.950E-09	1.609E-09	1.369E-09	1.192E-09	1.054E-09	9.448E-10
SW	1.536E-08	8.281E-09	5.458E-09	3.157E-09	2.136E-09	1.575E-09	1.226E-09	9.913E-10	8.243E-10	7.001E-10	6.048E-10
WSW	1.102E-08	5.983E-09	3.974E-09	2.336E-09	1.607E-09	1.203E-09	9.507E-10	7.791E-10	6.554E-10	5.619E-10	4.887E-10
W	1.305E-08	7.312E-09	4.991E-09	3.086E-09	2.213E-09	1.697E-09	1.340E-09	1.081E-09	8.956E-10	7.582E-10	6.530E-10
WNW	1.779E-08	1.028E-08	7.216E-09	4.685E-09	3.462E-09	2.662E-09	2.081E-09	1.682E-09	1.398E-09	1.187E-09	1.026E-09
NW	2.033E-08	1.153E-08	7.977E-09	5.057E-09	3.717E-09	2.927E-09	2.381E-09	1.964E-09	1.639E-09	1.394E-09	1.204E-09
NNW	1.859E-08	1.083E-08	7.626E-09	4.947E-09	3.652E-09	2.830E-09	2.227E-09	1.797E-09	1.491E-09	1.264E-09	1.090E-09

Table 2.7-150 Annual Average X/Q Values (2.26 Day Decay, Undepleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	.5-1	1-2	2-3	3-4	4-5	5-10	10-20	20-30	30-40	40-50
N	5.456E-07	1.713E-07	7.169E-08	4.176E-08	2.823E-08	1.434E-08	6.221E-09	3.458E-09	2.260E-09	1.590E-09
NNE	9.156E-07	2.634E-07	1.045E-07	6.112E-08	4.188E-08	2.061E-08	8.344E-09	4.389E-09	2.870E-09	2.087E-09
NE	1.253E-06	3.257E-07	1.174E-07	6.598E-08	4.433E-08	2.254E-08	9.936E-09	5.652E-09	3.901E-09	2.959E-09
ENE	1.019E-06	2.687E-07	9.949E-08	5.691E-08	3.868E-08	2.003E-08	9.068E-09	5.265E-09	3.689E-09	2.834E-09
E	8.710E-07	2.297E-07	8.550E-08	4.924E-08	3.370E-08	1.755E-08	7.896E-09	4.491E-09	3.063E-09	2.286E-09
ESE	8.656E-07	2.237E-07	8.203E-08	4.670E-08	3.169E-08	1.637E-08	7.383E-09	4.271E-09	2.971E-09	2.261E-09
SE	7.186E-07	1.879E-07	6.936E-08	3.966E-08	2.699E-08	1.403E-08	6.399E-09	3.741E-09	2.629E-09	2.022E-09
SSE	6.977E-07	1.816E-07	6.721E-08	3.839E-08	2.603E-08	1.374E-08	6.815E-09	4.568E-09	3.633E-09	3.029E-09
S	5.606E-07	1.428E-07	5.182E-08	2.937E-08	1.986E-08	1.035E-08	4.886E-09	3.030E-09	2.260E-09	1.829E-09
SSW	3.914E-07	1.034E-07	3.796E-08	2.158E-08	1.459E-08	7.503E-09	3.371E-09	1.953E-09	1.370E-09	1.054E-09
SW	3.745E-07	1.226E-07	4.995E-08	2.807E-08	1.837E-08	8.600E-09	3.215E-09	1.585E-09	9.947E-10	7.016E-10
WSW	2.736E-07	8.766E-08	3.524E-08	1.976E-08	1.305E-08	6.210E-09	2.376E-09	1.210E-09	7.810E-10	5.625E-10
W	3.525E-07	1.084E-07	4.263E-08	2.380E-08	1.559E-08	7.555E-09	3.121E-09	1.692E-09	1.084E-09	7.599E-10
WNW	4.668E-07	1.425E-07	5.661E-08	3.199E-08	2.116E-08	1.059E-08	4.704E-09	2.643E-09	1.688E-09	1.190E-09
NW	5.206E-07	1.610E-07	6.435E-08	3.635E-08	2.410E-08	1.191E-08	5.111E-09	2.919E-09	1.960E-09	1.396E-09
NNW	4.430E-07	1.374E-07	5.643E-08	3.246E-08	2.185E-08	1.113E-08	4.967E-09	2.808E-09	1.803E-09	1.267E-09

Table 2.7-151 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.545E-06	8.741E-07	5.153E-07	2.954E-07	1.459E-07	9.116E-08	6.355E-08	4.737E-08	3.698E-08	2.987E-08	2.488E-08
NNE	4.543E-06	1.517E-06	8.587E-07	4.677E-07	2.172E-07	1.319E-07	9.069E-08	6.716E-08	5.325E-08	4.371E-08	3.635E-08
NE	6.773E-06	2.145E-06	1.159E-06	6.039E-07	2.558E-07	1.464E-07	9.744E-08	7.096E-08	5.482E-08	4.415E-08	3.667E-08
ENE	5.417E-06	1.738E-06	9.455E-07	4.942E-07	2.125E-07	1.237E-07	8.353E-08	6.153E-08	4.799E-08	3.895E-08	3.256E-08
E	4.628E-06	1.490E-06	8.088E-07	4.230E-07	1.822E-07	1.063E-07	7.202E-08	5.325E-08	4.170E-08	3.398E-08	2.852E-08
ESE	4.672E-06	1.495E-06	8.019E-07	4.149E-07	1.765E-07	1.023E-07	6.873E-08	5.045E-08	3.924E-08	3.179E-08	2.654E-08
SE	3.819E-06	1.233E-06	6.674E-07	3.473E-07	1.487E-07	8.648E-08	5.832E-08	4.294E-08	3.348E-08	2.719E-08	2.274E-08
SSE	3.768E-06	1.200E-06	6.458E-07	3.345E-07	1.433E-07	8.353E-08	5.637E-08	4.148E-08	3.230E-08	2.617E-08	2.184E-08
S	3.143E-06	9.727E-07	5.148E-07	2.644E-07	1.114E-07	6.410E-08	4.287E-08	3.136E-08	2.433E-08	1.967E-08	1.639E-08
SSW	2.056E-06	6.629E-07	3.640E-07	1.905E-07	8.155E-08	4.723E-08	3.176E-08	2.332E-08	1.814E-08	1.468E-08	1.224E-08
SW	1.562E-06	5.816E-07	3.601E-07	2.140E-07	1.066E-07	6.535E-08	4.453E-08	3.249E-08	2.488E-08	1.976E-08	1.613E-08
WSW	1.174E-06	4.288E-07	2.623E-07	1.544E-07	7.567E-08	4.604E-08	3.127E-08	2.279E-08	1.745E-08	1.386E-08	1.144E-08
W	1.605E-06	5.627E-07	3.354E-07	1.928E-07	9.195E-08	5.529E-08	3.735E-08	2.714E-08	2.075E-08	1.648E-08	1.346E-08
WNW	2.199E-06	7.530E-07	4.421E-07	2.531E-07	1.207E-07	7.303E-08	4.968E-08	3.635E-08	2.797E-08	2.233E-08	1.835E-08
NW	2.412E-06	8.351E-07	4.942E-07	2.849E-07	1.370E-07	8.314E-08	5.657E-08	4.137E-08	3.181E-08	2.538E-08	2.091E-08
NNW	2.128E-06	7.133E-07	4.163E-07	2.389E-07	1.167E-07	7.206E-08	4.972E-08	3.675E-08	2.851E-08	2.291E-08	1.907E-08

Table 2.7-151 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Annual Average X/Q (sec/m^3)											
	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	2.116E-08	1.222E-08	8.483E-09	5.337E-09	3.819E-09	2.863E-09	2.222E-09	1.770E-09	1.437E-09	1.194E-09	1.010E-09
NNE	3.089E-08	1.712E-08	1.152E-08	6.874E-09	4.756E-09	3.570E-09	2.824E-09	2.315E-09	1.943E-09	1.666E-09	1.450E-09
NE	3.120E-08	1.801E-08	1.261E-08	8.026E-09	5.837E-09	4.565E-09	3.740E-09	3.163E-09	2.728E-09	2.398E-09	2.134E-09
ENE	2.786E-08	1.642E-08	1.166E-08	7.567E-09	5.583E-09	4.419E-09	3.659E-09	3.124E-09	2.718E-09	2.408E-09	2.160E-09
E	2.450E-08	1.450E-08	1.029E-08	6.628E-09	4.832E-09	3.769E-09	3.070E-09	2.578E-09	2.212E-09	1.932E-09	1.709E-09
ESE	2.270E-08	1.330E-08	9.413E-09	6.088E-09	4.479E-09	3.531E-09	2.909E-09	2.471E-09	2.144E-09	1.893E-09	1.693E-09
SE	1.948E-08	1.151E-08	8.196E-09	5.348E-09	3.963E-09	3.147E-09	2.612E-09	2.234E-09	1.948E-09	1.728E-09	1.551E-09
SSE	1.865E-08	1.123E-08	8.215E-09	5.754E-09	4.636E-09	4.010E-09	3.601E-09	3.268E-09	2.944E-09	2.655E-09	2.392E-09
S	1.398E-08	8.290E-09	5.965E-09	4.011E-09	3.080E-09	2.540E-09	2.189E-09	1.941E-09	1.747E-09	1.592E-09	1.455E-09
SSW	1.045E-08	6.126E-09	4.334E-09	2.802E-09	2.066E-09	1.636E-09	1.357E-09	1.162E-09	1.013E-09	8.986E-10	8.064E-10
SW	1.348E-08	7.098E-09	4.588E-09	2.576E-09	1.705E-09	1.235E-09	9.488E-10	7.577E-10	6.223E-10	5.230E-10	4.469E-10
WSW	9.647E-09	5.118E-09	3.338E-09	1.912E-09	1.292E-09	9.563E-10	7.468E-10	6.026E-10	4.974E-10	4.187E-10	3.577E-10
W	1.127E-08	6.199E-09	4.175E-09	2.539E-09	1.769E-09	1.312E-09	1.010E-09	7.956E-10	6.441E-10	5.341E-10	4.513E-10
WNW	1.542E-08	8.792E-09	6.119E-09	3.925E-09	2.793E-09	2.076E-09	1.579E-09	1.244E-09	1.010E-09	8.404E-10	7.120E-10
NW	1.763E-08	9.840E-09	6.728E-09	4.223E-09	3.064E-09	2.342E-09	1.848E-09	1.490E-09	1.217E-09	1.014E-09	8.605E-10
NNW	1.622E-08	9.339E-09	6.532E-09	4.212E-09	3.017E-09	2.255E-09	1.727E-09	1.360E-09	1.104E-09	9.171E-10	7.765E-10

Table 2.7-151 Annual Average X/Q Values (8.0 Day Decay, Depleted) for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

	X/Q (sec/m^3) for Each Segment									
	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	4.973E-07	1.548E-07	6.444E-08	3.724E-08	2.498E-08	1.255E-08	5.361E-09	2.861E-09	1.772E-09	1.198E-09
NNE	8.313E-07	2.350E-07	9.226E-08	5.359E-08	3.651E-08	1.769E-08	6.965E-09	3.588E-09	2.319E-09	1.668E-09
NE	1.131E-06	2.845E-07	9.990E-08	5.537E-08	3.686E-08	1.854E-08	8.071E-09	4.574E-09	3.162E-09	2.398E-09
ENE	9.210E-07	2.357E-07	8.545E-08	4.841E-08	3.271E-08	1.685E-08	7.595E-09	4.425E-09	3.122E-09	2.408E-09
E	7.888E-07	2.020E-07	7.367E-08	4.206E-08	2.865E-08	1.485E-08	6.643E-09	3.773E-09	2.579E-09	1.932E-09
ESE	7.840E-07	1.965E-07	7.037E-08	3.960E-08	2.667E-08	1.366E-08	6.112E-09	3.535E-09	2.472E-09	1.893E-09
SE	6.509E-07	1.652E-07	5.967E-08	3.379E-08	2.285E-08	1.181E-08	5.365E-09	3.151E-09	2.233E-09	1.728E-09
SSE	6.306E-07	1.592E-07	5.766E-08	3.258E-08	2.194E-08	1.154E-08	5.804E-09	4.013E-09	3.240E-09	2.643E-09
S	5.053E-07	1.244E-07	4.393E-08	2.456E-08	1.647E-08	8.522E-09	4.032E-09	2.544E-09	1.938E-09	1.587E-09
SSW	3.533E-07	9.051E-08	3.251E-08	1.830E-08	1.230E-08	6.289E-09	2.815E-09	1.639E-09	1.161E-09	8.982E-10
SW	3.444E-07	1.121E-07	4.526E-08	2.510E-08	1.622E-08	7.400E-09	2.636E-09	1.246E-09	7.607E-10	5.242E-10
WSW	2.513E-07	7.999E-08	3.182E-08	1.760E-08	1.149E-08	5.334E-09	1.954E-09	9.621E-10	6.037E-10	4.194E-10
W	3.225E-07	9.806E-08	3.805E-08	2.095E-08	1.354E-08	6.425E-09	2.560E-09	1.313E-09	7.991E-10	5.360E-10
WNW	4.272E-07	1.289E-07	5.057E-08	2.821E-08	1.844E-08	9.077E-09	3.910E-09	2.069E-09	1.251E-09	8.432E-10
NW	4.769E-07	1.459E-07	5.758E-08	3.209E-08	2.102E-08	1.019E-08	4.265E-09	2.337E-09	1.489E-09	1.018E-09
NNW	4.035E-07	1.240E-07	5.049E-08	2.873E-08	1.915E-08	9.620E-09	4.196E-09	2.247E-09	1.367E-09	9.203E-10

Table 2.7-152 Annual Average D/Q Values for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 1 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	**0.25**	**0.5**	**0.75**	**1.0**	**1.5**	**2.0**	**2.5**	**3.0**	**3.5**	**4.0**	**4.5**
N	2.765E-08	1.153E-08	7.216E-09	3.951E-09	1.625E-09	8.936E-10	5.656E-10	3.900E-10	2.846E-10	2.164E-10	1.697E-10
NNE	5.129E-08	2.093E-08	1.227E-08	6.502E-09	2.568E-09	1.388E-09	8.697E-10	5.958E-10	4.371E-10	3.353E-10	2.624E-10
NE	6.475E-08	2.432E-08	1.330E-08	6.599E-09	2.436E-09	1.249E-09	7.543E-10	5.040E-10	3.602E-10	2.702E-10	2.103E-10
ENE	4.778E-08	1.835E-08	1.017E-08	5.090E-09	1.892E-09	9.768E-10	5.931E-10	3.978E-10	2.851E-10	2.144E-10	1.670E-10
E	3.941E-08	1.587E-08	8.962E-09	4.513E-09	1.672E-09	8.643E-10	5.256E-10	3.531E-10	2.536E-10	1.910E-10	1.491E-10
ESE	3.832E-08	1.556E-08	8.798E-09	4.425E-09	1.634E-09	8.431E-10	5.120E-10	3.438E-10	2.468E-10	1.859E-10	1.452E-10
SE	3.211E-08	1.300E-08	7.355E-09	3.706E-09	1.372E-09	7.094E-10	4.314E-10	2.899E-10	2.082E-10	1.569E-10	1.225E-10
SSE	3.073E-08	1.188E-08	6.595E-09	3.298E-09	1.222E-09	6.298E-10	3.820E-10	2.561E-10	1.835E-10	1.380E-10	1.075E-10
S	2.532E-08	9.258E-09	4.993E-09	2.456E-09	9.030E-10	4.602E-10	2.768E-10	1.843E-10	1.313E-10	9.831E-11	7.635E-11
SSW	2.053E-08	7.652E-09	4.146E-09	2.039E-09	7.477E-10	3.803E-10	2.283E-10	1.519E-10	1.082E-10	8.103E-11	6.296E-11
SW	2.861E-08	1.292E-08	8.666E-09	4.786E-09	1.980E-09	1.079E-09	6.775E-10	4.647E-10	3.381E-10	2.567E-10	2.013E-10
WSW	1.856E-08	8.272E-09	5.513E-09	3.041E-09	1.256E-09	6.867E-10	4.324E-10	2.971E-10	2.165E-10	1.645E-10	1.335E-10
W	2.451E-08	1.109E-08	6.617E-09	3.708E-09	1.482E-09	7.895E-10	4.882E-10	3.315E-10	2.397E-10	1.812E-10	1.418E-10
WNW	2.936E-08	1.354E-08	8.467E-09	4.474E-09	1.784E-09	9.530E-10	5.909E-10	4.021E-10	2.911E-10	2.204E-10	1.725E-10
NW	2.813E-08	1.310E-08	8.119E-09	4.721E-09	1.914E-09	1.030E-09	6.416E-10	4.378E-10	3.176E-10	2.407E-10	1.886E-10
NNW	2.201E-08	8.907E-09	5.592E-09	3.098E-09	1.294E-09	7.174E-10	4.563E-10	3.155E-10	2.306E-10	1.754E-10	1.416E-10

Table 2.7-152 Annual Average D/Q Values for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 2 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Distance in Miles from the Site										
Sector	**5**	**7.5**	**10**	**15.0**	**20**	**25.0**	**30**	**35.0**	**40**	**45.0**	**50**
N	1.364E-10	6.574E-11	3.996E-11	2.105E-11	2.895E-11	2.092E-11	1.361E-11	1.056E-11	8.277E-12	6.632E-12	5.417E-12
NNE	2.107E-10	9.883E-11	5.986E-11	3.098E-11	1.950E-11	1.378E-11	1.050E-11	8.413E-12	6.976E-12	5.945E-12	5.189E-12
NE	1.683E-10	7.727E-11	4.722E-11	2.456E-11	1.539E-11	1.090E-11	8.410E-12	6.876E-12	5.845E-12	5.089E-12	4.558E-12
ENE	1.339E-10	6.177E-11	3.780E-11	1.972E-11	1.240E-11	8.871E-12	6.932E-12	5.752E-12	4.958E-12	4.373E-12	3.970E-12
E	1.197E-10	5.551E-11	3.412E-11	1.794E-11	1.127E-11	8.109E-12	6.156E-12	4.855E-12	3.938E-12	3.263E-12	2.755E-12
ESE	1.166E-10	5.409E-11	3.330E-11	1.752E-11	1.103E-11	7.967E-12	6.093E-12	4.858E-12	3.998E-12	3.425E-12	3.212E-12
SE	9.837E-11	4.570E-11	2.807E-11	1.479E-11	9.318E-12	6.704E-12	5.267E-12	4.368E-12	3.782E-12	3.359E-12	3.062E-12
SSE	8.619E-11	3.991E-11	2.449E-11	1.278E-11	8.090E-12	5.787E-12	9.466E-12	1.413E-11	1.202E-11	9.480E-12	7.206E-12
S	6.103E-11	2.786E-11	1.703E-11	8.808E-12	5.503E-12	3.905E-12	3.037E-12	2.521E-12	3.209E-12	3.650E-12	5.129E-12
SSW	5.036E-11	2.303E-11	1.408E-11	7.300E-12	4.574E-12	3.248E-12	2.514E-12	2.067E-12	1.774E-12	1.705E-12	1.993E-12
SW	1.619E-10	7.624E-11	4.581E-11	2.359E-11	1.475E-11	1.031E-11	7.719E-12	6.045E-12	4.906E-12	4.128E-12	3.646E-12
WSW	1.073E-10	5.018E-11	2.988E-11	1.523E-11	9.519E-12	6.752E-12	6.160E-12	5.460E-12	4.419E-12	3.579E-12	2.971E-12
W	1.139E-10	5.332E-11	3.228E-11	2.195E-11	1.703E-11	1.165E-11	8.529E-12	6.465E-12	5.032E-12	4.023E-12	3.284E-12
WNW	1.387E-10	6.622E-11	3.962E-11	3.293E-11	2.289E-11	1.552E-11	1.118E-11	8.433E-12	6.563E-12	5.243E-12	4.281E-12
NW	1.517E-10	7.161E-11	4.338E-11	2.266E-11	2.469E-11	1.806E-11	1.301E-11	9.672E-12	7.554E-12	6.050E-12	4.943E-12
NNW	1.137E-10	5.372E-11	3.236E-11	2.460E-11	2.173E-11	1.439E-11	1.030E-11	7.814E-12	6.088E-12	4.869E-12	3.976E-12

Table 2.7-152 Annual Average D/Q Values for Mixed-Mode Release from the Turbine Building Stack (Based on 1985-1989 met data) (Sheet 3 of 3)

Relative Deposition per Unit Area (m^{-2}) at Fixed Points by Downwind Sectors

	Segment Boundaries in Miles from the Site									
Sector	**.5-1**	**1-2**	**2-3**	**3-4**	**4-5**	**5-10**	**10-20**	**20-30**	**30-40**	**40-50**
N	6.723E-09	1.817E-09	5.828E-10	2.887E-10	1.712E-10	6.998E-11	2.876E-11	2.014E-11	1.056E-11	6.669E-12
NNE	1.163E-08	2.918E-09	8.983E-10	4.437E-10	2.648E-10	1.064E-10	3.229E-11	1.399E-11	8.461E-12	5.970E-12
NE	1.277E-08	2.834E-09	7.861E-10	3.670E-10	2.125E-10	8.414E-11	2.552E-11	1.110E-11	6.922E-12	5.116E-12
ENE	9.728E-09	2.196E-09	6.173E-10	2.904E-10	1.688E-10	6.714E-11	2.049E-11	9.037E-12	5.787E-12	4.397E-12
E	8.520E-09	1.944E-09	5.469E-10	2.582E-10	1.507E-10	6.028E-11	1.857E-11	8.171E-12	4.878E-12	3.275E-12
ESE	8.356E-09	1.902E-09	5.330E-10	2.513E-10	1.466E-10	5.874E-11	1.814E-11	8.034E-12	4.883E-12	3.516E-12
SE	6.987E-09	1.596E-09	4.489E-10	2.120E-10	1.237E-10	4.957E-11	1.531E-11	6.827E-12	4.402E-12	3.374E-12
SSE	6.304E-09	1.420E-09	3.977E-10	1.869E-10	1.086E-10	4.334E-11	1.330E-11	7.873E-12	1.199E-11	9.390E-12
S	4.813E-09	1.051E-09	2.887E-10	1.339E-10	7.718E-11	3.042E-11	9.166E-12	3.984E-12	2.931E-12	4.067E-12
SSW	3.989E-09	8.713E-10	2.383E-10	1.103E-10	6.365E-11	2.512E-11	7.594E-12	3.308E-12	2.083E-12	1.832E-12
SW	7.887E-09	2.203E-09	6.995E-10	3.433E-10	2.031E-10	8.175E-11	2.460E-11	1.046E-11	6.089E-12	4.180E-12
WSW	5.027E-09	1.400E-09	4.461E-10	2.197E-10	1.329E-10	5.384E-11	1.595E-11	7.253E-12	5.264E-12	3.603E-12
W	6.317E-09	1.669E-09	5.059E-10	2.437E-10	1.432E-10	5.744E-11	2.206E-11	1.184E-11	6.509E-12	4.048E-12
WNW	7.819E-09	2.012E-09	6.119E-10	2.959E-10	1.742E-10	7.050E-11	2.995E-11	1.575E-11	8.504E-12	5.278E-12
NW	7.716E-09	2.145E-09	6.637E-10	3.227E-10	1.904E-10	7.686E-11	2.817E-11	1.781E-11	9.820E-12	6.086E-12
NNW	5.220E-09	1.439E-09	4.696E-10	2.338E-10	1.413E-10	5.755E-11	2.505E-11	1.471E-11	7.867E-12	4.899E-12

Figure 2.7-1 Climatological Observing Stations near the Fermi Site

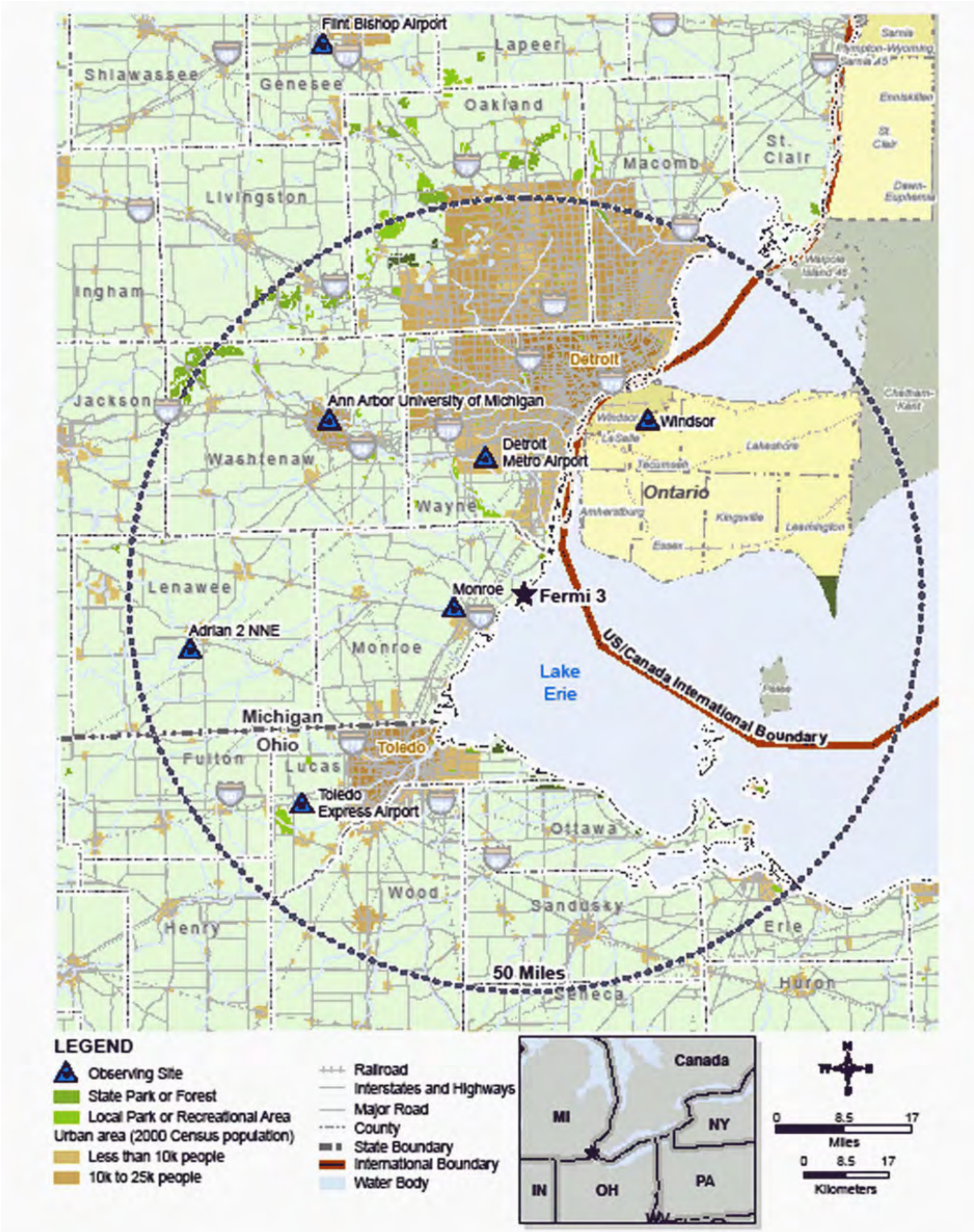
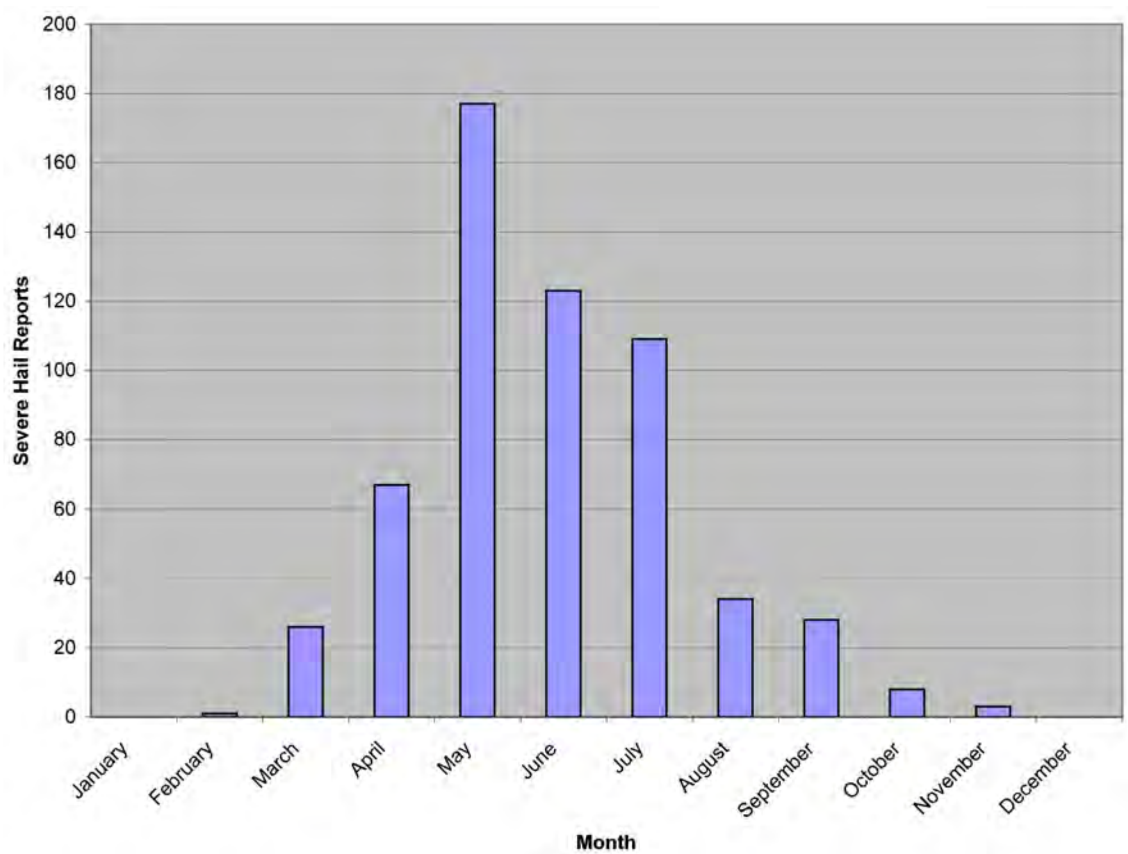
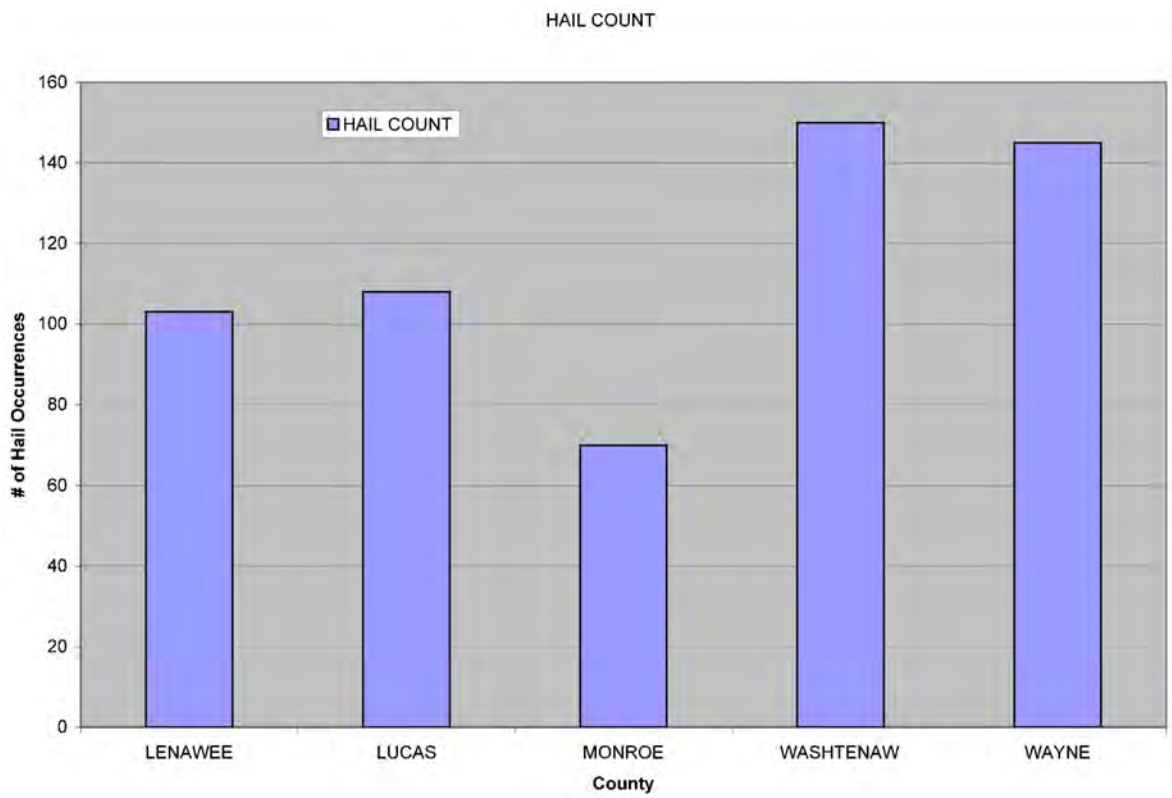


Figure 2.7-2 Total Reports of Severe Hail for the Five-County Area (1955-2007)



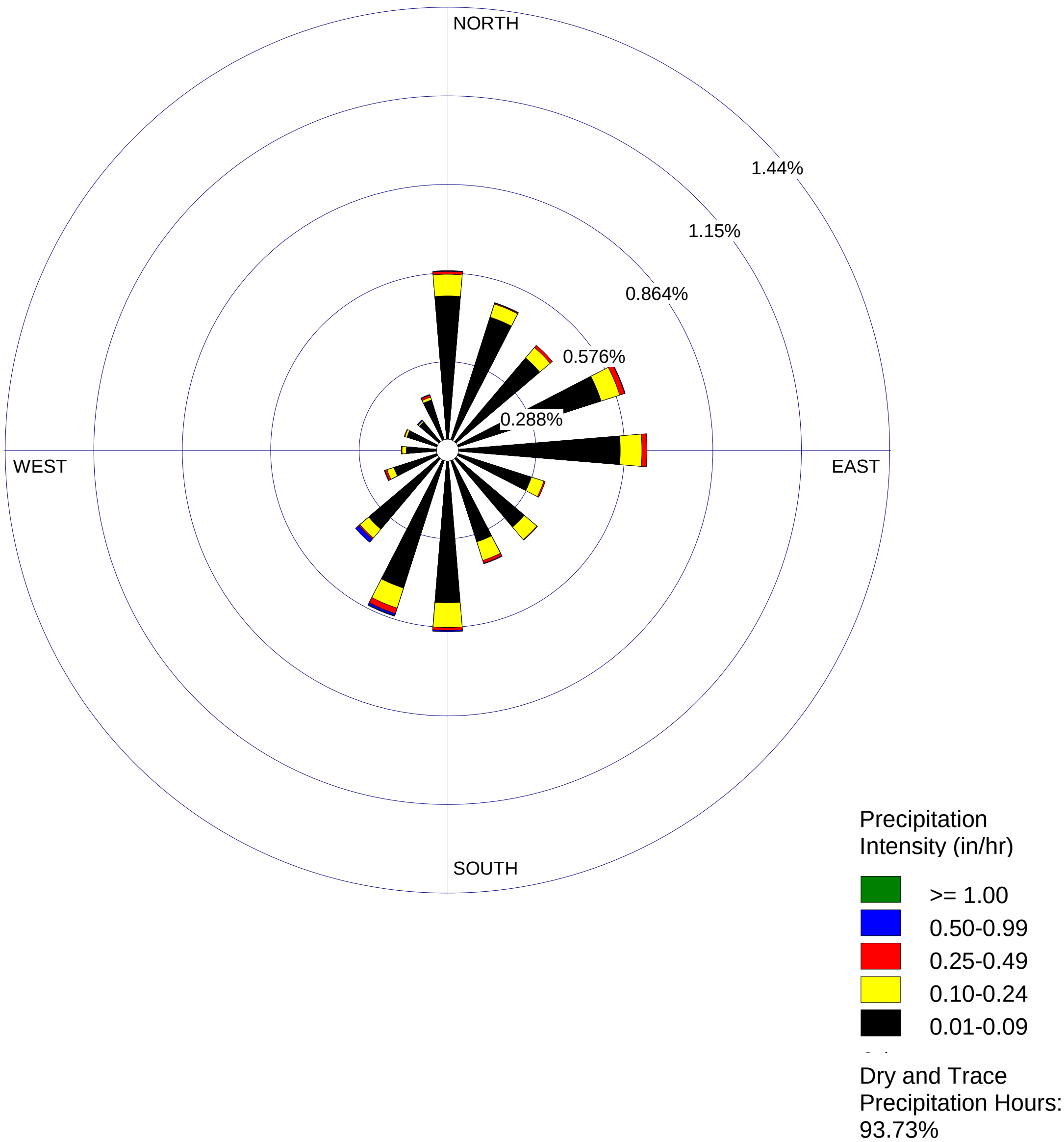
Source: Reference 2.7-29

Figure 2.7-3 Total Hail Reports for the Five-County Area (1955-2007)



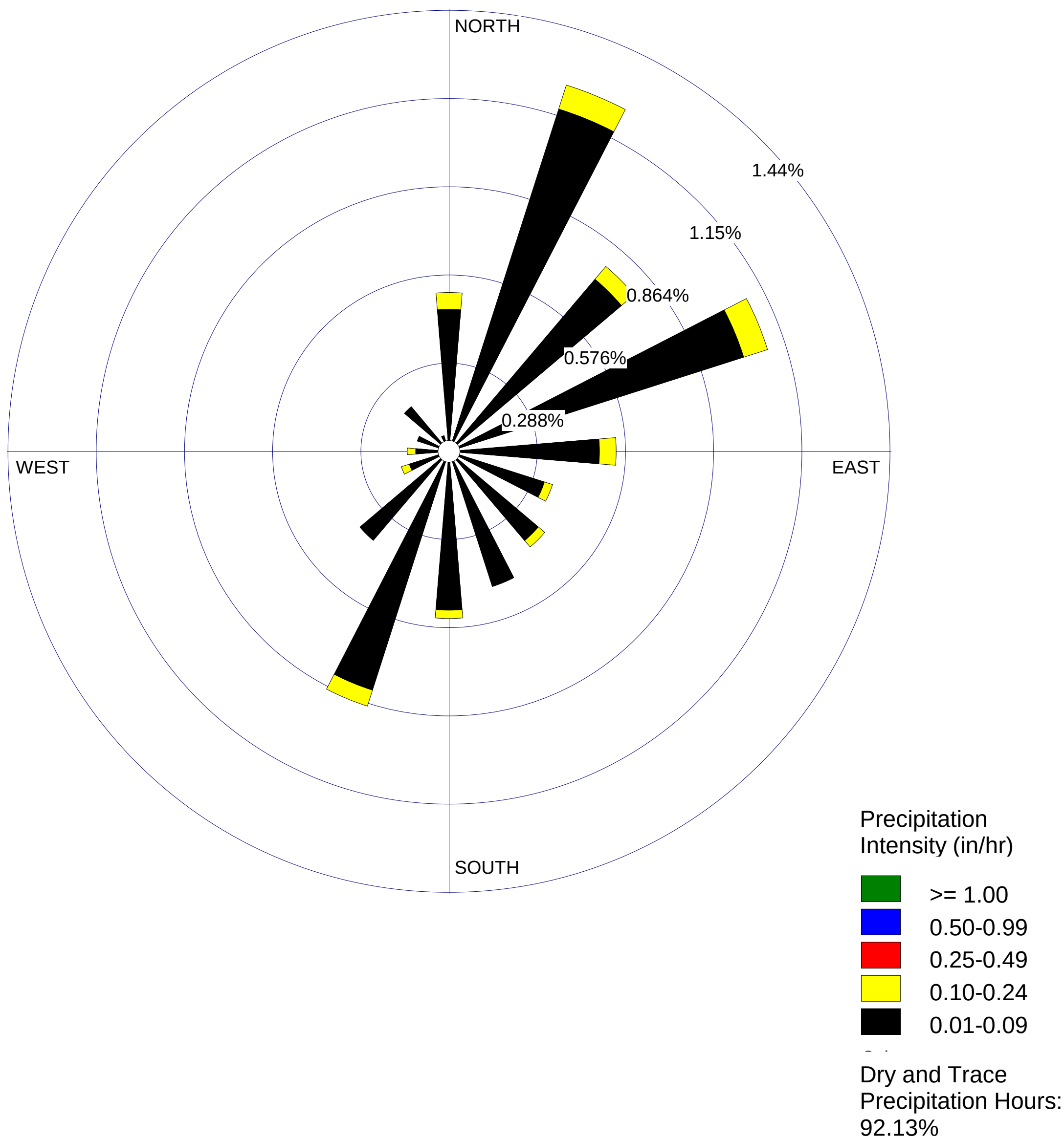
Source: Reference 2.7-29 and Reference 2.7-34

Figure 2.7-4 Detroit Metropolitan Airport Annual Precipitation Rose (2003-2007)



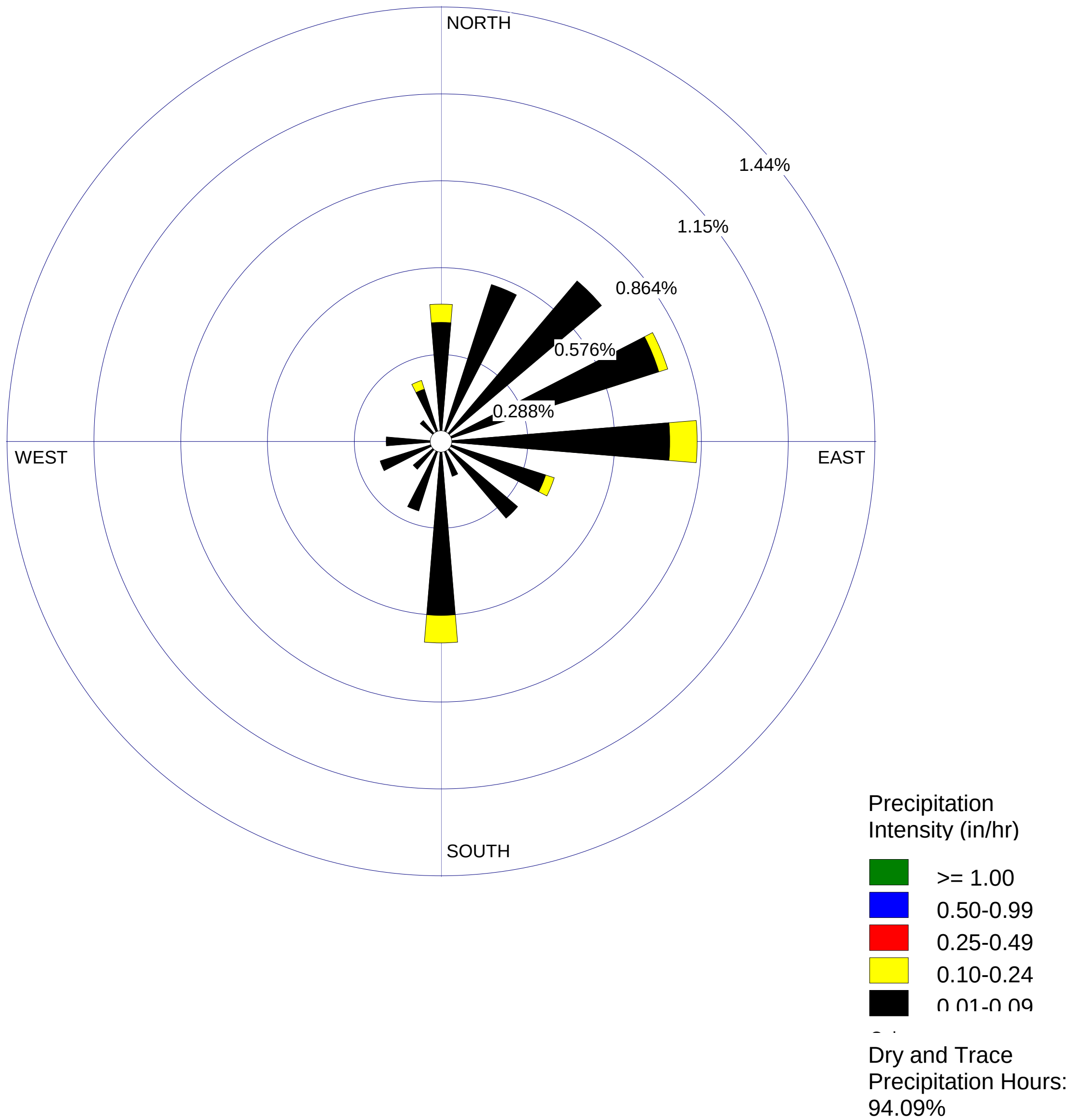
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-5 Detroit Metropolitan Airport January Precipitation Rose (2003-2007)



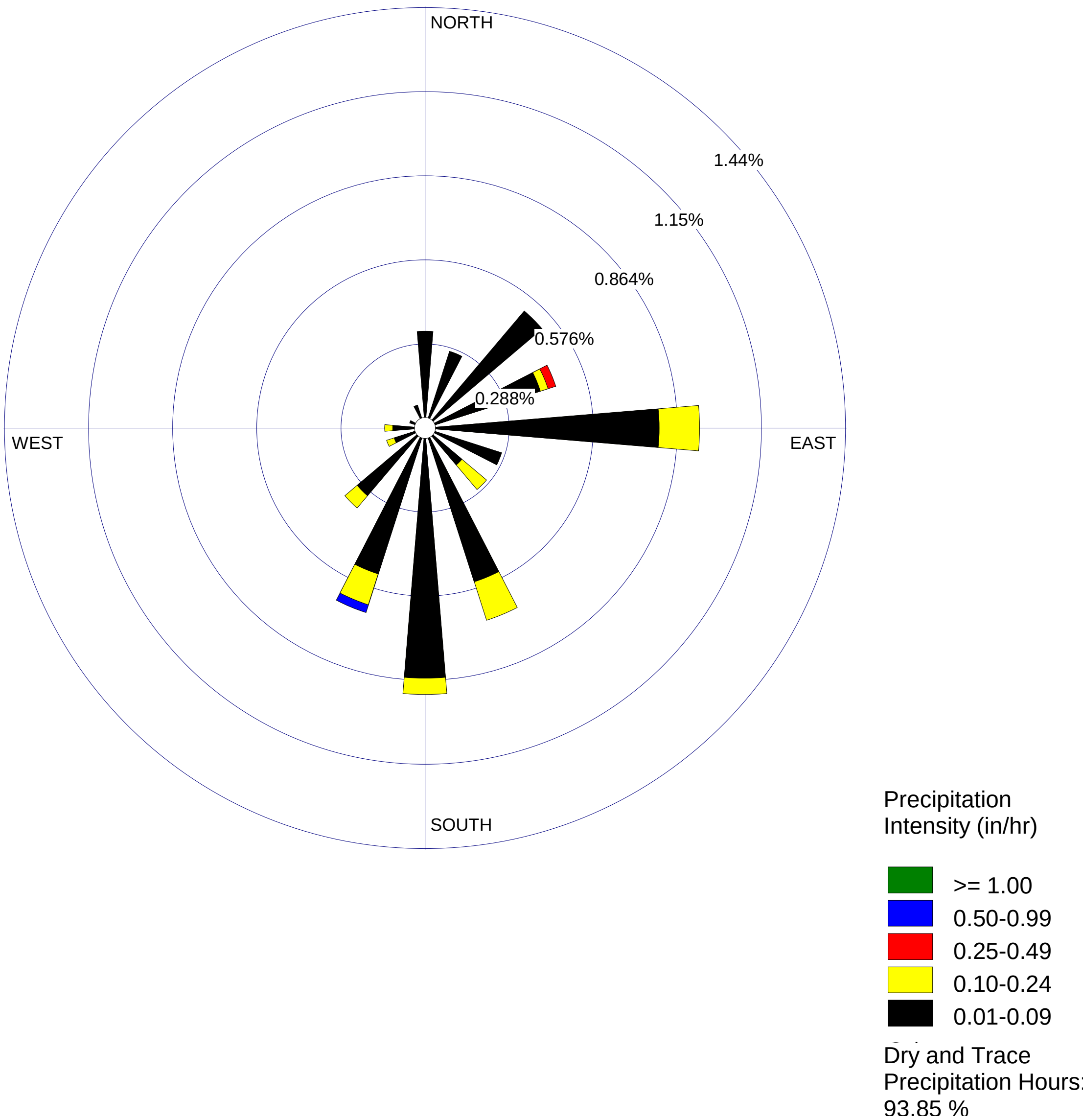
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-6 Detroit Metropolitan Airport February Precipitation Rose (2003-2007)



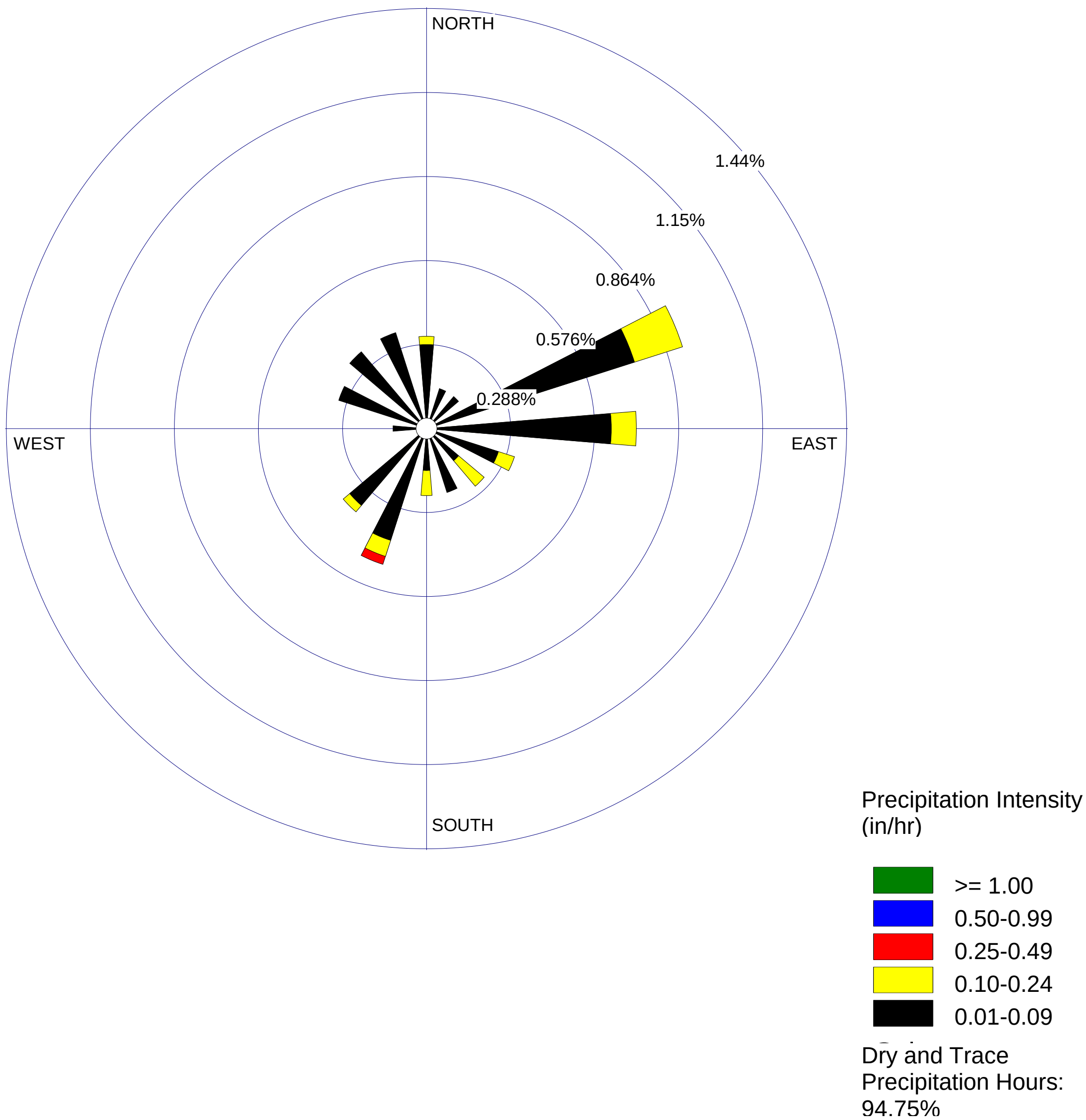
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-7 Detroit Metropolitan Airport March Precipitation Rose (2003-2007)



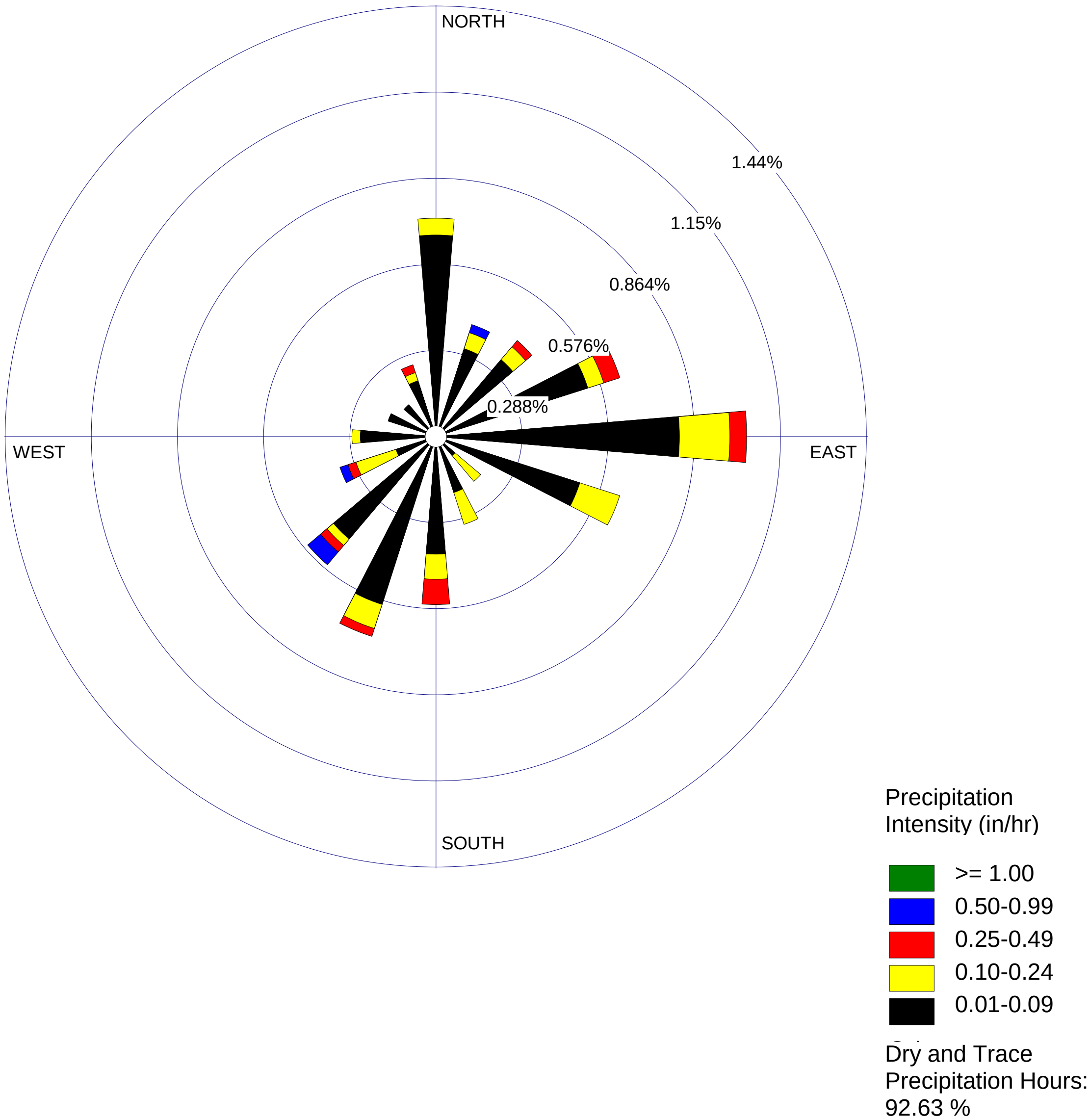
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-8 Detroit Metropolitan Airport April Precipitation Rose (2003-2007)



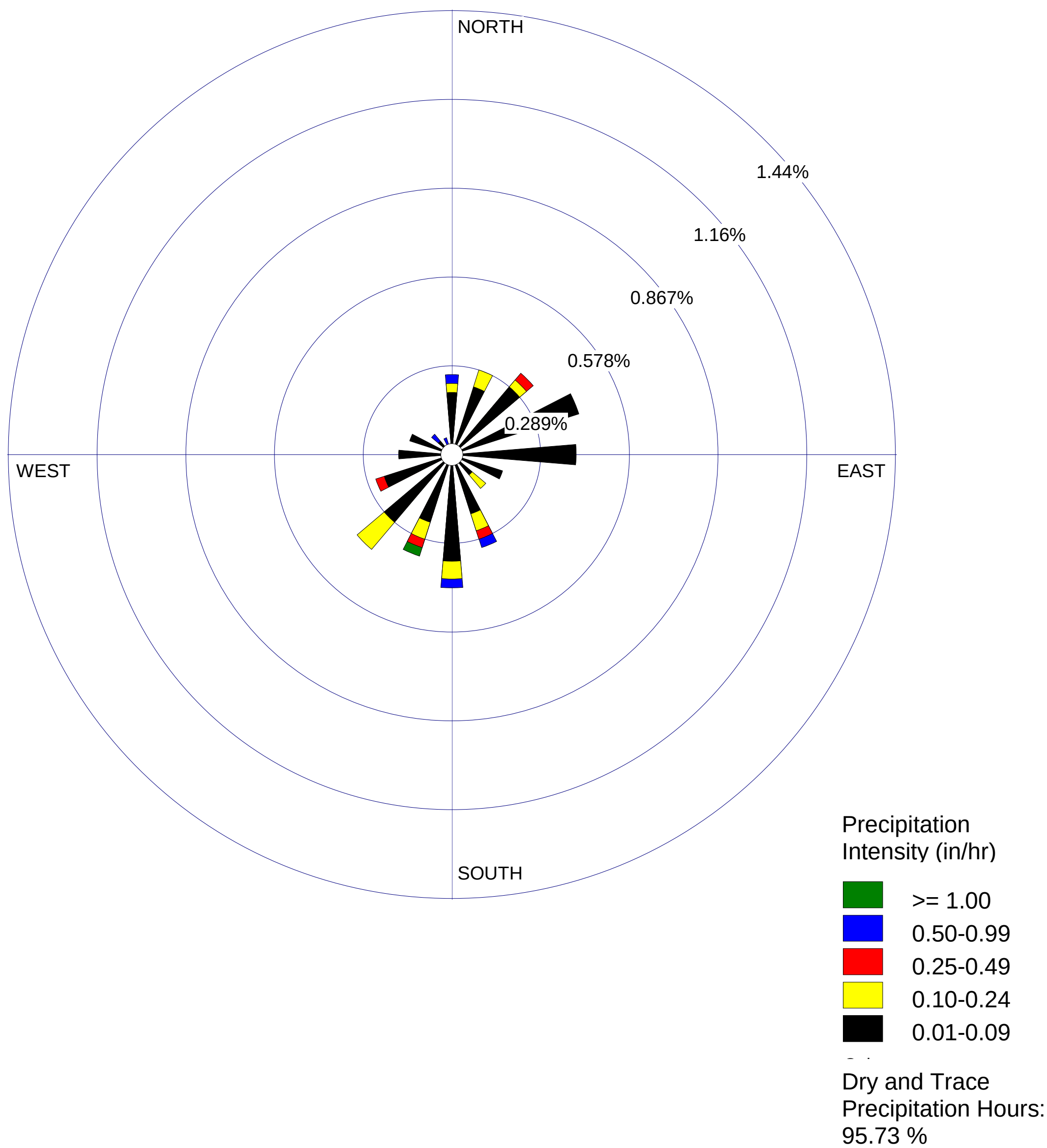
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-9 Detroit Metropolitan Airport May Precipitation Rose (2003-2007)



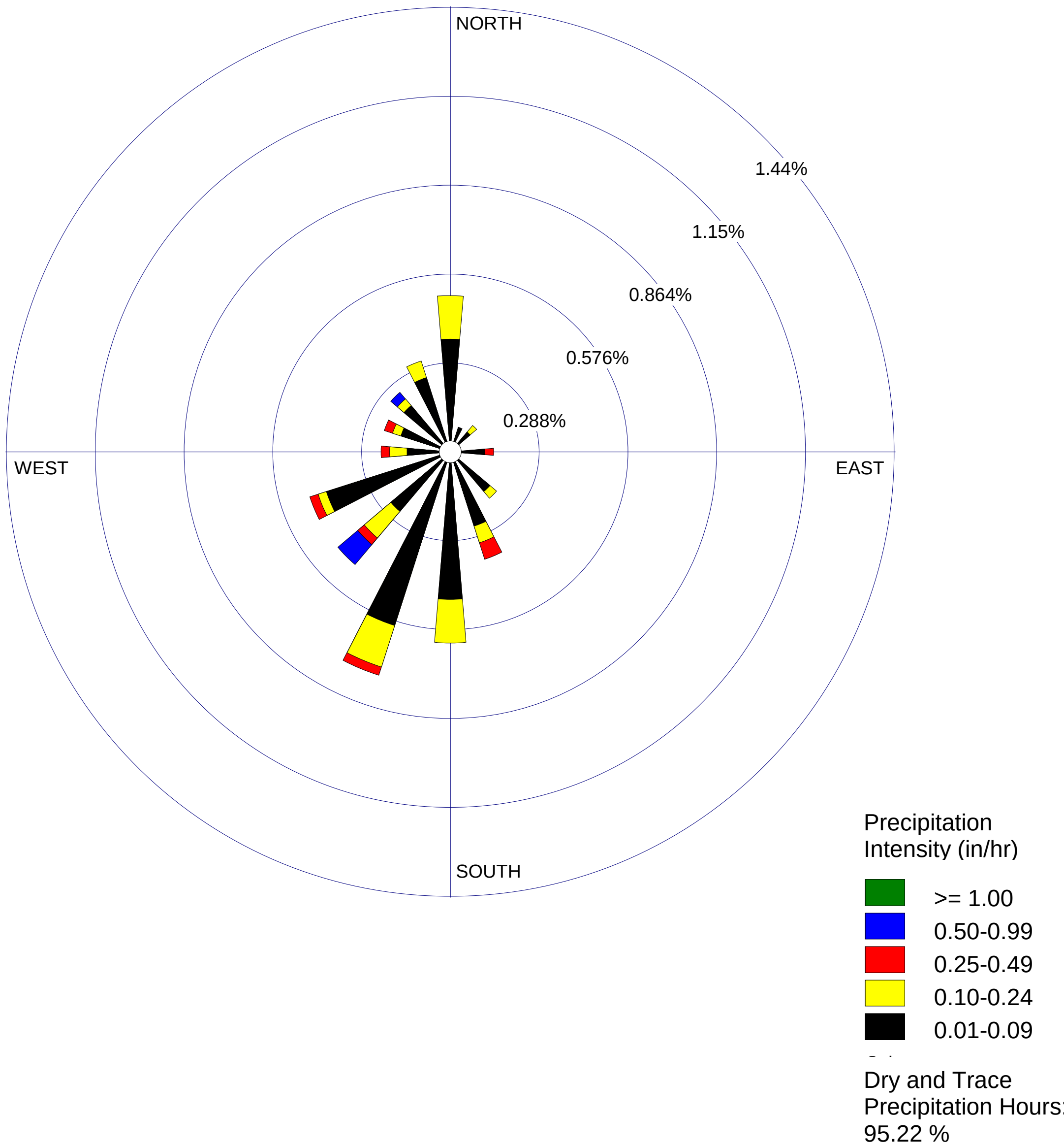
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-10 Detroit Metropolitan Airport June Precipitation Rose (2003-2007)



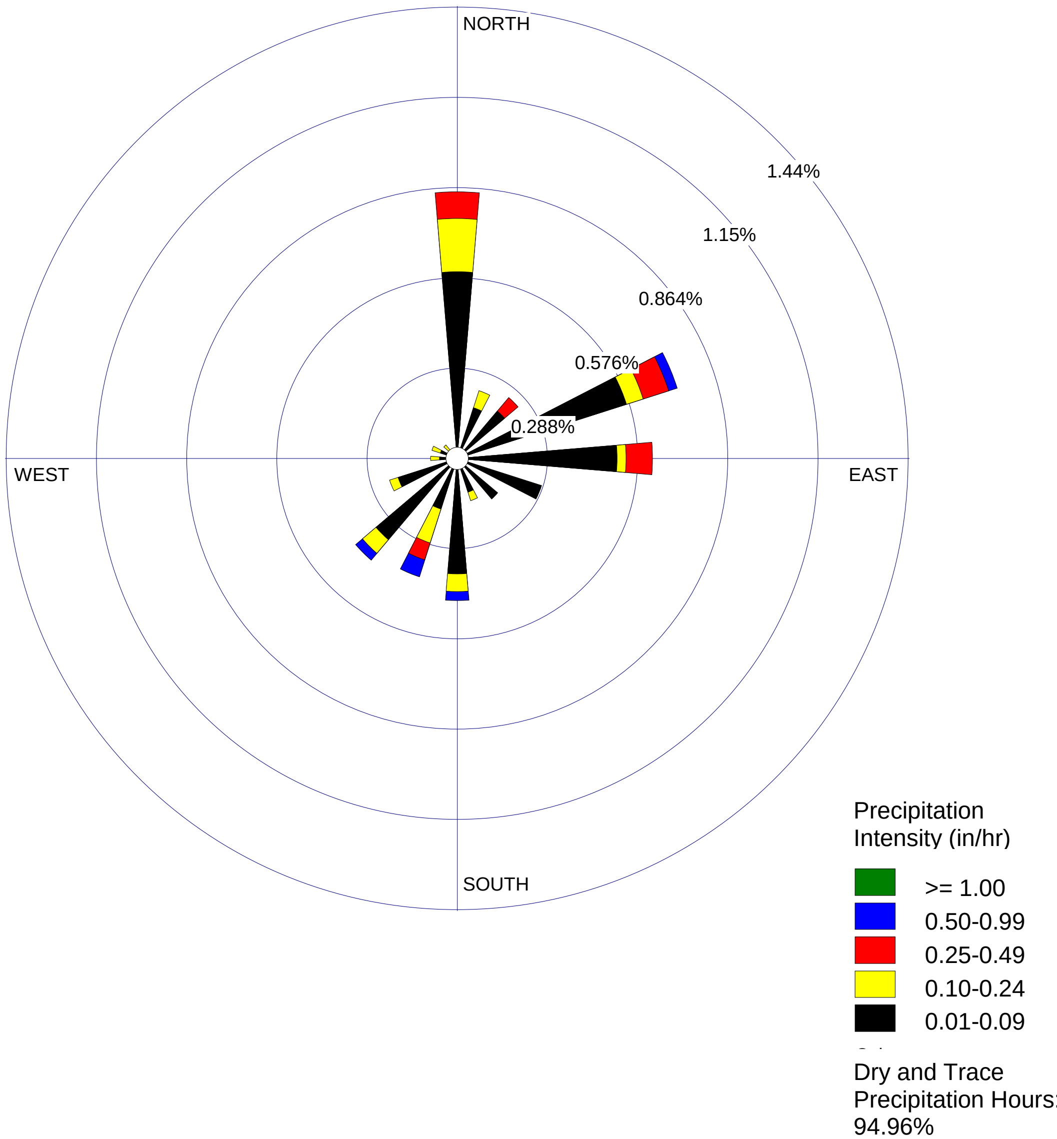
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-11 Detroit Metropolitan Airport July Precipitation Rose (2003-2007)



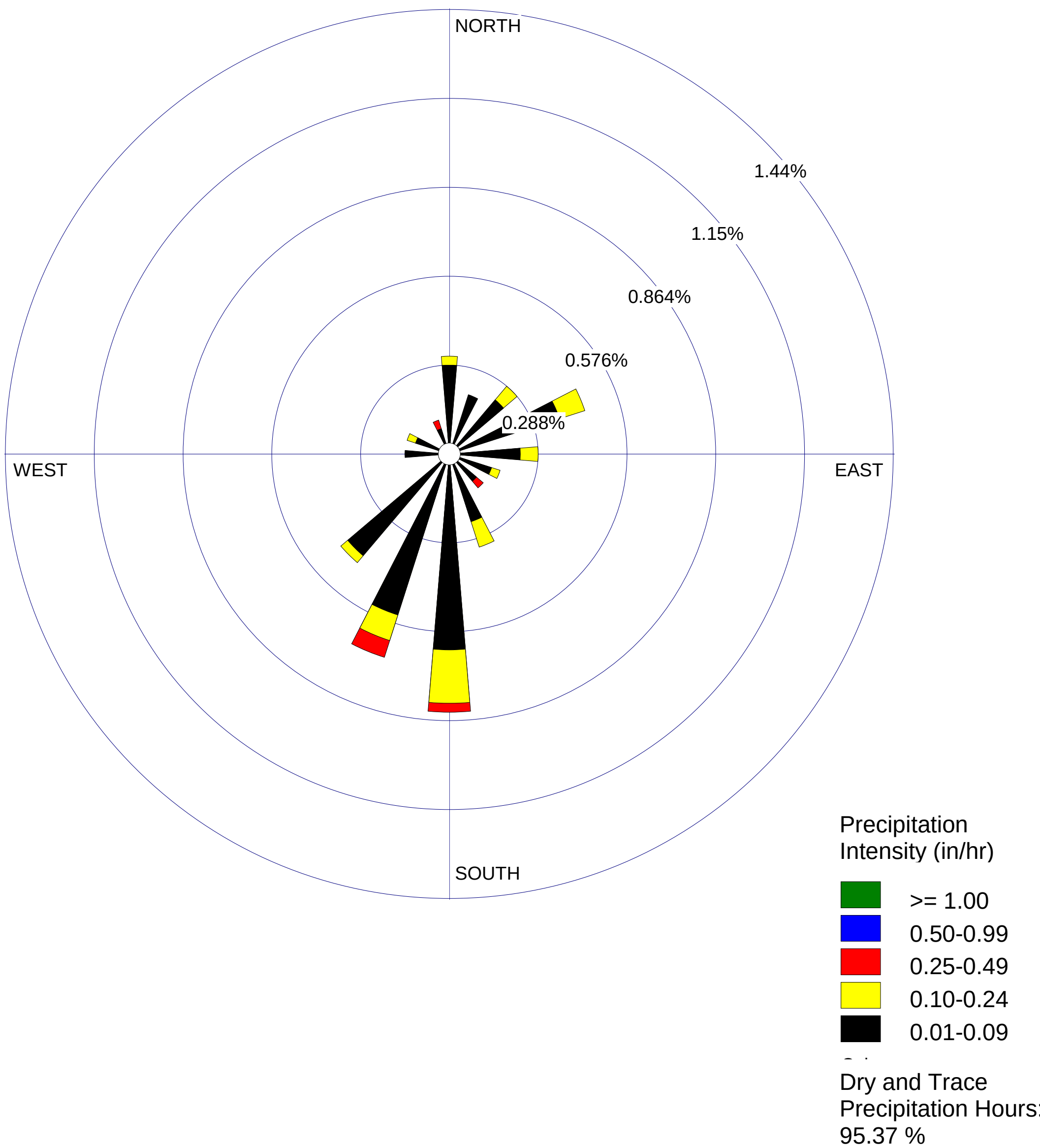
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-12 Detroit Metropolitan Airport August Precipitation Rose (2003-2007)



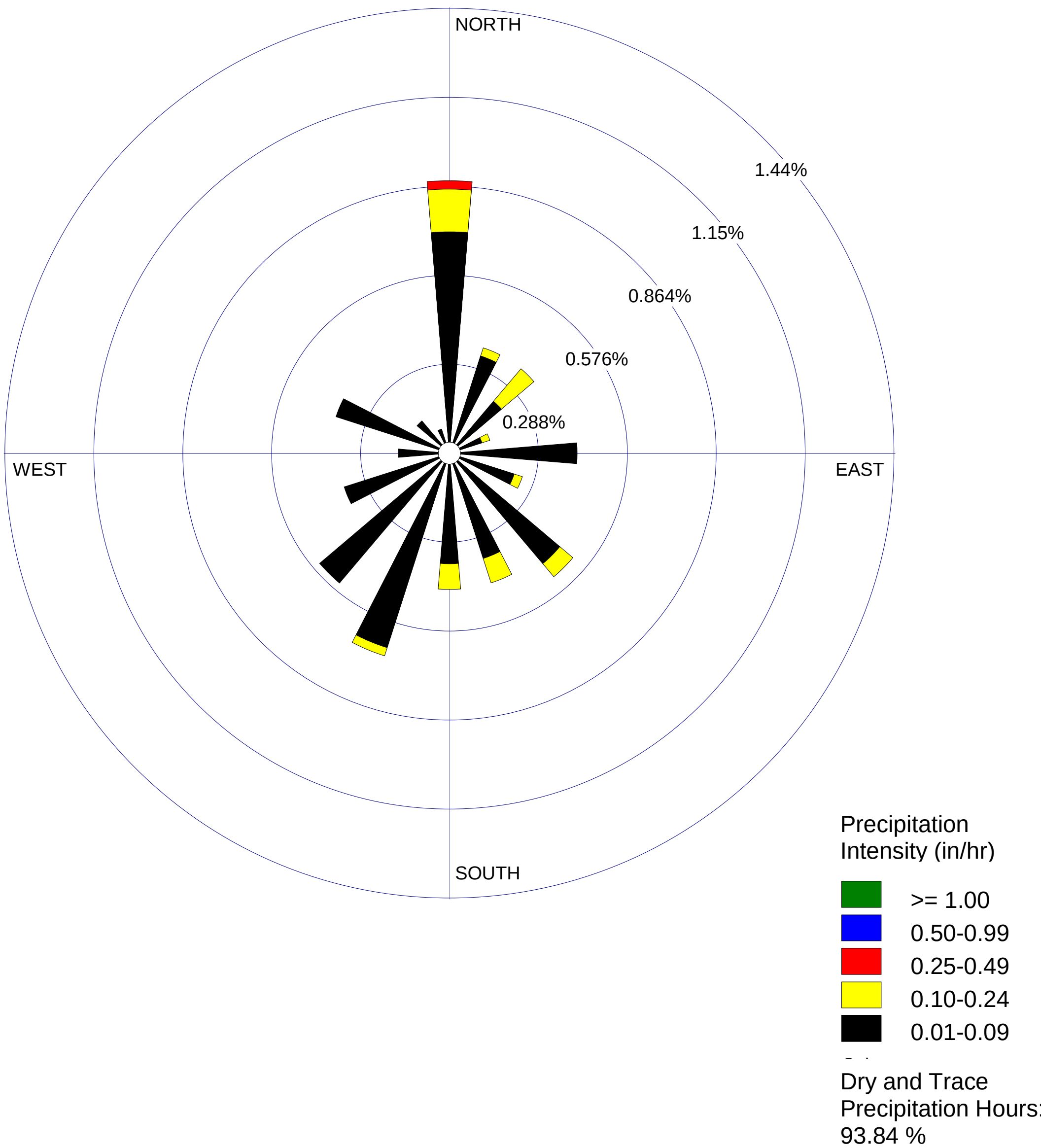
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-13 Detroit Metropolitan Airport September Precipitation Rose (2003-2007)



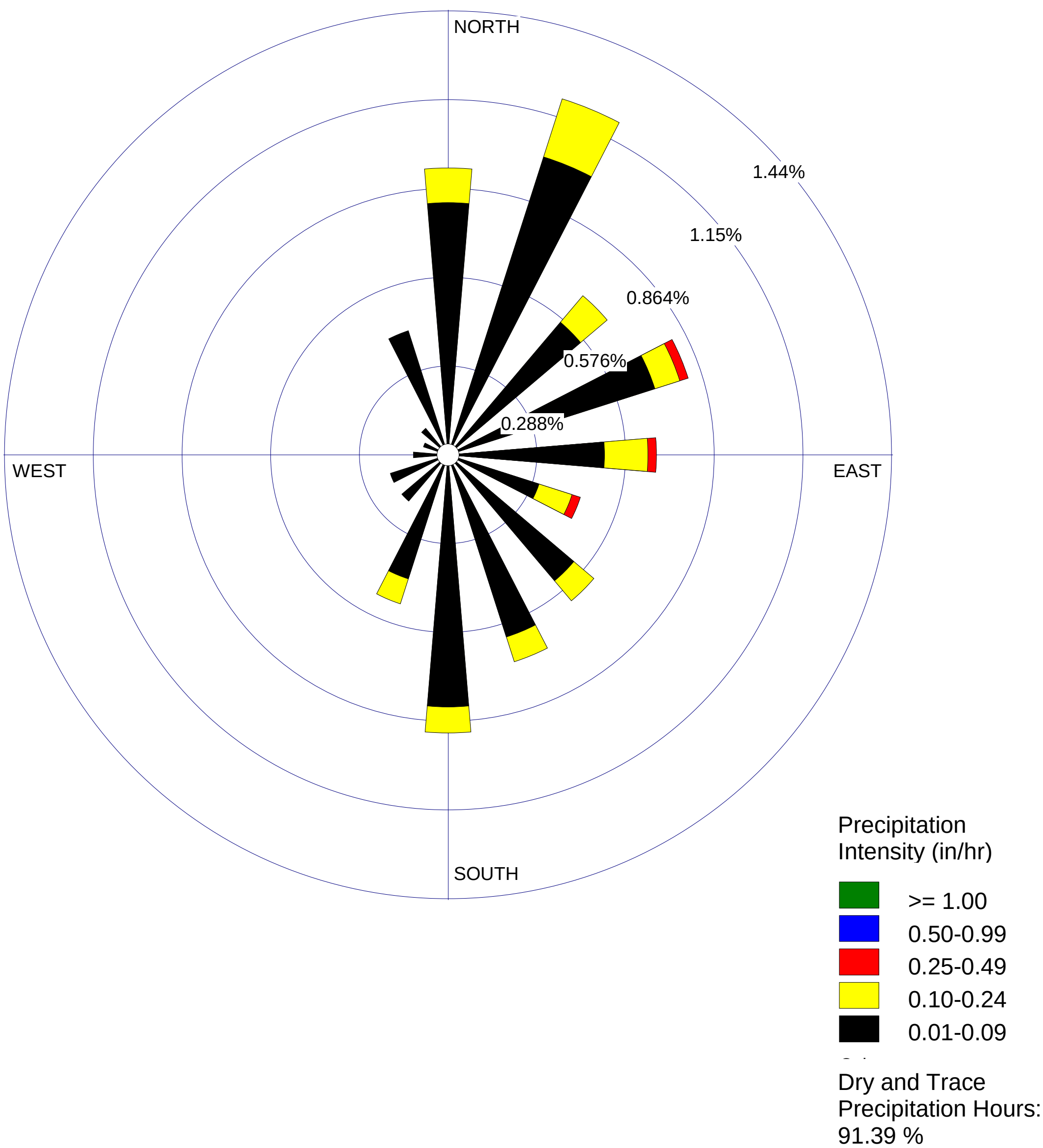
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-14 Detroit Metropolitan Airport October Precipitation Rose (2003-2007)



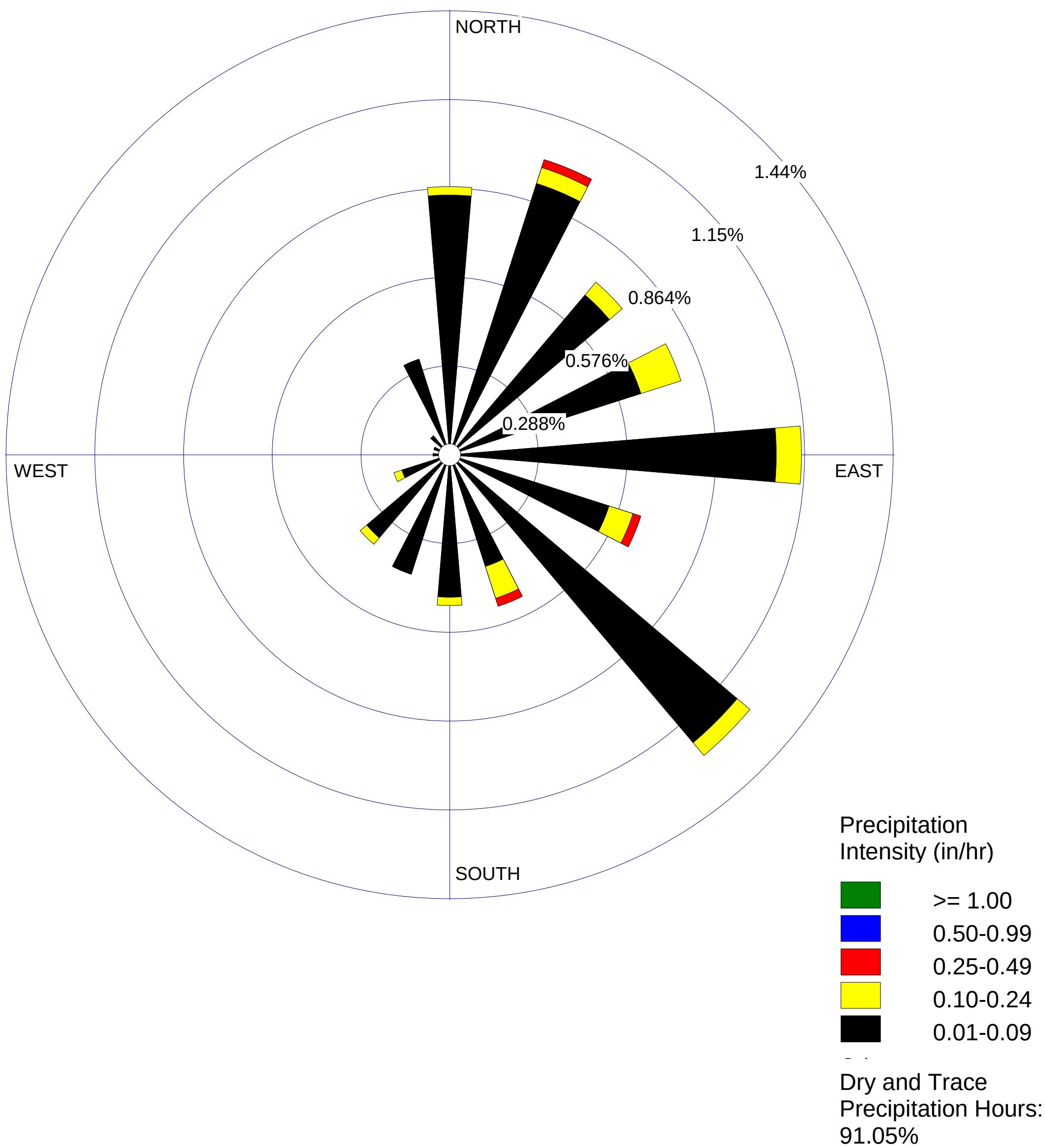
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-15 Detroit Metropolitan Airport November Precipitation Rose (2003-2007)



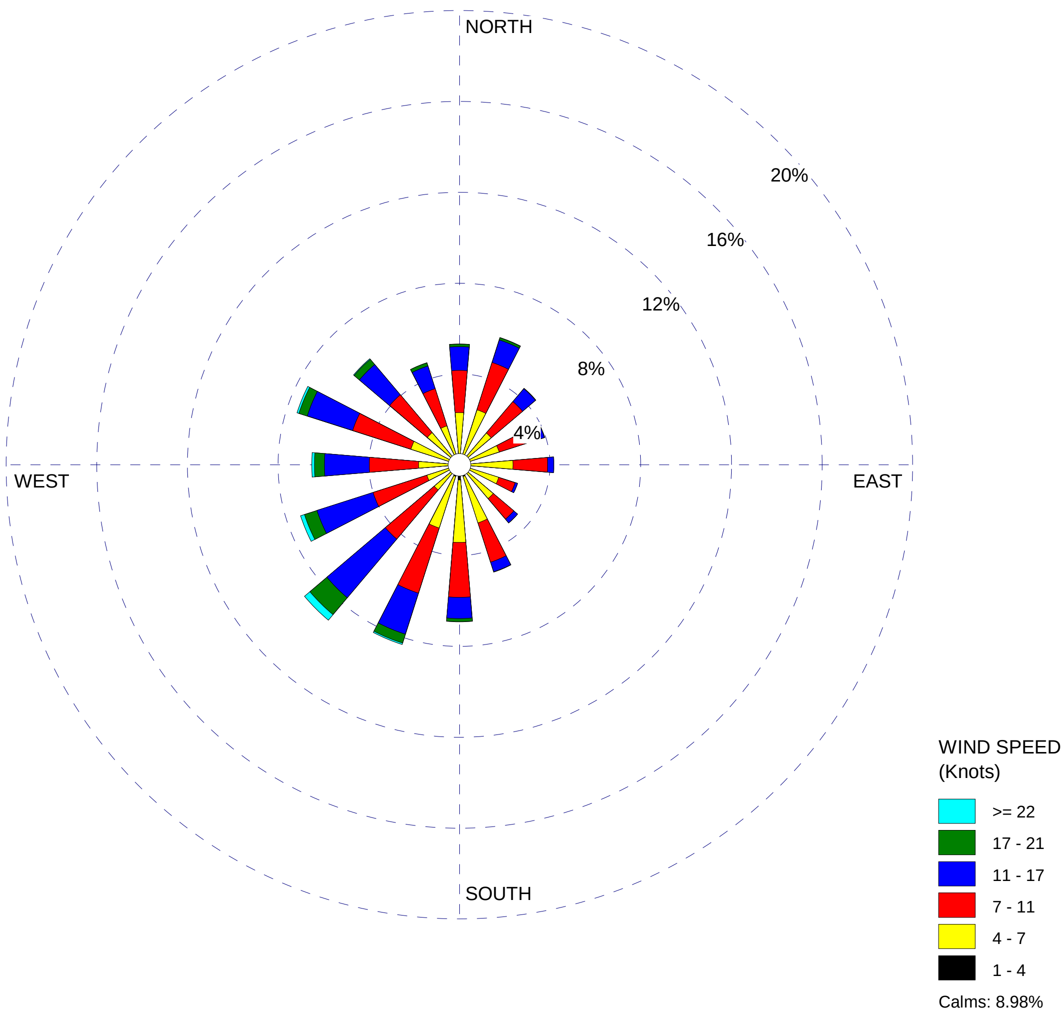
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-16 Detroit Metropolitan Airport December Precipitation Rose (2003-2007)



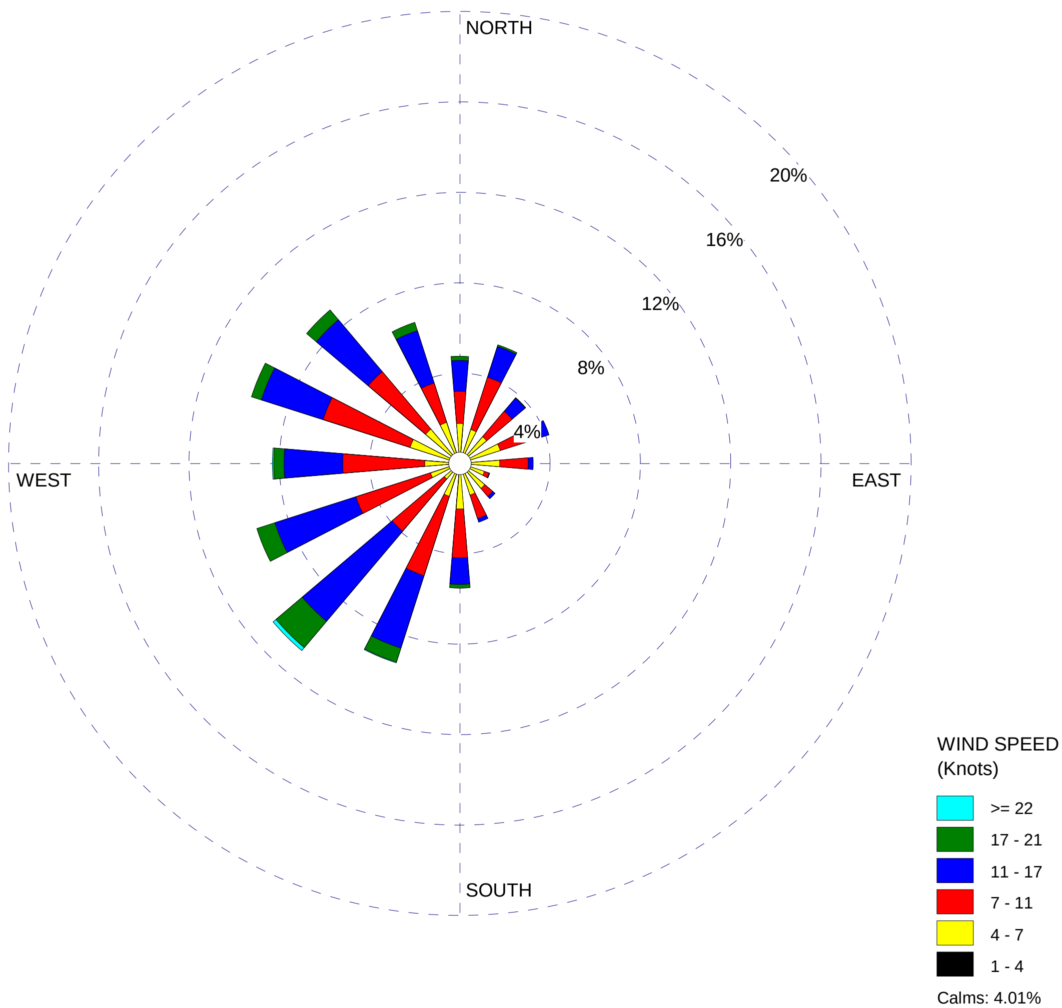
Source: Reference 2.7-41 and Reference 2.7-44

Figure 2.7-17 Detroit Metropolitan Airport Annual Wind Rose (2003-2007)



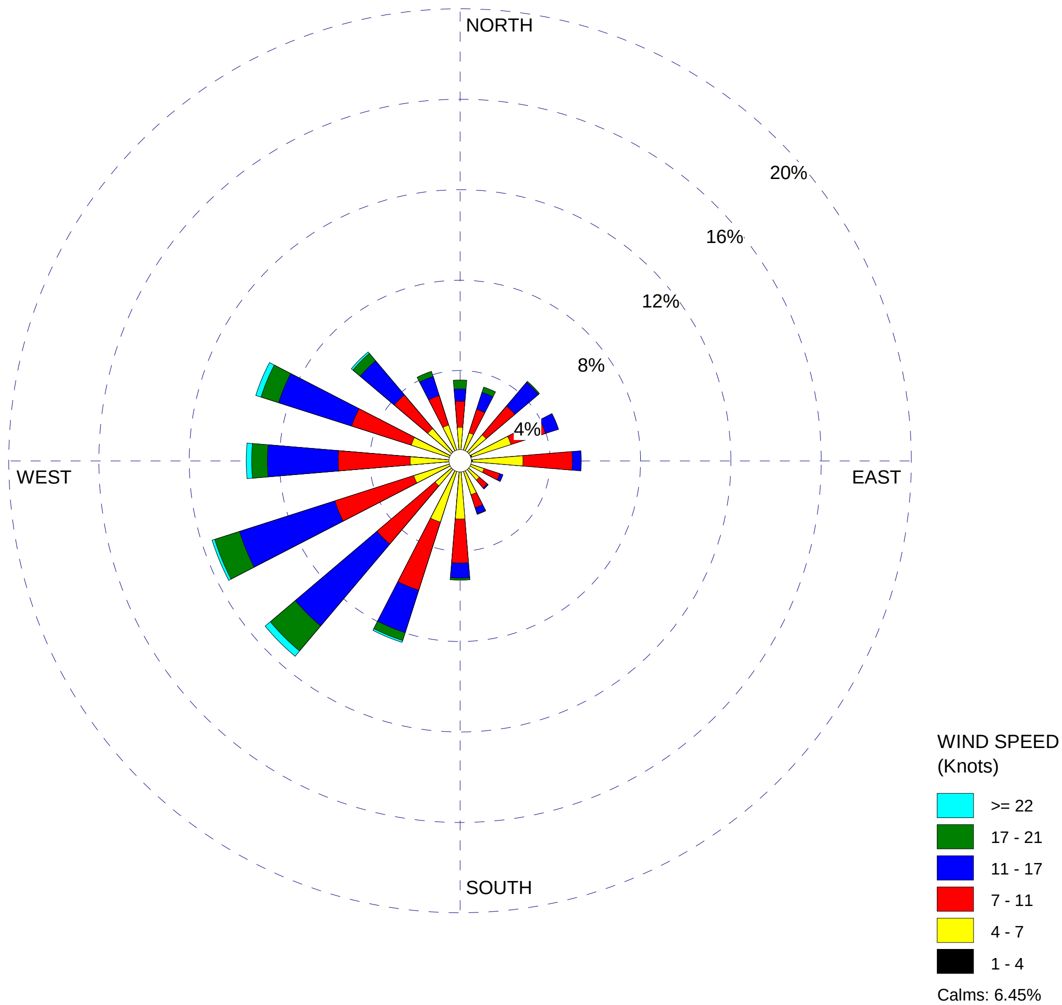
Source: Reference 2.7-41

Figure 2.7-18 Detroit Metropolitan Airport January Wind Rose (2003-2007)



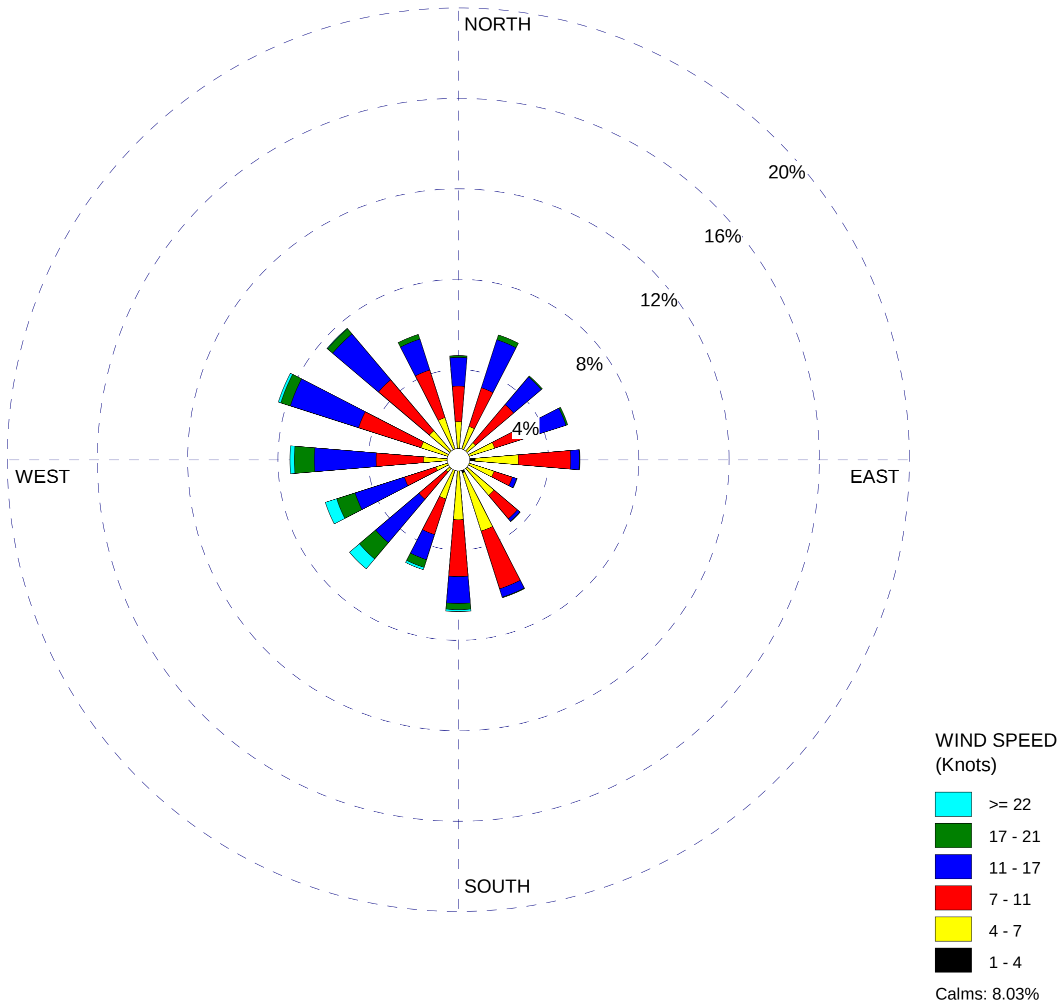
Source: Reference 2.7-41

Figure 2.7-19 Detroit Metropolitan Airport February Wind Rose (2003-2007)



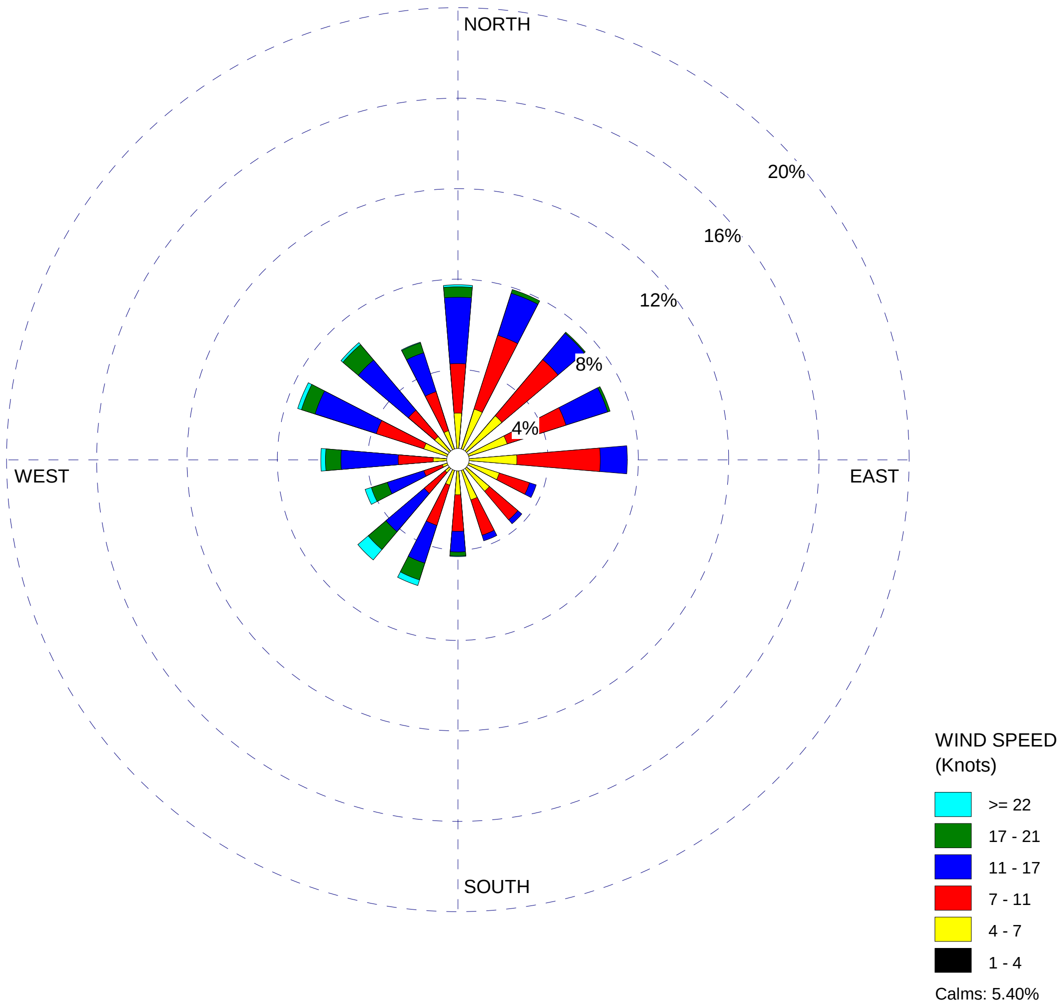
Source: Reference 2.7-41

Figure 2.7-20 Detroit Metropolitan Airport March Wind Rose (2003-2007)



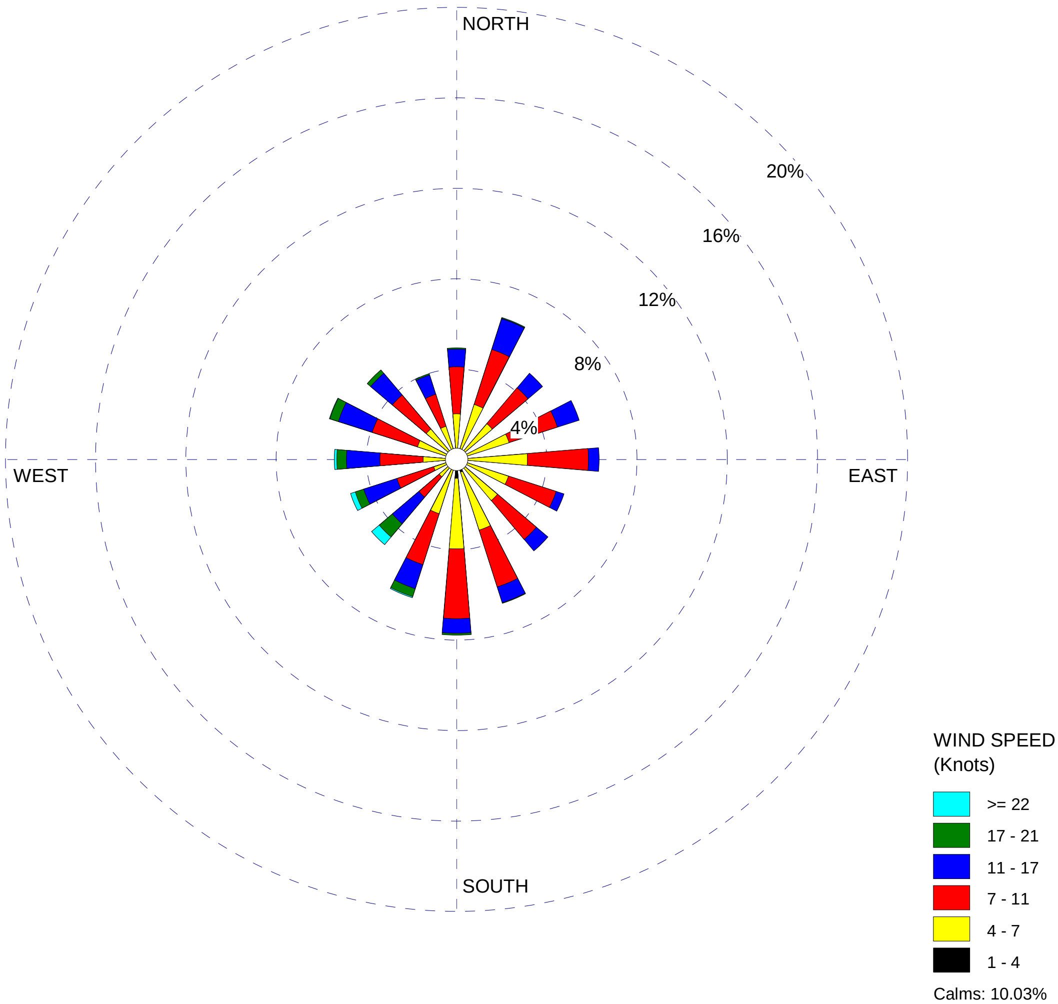
Source: Reference 2.7-41

Figure 2.7-21 Detroit Metropolitan Airport April Wind Rose (2003-2007)



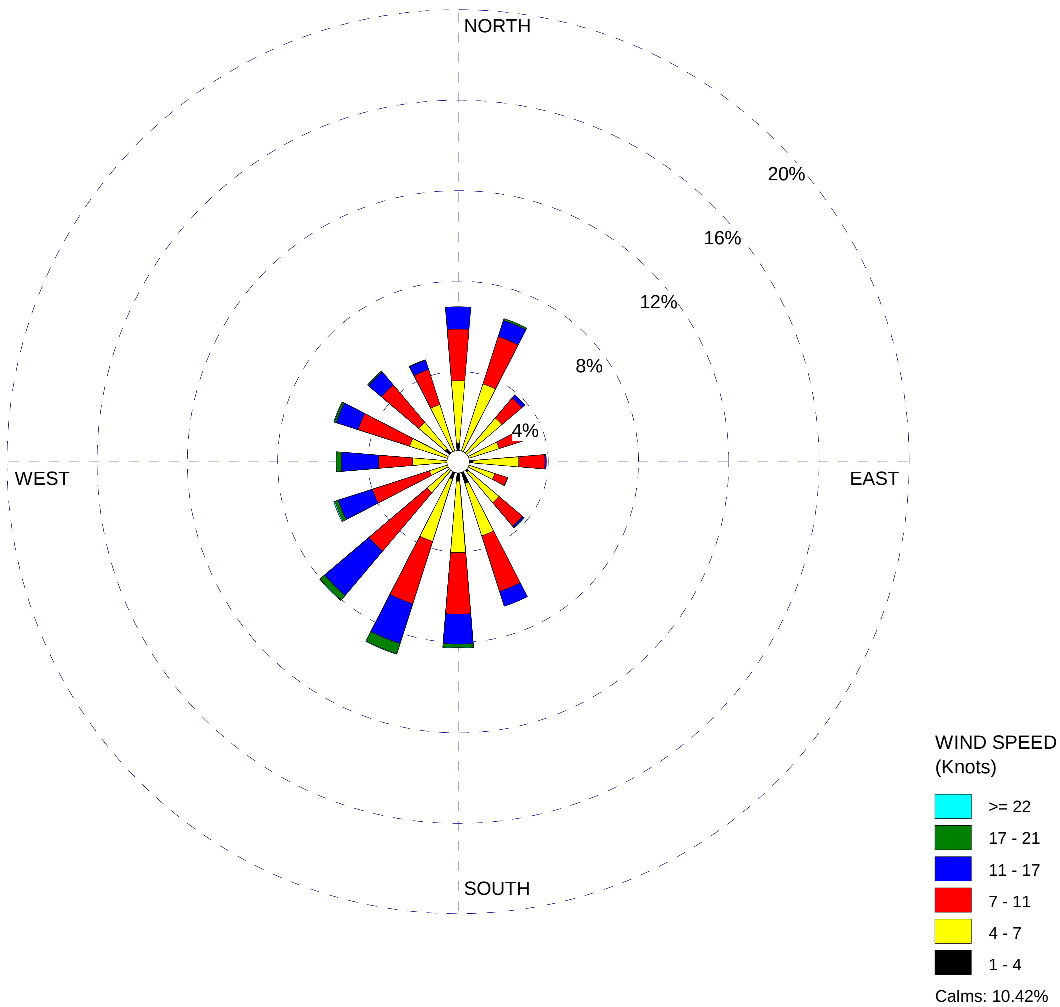
Source: Reference 2.7-41

Figure 2.7-22 Detroit Metropolitan Airport May Wind Rose (2003-2007)



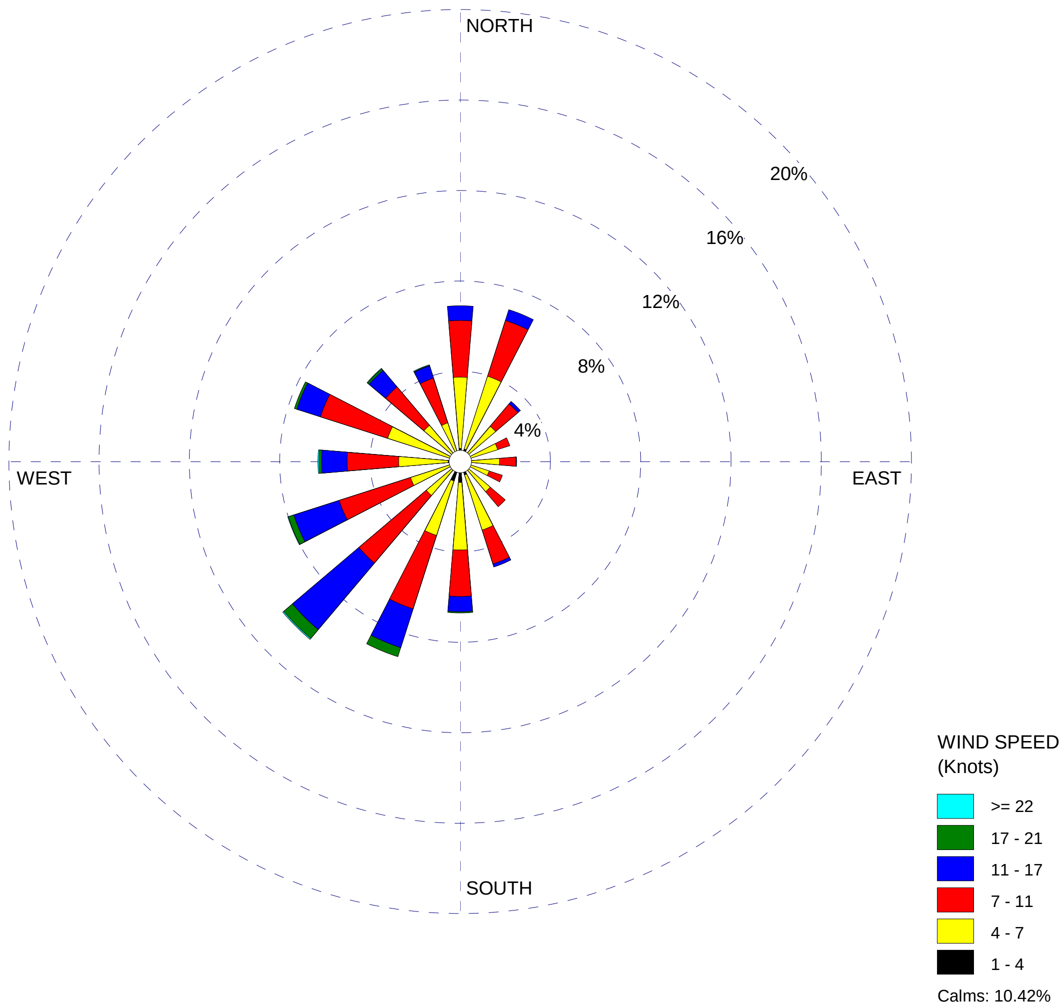
Source: Reference 2.7-41

Figure 2.7-23 Detroit Metropolitan Airport June Wind Rose (2003-2007)



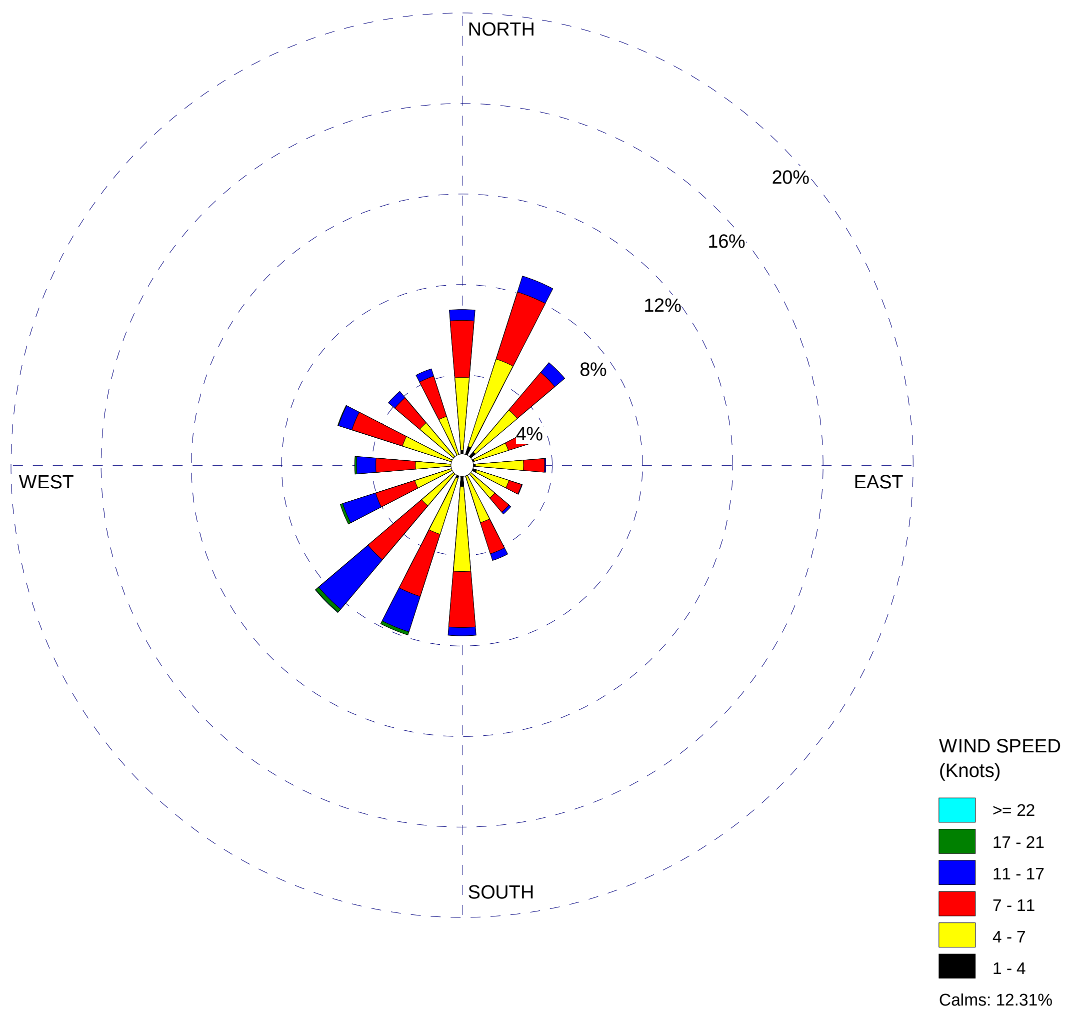
Source: Reference 2.7-41

Figure 2.7-24 Detroit Metropolitan Airport July Wind Rose (2003-2007)



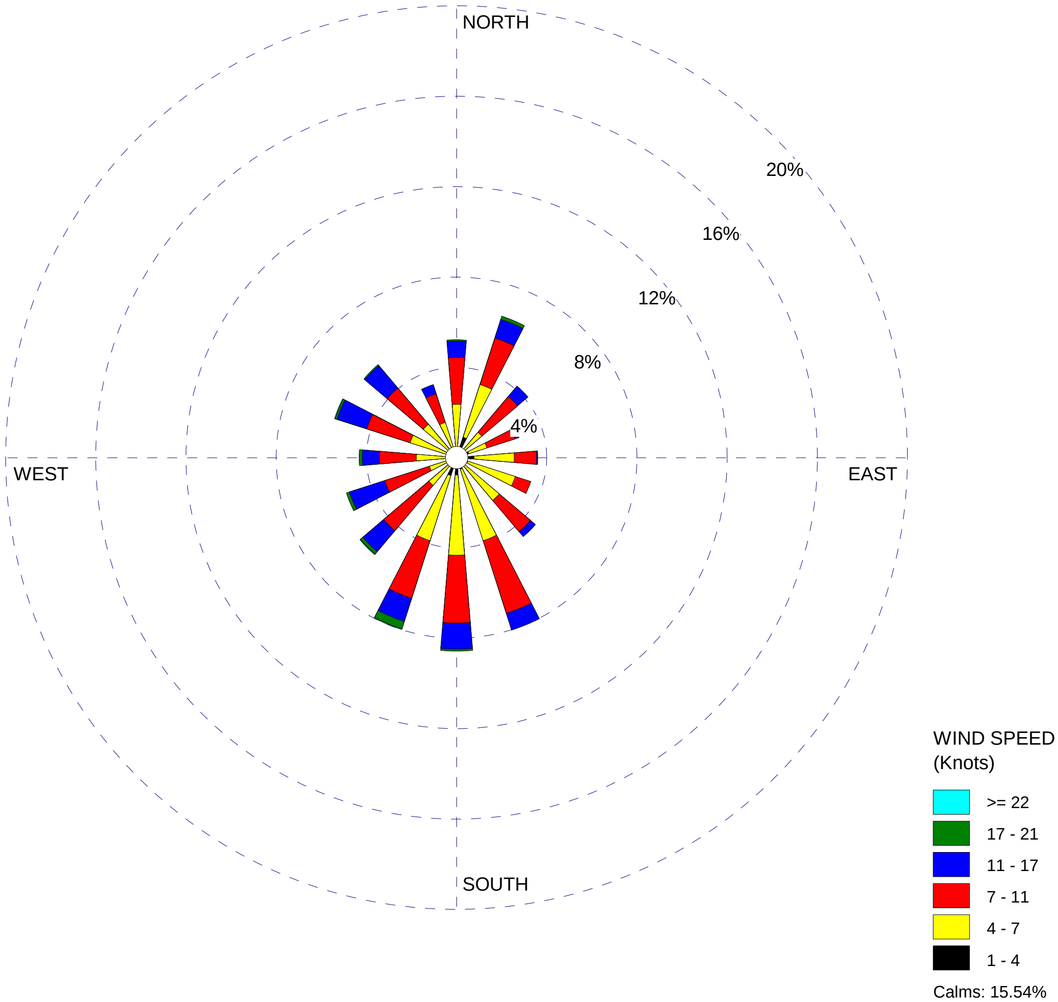
Source: Reference 2.7-41

Figure 2.7-25 Detroit Metropolitan Airport August Wind Rose (2003-2007)



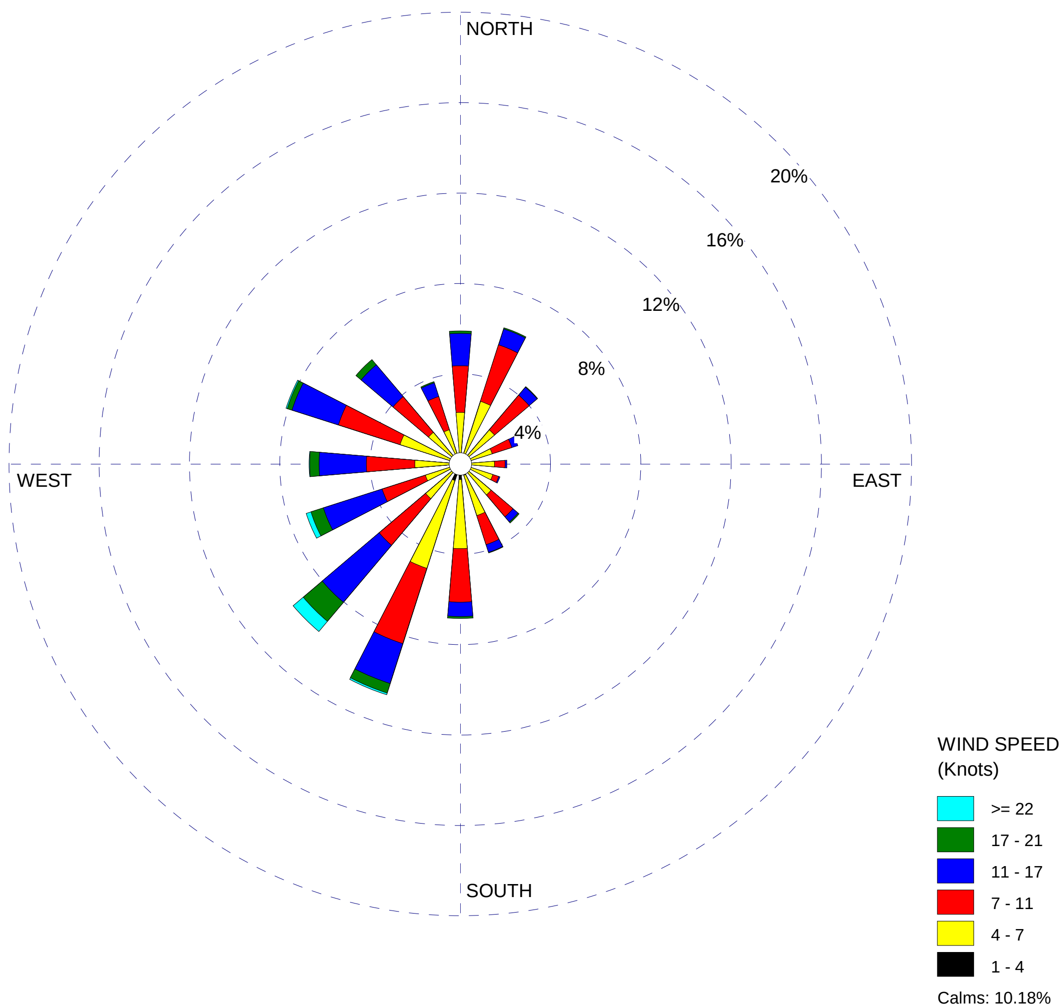
Source: Reference 2.7-41

Figure 2.7-26 Detroit Metropolitan Airport September Wind Rose (2003-2007)



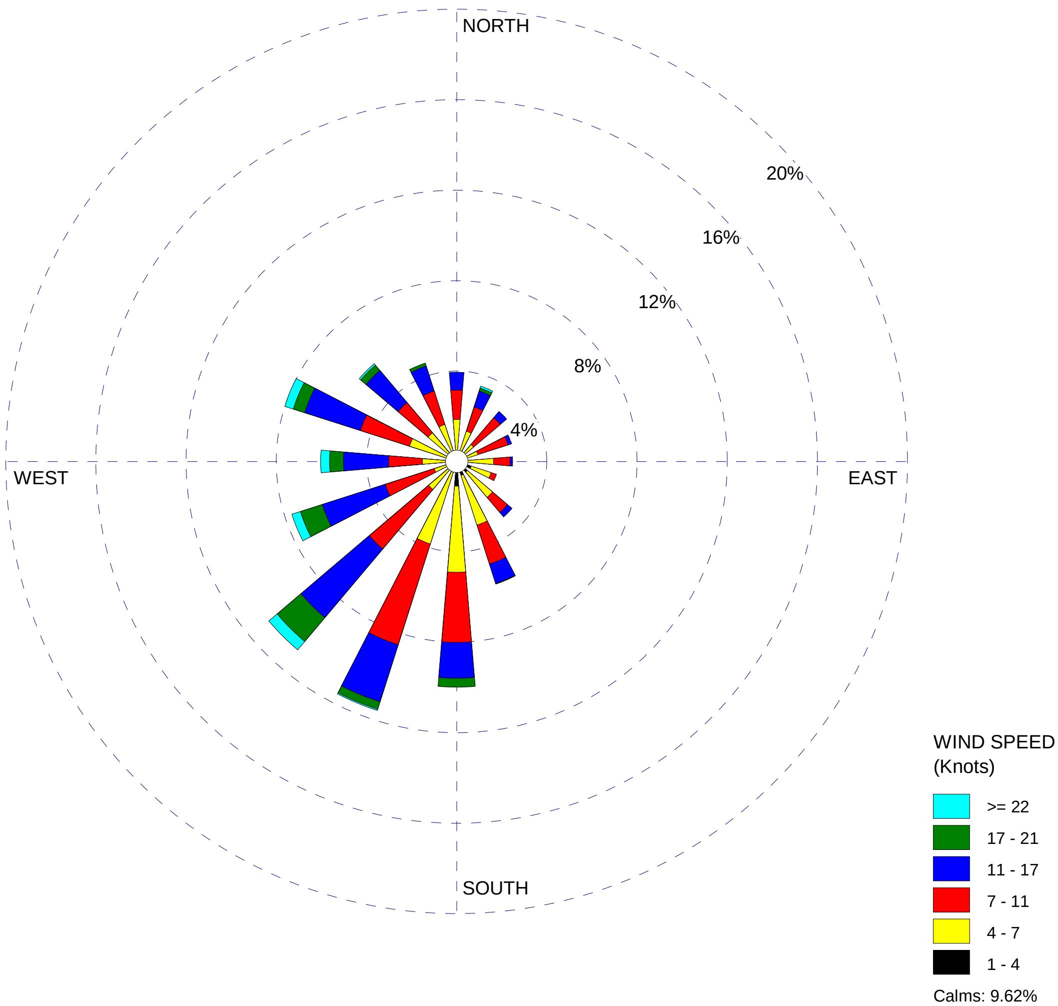
Source: Reference 2.7-41

Figure 2.7-27 Detroit Metropolitan Airport October Wind Rose (2003-2007)



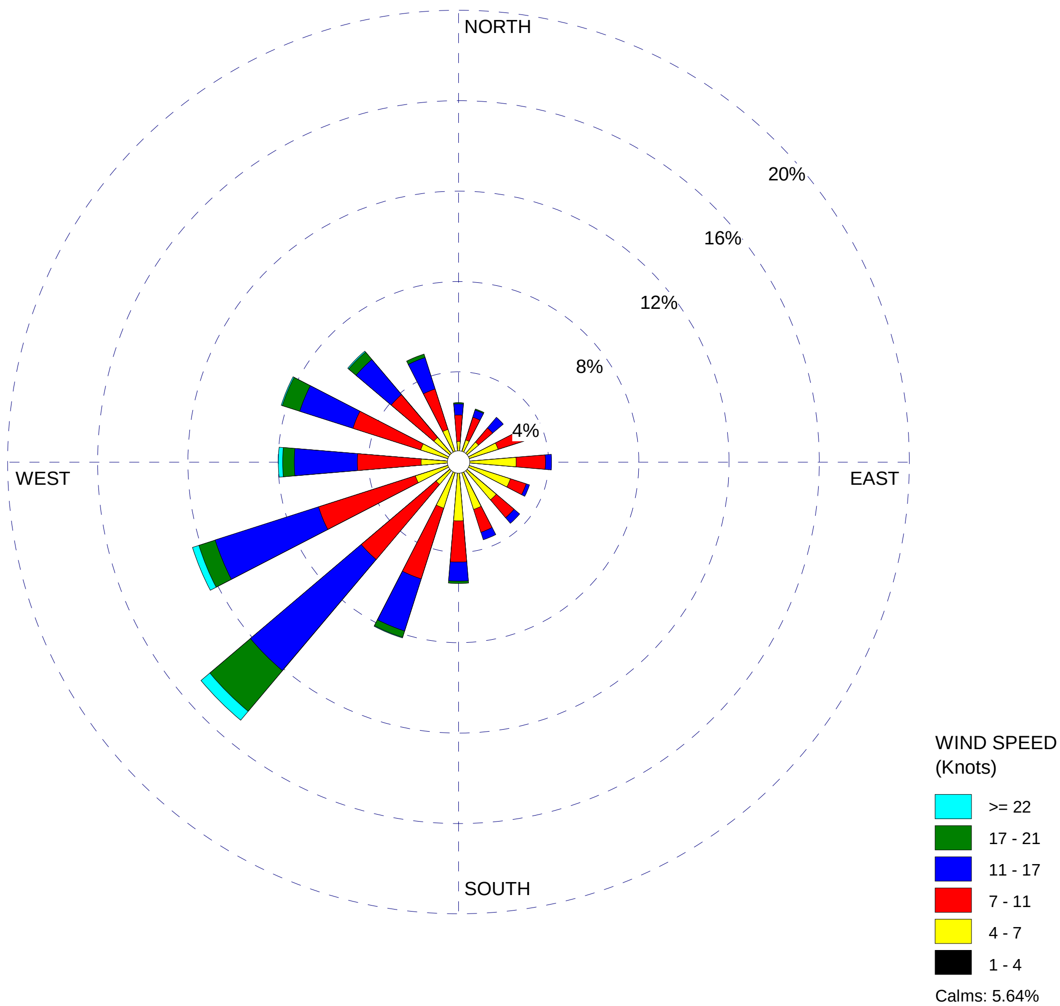
Source: Reference 2.7-41

Figure 2.7-28 Detroit Metropolitan Airport November Wind Rose (2003-2007)



Source: Reference 2.7-41

Figure 2.7-29 Detroit Metropolitan Airport December Wind Rose (2003-2007)



Source: Reference 2.7-41

Figure 2.7-30 Fermi Site 10-Meter Annual Wind Rose (2003-2007)

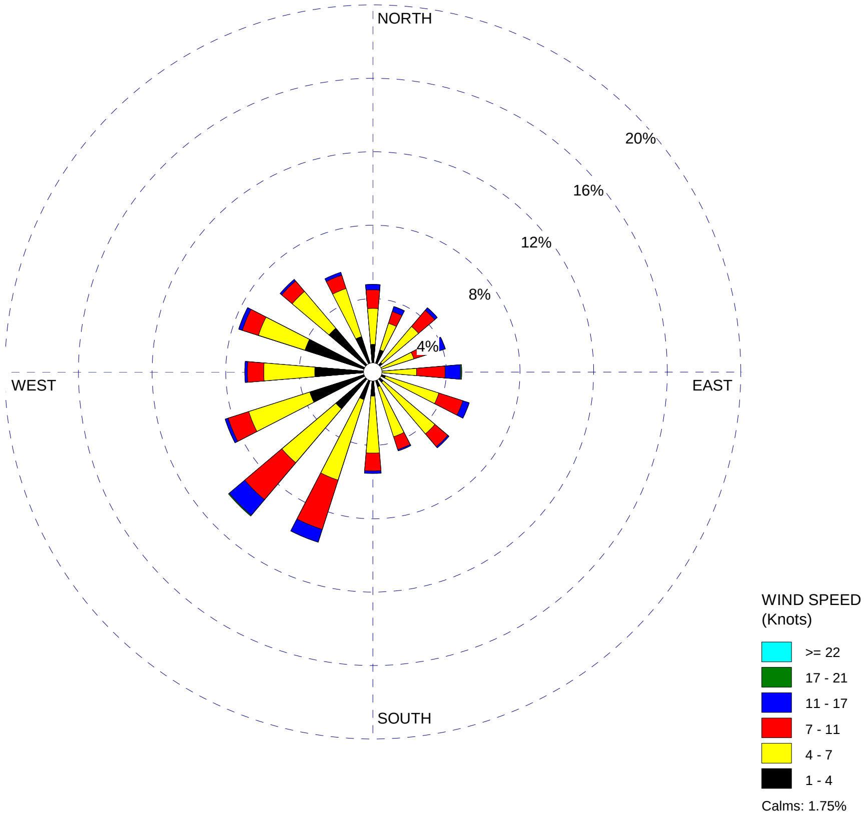


Figure 2.7-31 Fermi Site 10-Meter January Wind Rose (2003-2007)

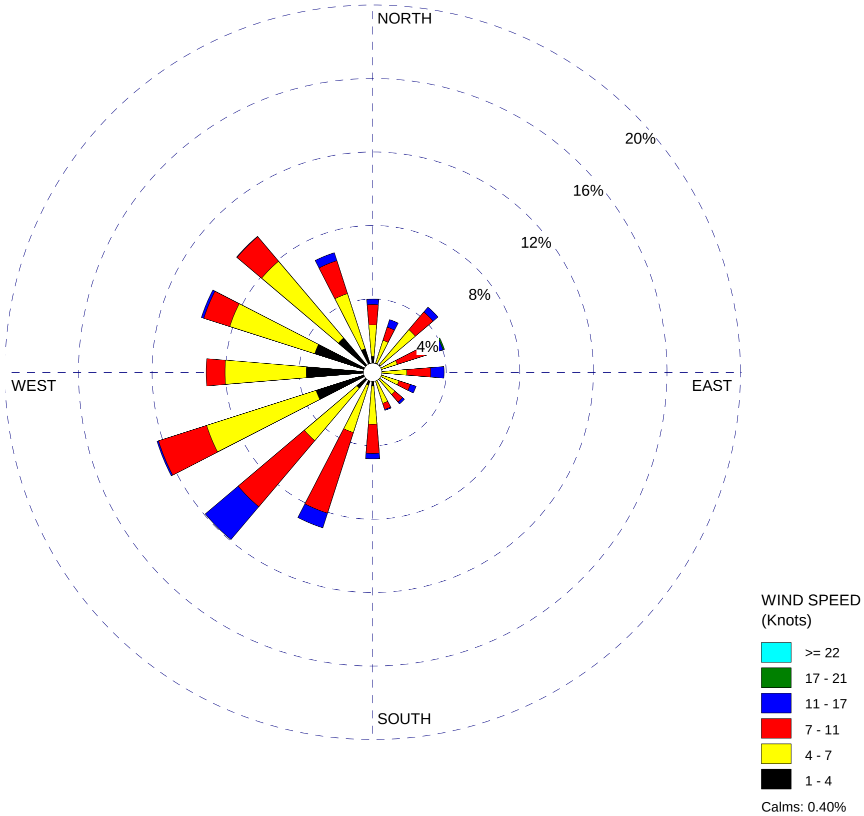


Figure 2.7-32 Fermi Site 10-Meter February Wind Rose (2003-2007)

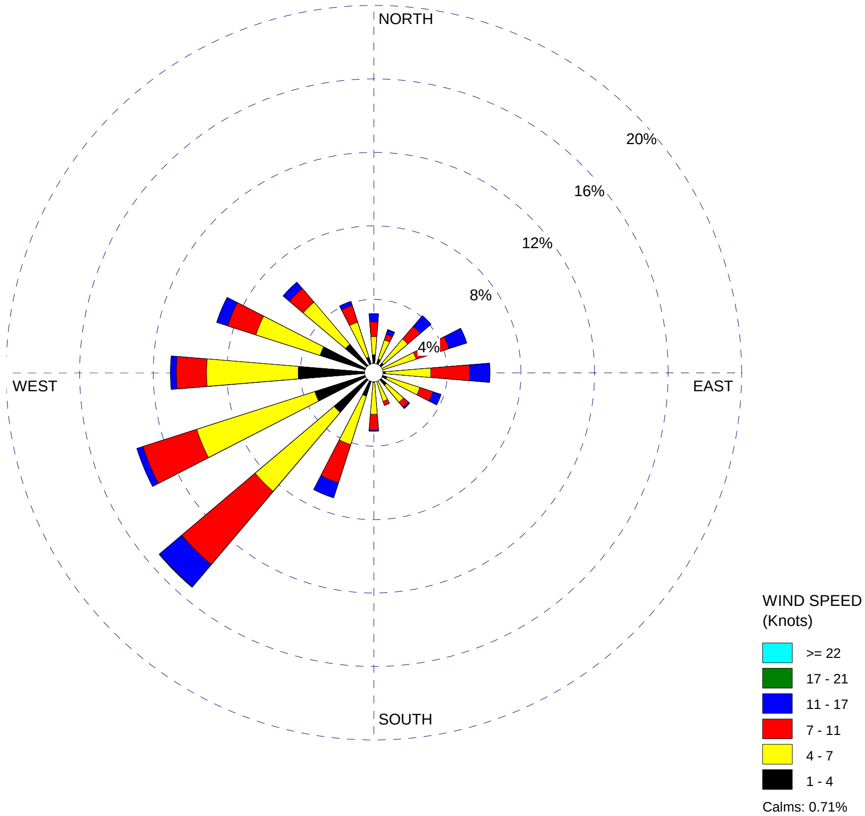


Figure 2.7-33 Fermi Site 10-Meter March Wind Rose (2003-2007)

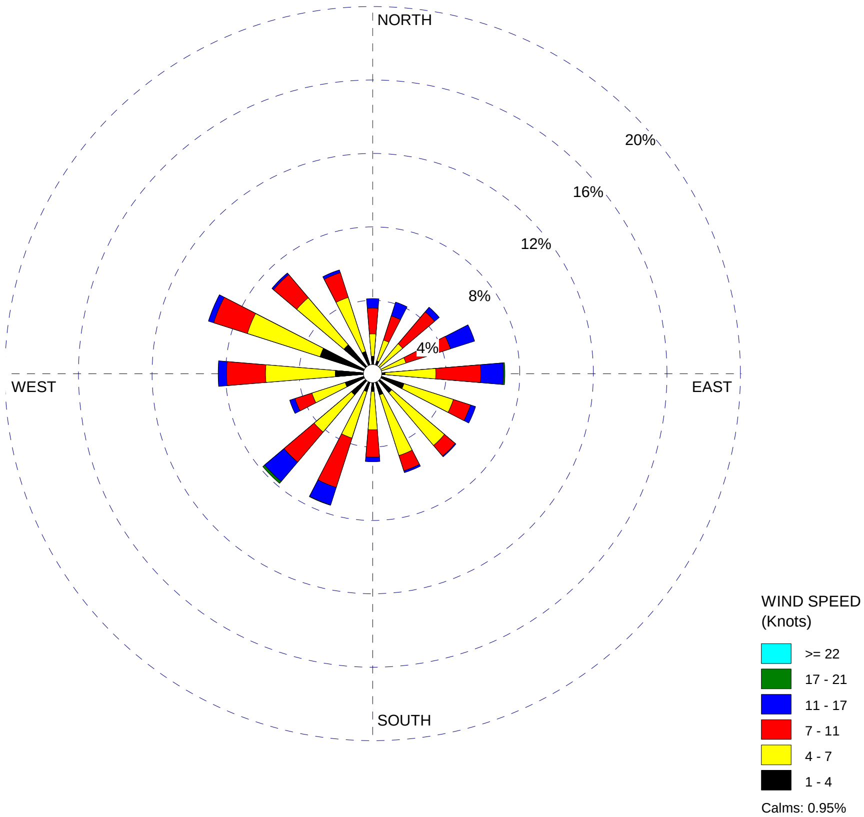


Figure 2.7-34 Fermi Site 10-Meter April Wind Rose (2003-2007)

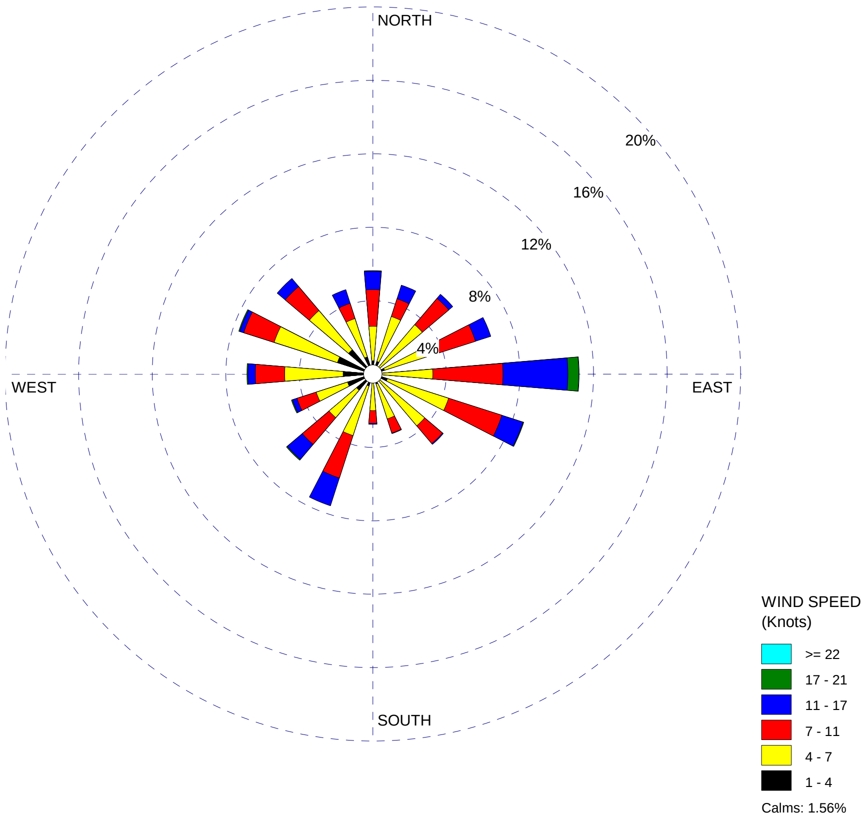


Figure 2.7-35 Fermi Site 10-Meter May Wind Rose (2003-2007)

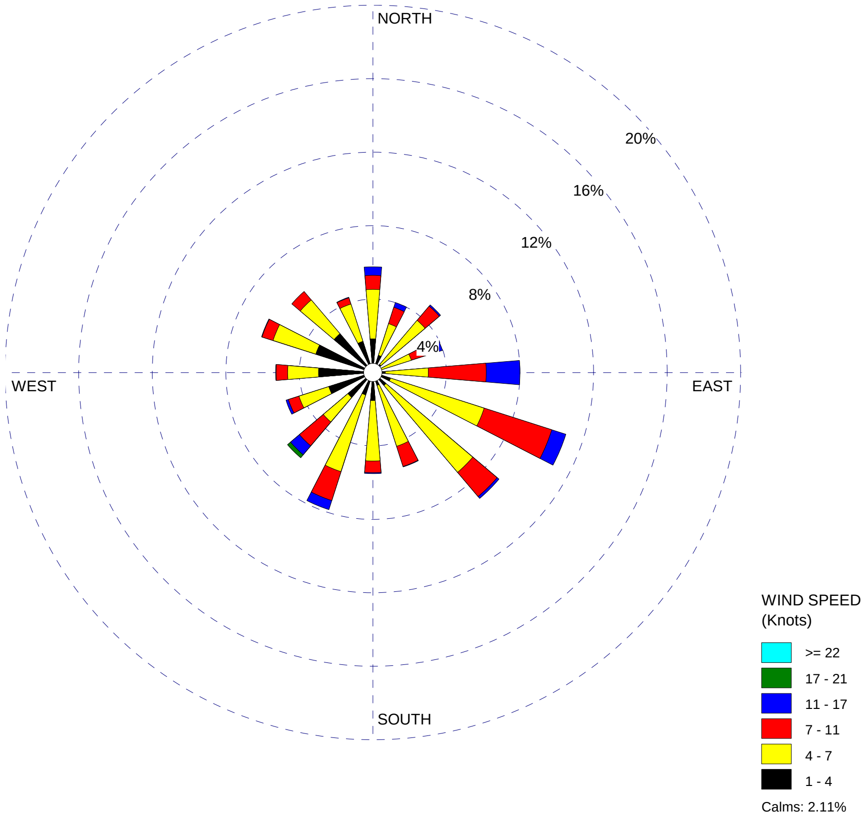


Figure 2.7-36 Fermi Site 10-Meter June Wind Rose (2003-2007)

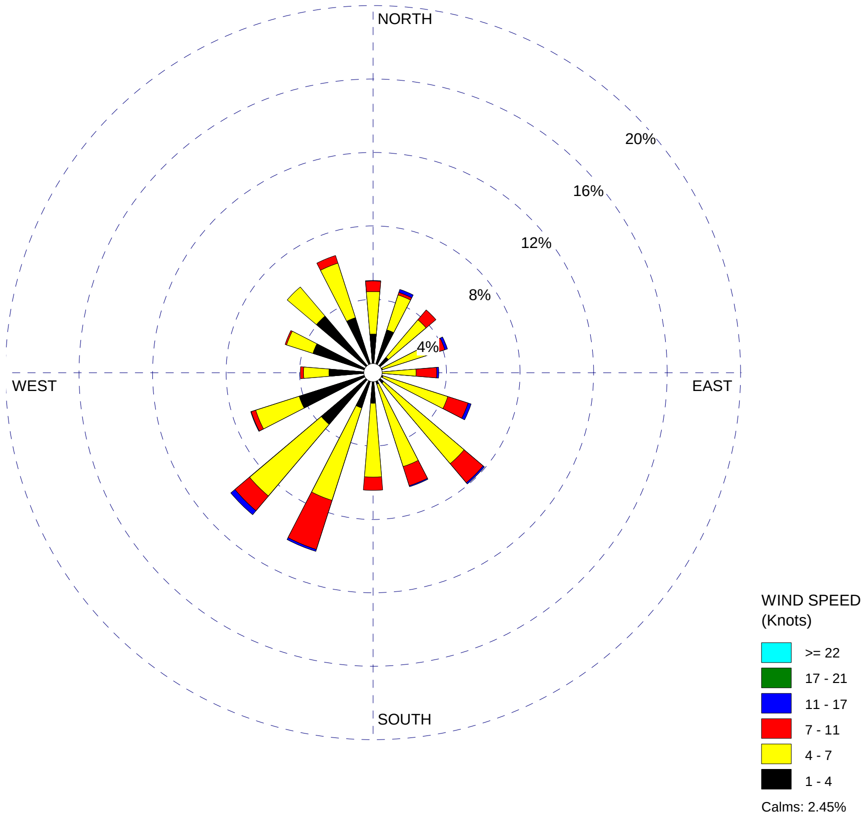


Figure 2.7-37 Fermi Site 10-Meter July Wind Rose (2003-2007)

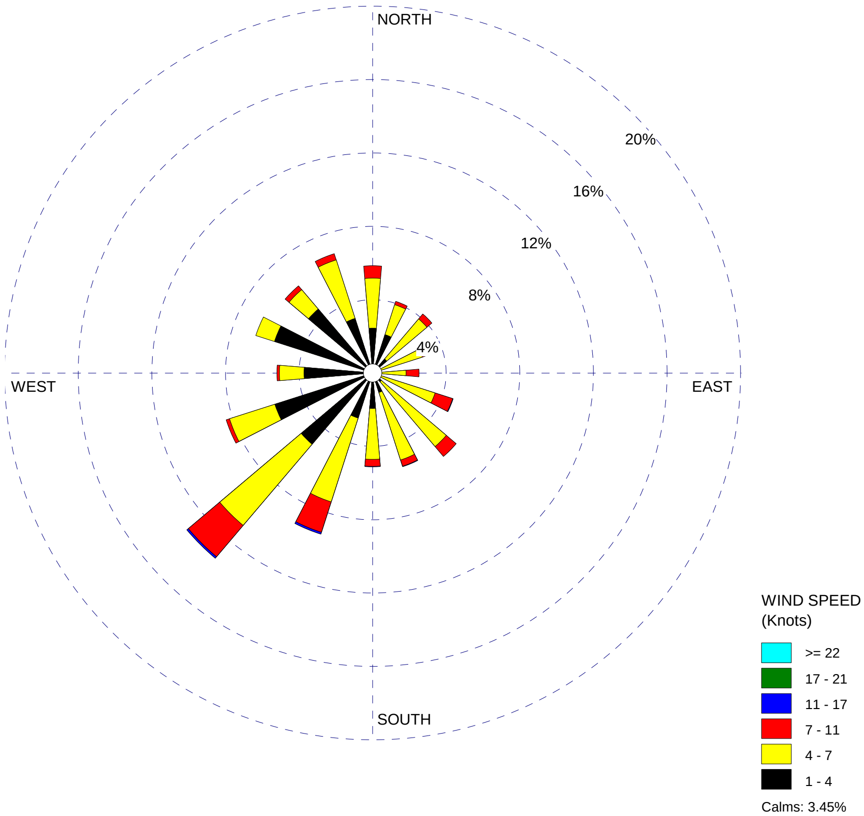


Figure 2.7-38 Fermi Site 10-Meter August Wind Rose (2003-2007)

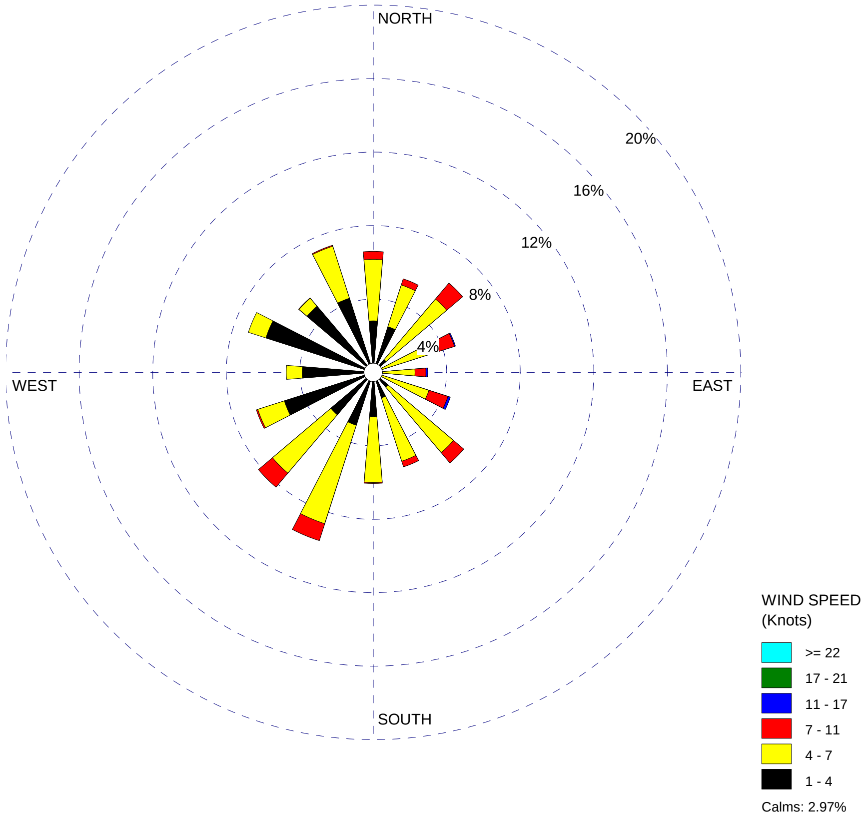


Figure 2.7-39 Fermi Site 10-Meter September Wind Rose (2003-2007)

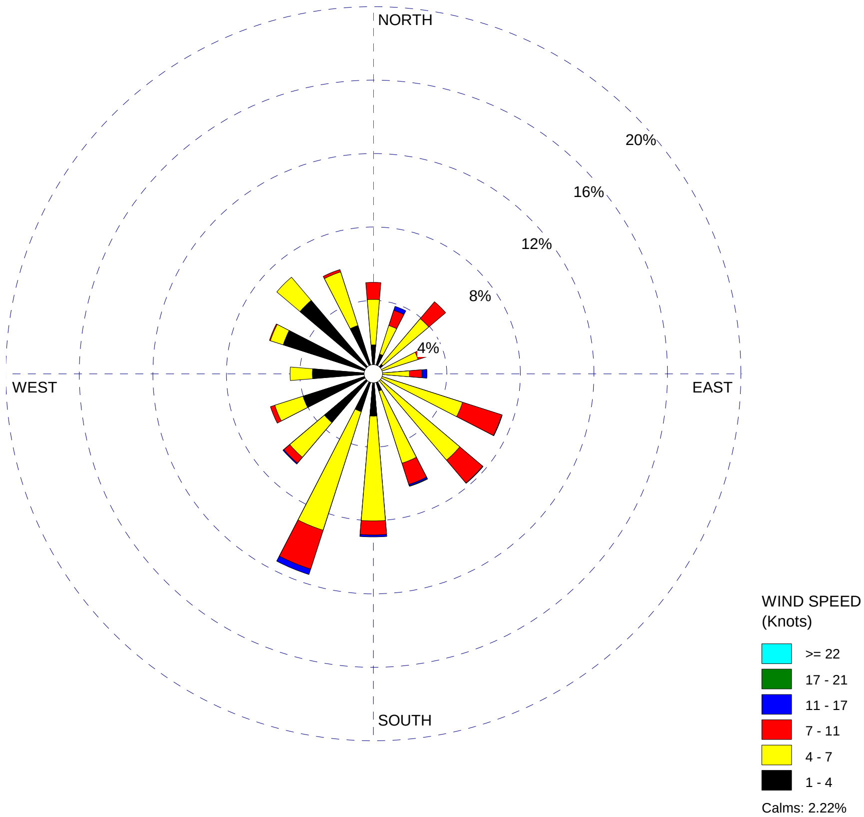


Figure 2.7-40 Fermi Site 10-Meter October Wind Rose (2003-2007)

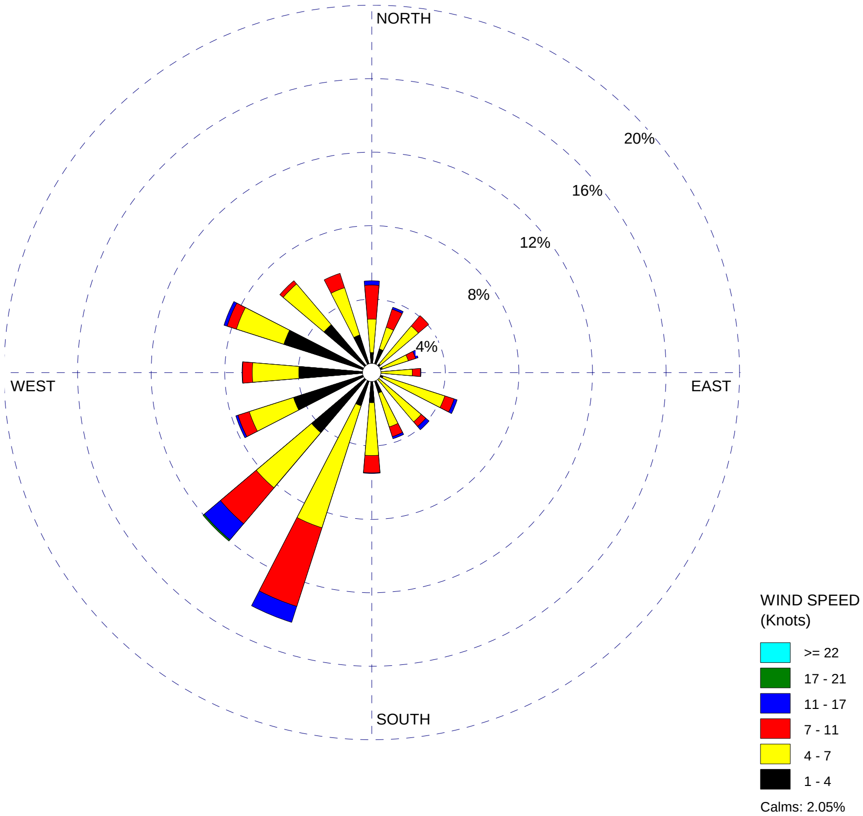


Figure 2.7-41 Fermi Site 10-Meter November Wind Rose (2003-2007)

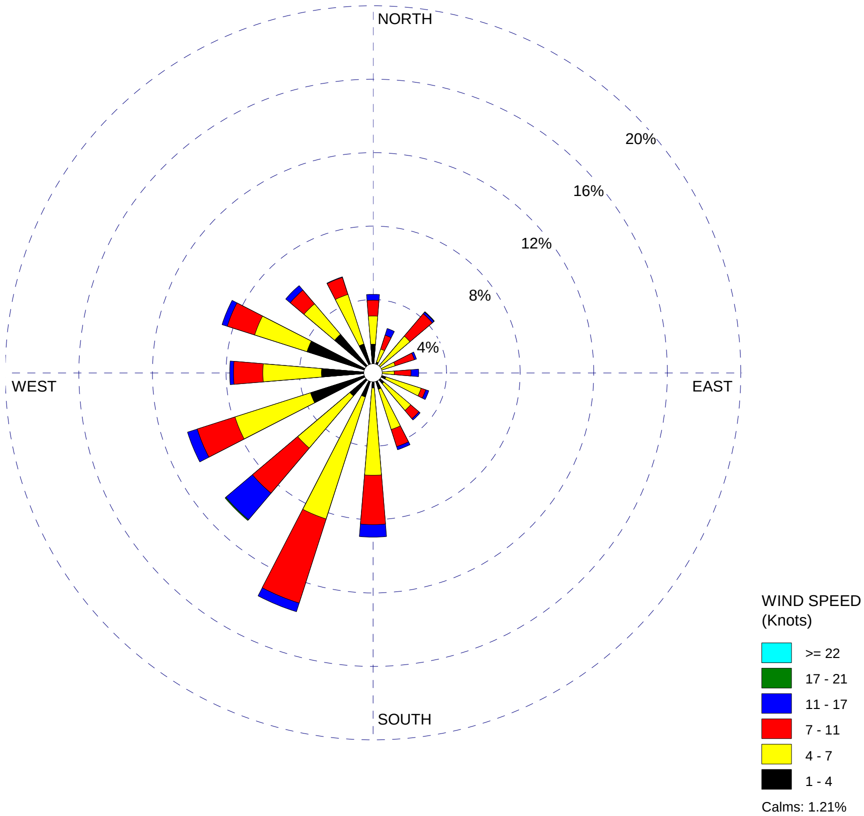


Figure 2.7-42 Fermi Site 10-Meter December Wind Rose (2003-2007)

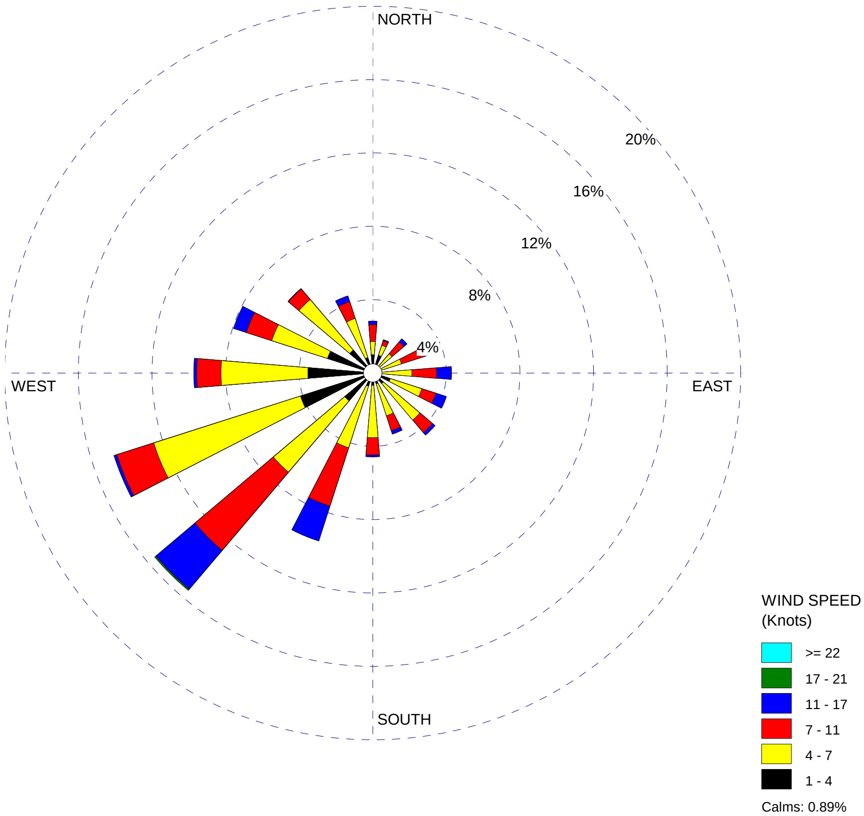


Figure 2.7-43 Fermi Site 60-Meter Annual Wind Rose (2003-2007)

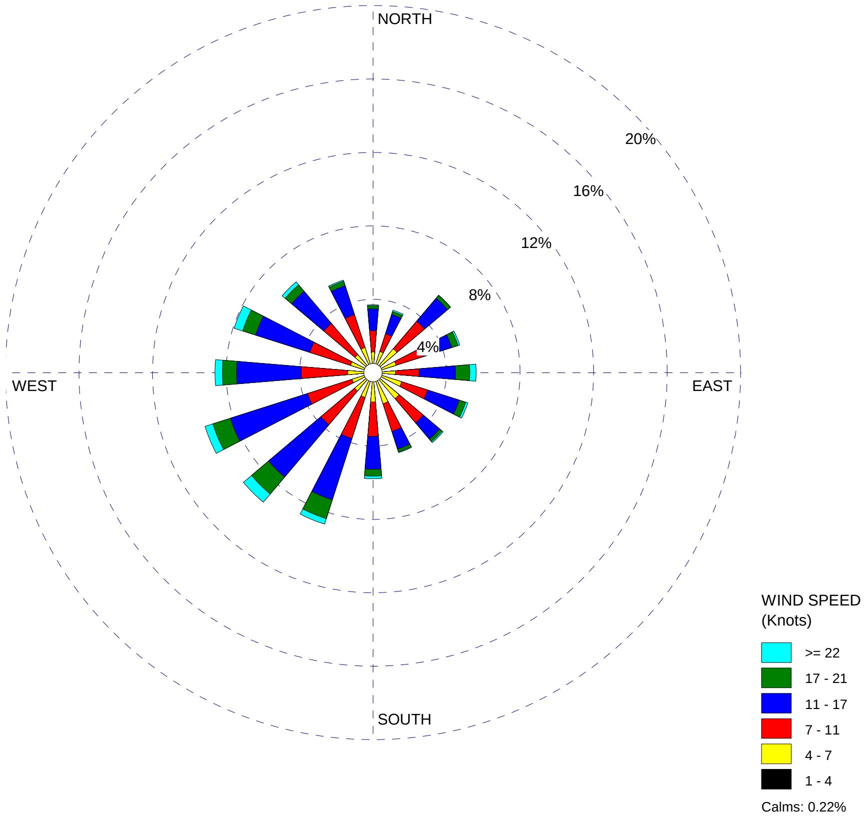


Figure 2.7-44 Fermi Site 60-Meter January Wind Rose (2003-2007)

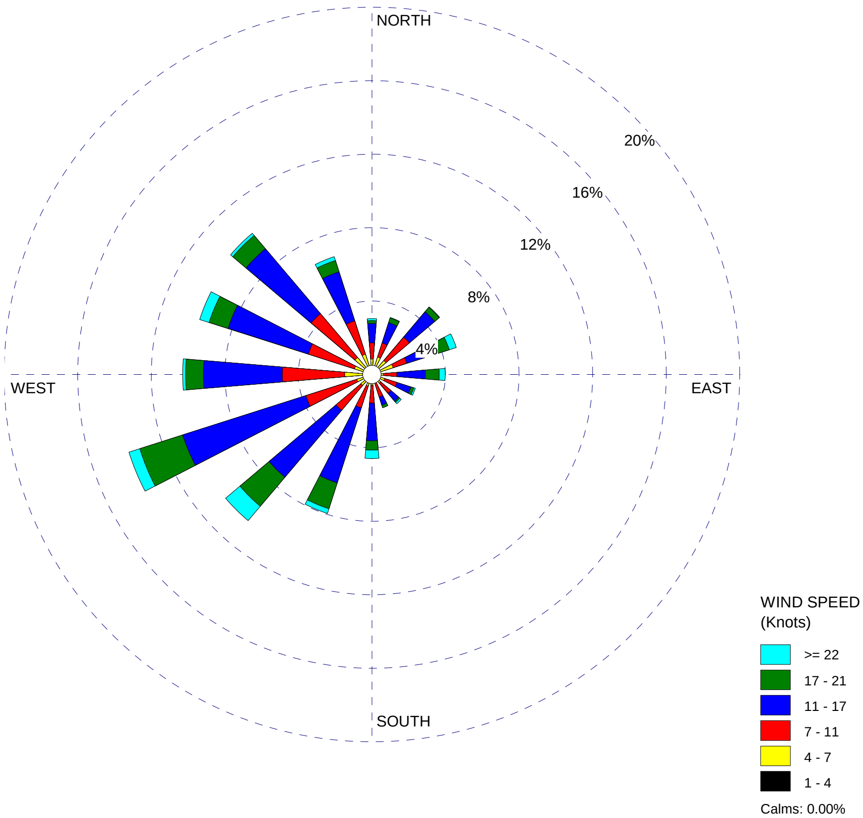


Figure 2.7-45 Fermi Site 60-Meter February Wind Rose (2003-2007)

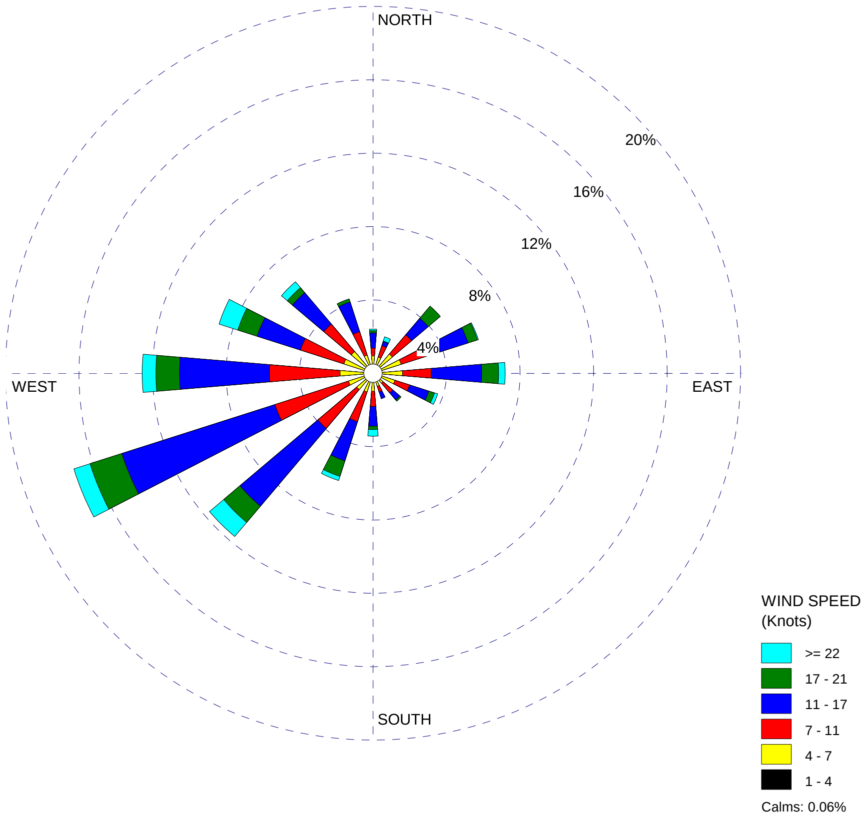


Figure 2.7-46 Fermi Site 60-Meter March Wind Rose (2003-2007)

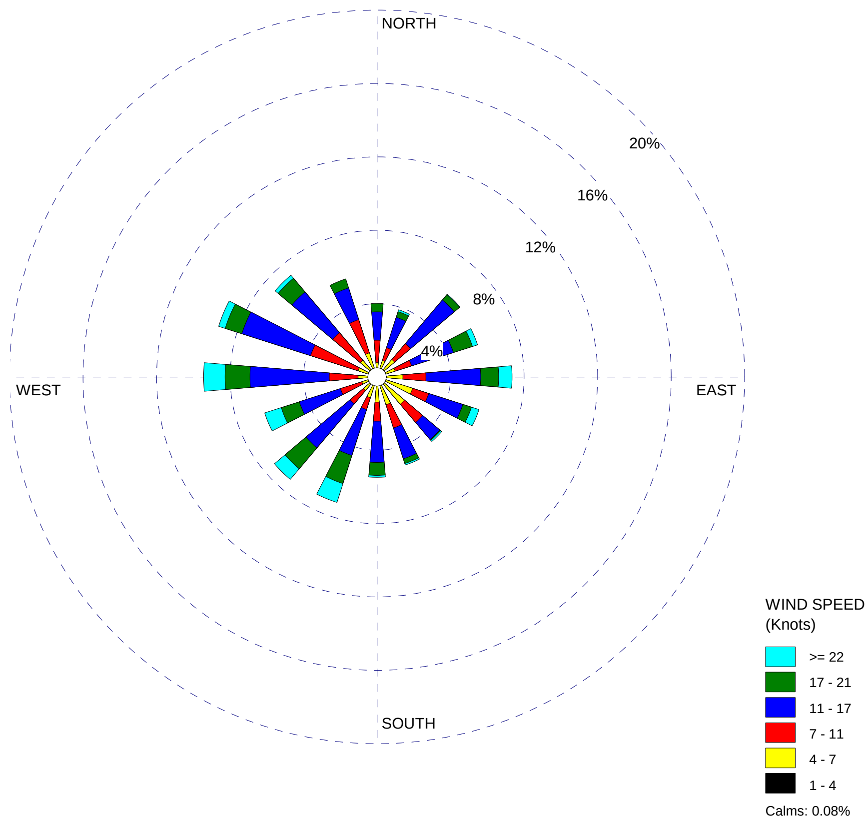


Figure 2.7-47 Fermi Site 60-Meter April Wind Rose (2003-2007)

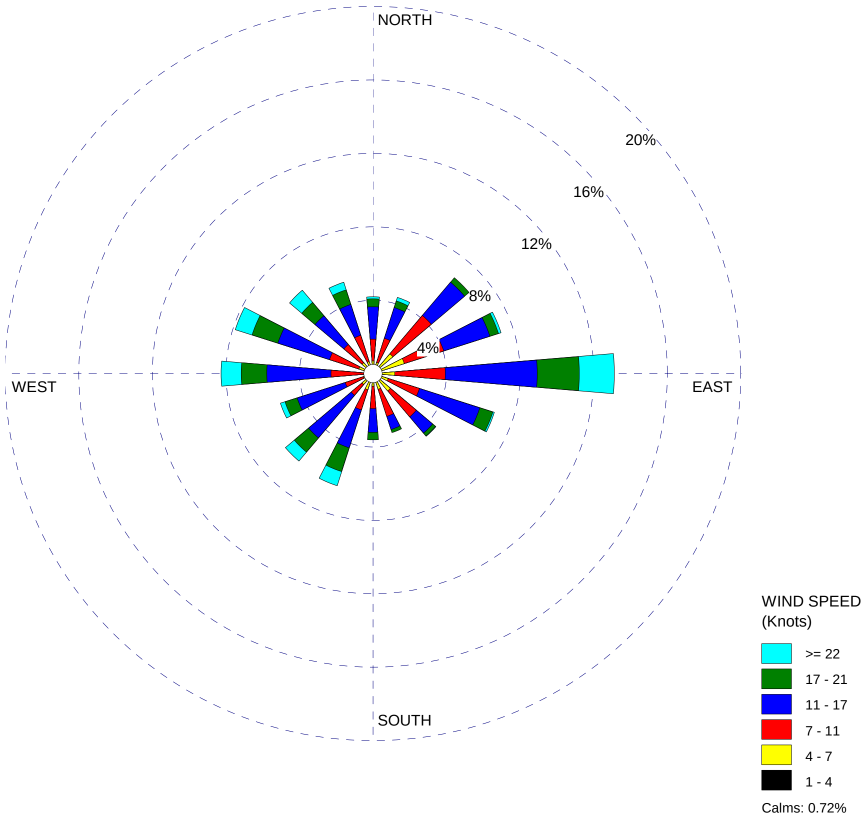


Figure 2.7-48 Fermi Site 60-Meter May Wind Rose (2003-2007)

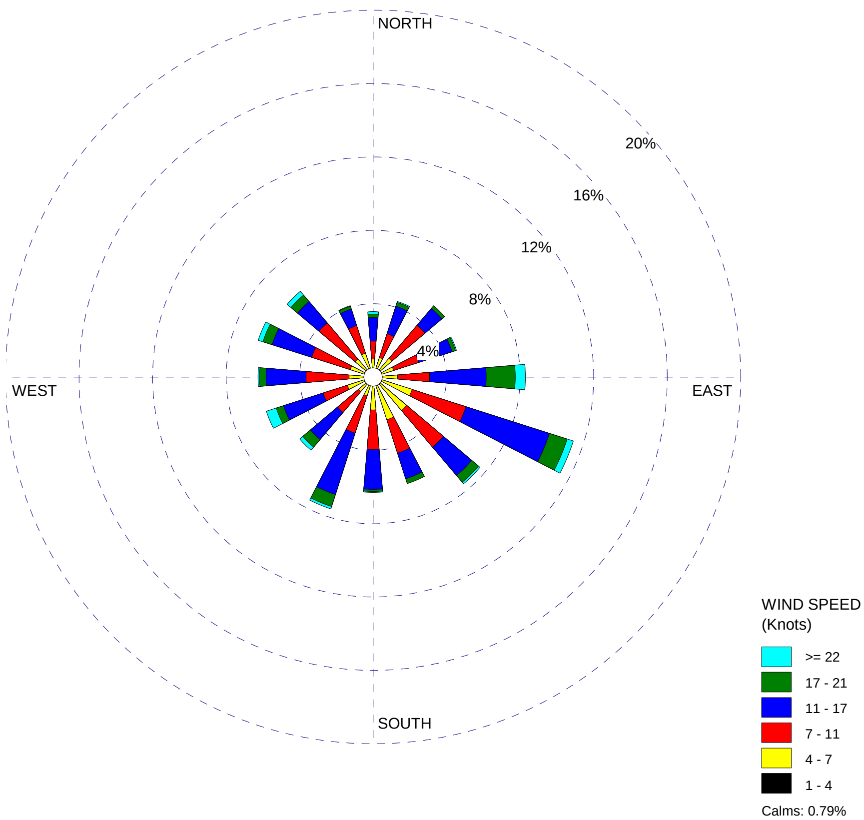


Figure 2.7-49 Fermi Site 60-Meter June Wind Rose (2003-2007)

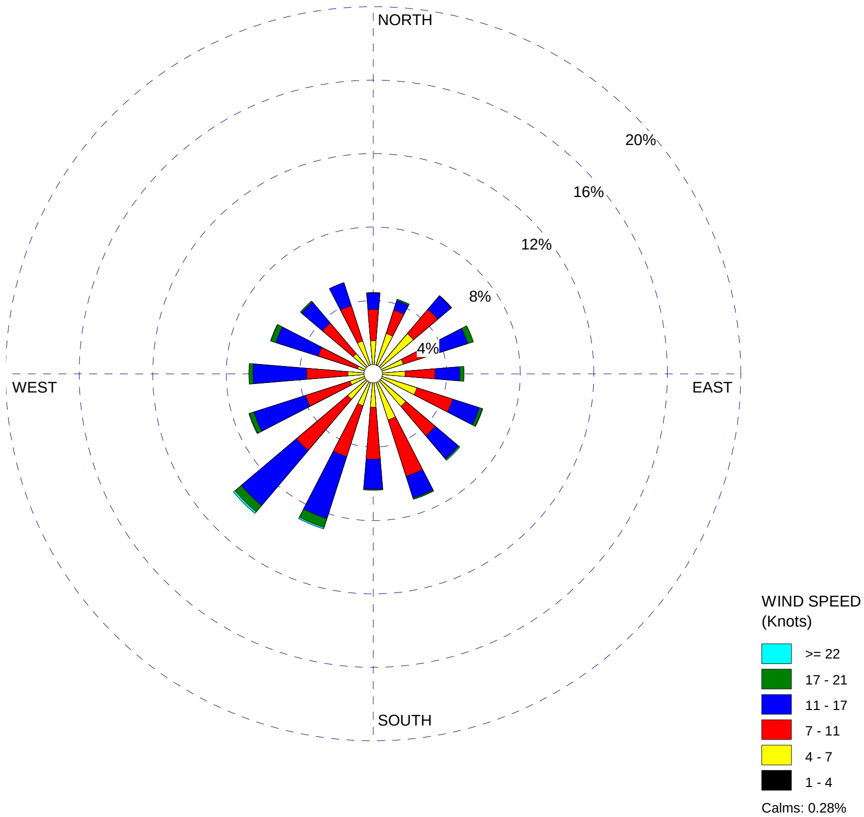


Figure 2.7-50 Fermi Site 60-Meter July Wind Rose (2003-2007)

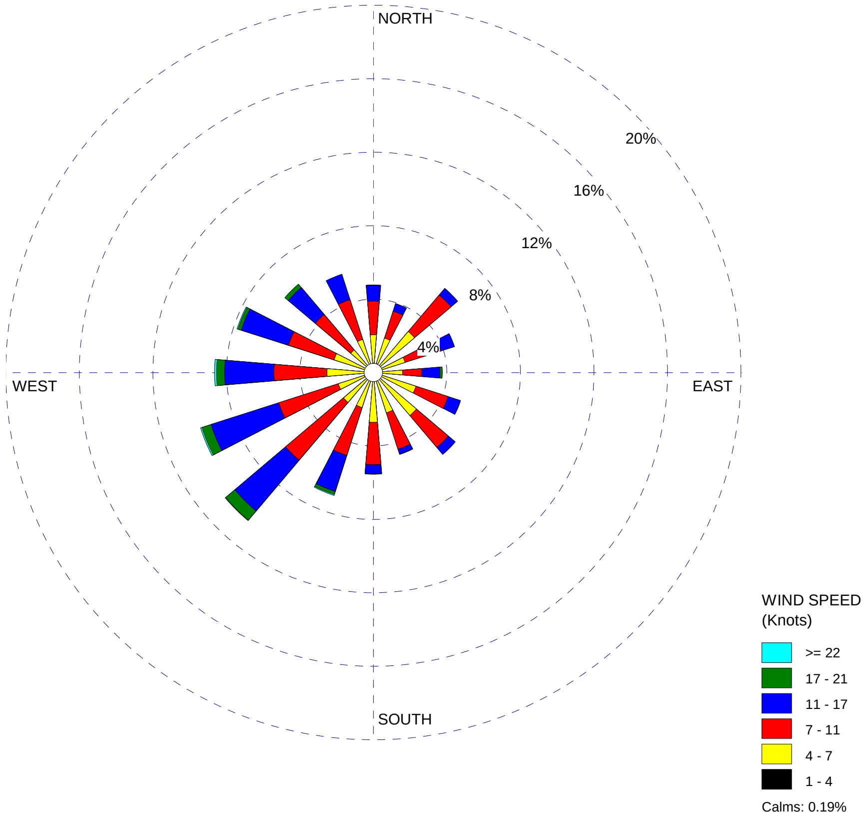


Figure 2.7-51 Fermi Site 60-Meter August Wind Rose (2003-2007)

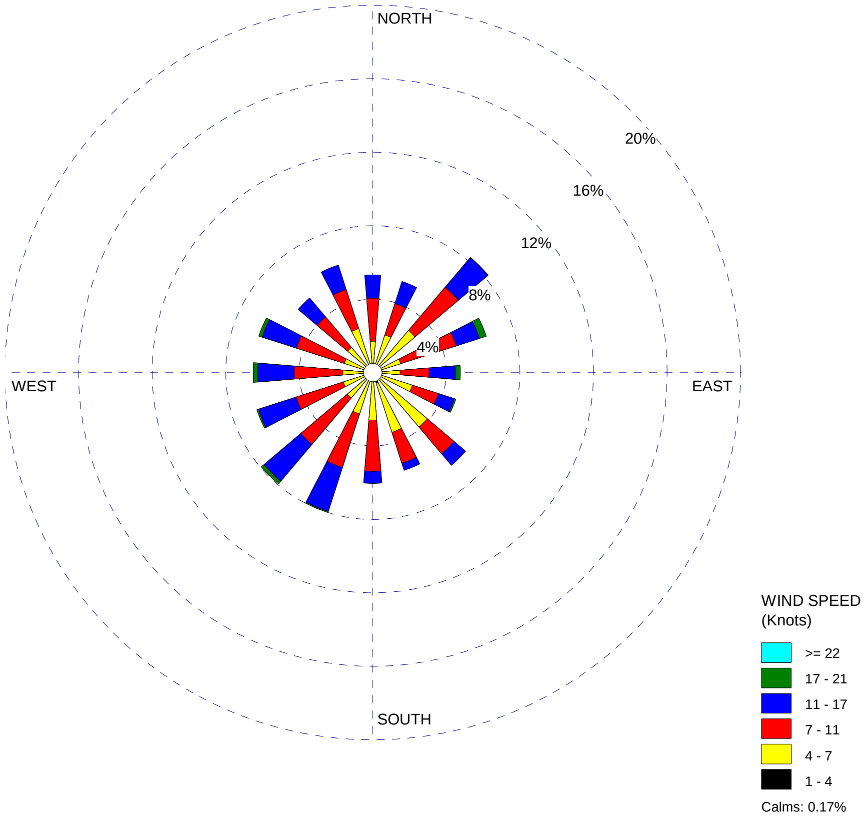


Figure 2.7-52 Fermi Site 60-Meter September Wind Rose (2003-2007)

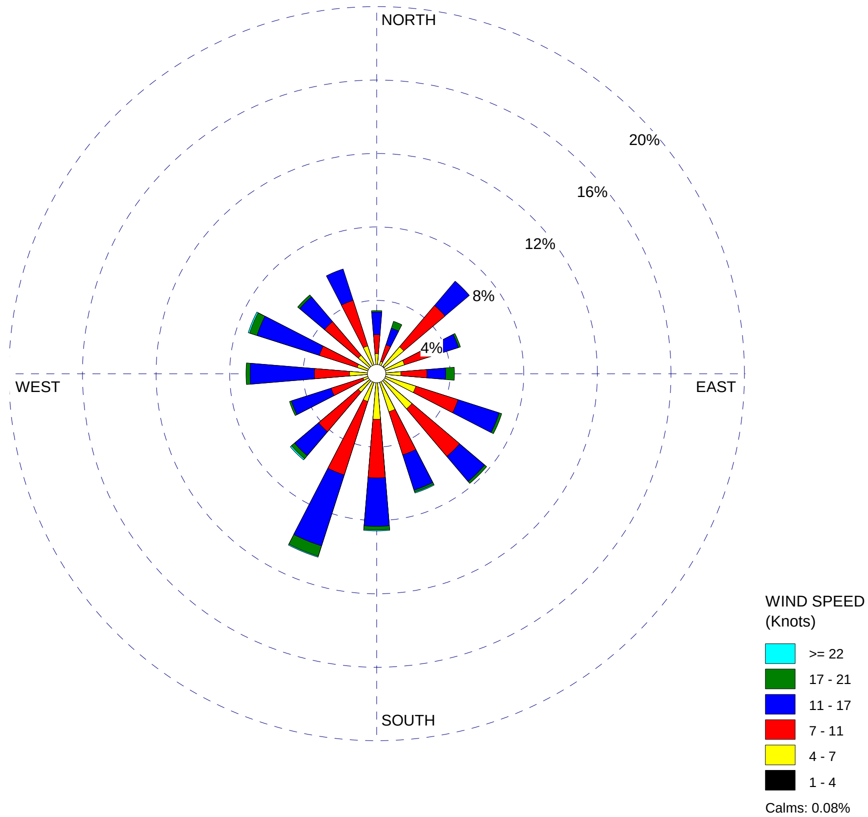


Figure 2.7-53 Fermi Site 60-Meter October Wind Rose (2003-2007)

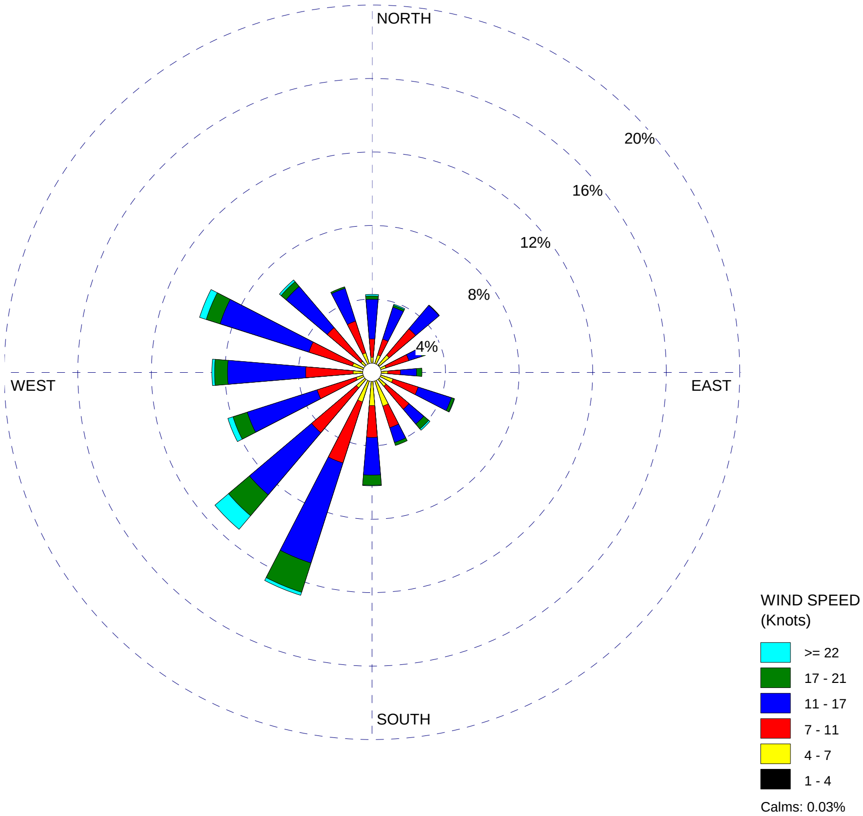


Figure 2.7-54 Fermi Site 60-Meter November Wind Rose (2003-2007)

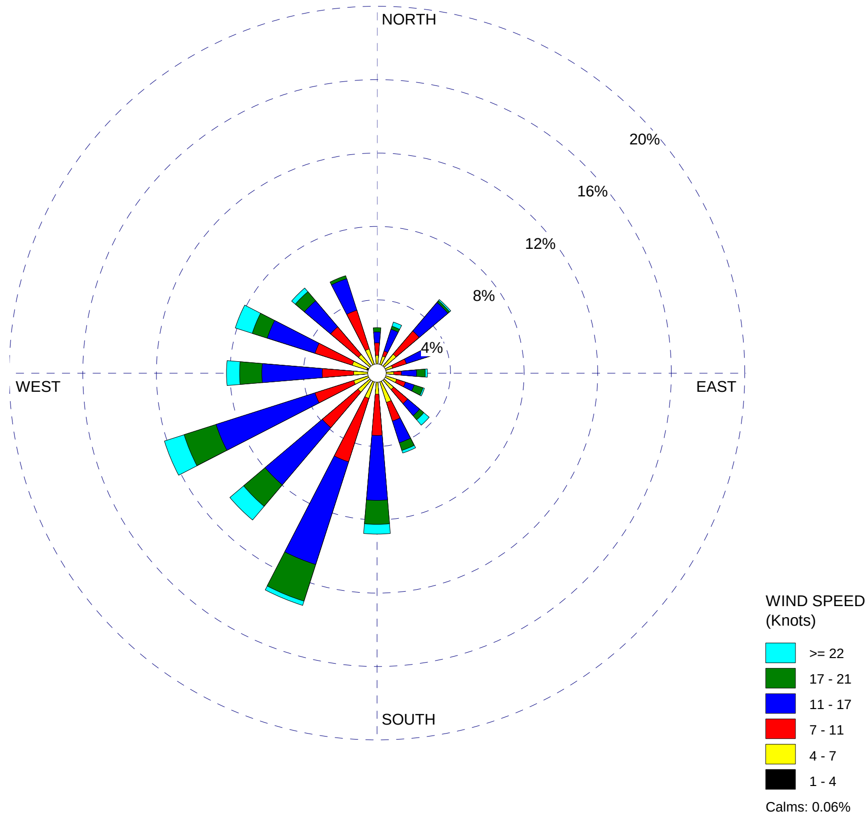


Figure 2.7-55 Fermi Site 60-Meter December Wind Rose (2003-2007)

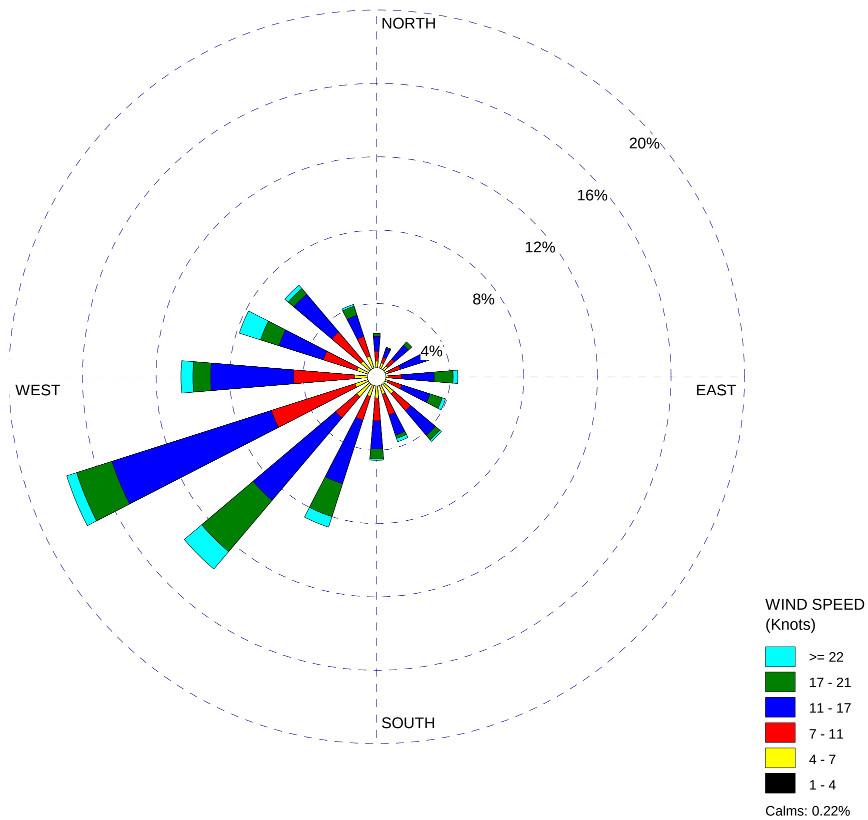


Figure 2.7-56 Topographic Features Within 5 Miles of the Fermi Site

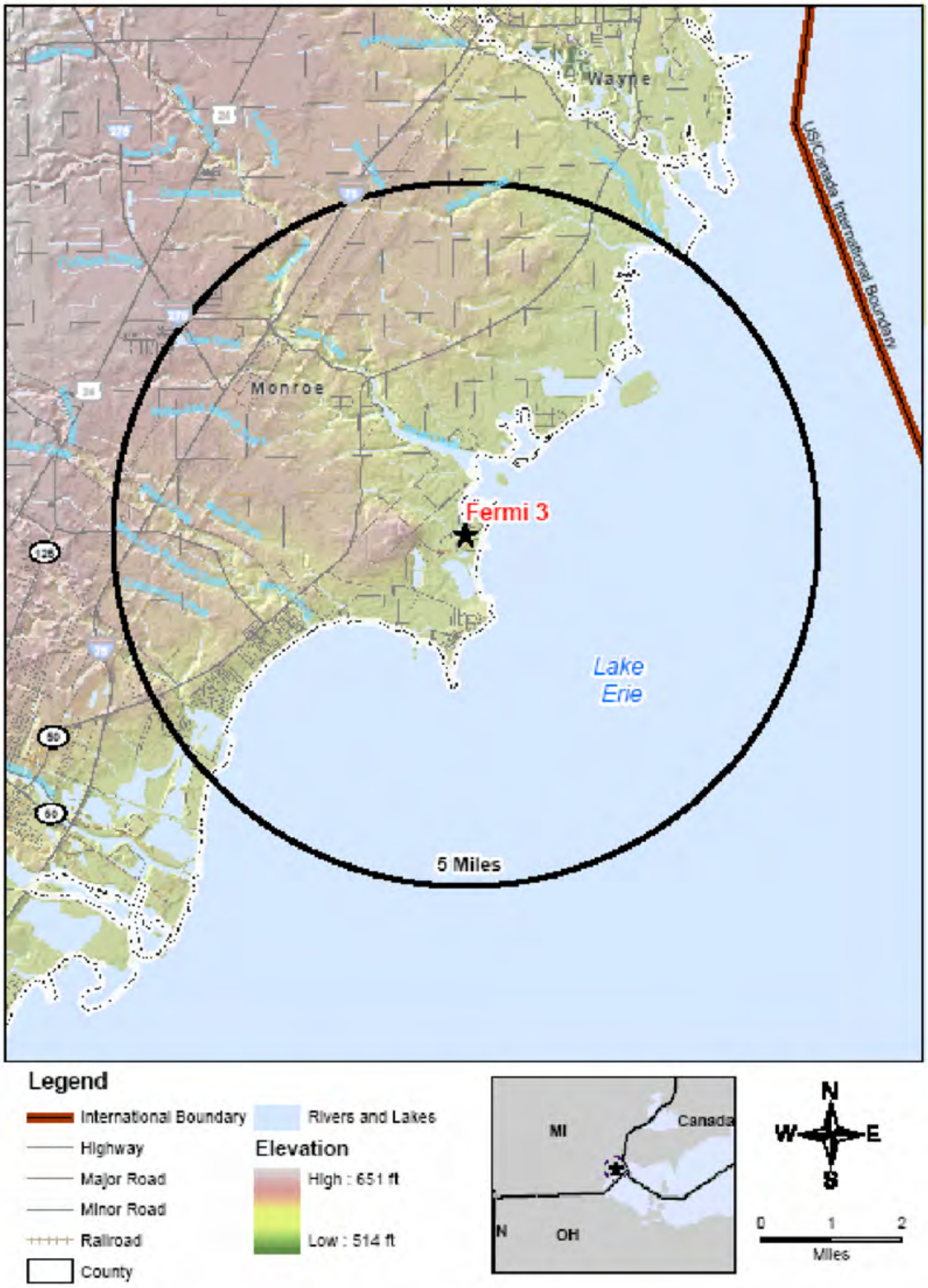


Figure 2.7-57 Topographic Features Within 50 Miles of the Fermi Site

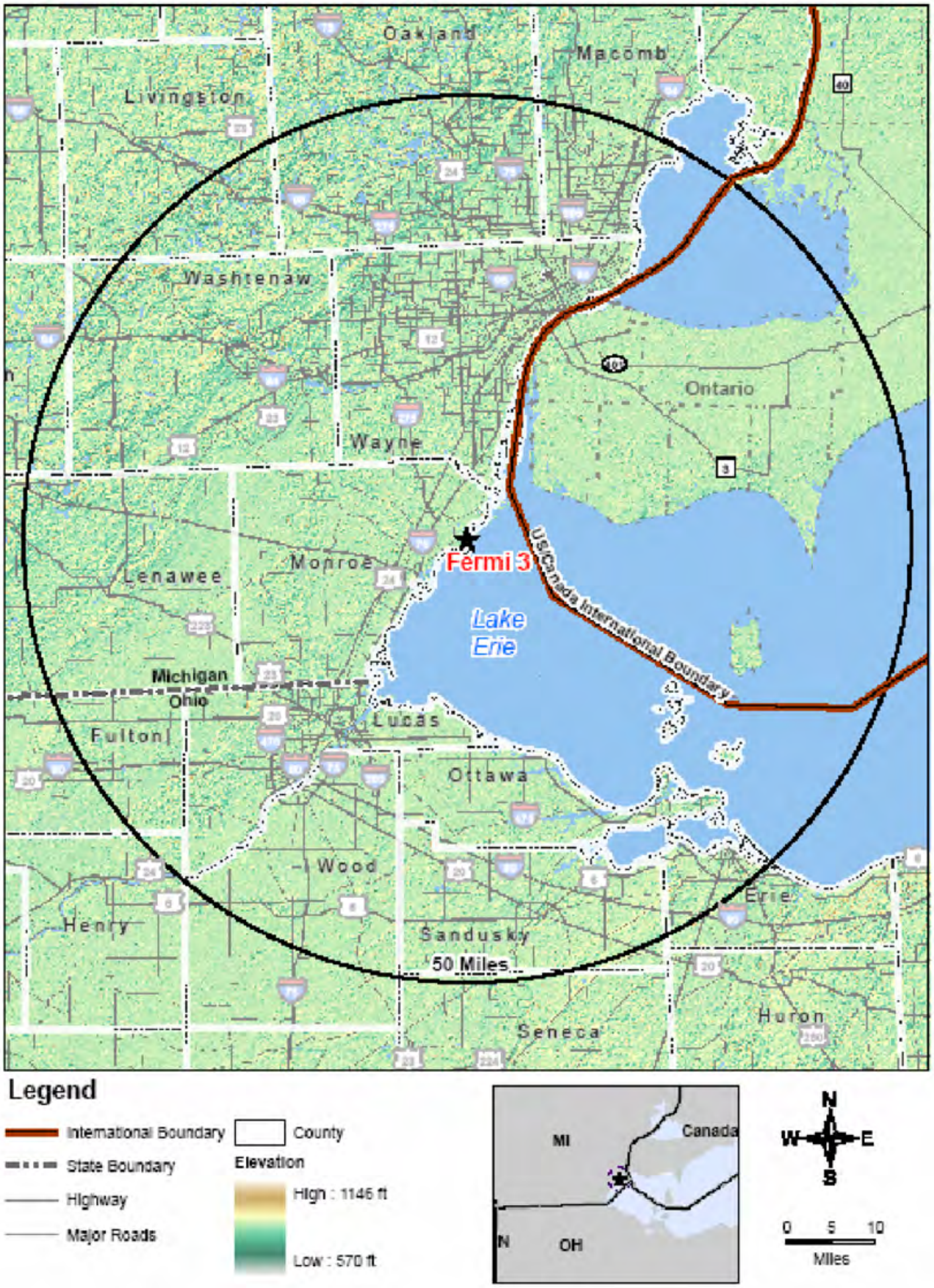


Figure 2.7-58 Terrain Elevation Profiles Within 5 Miles of the Fermi Site (Sheet 1 of 2)

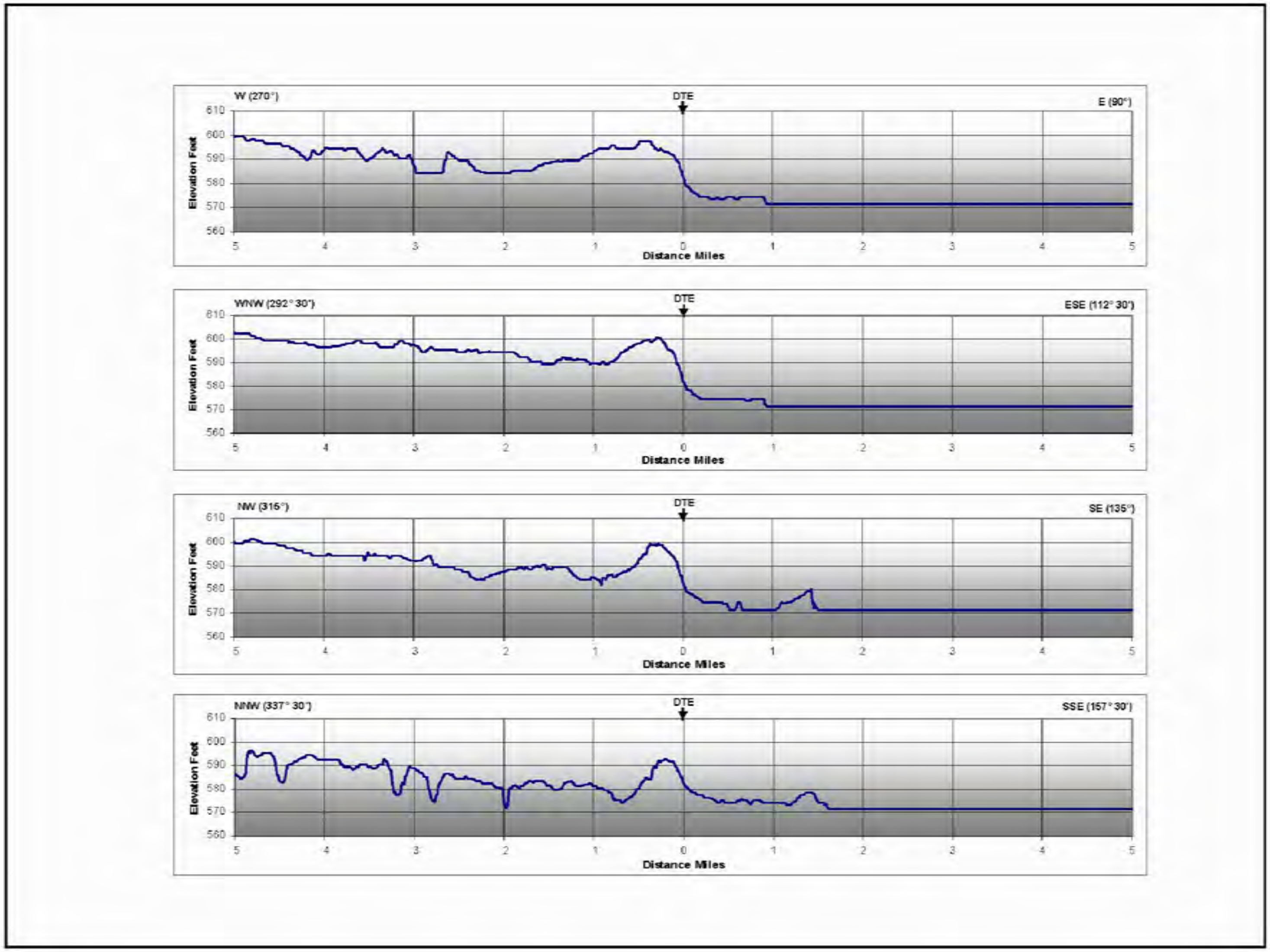


Figure 2.7-58 Terrain Elevation Profiles Within 5 Miles of the Fermi Site (Sheet 2 of 2)

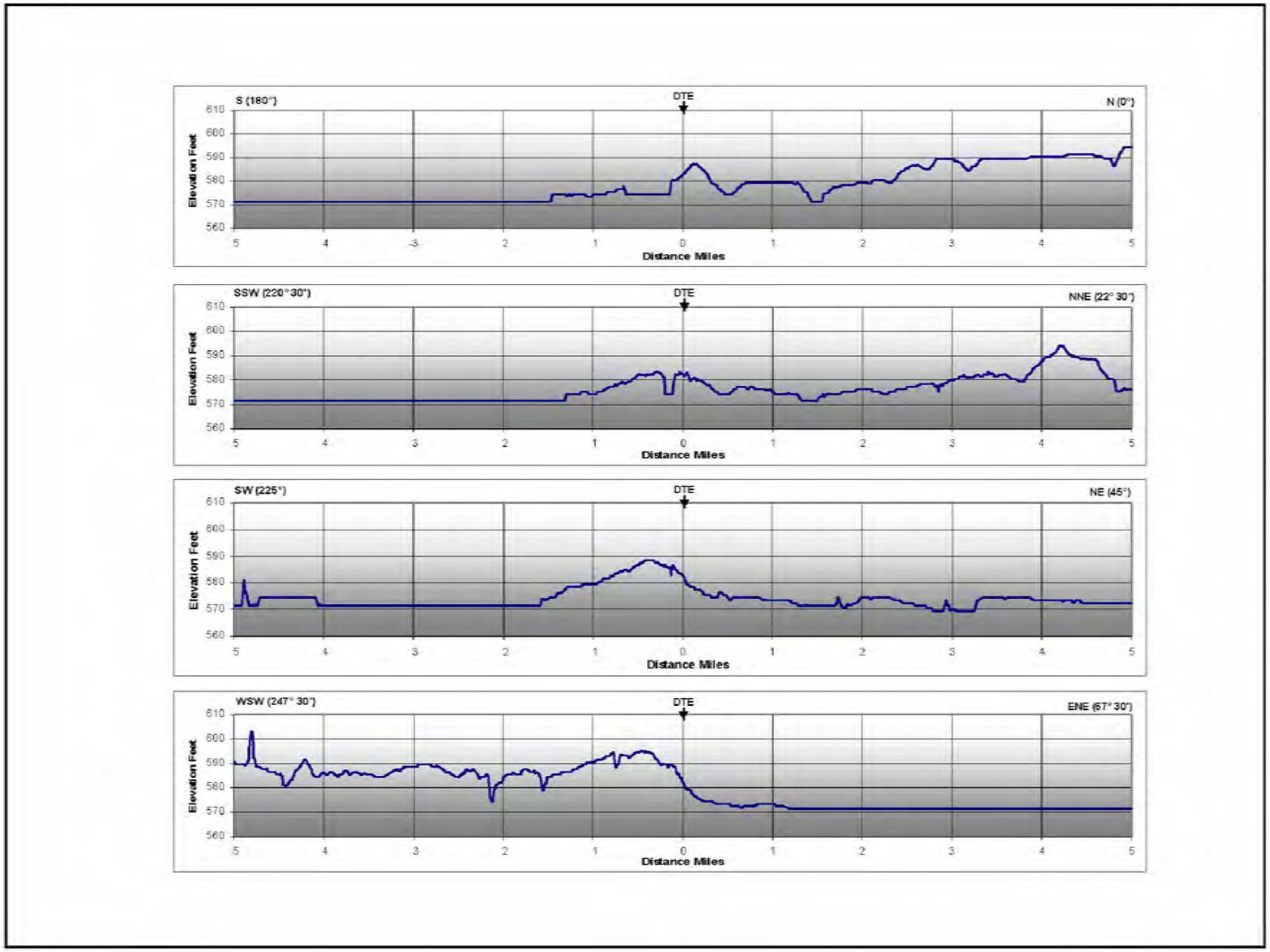


Figure 2.7-59 Terrain Elevation Profiles Within 50 Miles of the Fermi Site (Sheet 1 of 2)

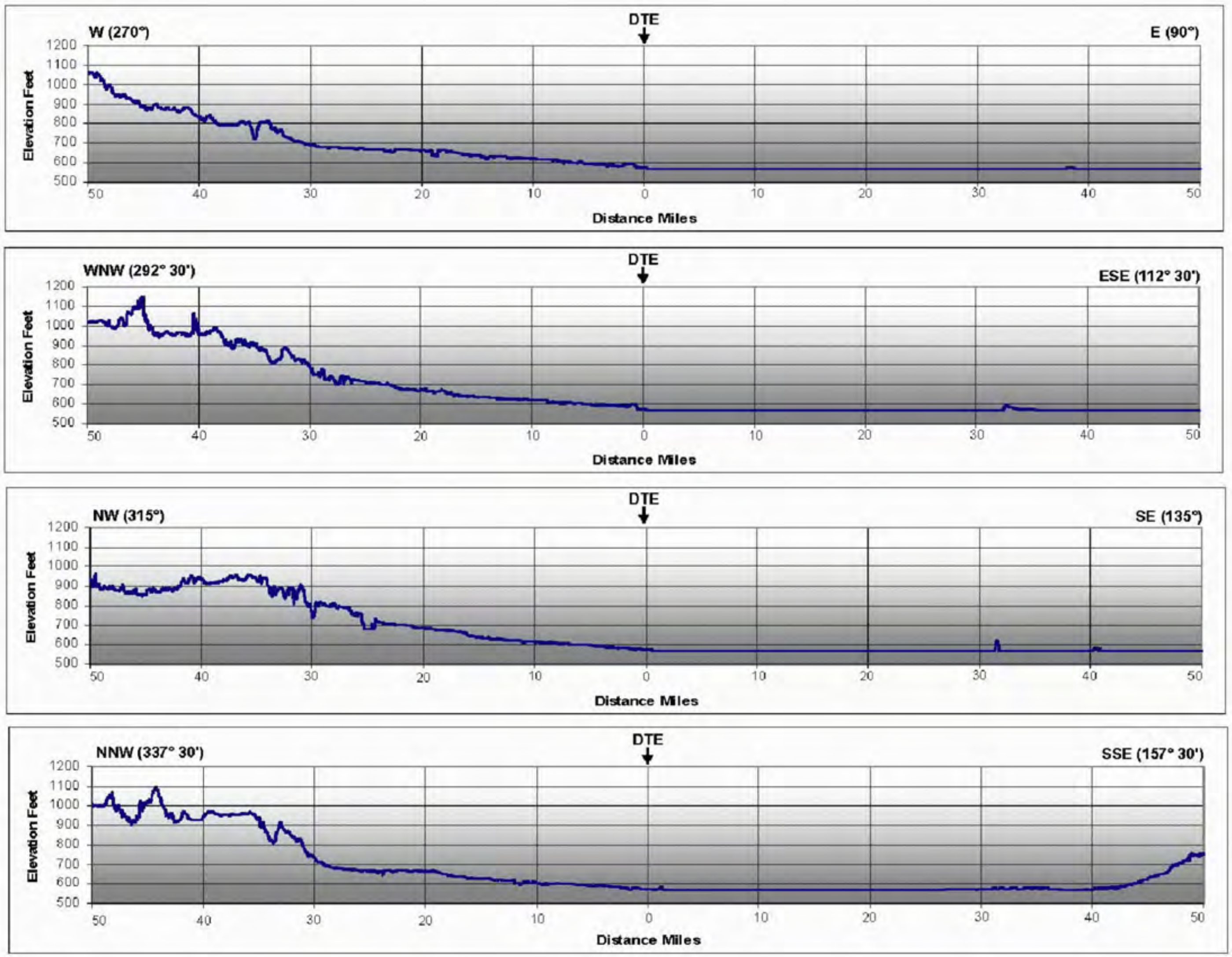
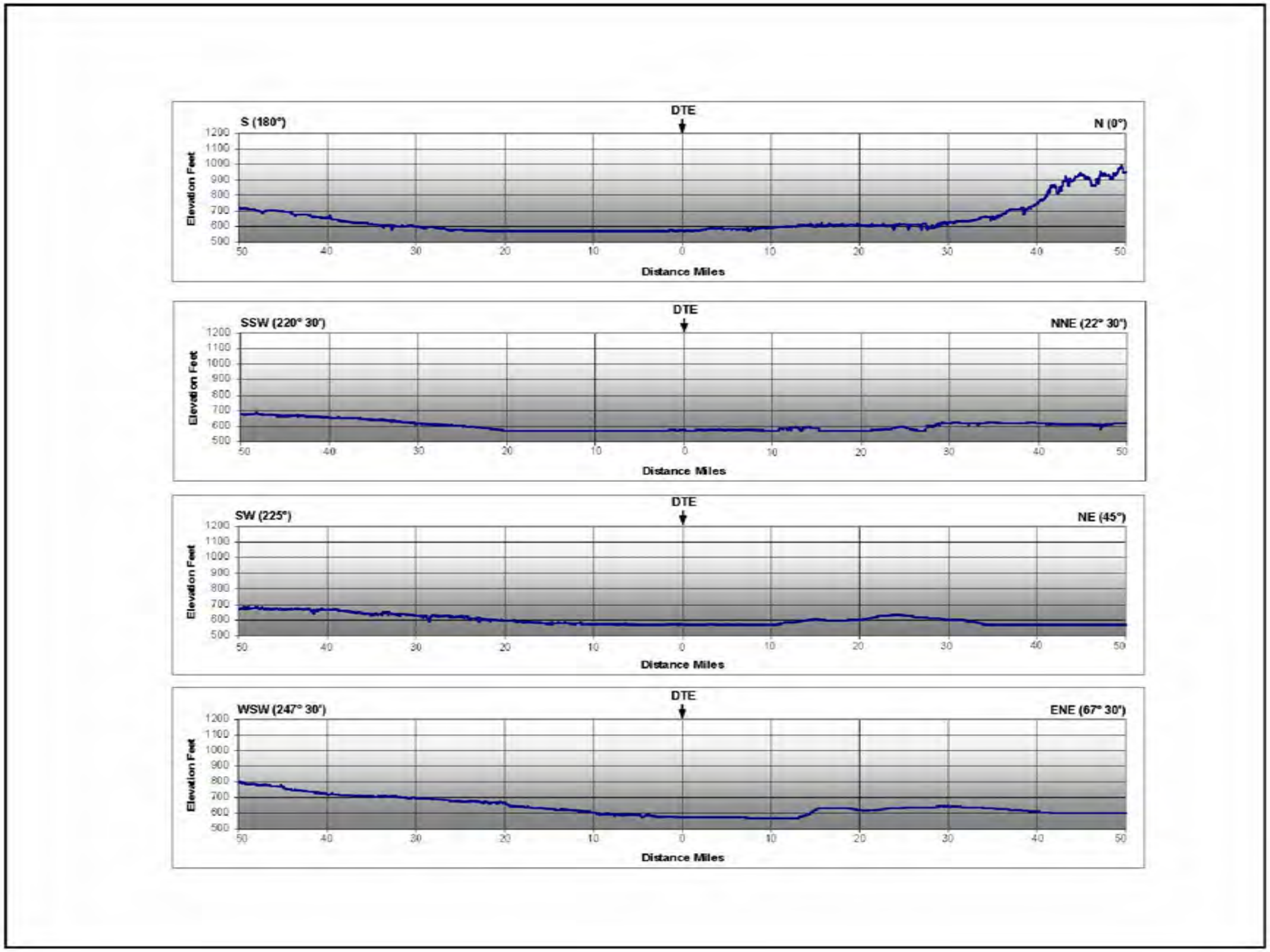


Figure 2.7-59 Terrain Elevation Profiles Within 50 Miles of the Fermi Site (Sheet 2 of 2)



2.8 Related Federal Project Activities

The purpose of this section is to identify Federal activities directly related to the proposed project in order to: (1) determine the need for other Federal agencies (i.e., cooperating agencies) to participate in the preparation of the environmental impact statement; and (2) assess the interrelationship and cumulative environmental impacts of the proposed project and related federal activities.

The scope of this review is limited to directly-related Federal project activities that affect land acquisitions or use, transmission line routing, plant siting and water supply, construction or operation of Fermi 3, or the need for power. Actions related to the granting of licenses, permits, or approvals by other Federal agencies are not discussed in this section.

2.8.1 Federal Actions Related to Land Acquisitions or Use Affecting Fermi 3 Project

No Federal actions associated with the acquisition and/or use of the proposed site and transmission corridors or any other offsite property needed for the proposed project were identified. Fermi 3 is sited on the existing Enrico Fermi (Fermi) site that is owned by the Applicant. While no Federal actions are associated with the acquisition or use of the land for the construction or operation of Fermi 3, Detroit Edison and the USFWS entered a Cooperative Agreement (Agreement) September 25, 2003 concerning portions of the Fermi site. Under the Agreement, Detroit Edison authorized the USFWS to include certain lands and waters on the Fermi site within the DRIWR. The Agreement allows either party to end the agreement either in whole or in part through mutual agreement, or at the option of either party, upon 90 days written notice to the other. Therefore, lands currently operated as part of the DRIWR, subject to the National Wildlife Refuge System rules, will be removed from the Agreement. However, the Applicant intends to return all available wetlands, that can be returned, to the DRIWR following construction.

The offsite 345 kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. The Applicant has no control over the construction or operation of the offsite transmission system. ITC*Transmission* has identified the need for additional transmission lines and an undeveloped corridor to accommodate Fermi 3. New transmission lines associated with Fermi 3 will largely be placed within existing transmission corridors, and existing infrastructure within the corridors will be used. Activities associated with the transmission system may require the acquisition of new right-of-ways, and will involve the construction of new transmission towers. However, it is not expected that these activities will require any Federal action.

2.8.2 Plant Siting and Cooling Water Source and Supply

No directly related Federal activities or relevant cooperating agencies that affect plant siting or water supply were identified. Fermi 3 utilizes a closed-cycle hyperbolic natural draft cooling tower for the Normal Power Heat Sink (NPHS), and mechanical draft cooling towers for the Alternative Heat Sink. Makeup cooling water for the cooling towers is drawn through an intake bay formed by two rock groins extending into Lake Erie.

2.8.3 Other Federal Actions Affecting Construction or Operation

A review of Federal agency public records was conducted to identify other planned Federal projects or activities that must be completed as a condition of plant construction or operation. No other Federal activities were identified that would affect the construction or operation of Fermi 3.

2.8.4 Federal Agency Plans Influencing Need for Power Justification

A review of the need for power analysis was conducted to identify Federal agency plans or commitments resulting in significant new power purchases within the Applicant's service area that were used to justify a need for power. No Federal projects or activities were identified as generating significant new power purchases within the Applicant's service area, nor have Federal projects or activities been used to justify a need for power.

2.8.5 Planned Federal Projects Contingent on Plant Construction or Operation

Based on review of Federal agency public records there are no planned Federal projects or activities that are contingent on plant construction and operation. There are currently no special relationships between the Applicant and Federal agencies dependent upon construction of Fermi 3.

2.8.6 References

None.

Appendix 2A Life Histories of Aquatic Species

The following species are considered important species in aquatic ecosystems within the vicinity of the Fermi site. These life histories provide detailed information on any critical life-support requirements such as spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes. Supplemental life history data was gathered from NatureServe wildlife database (Reference 2.4-9 and Reference 2.4-80).

Alewife-*Alosa pseudoharengus*

The alewife has a native range in North America from Labrador, Canada down the Atlantic coast to North Carolina. It has been introduced into the Great Lakes and streams and rivers west to the Mississippi, as well as in Nebraska. This species was likely introduced in Lake Ogallala as a pelagic forage fish.

The alewife inhabits nearshore areas of the Atlantic Ocean, or open-water areas of lakes. Ocean populations will migrate to quiet portions of rivers or streams (freshwater or brackish) to spawn, while land-locked populations migrate locally to shallow inshore areas. Optimum temperature range for this species is 52 to 66°F for adults and 63 to 66°F for juveniles.

This species generally spawns at night in the spring or summer, depending on locality. The eggs hatch in a week or less, and larvae will school in the vicinity of the spawning area until they are ready to leave the nursery. Juveniles reach sexual maturity in 2-4 years, and marine adults may attain sizes up to 16 inches and live as long as 8 years.

Juvenile alewives feed on diatoms, and zooplankton such as copepods and ostracods. Adult fish will feed on zooplankton, crustaceans, insects, and eggs. Larger individuals will prey on small fishes, as well.

The alewife is a target for larger predatory fish and are commercially harvested for use in animal food.

Black crappie-*Pomoxis nigromaculatus*

The native range of the black crappie is difficult to determine, but it is currently distributed from Quebec and Manitoba, south through the St. Lawrence, Great Lakes, and Mississippi River basins to the Gulf of Mexico, as well as the Atlantic Slope from Virginia to Florida and Gulf Slope west to Texas.

The black crappie generally inhabits lakes, ponds, sloughs, and the backwaters of pools and streams. It prefers clear water with some aquatic vegetation, and is often found over mud or sand substrates. Optimum temperature range for the black crappie is 73 to 90°F.

Black crappie spawn in May, June, or July. Males construct a nest by fanning out small depressions on the bottom in and around brush, rocks, or vegetation in water between 1 and 5 feet deep. Females then lay 5,000 to 30,000 eggs in the nest. This species may live up to 15 years and attain a length of 18 inches.

Juveniles feed upon planktonic crustaceans and free-swimming, nocturnal insect larvae. As adults, black crappie will become piscivorous upon smaller species.

Black crappie are a common game fish and are highly regarded by recreational fisherman. It is also one of the largest and most popular of the sport fishes. It can be caught during all seasons and during the day or at night under lights.

Bluegill-*Lepomis macrochirus*

Bluegill are distributed from Quebec, south through the St. Lawrence, Great Lakes, and Mississippi River basins to northern Mexico, as well as the Atlantic and Gulf Slope drainages. This species is widely distributed throughout North America and many other parts of the world.

These sunfish are frequently found in shallow lakes, ponds, reservoirs, sloughs, and slow-flowing streams. Often they are associated with rooted aquatic vegetation and silt, sand, or gravel substrates. Bluegill are capable of withstanding a wide range of temperatures (34 to 97°F), although temperatures around 81°F seem to be optimum for northern ranging specimens.

Bluegill lay eggs in a nest made in shallow water by the male on bottoms of gravel, sand, or mud that contain pieces of debris. After their yolk sac is absorbed, larvae move from the littoral to limnetic zone, then return to littoral zone 30 to 40 days later. Adult bluegills can attain sizes between 10 to 16 inches and may live over 10 years.

Young bluegill feed upon planktonic crustaceans, insects, and worms. Adults eats mainly aquatic insects, crayfishes, and small fishes, or, in some bodies of water, mostly zooplankton.

This species has popularity with recreational anglers of all ages because it can be easily caught, are valiant fighters for their size, and are exceptionally fine eating.

Bluntnose minnow-*Pimephales notatus*

The bluntnose minnow is one of the most common freshwater fishes in eastern North America, present in the Great Lakes, Hudson Bay, and Mississippi River basins north from Quebec to Manitoba, south to Louisiana and on the Atlantic Slope from the St. Lawrence in Quebec south to North Carolina.

This minnow is found in a variety of habitats including lakes, ponds, rivers, and creeks. It is most common in clear rocky streams, and schools either in mid-water or near the bottom. Bluntnose minnows are capable of withstanding temperatures ranging from approximately 45 to 95°F.

Bluntnose minnows spawn from May to August over sandy, gravelly shoals. The male digs a nest in which several females may lay eggs. The male then guards the nest until the eggs hatch, usually within 6-10 days. Females will grow to sexual maturity in one year, while males generally take two. Maximum life expectancy of this minnow is five years, and it may grow up to 4 inches in length.

Both juvenile and adult minnows are primarily bottom feeders on detritus and algae in the winter. In the summer they have been shown to feed on insects, plant material, and zooplankton.

The bluntnose minnow's small size and abundance allows this species to commonly be used as a bait fish by recreational anglers.

Channel catfish-*Ictalurus punctatus*

Channel catfish occur mostly in the central drainages of North America, from southern Canada to northern Mexico, historically. It has been widely distributed throughout the United States as well as other countries.

This species prefers clean, well-oxygenated water of rivers and streams, but will occur in ponds and lakes as well. They occur from clear, rapid flowing waters over firm bottoms, to turbid slow moving water over mud substrates. Optimum temperature range for the channel catfish is 79 to 84°F.

Channel catfish have been known to migrate hundreds of miles throughout their lifetime. They generally spawn between April and July when temperatures are about 27 degrees Celsius. Females lay up to 20,000 eggs in a nest on holes dug in sandy substrates. Males then guard and fan over the nest during the 3-8 day incubation period. Larval development lasts about two weeks, and schools of larvae may persist for weeks after leaving the nest. Sexual maturity is reached anywhere from 2-8 years, and adults may reach over 51 inches and live up to 16 years.

Juvenile channel catfish eat mainly small invertebrates and insects, and prey increasingly on crayfish and fishes as they grow. Adults are mainly piscivorous, but will feed upon insects, small mammals, and vegetation.

The channel catfish size make it a highly sought after sport fish. They also have significant commercial value to fisherman in Lake St. Clair and Lake Erie.

Common reed-*Phragmites australis*

The common reed is an aquatic plant found in every U.S. state and is considered an invasive species. The common reed is a clonal grass species with woody hollow stems that typically grows up to six meters in height. Leaves are lanceolate, and flowers develop by mid summer. The common reed is wind-pollinated but self-incompatible. Seed set is highly variable and occurs through fall and winter and may be important in colonization of new areas. Germination occurs in spring on exposed moist soils. Vegetative spread by below-ground rhizomes can result in dense clones with up to 200 stems per square meter.

The common reed is most abundant along the Atlantic Coast and in freshwater and brackish tidal wetlands of the northeastern United States as far south as North Carolina. It occurs in all eastern states and populations are expanding, particularly in the Midwest (Reference 2.4-41).

Common shiner-*Luxilus cornutus*

The common shiner is part of the minnow and carp family. This species is widely distributed across North American from Canada down to the Gulf Coast region. It is small, averaging 2.5 inches, but some specimens can reach approximately 8 inches. Its preferred habitat is creeks and small to medium rivers, clear cool water, and a moderate to swift current with gravel to rubble bottom. In the north, it can be found abundantly in lakes and reservoirs.

The common shiner spawns in late spring and early summer over gravel beds in running water. Nests are made in the gravel by the male or a nest of another species is utilized. Eggs become lodged in the gravel and are protected by the male until they hatch. Once hatched, the common shiner will reach sexual maturity in 2-3 years. Both adults and juveniles are opportunistic omnivores feeding on aquatic insects, adults and larvae, and other plant material. The common shiner is a hardy species which thrives in temperatures up to 72°F.

Common shiners serve as forage fish for game fish and are often used as a bait minnow for anglers.

Emerald shiner-*Notropis atherinoides*

The emerald shiner is a small, slender fish that belongs to the carp and minnow family. This species is widely distributed across North America from Canada to Virginia through Texas. The emerald shiner prefers large, deep rivers and large lakes or reservoirs. They are also found in embayments and backwaters of these systems. Generally, they are found near the surface in open waters. This species is tolerant of turbidity in Great Plains streams, but rarely in other areas. The emerald shiner is capable of withstanding a wide range of temperatures, with an upper lethal limit documented at about 100°F.

Emerald shiners are broadcast spawners with no real substrate preference. They have been known to spawn over sand, gravel, vegetation, and other cover. Adults range in size from 2 to 3.5 inches with a maximum size of 4 inches. Generally, they feed on zooplankton, insects, and flying insects.

The emerald shiner serves as an important forage species for predatory fishes in areas where it is abundant.

Fishhook water flea-*Cercopagis pengoi*

The fishhook water flea is an invasive species native to Southwest Asia and is believed to have arrived in the Great Lakes Region via ballast water in the late 1990s. This species is similar to the spiny water flea, as it is also a relatively large plankton species with a high reproductive rate. Its distribution and characteristics are analogous to that of the spiny water flea (Reference 2.4-43).

Freshwater drum-*Aplodinotus grunniens*

This species of drum is widely distributed throughout North and Central America. It ranges from the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River Basins, Gulf Coast drainages, south through eastern Mexico and down to Guatemala.

Freshwater drum occur in a variety of habitats, but seem to prefer large, silty lakes and large rivers. They generally occur over mud bottoms in open water. Optimum temperature for this species is approximately 86°F.

Spawning usually occurs in the spring or summer when water temperatures reach 19-22 degrees Celsius. They are generally pelagic spawners, utilizing open water far from shore, where their fertilized eggs float on the surface 1-2 days before hatching. Juvenile males generally reach sexual maturity in 2-4 years, while females take 4-6 years. Maximum life expectancy for this drum is ten years, with a growth potential of 37 inches.

Juvenile drum tend to feed upon minute crustaceans and insect larvae. Adults are mostly benthic foragers, and prey items include insect larvae, crustaceans, fishes, and bivalves.

Freshwater drums are harvested commercially in Lake Erie. This species is not a recreationally significant fish as anglers' opinions of the species is mixed on the suitability for consumption.

Gizzard shad-*Dorosoma cepedianum*

The gizzard shad is in the Family Clupeidae, the herring family. It is distributed through the mid to eastern region of the United States and the middle and south of Canada around the Great Lakes. As an adult, the gizzard shad will reach 9 to 14 inches in length and be up to two pounds. This fish can thrive in a wide variety of habitats including large rivers, reservoirs, lakes, swamps, bays, sloughs, and similar quiet open waters. Young and juveniles live in the more clear and shallow waters versus adult gizzard shad that stay in deeper waters, near bottom. This species is capable of withstanding temperatures from approximately 43 to 91°F; however, the gizzard shad will begin to experience decreased body functions in a much shorter time period when exposed to lower water temperatures.

These fish spawn at night during the spring and summer in shallow waters over rocky substrate. The eggs are scattered and adhere to objects on the bottom substrate until hatching 2 to 4 days later. The juveniles obtain sexual maturity in 2 to 3 years and have a lifespan of approximately 4 to 6 years.

Juvenile gizzard shad are planktivores, eating protozoans, small crustaceans, Chlorophyta, and Chrysophyta. Adults are primarily bottom filter-feeding detritivores, acquiring food from aufwuch[1] assemblages in littoral areas.

Gizzard shad have been used by anglers as a bait fish. Young gizzard shad are important forage fish for sport and other predator fish. However, their rapid growth makes them too large by the end of their first year of life to be eaten by most fish. The gizzard shad has also been considered a nuisance as it can overpopulate water bodies and is prone to massive die-offs.

Lake whitefish-*Coregonus clupeaformis*

During the late 19th and early 20th centuries, large numbers of lake whitefish entered the Detroit River each year to spawn. Whitefish prefer rock, honeycomb limestone, gravel or sand for optimal spawning conditions. Reports indicate that the lower Detroit River was a prolific spawning area prior to the construction of the Livingstone Shipping Channel. The timing of this construction

1. Aufwuch – refers to the small animals and plants that encrust hard substrates, such as rocks, in aquatic environments.

coincides with the degradation of whitefish populations in the river and western Lake Erie. The primary sources of food for the lake whitefish in the Western Lake Erie Basin are two small, bottom-dwelling organisms called *Diporeia* and chironomids. Lake whitefish have a narrow temperature tolerance, requiring cold, well oxygenated bottom waters throughout the summer in order to survive. They require relatively silt-free river or lake spawning areas for successful reproduction. Optimum temperature for the lake whitefish ranges from 50 to 57°F for adults and 60 to 67°F for juveniles.

Lake whitefish are recognized as an indicator of ecosystem health and are an integral component of the Great Lakes food web. Recently, populations of lake whitefish were once again discovered in the Detroit River, but further studies are necessary to ascertain their presence in other tributaries of western Lake Erie.

Little information exists regarding whitefish life history, habitat requirements, and ecological niche in Lake Erie and its tributaries including the Detroit River. The Detroit River-Western Lake Erie Basin Indicator Project, sponsored by the EPA has identified a need for the collection of life history data for the lake whitefish and incorporated this need into ongoing monitoring and restoration studies on Lake Erie and the Detroit River.

Largemouth bass-*Micropterus salmoides*

The largemouth bass is widely distributed throughout North America, from the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River basins, as well as the Atlantic drainages from North Carolina to Florida, to northern Mexico. This popular gamefish has been introduced widely throughout the United States and the rest of the world, where it is sometimes considered to have had adverse ecological impacts.

This bass will inhabit clear waters of lakes, ponds, reservoirs, and swamps. Largemouths may also be found in the pools or backwater areas of creeks and rivers. They are usually associated with muddy bottoms and aquatic vegetation as well. The largemouth bass is capable of withstanding temperatures ranging from 50 to 90°F.

Largemouth bass spawn in spring and summer when the water temperature reaches at least 15 degrees Celsius. Males become aggressive and territorial as they dig nests in shallow water. After the female deposits eggs in the nest, the male guards and fans the eggs, which hatch within five days. The hatchlings will reach sexual maturity in 2-5 years, and may attain sizes of nearly 39 inches with a life expectancy up to 23 years.

This species feeds mainly upon zooplankton as fry. As the juvenile grows it begins to prey upon insects, crustaceans, and fish fry. Adults are mainly piscivorous, but will feed upon crawfish and frogs as well. Largemouth bass have also been shown to be cannibalistic and do not feed while spawning.

The largemouth bass is a major sport fish in the Great Lakes. It’s excellent fighting ability and good taste makes it a valuable resource for recreational fishing.

Pumpkinseed-*Lepomis gibbosus*

The pumpkinseed belongs to the family of sunfishes and freshwater basses. This species is distributed across the United States from coast to coast and up into Canada. This species length ranges from 5 to 6 inches, but some may approach 10 inches. The pumpkinseed can be found in a variety of habitats including lakes, reservoirs, ponds, sloughs, and sluggish streams that have quiet, clear water with aquatic vegetation and some organic debris. Temperature tolerance ranges from 39 to 72°F.

This species spawns in spring and summer with the males digging a pit in the substrate in which the eggs are deposited. The male guards the eggs until they hatch 3 to 5 days later. Sexual maturity occurs in the 2nd or 3rd year. Immature pumpkinseeds feed on zooplankton while adults feed upon snails, aquatic insects, and other invertebrates.

Though there is not a large recreational fishing demand on the pumpkinseeds due to their small size; they are popular with young fisherman because of willingness to bite worms, their large numbers, and location close to shore.

Rainbow smelt-*Osmerus mordax*

Though the rainbow smelt was once an exclusively anadromous species; the smelt now successfully inhabits freshwater systems in the northeastern and central United States. More specific to the Great Lakes Region, it was introduced to Michigan's inland waters as food for stocked salmon in the 1900s. The rainbow smelt escaped to Lake Michigan, and by 1930 the rapidly growing population had spread into Lake Superior and beyond. Most adult smelt do not exceed 7 to 9 inches and weigh no more than a few ounces. Rainbow smelt are sensitive to bright lights and warm temperatures so they are usually found in the deeper, cool depths offshore.

They spawn in the spring with females producing 12,000 to 50,000 eggs that sink to the bottom and attached to gravel substrate. The eggs rapidly hatch and sexual maturity is reached at 2 years of age. Adults can live up to 8 years. This carnivorous species feeds primarily upon crustaceans and small fish but also eat terrestrial and aquatic insects.

These fish are a target for recreational anglers and well as being commercially caught for animal feeds.

Rock bass-*Ambloplites rupestris*

The rock bass is actually a member of the sunfish family. It is native to the freshwaters of east-central North America, but can be found in some western states and southern Canada. Their average length is 6 to 8 inches with some growing up to 12 inches. Rock bass weight ranges from 4 to 8 ounces. Its preferred habitat is clear, silt free, rocky streams; small, cool, weedy lakes, or shallow, rocky areas of a larger lake. In winter, it remains relatively inactive in deeper waters. Optimum temperature for the rock bass ranges from 50 to 84°F.

Adults live in groups and spawning occurs in late spring in shallow depressions made by the male. The male guards the eggs until they hatch 3 to 4 days later. Sexual maturity is reached at 2 to 3 years of age and adults can live up to 12 years. The rock bass eats a wide variety of foods, including crayfish, small fish, and insects.

These fish are a commercial species in the Great Lakes and are an important sport fish.

Round goby-*Neogobius melanostomus*

The round goby is an invasive species abundant throughout the Great Lakes Region with origins in the Black and Caspian Seas. They are currently undergoing a population explosion in Lake Erie, are present in the Detroit River, and are most likely present in Swan Creek and Stony Creek. This species of goby is a small fish that utilizes bivalves, amphipod crustaceans, small fish, and fish eggs as its main food source. Thermal tolerance for this species ranges from 39 to 68°F. It is commonly believed that the round goby was introduced to the Great Lakes through ballast water. Known to compete with other fish for food and consume eggs and juvenile fish, the round goby is seen as a detriment to the Lake Erie ecosystem.

Sea lamprey-*Petromyzon marinus*

The sea lamprey is a primitive jawless fish originating in the Atlantic Ocean. The sea lamprey is an invasive species and is larger and far more predacious than the lamprey species' native to Lake Erie, capable of withstanding temperatures ranging from 41 to 68°F. They were first observed in Lake Erie in 1921, and often move into its tributaries to spawn. Many tributaries of Lake Erie are treated with chemicals called lampricides to prevent further expansion of the species. Although Lake Erie and Swan Creek are the only waterways of concern with confirmed occurrence, Stony Creek and the Detroit River could potentially have individuals present during spawning runs.

A single sea lamprey can kill as much as 40 pounds of fish in its lifetime, and it is estimated that only one in seven fish survive an attack by a sea lamprey. They have a strong advantage over the many species of fish native to Lake Erie because they have no natural predators in the lake. The sea lamprey has caused the most damage to native fishes including the lake trout (*Salvelinus namaycush*), lake whitefish and hornyhead chub (*Nocomis biguttatus*). The sea lamprey has no economic value, and during its peak abundance, it is estimated that 85 percent of lake trout encountered that have not been killed by the lamprey will have scarring from their attacks (Reference 2.4-39).

Spiny water flea-*Bythotrephes* spp.

The spiny water flea is an invasive species native to Europe and Northern Asia and is believed to have arrived in the Great Lakes Region via ballast water in the mid-1980s. The spiny water flea is very abundant in the central basin of Lake Erie, but may be found throughout the lake. There are populations found in inland lakes of the Great Lakes Region, and it is presumed that the spiny water fleas may occur in tributaries of Lake Erie such as Swan Creek, Stony Creek, and the Detroit River as well.

This is a large plankton species, about ½ inch in length, and has a very high reproductive rate. Scientists fear that as the population in Lake Erie starts to increase, they will eradicate many of the native zooplankton species, their main food source. The spiny water flea also competes with juvenile fish as they share many similar food sources such as zooplankton, fish larvae, and eggs. This species is not an attractive prey to the native inhabitants of Lake Erie because of the sharp spines located on its tail. It is assumed that there will be few deterrents to the success of its rapidly growing population (Reference 2.4-73).

Spottail shiner-*Notropis hudsonius*

The spottail shiner is a member of the carp and minnow family. It is distributed across the northeast portions of the United States and across much of Canada. It is considered a medium sized minnow, growing 3 to 4 inches in length. Its habitat ranges from large lakes and rivers to small streams, but does prefer clear water and is considered the “big water” member of the minnow family. Temperature range for the spottail shiner is 50 to 75°F.

The spottail shiner spawns in late spring or early summer and once hatched, juveniles reach sexual maturity in 1 to 2 years. Both young spottail shiner and adults feed upon insects, crustaceans, and filamentous algae.

This species serves as a popular bait minnow for the recreational angler.

Walleye-*Sander vitreus*

Walleye are the largest member of the perch family. They can be found in all the Great Lakes as well as across the central-east United States and up into Canada. It ranges in length from 13 to 25 inches and weighs 1 to 5 pounds. Walleye can be found in a variety of large bodies of freshwater including lakes, pools, backwaters, rivers and flooded marshes. They prefer deep waters and avoid bright light. Optimum temperature for the walleye ranges from 72 to 75°F.

This species spawns in late spring or early summer in turbulent rocky areas in rivers, coarse gravel shoals in lakes or flooded marshes. Eggs are dispersed, then abandoned and will hatch approximately 26 days later. It has been documented that adults may migrate up to 100 miles between spawning habitat and non-spawning habitat. Male juvenile walleye will reach sexual maturity in 2 to 4 years and females 3-8 years. Young walleye up to 6 weeks of age mainly eat copepods, cladocera, and small fishes while adults feed upon fishes and larger invertebrates.

This popular game fish can be caught year round in the Great Lakes and it sought for its excitement to catch and its favorable taste.

White bass-*Morone chrysops*

The white bass is a freshwater member of the sea bass family. It is distributed across the United States and eastern Canada, specifically in Lake Michigan, Lake Huron, Lake Ontario, and Lake Erie. This fish prefers open water habitat in lakes and some large rivers. Optimum temperature for the white bass is approximately 89°F.

White bass spawn in spring with each female releasing between 242,000 and 933,000 eggs in shallower water, which sink and adhere to the bottom substrate. Soon after spawning, the parents abandon the eggs and move to deeper waters. The eggs hatch approximately 4.5 days later and the young fish remain in shallow water for a period of time before migrating to deeper areas. White bass usually do not live past 7 years of age. They are carnivores, eating microscopic crustaceans, insect larvae, and other fish.

It can be easily caught and is an excellent eating fishing causing it to be a highly sought after game fish.

White crappie-*Pomoxis annularis*

The white crappie has a wide ecological tolerance and is typically found in impoundments, lakes, ponds, and large streams. This species prefers quiet waters and is attracted to structures, such as submerged logs and brush piles. Young crappie feed primarily on planktonic crustaceans, while adult white crappies eat aquatic insects, some crustaceans, and a large number of small fishes. The white crappie is also popular game and food fish. Optimum temperature for this species is approximately 88°F, although the white crappie is capable of withstanding much lower temperatures.

Spawning takes place from April to early June when average daily water temperatures range from 14 to 23°C, with preferred spawning temperatures between 16 and 20°C. Egg numbers in females can range from 27,000-68,000. Eggs are 0.89 mm in diameter, colorless, demersal, and adhesive. Sexual maturity is attained in the second to fourth year and when fish are approximately 152-203 mm (6-8 in) in length.

White crappie is one of the most popular panfish and can be caught year round, day or night. It is also one of the largest of the sport fishes with a sweet, flaky, white flesh that is excellent eating.

White perch-*Morone americana*

These fish belong to the family of temperate basses, a group of food and sport fish. White perch are native to the east coast but can be found in the Great Lakes area and are considered an exotic species. On the Atlantic coast they can be found in brackish waters, but have adapted to inland, freshwater lakes and tributaries. White perch prefer clear water and have no preference for substrate type. Optimum temperature for the white perch ranges from 50 to 86°F.

They spawn in the spring by randomly releasing their eggs in the shallow waters the Great Lakes tributaries. Eggs sink and stick to the bottom until hatching 4 days later. After hatching the young feed on microplankton and as they grow larger feed upon aquatic insects, invertebrates, other fishes, and the eggs of other fish species.

Though generally regarded as undesirable as a game fish in the Great Lakes, in the Eastern United States it is considered an excellent sport fish.

Yellow perch-*Perca flavescens*

The yellow perch belongs to the family Percidae or the perch family. It can be found in almost all 50 states as well as most of Canada. More specifically, the yellow perch is one of the most common fishes to Michigan waters, is commonly found in Lake Erie, and is assumed to occur throughout the

Detroit River, Swan Creek, and Stony Creek as well. They travel in schools, generally preferring the clear shallower waters of lakes or weedy backwaters of creeks and rivers. Yellow perch usually grow 6 to 10 inches in length and weigh between 6 and 16 ounces. Thermal tolerances for this species ranges from 32 to 86°F.

This species spawns in the spring in shallower waters over submerged beds of aquatic vegetation or over sand, gravel, or rubble. Eggs hatch in 10 to 20 days with males reaching sexual maturity at 2-3 years and females at 3-4 years. Their maximum lifespan is 10 years. Larvae and young yellow perch primarily feed upon zooplankton and as adults feed among plants, invertebrates, and other fishes.

Primary food sources for the yellow perch include mayfly larvae, caddisfly larvae, amphipods, chironomids, and zooplankton. This species feeds actively year round, leading the yellow perch to be recreationally targeted not only in warmer months, but also by ice fisherman in the winter. These large bodied, large-finned panfish have the distinction of being the most frequently caught game fish in Michigan.

In the late 1980s and early 1990s, after a 40 year absence due to pollution and eutrophication, large benthic invertebrates including mayfly larvae, caddisfly larvae, and amphipods recolonized western Lake Erie. When burrowing mayflies began to recolonize the lake as water quality improved, the yellow perch population began to rebound as well. Of high value economically, the yellow perch is also an indicator of water quality and ecological conditions on Lake Erie. Yellow perch are also beneficial because they feed on the round goby, a nonnative, invasive species.

Appendix 2B Life Histories of Threatened and Endangered Species

The following species are listed as threatened, endangered, or as a Species of Concern either by the federal government or by the State of Michigan, Ohio, and the Canadian Government. The listed species could potentially occur within the region of the Fermi site. These life histories provide available information on abundance, and any critical life-support requirements such as spawning areas, nursery grounds, food habits, and feeding areas. Supplemental life history data was gathered from NatureServe wildlife database (Reference 2.4-49 and Reference 2.4-80).

B.1 Threatened and Endangered Species

Aurora trout-*Salvelinus fontinalis timagamiensis*

This species was originally found in two small lakes in northeastern Ontario. The Aurora trout disappeared in the early 1960s when acid rain and other pollution disrupted its ability to reproduce. The species was reintroduced into both lakes in the early 1990s. Today the fish reproduces naturally in only one lake. Low water pH due to acid rain is a continuing threat. The Aurora trout was also introduced into ten other lakes, but has failed to establish reproducing populations in all but one.

Aurora trout prefer colder waters (below 20°C) and seek these out by moving to deeper water or by inhabiting groundwater springs. Thermal tolerances for this species ranges from 32 to 77°F. A water pH of at least five is necessary for the fish to reproduce successfully and thrive. An adult aurora will measure between 25 and 45 centimeters in length and weigh approximately 2 kilograms. The fish reach sexual maturity at between two and four years of age, and then spawn every year in nests built in groundwater springs.

This species feeds on a wide variety of prey including worms, leeches, crustaceans, aquatic and land-based insects, spiders, mollusks, frogs, salamanders and a number of fish species, including young brook trout (Reference 2.4-36).

Black sandshell-*Ligumia recta*

This species is widespread in eastern and central U.S. and Canada, occurring from the Great Lakes basin south into Mississippi River drainage to Louisiana and in some Gulf Coast drainages. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

The black sandshell is typically found in medium-sized to large rivers in locations with strong current and substrates of coarse sand and gravel with cobbles in water depths from several inches to six feet or more.

The largemouth bass, green sunfish, redbreast sunfish, rockbass, white perch, yellow perch, platy and convict cichlids have been identified as suitable host fish for this species. Gravid females have been found to display marginal papillae to attract fish hosts for their parasitic larvae (Reference 2.4-45, Reference 2.4-47, and Reference 2.4-51).

Blacknose shiner-*Notropis heterolepis*

This species occurs in the Atlantic, Great Lakes, Hudson Bay, and Mississippi River basins from Nova Scotia to Saskatchewan, south to Ohio, Illinois, south-central Missouri, and (formerly) Kansas. It is also common in some parts of range (especially Ontario, Michigan, and Wisconsin).

The blacknose shiner typically favors cool weedy creeks, small rivers, and lakes, usually over sand. As stated above, this species is found in cold-water habitats, usually around 66°F. The species is tolerant of oxygen depletion in winterkill lakes.

This species spawns in spring and summer and usually over sandy substrates. This species becomes sexually mature in 1 year (Reference 2.4-50).

Channel darter-*Percina copelandi*

The channel darter is only listed as endangered by the state of Michigan. Its distribution extends from the upper St. Lawrence drainages, through the Great Lakes basin, and into the Ohio River basin. The darter is found primarily in the Ohio River basin, but isolated populations occur southward to Louisiana. In Michigan, the darter's range includes the nearshore areas of Lake Erie and Lake Huron. Since 1994, it has only been recorded in the Au Sable, Pine and St. Clair Rivers in Michigan.

The channel darter's habitat includes rivers and large creeks with moderate current over sand and gravel substrate. It has also been recorded in wave-swept areas of Lake Huron and Lake Erie with coarse-sand, fine-gravel beach and sandbar substrates. The darter is usually found in deeper water, but will move into shallow water (<1 m) at night.

Flowing water is essential to channel darter spawning, which has been observed in the Cheboygan River, located north-northwest of the Fermi site, in mid-July. Optimum spawning temperatures for this species is approximately 68-72°F. Males maintain a 1-meter nest station around a large rock, where the female buries herself partially to deposit her eggs. After the male fertilizes them, both parents depart the nest of adhesive eggs and provide no parental care.

Channel darters are benthic feeders whose diet is comprised of small invertebrates including mayfly and midge larvae, small crustaceans, and algae and organic debris.

The channel darter has not been recorded in Monroe County in some time, most likely due to unsuitable habitat conditions (Reference 2.4-23).

Creek chubsucker-*Erimyzon oblongus*

The creek chubsucker has only been listed as endangered by the state of Michigan. This species occurs throughout most of the eastern United States, but is becoming increasingly rare toward the edges of its distribution. The creek chubsuckers northern range terminates in Michigan, where it has been found in the Kalamazoo, St. Joseph, and Raisin Rivers and their tributaries. For the last two decades it has only been reported in the Kalamazoo River, located west of Monroe County.

The creek chubsucker inhabits headwaters and clear creeks with moderate currents over sand-gravel substrate, sometimes near aquatic vegetation. This holds true in Michigan, where it has been reported in moderately swift streams up to five feet deep with sand, gravel and mud bottoms.

The creek chubsucker migrates upstream to spawn in early spring. Eggs are generally scattered over substrates, but males have been observed building nests. Adults may produce up to 9,000 eggs per year. Juveniles of this species prefer to form schools in vegetated areas with less current, but migrate to deeper downstream areas as they become adults. Life expectancy of the creek chubsucker is approximately five years. Optimal temperature for spawning is approximately 63°F.

The diet of the creek chubsucker is mostly small invertebrates living on the substrate. However, the terminal mouth of the creek chubsucker suggests that it may feed less on the bottom than other species of suckers.

The habitat near the Fermi site is not an ideal habitat for the creek chubsucker. However, many populations remaining in Michigan have adapted to non-traditional habitats (Reference 2.4-22).

Eastern pondmussel-*Ligumia nasuta*

The eastern pondmussel is listed as an endangered species within Ohio. Its native range includes eastern North America from the lower Great Lakes to New York, New Hampshire and in coastal rivers to South Carolina. In Canada, only two populations are believed to exist; in the delta area of Lake St. Clair (in the transition zone between wetlands and open water) and in a small tributary of the upper St. Lawrence River, Lyn Creek, near the outlet of Lake Ontario. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

The Eastern pondmussel prefers sheltered areas of lakes or slow streams in substrates of sand and mud. In the late summer, the female eggs are fertilized in a special area of the gill (*marsupium*) where they develop into larvae (*glochidia*). Once released the following spring, glochidia require a suitable host on which they become encysted and feed. They remain on the host until they develop into juveniles, at which time they drop off and bury in the sediment. They remain buried until sexual maturity, estimated to be between 6 and 12 years.

The Eastern Pondmussel is a filter-feeder. Adults consume bacteria, algae and particulate matter from the water. Juveniles feed on similar food; however, because they live entirely buried in the sediment, their food is obtained directly from the sediment and pore water (Reference 2.4-37).

Eastern sand darter-*Ammocrypta pellucida*

The eastern sand darter may be found from the St. Lawrence River drainage, the Lake Champlain drainage in Vermont, south to West Virginia and Kentucky, and west through Ontario and Michigan. Within Michigan, this darter was found historically in the Huron, Detroit, St. Joseph, Raisin, and Rouge Rivers, as well as Lake St. Clair. However, in the last two decades it has only been recorded in the Lake St. Clair and Huron River drainages.

The preferred habitats of the eastern sand darter are streams and rivers with sandy substrates, and lakes with sandy shoals. They frequently occur in slow moving waters that deposit fine sand, often just downstream of a bend. This species is found in cold-water habitats, usually around 66°F.

Spawning occurs from April through June when water temperatures are around 20-23 degrees Celsius. They deposit their eggs singly, and bury them in the sandy substrate. These darters reach sexual maturity at age one and have a life expectancy of only 2-3 years. The eastern sand darter spends a large amount of its time half-buried in the substrate, presumably to conserve energy and maintain its position on the bottom.

The eastern sand darter feeds mostly on chironomid larvae, but will also prey upon oligochaetes and cladocerans.

The eastern sand darter currently has no known populations in Monroe County (Reference 2.4-30).

Fawnsfoot-*Truncilla donaciformis*

This species occurs in the Mississippian region; Great Lakes: Michigan and Erie; Mobile basin; Gulf Coastal region west to the Rio Grande system of Texas and Mexico (Nuevo Leon and Tamaulipas), and Calcacieu River system of Louisiana. Recently this species has been confirmed to be likely extirpated from the main channel of the Detroit River between Lake St. Clair and Lake Erie, Michigan/Ontario; due to zebra mussel invasion. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

This species occurs in both large and medium-sized rivers at normal depths varying from less than three feet up to 15 to 18 feet in big rivers. A substrate of either sand or mud is suitable and although it is typically found in moderate current, it can adapt to a lake or embayment environment lacking current (Reference 2.4-52).

Greater redhorse-*Moxostoma vaelenciennesi*

In Michigan, this species occurs in the St. Joseph, Kalamazoo, Grand, Muskegan, Shiawassee, Cass, and Black, Mainstee, and AuSable Rivers. In Ohio, this species occurs in Bad Creek, the Sandusky, Ottawa, St. Joseph and Auglaize Rivers, and the Maumee River system. Thermal tolerance temperature for this species has been observed at approximately 88°F.

Spawning occurs in May or June throughout most of the range. Within the Thousand Islands area of the St. Lawrence River, spawning occurred during late June and early July, when water temperatures reached 16.7-18.9 °C. The spawning dates in the St. Lawrence River may run late due to the delayed warming of the river system. In all situations, the spawning runs closely follows that of the white sucker.

Generally, it takes males between five and six years to reach maturity. Maturation is evidenced by the presence of tubercles on breeding individuals.

Typical habitat is moderate to fast-flowing, medium-sized to large rivers. This species prefers clear water with substrates of clean sand, gravel, or boulder. The greater redhorse is sensitive to siltation, but occurrence in moderately polluted waters suggests some tolerance of siltation as long as sufficient current exists to keep spawning areas free of silt deposition. Spawning habitat is largely the same as non-spawning habitat--shallow runs with sand and gravel substrates.

The greater redhorse is likely to eat various bottom invertebrates and some plant material; aquatic insects and mollusks may be included the main diet (Reference 2.4-53).

Kidney shell-*Ptychobranchus fasciolaris*

The kidney shell was once generally distributed throughout the Ohio, Tennessee, and Cumberland River systems. In the Great Lakes drainage, it was found in Lake Erie and Lake St. Clair and some of their tributaries, the Detroit River, the Niagara River and some of its tributaries, and at least one tributary to lower Lake Huron. It was historically known from Alabama, Illinois, Indiana, Kentucky, Michigan, Mississippi, New York, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and Ontario. In Canada, it is only known from southern Ontario.

Recently this species has been confirmed to be likely extirpated from the main channel of the Detroit River between Lake St. Clair and Lake Erie, Michigan/Ontario; due to zebra mussel invasion.

This species is most commonly found in small (6-16 m wide) to medium-sized (15-20 m wide) rivers, and is rarely found in large rivers (>30-50 m wide). It also occurs in Lake Erie, Lake St. Clair and Lake Chautauqua, where it attains a much smaller size. It has also been found in shallow (<1 m) sections of impoundments that still have some moving water. It is usually absent from headwater creeks less than 3 m wide. It favors riffle areas with substrates of firmly-packed coarse gravel and sand and moderate to swift flows, and has an aversion to ponded or backwater conditions. The species is tolerant of a variety of habitat conditions, although rivers with moderately strong current and a substrate of coarse gravel and sand provide the most suitable one. It may be found at depths of less than three feet up to those as great as 18 to 24 feet. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

The kidney shell, like most freshwater mussels, is considered to be dioecious, although it may be occasionally hermaphroditic. Hermaphroditism affords benefits when population densities are low; under such conditions, females may switch to self-fertilization to ensure that recruitment continues. There are no sexual differences in the shell of *P. fasciolaris*, except that males are slightly more compressed than females - a feature that cannot be used with any certainty to separate the sexes.

The lifespan of *P. fasciolaris* is not known, but members of the Subfamily Lampsilinae generally grow more rapidly and have shorter life spans than members of the Ambleminae, which can live for over 40 years. For comparison, life spans of three other COSEWIC-listed lampsilines are: 10-20 years for *L. fasciola*, more than 15 years for *Epioblasma torulosa* rangiana, and up to 11 years for *V. fabalis*. *Ptychobranchus fasciolaris* is a long-term brooder (bradytictic).

The breeding season begins in August, and glochidia are discharged the following June to perhaps as late as August (Reference 2.4-54).

Primary food sources are bacteria, algae, particles of organic detritus, and some protozoans. Food availability is not normally a limiting factor, although it could be in the presence of high densities of zebra mussels, which are extremely efficient filter-feeders. During the parasitic larval stage, glochidia feed on the body fluids of the host.

Lake chubsucker-*Erimyzon sucetta*

This species range includes the Atlantic Slope from southern Florida to southeastern Virginia; Gulf Slope drainages from southern Florida (Charlotte Harbor) to the Guadalupe River, Texas; Great Lakes and Mississippi River basin lowlands from southern Ontario to Wisconsin and south to the Gulf. Ranges in the north are sporadic and more common through the lower Coastal Plain. The lake chubsucker occurs in all Mobile basin drainages below the Fall Line and in all coastal drainages between the Escatawpa and Chattahoochee drainages in Alabama.

The lake chubsucker favors ponds, lakes, oxbows, sloughs, swamps, impoundments, and similar waters of little or no flow that are clear and have bottoms of sand or silt mixed with organic debris and where aquatic vegetation usually is present. This species rarely occurs in streams. Thermal tolerances for this species ranges from 39 to 68°F. The lake chubsucker eggs are broadcast over beds of vegetation or in gravelly area cleared by male. This species spawns over gravel in streams or in still water over vegetation. The species spawns in spring and early summer; eggs hatch in about a week; and specimens become sexually mature at age 3.

The lake chubsucker typically eats small crustaceans, chironomid larvae, algae, and other small aquatic organisms (Reference 2.4-55).

Lake sturgeon-*Acipenser fulvescens*

The lake sturgeon is listed as a threatened species in Michigan, and is endangered in Ohio. Historically, it has been found in the Hudson Bay watershed, the St. Lawrence estuary, the upper and middle Mississippi River and Great Lakes basins, and scattered throughout the Tennessee, Ohio, and lower Mississippi drainages. It has become rare throughout its historic range, and population estimates are around one percent of their original numbers. Michigan populations are some of the largest, and are scattered throughout most counties bordering the Great Lakes, as well as some inland lakes and rivers.

The lake sturgeon is a benthic organism that occurs in large rivers and the shallow areas of large lakes where food is abundant. They tend to avoid aquatic vegetation and prefer deep run and pool habitats of rivers. Their habitat use varies in lakes, depending on what conditions are available. This species optimal temperature is between 57-63°F.

Lake sturgeon begin spawning migrations in May when the water temperature reaches 10-12 degrees Celsius, but do not actually begin spawning until the water is between 13 and 18 degrees Celsius. Spawning habitat is defined by swift currents, clean rocky substrates, and depths of two to fifteen feet. Large females spawn only once every 3-7 years, but will lay hundreds of thousands of black, adhesive eggs. The eggs are instantly fertilized by a male, who may spawn every one or two years. The eggs hatch in five days, and the juveniles grow relatively quickly for ten years, but growth slows considerably thereafter. Males reach sexual maturity at about 15 years of age, while females do at about 25 years of age. The lake sturgeon has the greatest life expectancy of any freshwater fish, with some individuals reaching 80 years of age. The most recently documented spawning area along Michigan's Lake Erie shoreline is near Stony Point in Monroe County, however activity has diminished recently and may have ceased.

The lake sturgeon is a bottom feeder that uses its protrusible mouth to extract prey as it forages over gravel, sand, and/or mud substrates. Prey for this sturgeon includes snails, clams, crustaceans, fish, and aquatic insect larvae. The sturgeon will also prey upon eggs of other species of fish during foraging.

Lake Erie was formerly one of the most productive waters for lake sturgeon in North America. The lake sturgeon population in Michigan is estimated to be approximately one percent of its former abundance. In the 1800s, sturgeon were perceived as a pest and a nuisance because they often caused damage to fishing gear in nearshore waters. In the 1860s, the lake sturgeon population was greatly reduced in Lake Erie as a bycatch of the booming gill net fishery. In the following years, over-harvesting, limited reproduction and destruction of spawning habitats nearly eradicated the sturgeon population in the lake.

Lake sturgeon can be utilized as an indicator of ecosystem health because they are very sensitive to human disturbances such as habitat decline and pollution as illustrated by their sharp decline in the late 1800s and early 1900s. As mentioned previously, the most recently documented spawning area on the Lake Erie shoreline was near Stony Point in Monroe County, but activity has diminished and may have ceased altogether. They are not known to occur contemporarily in Swan and Stony Creeks (Reference 2.4-35).

Longnose sucker-*Catostomus catostomus*

The longnose sucker is the most widespread sucker in northern North America. Throughout most of Alaska and Canada, south to New England, West Virginia-Maryland, northern Ohio, northern Indiana, Minnesota, Nebraska, eastern Colorado, Idaho, and Washington. The species is also in northeastern Asia.

This species prefers cold clear waters. Thermal tolerances for this species ranges from 32 to 59°F. It is a bottom dweller in lakes and tributary streams up to a depth of 600 feet in the Great Lakes. It also occurs in brackish water near mouths of Arctic streams. The longnose sucker often spawns in flowing shallow stream water over gravel; otherwise in lakes. Eggs sink and stick to the substrate. Young stay in gravel 1-2 weeks before emerging.

Spawns in occurs in the spring and eggs hatch in about 2 weeks. Specimens become sexually mature in 4-7 years, or as late as 9 years (Reference 2.4-56).

Mudpuppy mussel (salamander mussel)-*Simpsonaisa ambigua*

Historically, this species occurred throughout the upper Mississippi River drainage and as far south as the Cumberland River drainage of Tennessee. It is known from the Lake St. Clair, Lake Huron, and Lake Erie drainages; and from the Ohio River system, the Cumberland River system (Red

River, Kentucky), and the upper Mississippi River system (Illinois, Iowa, Wisconsin, Missouri and Arkansas).

In Minnesota, it is present only in the lower St. Croix River where it is rare and localized. Its distribution in part is apparently related to the distribution of its glochidial host, the mudpuppy. In Canada, it is known from the Sydenham River and a potentially extant occurrence in the Thames River in London, Ontario.

The preferred habitat for this species is in sand or silt under large, flat stones in areas of a swift current. Its presence is presumably linked to the mudpuppy, *Necturus maculosus*. In Canada, the mudpuppy mussel is found in all types of clear, freshwater habitat, including creeks, streams, rivers and lakes; it is found on a variety of substrates (mud, silt, sand, gravel, cobble or boulder) in areas of swift current. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

The host of this species is the mudpuppy. It is suspected "that *necturus* eats the adult mussel and in seeking food visits one rock after another. In satisfying its appetite it becomes infected with the mussel glochidia, nourishing them, and when they have matured serves as a transporting and distributing agent for the young mussels." Glochidia were found deeply imbedded in the external gills of the mudpuppy. There is some evidence that the glochidia are released in the fall (Reference 2.4-57).

Northern madtom-*Noturus stigmosus*

The northern madtom is found in Lake Erie and Ohio River basins from western Pennsylvania, southern Ontario, and West Virginia, to the Ohio River in southern Illinois. The species is uncommon and is disappearing on the edges of its range. It is protected in Canada as an endangered species.

Inhabits mixed sand and rock riffles and runs with debris in small to large, often swift rivers. This species is found in cold-water habitats, usually around 66°F. This species forages at night, feeding largely on aquatic insect larvae. This species typically spawns from fourth week of June to third week of August (Reference 2.4-46).

Northern riffelshell-*Epioblasma torulosa rangiana*

The northern riffelshell is federally and state endangered. Currently, the northern riffelshell have only been found in the Black, St. Clair and Detroit Rivers. More specifically, it is found in the Detroit River in Wayne County, Michigan. The northern riffelshell is of moderate size with large adults reaching two inches. The shell is light green-yellow to olive green, with dark, narrow, closely-spaced rays. This mussel requires swiftly moving, well-oxygenated water. Average threshold temperatures for most freshwater mussel species is approximately 88°F. Riffle and run areas with fine to coarse gravel are the preferred habitats. It is believed that this species can reach 15 years of age. The northern riffelshell is graved from late summer to the following spring, at which time the glochidia are released. The Detroit River may still have a viable reproducing population despite human impacts and zebra mussel infestation in the river. In 1992, 110 mussels were transplanted from the Detroit River to the St. Clair River. The survival of this species depends on the protection and preservation of habitat and host fish. Siltation and run-off must be reduced to facilitate the recovery of this species (Reference 2.4-49).

Pocketbook-*Lampsilis ovata*

The range includes the Interior Basin: the Mississippi and Ohio drainages, St. Lawrence drainage from Lake Superior to the Ottawa River and Lake Champlain, Hudson Bay drainage; Atlantic slope: and the Potomac River system in Maryland. This extensive range includes various forms, subspecies and possibly valid species, such as *Lampsilis ventricosa* (*Lampsilis cardium*) and *Lampsilis satura*; as the taxonomy of this species complex is convoluted.

This species is generalized in habitat preference, adapting well to both impoundment situations as well as free-flowing, shallow rivers. It may be found in big rivers (reservoirs) at depths of 15 to 20 feet and in small streams in less than two feet of water. Average threshold temperatures for most freshwater mussel species is approximately 88°F. Although usually found in moderate to strong current, it can survive in standing water. The most suitable substrate consists of a mixture of gravel and coarse sand mixed with some silt or mud (Reference 2.4-58).

Pondhorn-*Uniomerus tetralasmus*

This species is found throughout much of the central and lower Mississippian Region; Great Lakes; Southern Atlantic Slope; Peninsular Florida; Gulf Coastal Region, to the lower Rio Grande system into Mexico. The western range extends through Iowa and Missouri to Colorado and western Oklahoma.

This species typically inhabits the quiet or slow-moving, shallow waters of sloughs, borrow pits, ponds, ditches, and meandering streams. Average threshold temperatures for most freshwater mussel species is approximately 88°F. It is tolerant of poor water conditions and can be found well buried in a substrate of fine silt and/or mud. It has been known to survive for extended periods of time when a pond or slough has temporarily dried up by burying itself deep into the substrate.

This species is likely bradytictic and the glochidial host is the golden shiner (*Notemigonus crysoleucas*) (Reference 2.4-59).

Pugnose minnow-*Opsopoeodus emiliae*

The pugnose minnow is listed by both Michigan and Ohio as endangered. The pugnose minnow has been documented from the southern Great Lakes basin, through the Mississippi River valley, to the Gulf of Mexico. Although common in the southeastern portion of its range, it is becoming rare in the northern portion. Historically, the pugnose minnow was documented in Michigan tributaries and nearshore areas of Lake Erie and Lake St. Clair, however the only record in the past twenty years was in the Detroit River near Grosse Isle, located approximately 15 mile northeast of the Fermi site.

The pugnose minnow inhabits the slow, clear waters of rivers and shallow regions of lakes. This species is found in cold-water habitats, usually around 66°F. It is found in greatest abundance in weedy areas over sand or organic substrate. Historically, it has also been found in turbid areas of the Huron River that lacked submergent vegetation, most likely due to remnant populations changing habitats in submarginal conditions.

The life history of the pugnose minnow is not well documented. The male selects a spawning site where the female lays adhesive eggs, usually under a flat rock. Males then guard the nest, but will make excursions away, unlike bluntnose and fathead minnows. Species growth is rapid, reaching its adult size of two inches in length within two years.

The vertically-oriented mouth of the pugnose minnow suggests adaptation for feeding near the water surface. Diet studies have shown the pugnose minnow feeds on microcrustaceans, fly larvae, and other aquatic invertebrates, as well as algae and plants (Reference 2.4-19).

The pugnose minnow is listed in Monroe County, MI, but has not been reported in previous impingement studies, or even recorded in the last two decades.

Pugnose shiner-*Notropis anogenus*

The original range of this species extended from western New York and eastern Ontario west to southeastern North Dakota, south to northern Iowa, Illinois, Wisconsin, Michigan, northern Indiana, and northern Ohio. However, the historical range was very limited, and occurrences in Illinois, Iowa, North Dakota, Indiana, Ohio, New York, and Ontario are largely peripheral to the main (but spotty) distribution in Minnesota, Wisconsin, and Michigan.

The only records in Ohio were from western Lake Erie, and none have been found in the state since 1931. The species may be extirpated from North Dakota.

Favorable habitat includes clear, heavily vegetated glacial lakes and vegetated pools and runs of low gradient creeks and rivers, over bottoms of sand, mud, marl, or gravel; these fishes are mostly in shallows in warm months, probably in deep water during rest of year. This species is found at temperatures ranging from 59 to 70°F.

The pugnose shiner spawns in June-July in Michigan. This species feeds on filamentous algae and cladocerans and likely other minute organisms (Reference 2.4-60).

Purple lilliput-*Toxolasma lividus*

The purple lilliput is state endangered. Spent shells have been found from sites in the Raisin River in Monroe Country. It is a small mussel, growing to a little over an inch in length. The shell is smooth, but with growth lines and is light to dark green or brown. The purple lilliput occurs in small to medium sized streams, less often in large rivers and lakes. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

This species' preferred substrate is well-packed sand or gravel and occurs in water depth less that one meter. It is a long-term breeder, holding the larvae internally for about a year; however, their life span in unknown. The purple lilliput requires clean water for survival, therefore any practice that leads to siltation, pollution, or poor water quality should be avoided (Reference 2.4-49).

Rayed bean-*Villsoa fabalis*

The rayed bean was historically known from 106 streams, lakes, and some man-made canals in 10 states and 3 Service regions. The mussel occurred in parts of the upper (i.e., Lake Michigan drainage), lower Great Lakes system, and throughout most of the Ohio and Tennessee River systems. Historically this species was known in Canada from the Thames, Sydenham, and Detroit Rivers and western Lake Erie in southwestern Ontario, but only still extant in the Sydenham and possibly the North Thames in Ontario where a live specimen was found in 2004. A new site was recently discovered in Swan Creek (Lower Maumee drainage) in Ohio.

The rayed bean is reported to be a long-term breeder in that it holds glochidia overwinter for spring release. Gravid females have been collected during mid to late May. The glochidial fish hosts include the Tippecanoe darter.

The rayed bean is generally known from smaller headwater creeks, but records exist in larger rivers. They are usually found in or near shoal or riffle areas, and in the shallow wave-washed areas of glacial lakes, including Lake Erie. In Lake Erie, it is generally associated with islands in the western portion of the lake. Average threshold temperatures for most freshwater mussel species is approximately 88°F. Substrates typically include gravel and sand. It is oftentimes associated with vegetation (e.g., water willow, *Justicia americana*; water milfoil, *Myriophyllum* sp.) in and adjacent to riffles and shoals. Specimens are typically buried among the roots of the vegetation (Reference 2.4-61).

River darter-*Percina shumardi*

The river darter is listed as endangered by the state of Michigan. Its distribution ranges from southern Canada to the Gulf of Mexico. Historically, the river darter was found in rivers and nearshore areas of eastern Michigan, however the last report of the darter was in the Huron River in 1941, and the most recent surveys have found no records of river darters.

The river darter is found in rivers and large streams with deep, fast-flowing riffles and cobble and boulder bottoms. This species is found in cold-water habitats, usually around 66°F. During nocturnal hours or when turbidity is high, the adult darters may move to shallower areas. This turbidity tolerance might explain its continued presence in the Mississippi River and its tributaries. The river darter has also been found in nearshore areas of the Great Lakes with depths approximating five meters.

The river darter tends to move upstream to spawn, toward the northern end of its range. Spawning occurs in late winter to early spring in southern areas, from April through May in the Midwest, and as late as June or July in Canada. The female darters are egg-burying spawners, expelling eggs into the substrate while partially buried. Neither males nor females provide parental care to their young. Species grow to three inches, mostly within the first year of development, and attain sexual maturity at age one. River darters are thought to live two to four years, with males having a greater life expectancy than females.

River darters tend to feed during the day upon a variety of small aquatic invertebrates. As juveniles, they primarily feed upon small zooplankton. Adult darters prey upon midge and caddisfly larvae, as well as some snail species (Reference 2.4-20).

Round hickorynut-*Obovaria subrotunda*

The round hickorynut is state endangered and can be found in the St Lawrence and Lake Erie/Lake St. Clair drainage, more specifically, in Lake St. Clair in Macomb County and in the Detroit River in Wayne County. This mussel has a near perfectly circular shell that is moderately thick and inflated. The exterior of the shell is brown, smooth, and lacks rays.

The round hickorynut inhabits medium to large rivers and along the shores of Lake Erie and Lake St. Clair, near the river mouths and prefers sand and gravel substrate in areas with moderate flow. Average threshold temperatures for most freshwater mussel species is approximately 88°F. It is a long-term breeder, holding fertilized eggs over the winter. The life span is unknown. Like most mussels, this species is sensitive to river impoundment, siltation and channel disturbance as well as pollution (Reference 2.4-49).

Round pigtoe-*Pleurobema sintoxia*

This species was historically distributed from New York and Ontario west to South Dakota, Kansas and Oklahoma, and south to Louisiana and Alabama. The current distribution of the round pigtoe is similar to the historical range. Average threshold temperatures for most freshwater mussel species is approximately 88°F. Although large river populations have for the most part disappeared from the upper Midwest, many populations still survive in tributaries of the Mississippi and Ohio Rivers. In Canada *Pleurobema sintoxia* is only known from southern Ontario including the Thames River. Recently this species has been confirmed to be nearly extirpated (last live specimens probably do not represent a viable population) in the main channel of the Detroit River between Lake St. Clair and Lake Erie, Michigan/Ontario; due to zebra mussel invasion. Long-standing populations exist in the Poteau River and tributaries, Arkansas and Oklahoma.

This round pigtoe is found in medium to large rivers in mixed mud, sand, and gravel. In Canada, the round pigtoe is typically found in medium-sized to large rivers but also occurs in Lake Erie and Lake St. Clair. In Tennessee occurrences include medium-sized and big rivers and in current on a firm substrate of coarse gravel and sand at depths of less than three feet to more than 20 feet.

For this species, age to maturity for this species is not known, but the juvenile stage for most unionids lasts 2-5 years. The round pigtoe is a short-term brooder (tachytictic) with the breeding season lasting from early May to late July in Wisconsin

Round pigtoes are filter feeders as adults. Their primary food sources are bacteria, algae, particles of organic detritus, and some protozoans. Food availability may be a limiting factor for the Lake St. Clair population due to the presence of high densities of zebra mussels, which are also filter-feeders. During the parasitic larval stage, glochidia feed on the body fluids of the host (Reference 2.4-62).

Sauger-*Sander canadensis*

The sauger is listed as a threatened species by the state of Michigan. Its native range includes the St. Lawrence, Great Lakes, Hudson Bay, and Mississippi River basins, as well as the Tennessee River in Alabama and Louisiana. The sauger has also been introduced into the Atlantic, Gulf, and southern Mississippi River drainages. This species was historically abundant in Lake Erie; however, it has only been recorded in the St. Clair River and Lake St. Clair in the past two decades.

Sauger prefer turbid areas of lakes, reservoirs, and large rivers, where the temperatures throughout the entire water column are within their preferences. This species prefers temperatures at approximately 86°F.

This species spawns over gravel and rubble shoals in May or June, when temperatures range from 3.9 - 6.1 degrees Celsius. Rather than building nests, the sauger broadcasts demersal, adhesive eggs over the shoals during the night. After hatching, young sauger spend up to nine days absorbing yolk while on the bottom. Males reach sexual maturity within three years, while females take four to six years. The life expectancy for the sauger is up to 13 years.

Saugers have a specialized structure in their eyes that makes them very sensitive to light. They prefer to feed at night in clearer waters or during the day in turbid areas. As juveniles, they tend to prey on zooplankton and aquatic insect larvae. Adults feed upon fish and invertebrates such as gizzard shad, emerald shiner, crappie, bass, freshwater drum, leeches, crayfish, and insects (Reference 2.4-31).

Shortnose cisco-*Ammocrypta pellucida*

The historical range of this species includes Lake Michigan, Lake Ontario, and Lake Huron. Apparently extinct; no individuals have been collected since 1985. This species also has limited distribution through the coastal northern Michigan watersheds.

The shortnose cisco generally prefers upper zones of deepwater areas of lakes and prefers temperatures ranging from 36 to 50°F. This species spawns at about 35-145 m, over sand, silt, or clay substrates in some areas. They spawn primarily in spring but may spawn also in fall in some areas. This species feed on crustaceans such as *Mysis* and *Pontoporeia* (Reference 2.4-63).

Silver shiner-*Notropis photogenis*

The silver shiner is only listed as endangered by the state of Michigan. This species ranges from the Great Lakes and their tributaries, through the Ohio River basin and Tennessee drainage, to northern Alabama and Georgia. This shiner is fairly common within most of the Ohio River basin, but occurs more rarely in the Great Lakes' tributaries. Within Michigan it is locally abundant in the St. Joseph and Raisin Rivers. Historically, the silver shiner had been identified in Monroe County and the Huron River.

Preferred habitat for the silver shiner is medium to large streams with moderate to high gradients. They are often found in the deeper water pools or eddies directly below riffles. This species is found in cold-water habitats, usually around 66°F. This species has been documented to prefer a variety of substrates, including gravel and boulder, pebble and cobble, and sand, mud and clay. Despite the disputes over substrate, it is agreed that silver shiners avoid areas with heavy vegetation and siltation. In Michigan, the shiner has been found to inhabit areas of strong current with wooded banks.

Reproduction of silver shiners is not well documented, due to the fact that spawning behavior has not been observed. Silver shiners are theorized to spawn around June, and may move into different habitats to do so. The juvenile shiners exhibit rapid growth, reaching sexual maturity at age two, and maximum size by age three.

Although the silver shiner primarily feeds at the surface, it will take mid-water prey as well. The majority of the silver shiner's prey are aquatic insects, with adult *Diptera* (true flies) representing the largest portion of gut samples. Silver shiners have even been documented as leaping into the air to capture low-flying insects.

The silver shiner is relatively rare in Michigan and is fairly tolerant to human impact. Populations appear to be stable. Previous impingement studies have not recorded this species, thus impingement is expected to be minimal. However, the silver shiner's population in the River Raisin, located south of the Fermi site, should be monitored in the case of adverse impact (Reference 2.4-21).

Snuffbox-*Epioblasma triquetra*

The snuffbox mussel is state endangered and can be found in Otter Creek in Monroe County and the Detroit River in Wayne County. The snuffbox is about 2 inches in length and their shells are triangular and thick, yellowish on the outside, and covered with numerous, broken, dark green rays. It inhabits small and medium-sized rivers. They prefer habitats that contain sand, gravel, or cobble substrate with a swift current and individuals are often found buried deep in the sediment. Average threshold temperatures for most freshwater mussel species is approximately 88°F. Reproduction occurs in early to mid-August and the snuffbox lives between 8-10 years. The only host for the snuffbox glochidia is the log perch. This species is sensitive to river impoundment, siltation and disturbance, due to its requirement for clean, swift current and relative immobility as an adult (Reference 2.4-49).

Southern redbelly dace-*Phoxinus erythrogaster* (Rafinesque)

The southern redbelly dace is listed as endangered by the state of Michigan. Its total distribution ranges from the Lake Erie and Lake Michigan drainages, through the Mississippi River basin south to Alabama, Arkansas, and Oklahoma. The northern limit of this species' range is in southeastern Michigan, in the Huron and Raisin Rivers.

The southern redbelly dace generally occurs in the clear and cool permanent headwaters of river systems. It prefers clear, wooded streams intermixed with small pools. These streams are usually small, with moderate gradients and overhanging vegetation that provides ample shade. Preferred substrates include mud bottoms of pools and clean gravel of riffles. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

Life history of this species has only been studied extensively in the southern portion of its range, where they spawn from April to June. Southern redbelly dace reach sexual maturity within one year at a length of about one and a half inches. The spawning fish migrate from pools to gravelly riffles where they utilize nests already built by other cyprinids. Two males pressure the sides of the typically larger female who then broadcasts 700 to 1000 eggs that are immediately fertilized.

This species is generally herbivorous, feeding upon filamentous algae, diatoms, and drifting or benthic detritus. Larger fish will also feed on chironomid and mayfly larvae, as well as small invertebrates (Reference 2.4-69).

Spotted gar-*Lepisosteus oculatus*

This species occurs in Lake Erie and southern Lake Michigan including drainages south through Mississippi River basin to Gulf Coast. Also occurs through the Gulf Slope drainages from lower Apalachicola River, Florida, to Nueces River, Texas, as well as some occurrence through Ontario province.

The spotted gar is most abundant in quiet clear pools and backwaters with abundant vegetation. The species also occurs in streams, sloughs, lakes, and swamps. It occasionally enters brackish water in the south. The spotted gar is tolerant of warm water with low dissolved oxygen levels. Thermal tolerances for this species ranges from 54 to 68°F. The species spawns in shallow water among rooted vegetation. It spawns in late spring and early summer. Eggs hatch within a week and the larvae cling to aquatic plants or debris. Males sexually mature in 2-3 years, females in 3rd or 4th year.

While most active in the early morning hours, the spotted gar adults eat mainly fishes (also crabs in southern waters). Very small young may feed on arthropods (Reference 2.4-64).

Threehorn wartyback-*Obliquaria reflexa*

This species occurs throughout most of the Mississippi River drainage from western Pennsylvania, north into Michigan and Minnesota, southwest to eastern Kansas, Oklahoma, and Texas; and in the Coosa-Alabama River and Tombigbee River systems in the southeast. Although once recorded from Lake Erie and its tributaries, recently this species has been confirmed to be likely extirpated from the main channel of the Detroit River between Lake St. Clair and Lake Erie, Michigan/Ontario; due to zebra mussel invasion. In Michigan, the northernmost range is the Grand and Saginaw Rivers. In western Michigan it has been recorded on the Black, Kalamazoo and St. Joseph Rivers. In eastern Michigan records are from Brownstown Creek, Detroit River, lower Raisin River and Lake Erie.

This species is typical of the large rivers where there is moderately strong current and a stable substrate composed of gravel, sand, and mud. Although found at depths of up to 20 feet, it seems to do well at a depth of no more than four to six feet often in shallow, sand- and mud-bottom river embayments with little or no current. It also occurs in many reservoirs. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

Fertilized eggs are brooded in the marsupia (water tubes) up to 11 months, where they develop into larvae, called glochidia. The glochidia are then released into the water where they must attach to the gill filaments and/or general body surface of the host fish. After attachment, epithelial tissue from the host fish grows over and encapsulates a glochidium, usually within a few hours. The glochidia then metamorphoses into a juvenile mussel within a few days or weeks. After metamorphosis, the juvenile is sloughed off as a free-living organism. Juveniles are found in the substrate where they develop into adults. *Obliquaria reflexa* is a long-term brooder, and probably breeds in the summer months in Michigan (Reference 2.4-47 and Reference 2.4-17).

Wavy-rayed lampmussel-Lampsilis fasciola

The wavy-rayed lampmussel is state threatened and is sporadically distributed in the Great Lake tributaries of Lake Michigan, Lake Erie, Lake Huron, and Lake St. Clair. This mussel has a rounded to ovate, moderately thick shell and is usually under 3.5 inches in length. The shell color ranges from yellow to yellowish green with numerous thin wavy green rays.

It occurs in small to medium sized shallow streams, in and hear riffles, with good currents. Average threshold temperatures for most freshwater mussel species is approximately 88°F. The wavy-rayed lampmussel prefers sand and/or gravel substrate. Males and females are dimorphic.

The release of the larvae (glochidia) coincides with host fish appearing in the shallow riffles. As adults, they remain relatively sessile, probably not moving more than 100 meters in a lifetime. This mussel, like most mussels, is sensitive to river impoundment, siltation and channel disturbance. The wavy-rayed lampmussel is often the first to be affected by disturbances because this species prefers areas with moderate flow and high oxygen content. Pollution is also a great threat to this species well being (Reference 2.4-49).

Western banded killifish-Fundulus diaphanous menoma

The western killifish is one of two subspecies of the banded killifish. The banded killifish (*Fundulus diaphanous*) occurs in the Atlantic Slope drainages from the Pee Dee River, South Carolina, north to Maritime Provinces and Newfoundland; St. Lawrence-Great Lakes and Mississippi River basins from Quebec to Manitoba, south to southern Pennsylvania, northern Illinois, and northeastern Nebraska. The western banded killisfish occurs in the remainder of the range except St. Lawrence and Lake Erie drainages, where the two subspecies intergrade.

The banded killifish prefers quiet waters of lakes, ponds, and sluggish streams usually over sand, gravel, or detritus-covered bottom where there are patches of submerged aquatic plants. Schools tend to stay in shallows in summer. Thermal tolerances for this species ranges from 50 to 77°F. Eggs are released in clusters, attach by filaments to plants in quiet weedy pools. This species spawns in late spring and summer. The eggs hatch in about 11-12 days. Individuals become sexually mature at age II in some localities. On the Atlantic coast of Nova Scotia, hybrids of *F. diaphanus* and *F. heteroclitus* are unisexual diploid gynogens.

This species mostly feeds at all water levels on various invertebrates and some plant material (Reference 2.4-66).

White catspaw-Epioblasma obliquata perobliqua

The white catspaw mussel is state endangered and from museum specimens, it has been confirmed that it once inhabited rivers in southeastern Michigan and nearshore areas in Lake Erie. Currently, the only know viable population is in Fish Creek, Indiana. The white catspaw is a medium sized mussel, up to two inches long. The exterior shell color is tan with many fine wavy green rays. Little is known of their required habitat because this species is so rare. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

This mussel prefers coarse, stable substrates, such as gravel and pebble and is typically found buried in the substrate. The exact breeding season is unknown, although other species of this genus typically release glochidia. The lifespan is estimated to exceed 15 years of age. The survival of the white catspaw mussel is currently in severe jeopardy. Changes in river hydrology and morphology can harm this riffle-dwelling species, and dredging, channelization and damming projects should be avoided (Reference 2.4-49).

Species of Concern

The following species are listed as Species of Concern that have the potential to be present on and in the vicinity of the Fermi site. Species of Concern are species which the USFWS is reviewing for consideration as Candidates for listing under the Endangered Species Act. Additional information is needed in order to propose as threatened or endangered.

Brindled madtom-*Noturus miurus*

The brindled madtom is listed as a species of “state special concern” by Michigan. It occurs from the lower Great Lakes drainage, the Ohio River basin, and the Mississippi River basin. They have also been collected in Oklahoma and southeastern Kansas. In the last twenty years, brindled madtom have been recorded in the Huron, Raisin, Belle, and Pine Rivers, as well as Stony Creek in Michigan.

The brindled madtom’s habitat is highly variable with relation to its latitudinal location. In the Midwest, it is generally found in slow-moving rivers with soft substrates and scattered emergent vegetation. Lake habitats are usually characterized by soft bottoms with an abundance of leaves and twigs. This species is found in cold-water habitats, usually around 66°F.

Reproduction of the brindled madtom has not been well documented. However, a Michigan study showed that it spawns from July to early August in water temperatures around 25 degrees Celsius. Spawning occurs in areas comprised of silty substrates and emergent vegetation. Males are nest-guarders, protecting a nest of about 40 large, amber eggs.

The diet of this madtom consists of aquatic insects, other drifting invertebrates, and plants. The brindled madtom is also nocturnal, thus it does the majority of its feeding at night.

Studies suggest that increased siltation is very detrimental to both eggs and adult madtoms because it reduces the amount of dissolved oxygen in the water and hinders feeding (Reference 2.4-71).

Elktoe mussel-*Alasmidonta marginata*

This species is of state special concern. The elktoe is a relatively small, thin-shelled mussel that may reach up to four inches in length. The exterior color of the elktoe shell is yellowish green, with prominent broad dark green rays and dots. It is a hermaphroditic species, containing both male and female sex parts. The elktoe is bradytictic, meaning that it is a long-term breeder. When fertilization occurs, the developing glochidia (larval mussels) are held in the gills for an extended period of time at which time the parasitic glochidia are released and adhere to a fish host. After metamorphosis, the young mussels drop to the substrate, where they spend the remainder of their lives buried in the substrate. The elktoe is a filter feeder, obtaining nutrition from material suspended in the water column.

The elktoe needs clean, fast-flowing water to survive. Therefore, changes to its habitat, such as river impoundment, siltation and channel disturbances, including dredging, negatively affect this species (Reference 2.4-49). Average threshold temperatures for most freshwater mussel species is approximately 88°F.

Purple wartyback-*Cyclonaias tuberculata*

This species is state listed as special concern. The purple wartyback has a roughly circular outline with numerous bumps covering about ¾ of the outside of the shell. The outer covering of the shell is yellow-brown or green-brown in young individuals, becoming dark brown in older individuals. The purple wartyback is found in medium to large rivers with gravel or mixed sand and gravel substrates in areas with relatively fast current. Like most freshwater mussels of the family Unionidae, this species requires a fish host to complete it's life cycle. The purple wartyback is a summer breeder and are likely to live over 25 years of age. Average threshold temperatures for most freshwater mussel species is approximately 88°F.

Threats to this species include habitat and water quality degradation from changes in water temperature and flow, the introduction of heavy metals, organic pollution such as excessive nutrients from fertilizers, pesticides and herbicides, dredging and increased sedimentation due to excessive erosion. Due to the unique life cycle of unionids, fish hosts must be present in order for reproduction to occur. The loss of habitat for these hosts can cause extirpation of unionid populations (Reference 2.4-49).

Silver chub-*Macrhybopsis storeriana*

The silver chub is listed as a species of "state special concern" in Michigan. Its distribution ranges from southern Canada, through the Lake Erie and Mississippi River drainages, to the Gulf Coast. In the past two decades the silver chub has occurred in Lake St. Clair and the Detroit River in Michigan.

The silver chub generally inhabits deep waters of low-gradient streams and rivers, as well as in lakes at depths less than ten meters. It has been suggested that this chub prefers pools with clean sand and fine gravel substrates, but will avoid silty areas by moving into riffles if necessary. However, this has been disputed by other studies that suggest that they are found in silty regions.

Reproduction of the silver chub is not well understood. Research suggests that the chub spawns in open water in May or June when water temperatures reach about 20 degrees Celsius in Michigan, and that spawning mortality may not be uncommon. Life expectancy is thought to be three to four years.

The silver chub feeds upon cladocerans, copepods, and chironomid larvae as a juvenile. Adults tend to feed upon mayflies, chironomid larvae, and amphipods. More minor items of prey include mollusks, water fleas, and small fish.

Little is known about the life history of the silver chub; therefore, inferring possible population impacts is difficult (Reference 2.4-29).

Slippershell mussel-*Alasmidonta viridis*

This species is of state special concern. The slippershell mussel is a small mussel, usually around one and a half inches long. The exterior of the shell is yellowish-brown, marked with fine green rays. The slippershell is typically found in creeks and headwaters of rivers, but has also been reported in larger rivers and in lakes. The slippershell mussel requires a fish host to complete its life cycle. The slippershell is probably a long-term (bradytictic) breeder, holding the larvae internally for about a year. These larvae (glochidae) then are released into the water and mush attach to a suitable fish host in order to survive. After development, it drops from its host and spends the remainder of its life in the substrate. The lifespan is unknown. This mussel is a filter feeder.

The slippershell mussel requires clear, clean water and substrates for survival. Average threshold temperatures for most freshwater mussel species is approximately 88°F. Therefore, any practices that lead to increased siltation and poor water quality will decrease the quality of the habitat of the slippershell. Also, since the slippershell cannot reproduce unless its fish host is present, conservation efforts should aim to maintain the composition of associated fish communities (Reference 2.4-49).

Chapter 3 Plant Description

This chapter discusses the construction and operation of Fermi 3. Chapter 3 is written for single unit operation. The parameters associated with Fermi 3 appearance, water use, transmission facilities, and its relationship to the surrounding area are described in the following sections:

- External Appearance and Plant Layout (Section 3.1)
- Reactor Power Conversion System (Section 3.2)
- Plant Water Use (Section 3.3)
- Cooling System (Section 3.4)
- Radioactive Waste Management System (Section 3.5)
- Nonradioactive Waste Systems (Section 3.6)
- Power Transmission System (Section 3.7)
- Transportation of Radioactive Materials (Section 3.8)

For purposes of this section, the site, vicinity, and region are defined in Chapter 2.

3.1 External Appearance and Plant Layout

This subsection describes the planning, layout and appearance of Fermi 3 and the existing facility structures. Subsection 3.1.1 provides an overview of the existing site, including layout, location and a brief description of the surrounding areas. Subsection 3.1.2 describes the Fermi 3 arrangement, including visual impacts from areas adjacent to the site and general aesthetic principles that will be applied.

3.1.1 Existing Fermi Site Description

The 1260 acre Fermi site is located on the western shore of Lake Erie. The Fermi site grade is approximately 581.8 ft NAVD 88. The grade at the power block area where the Category I structures are located is approximately 589.3 ft NAVD 88. Lake Erie supplies the makeup water requirements for the site.

The existing site arrangement includes Fermi 1 and Fermi 2. Fermi 1 is no longer operational; the unit has been defueled and will be dismantled. Fermi 2 is in operation. During construction of Fermi 2, the initial plan was to also construct and operate a third unit. Unit 3 originally was to be located north of Fermi 2, between Fermi 2 and the two natural draft cooling towers. The plans for the original Unit 3 were halted prior to construction. A complete description of the existing site is provided in the Fermi 2 Updated Safety Analysis Report (Reference 3.1-1). The buildings for Fermi 2 have a natural concrete exterior, neutral gray in color, which tends to reduce visual impact (Reference 3.1-2).

Figure 2.1-4 shows the building layout and site property boundary. Figure 2.1-4 indicates the presence of Fermi 1; although, as discussed above, the plan is to remove this Unit. Figure 2.4-2 provides a topographical map of the site and vicinity with the site property boundary indicated.

Two concrete natural draft cooling towers are used for heat dissipation for Fermi 2. Each tower is approximately 450 ft in diameter at the base; the maximum elevation is 400 ft above the grade elevation. As shown on Figure 3.1-2 through Figure 3.1-8, the natural draft cooling towers for Fermi 2 are the predominant visible structures on the site and are visible from outside the site property boundaries. On Figure 3.1-2 through Figure 3.1-8, the cooling towers for Fermi 2 are the two towers that have a visible plume.

Security fences surround the immediate Fermi 2 area. In addition, the Owner Controlled Area (OCA) is fence-lined to the west and south sides of the property boundary. Visitor and employee parking are currently located inside the OCA fence-line, with access to the plant through a security gate house that is controlled on a 24-hour per day basis.

The site is located within the Detroit River International Wildlife Refuge (DRIWR) as shown on Figure 2.2-2. As shown on Figure 2.1-4, the northern and southern areas of the site feature large lagoons, while the western portion contains some forested areas and Quarry Lake. Quarry Lake served as the rock quarry for the construction activities for Fermi 2. The eastern portion of the site adjacent to Lake Erie contains the power plant structures. The grounds in the immediate vicinity of the plant buildings are attractively landscaped.

The site is accessible by Lake Erie, road, and rail. Personnel access to the site is via Fermi Drive. Fermi Drive provides access to the site from Dixie Highway. Dixie Highway runs, generally, parallel to the western side of the site boundary. The major highways and rail lines in the area are found mainly west of the site, and a number of smaller state and county roads serve the area. Dixie Highway provides access to the Fermi site from Interstate 75. Interstate 75 connects Detroit, Michigan, to the north with Toledo, Ohio, to the south. Figure 2.1-2 and Figure 2.1-3 show the major highways and rail lines in the vicinity of the site.

Figure 2.1-3 provides an overhead aerial photograph of regions in the vicinity of the Fermi site. Figure 2.2-2 also shows the immediate vicinity of the site. The land within five miles of the Fermi site is primarily agricultural with the exception of small beach communities and the small Newport-Oldport residential area to the northwest. As shown on Figure 2.2-2, Estral Beach, Stony Point, Detroit Beach, and Woodland Beach are small towns located along the Lake Erie shore within five miles of the Fermi site. These communities are blended summer resort and permanent residential areas. The nearest of these is Stony Point, about two miles south of the Fermi site.

3.1.2 **New Facility Arrangement**

Fermi 3 is an ESBWR, a light water-cooled reactor. Fermi 3 will be located southwest of the Fermi 2.

The ESBWR standard plant layout is shown in the ESBWR Design Control Document (DCD Figure 1.1-1) (Reference 3.1-3). The locations of the major structures of Fermi 3 on the Fermi site are shown on Figure 2.1-4. Figure 2.4-2 provides a topographical map of the site and vicinity with the site property boundary indicated. A discussion of radioactive and non-radioactive waste release locations are provided in Section 3.5 and Section 3.6, respectively. Chapter 4 discusses impacts due to construction, and provides an overview of the areas affected by the construction activities.

Figure 4.2-1 shows the construction affected areas, including areas that were impacted by previous construction activities. Figure 4.3-1, Figure 4.3-2, and Figure 4.3-3 show the impacts to undeveloped areas, including which impacts are considered to be temporary and which impacts are permanent. Also shown are the terrestrial communities within each of these areas.

Fermi 3 will share certain support structures such as office buildings, potable water supply and sanitary discharge offsite with Fermi 2. Paved site roadways will connect Fermi 3 to the remainder of the Fermi site, providing routine and non-routine access onsite with minimal disturbance of the area.

The normal power heat sink (NPHS) for Fermi 3 will be provided by a concrete natural draft cooling tower. Lake Erie will be used for makeup water for the Circulating Water System (CIRC), the Plant Service Water System (PSWS), and the Fire Protection System (FPS). The intake from Lake Erie for Fermi 3 will be adjacent to the intake for Fermi 2, i.e., located between the two groins that protrude into Lake Erie. The outfall from the Fermi 3 CIRC and PSWS will be off-shore via an underwater discharge line.

Existing infrastructure will be modified to integrate Fermi 3 with Fermi 2; however, none of the Fermi 2 structures or facilities that directly support power generation will be shared. The electrical switchyard for Fermi 3 is separate from the Fermi 2 switchyard. The transmission lines from the Fermi 3 and Fermi 2 switchyards share common transmission towers as the lines leave the site. The existing Fermi 2 protected area will be expanded to include Fermi 3. Existing administrative buildings, warehouses, and other minor support facilities will be used, expanded, or replaced, based on prudent economic and operational considerations.

Figure 3.1-1 provides a low, oblique aerial photograph view of the site with the Fermi 3 major features superimposed. As shown on Figure 3.1-1, Fermi 3 is located relatively close to Fermi 2. The major plant structures are located, for the most part, on areas that were environmentally altered for construction and operation of Fermi 1 and Fermi 2. Aesthetic principles and concepts used in the design and layout of Fermi 3 include the following:

- The overall plant arrangement for Fermi 3 is such that building configurations and structural designs minimize the building volumes and quantities of bulk materials consistent with safety, operational, maintenance, and structural needs to provide an aesthetically pleasing effect.
- Locating the major plant structures on areas that were previously environmentally altered.
- Locating the major plant structures at least 1000 ft from the shoreline.
- Placing the intake structure in the existing developed section of shoreline.

These considerations and the relative proximity of the Fermi 3 plant structures to the existing Fermi 2 plant structures provide an integrated design for the site.

The Fermi site environmental conditions are described in Chapter 2. The land within five miles of the Fermi site is primarily agricultural with the exception of the small beach communities discussed above and the small Newport-Oldport residential area to the northwest. Visual impacts from the site to these areas are limited to the immediate residents and traffic on the Dixie Highway and the smaller arterial roads. The site does not impact areas that have a high degree of visitor use or recreational areas.

As discussed previously, the site currently has two natural draft cooling towers of comparable size. Figure 3.1-2 through Figure 3.1-8 show the visual effects of the site from various offsite locations. These photographs are taken from near the site boundary, providing views of the site from all directions (looking north, east and south). These points of view would encompass the visual effects to any other facilities that are located farther away from the site. As can be clearly seen in these photographs, the visually predominant existing structures are the two natural draft cooling towers. The vegetation on the site helps to shield the power plant structures from public viewing. As Fermi 3 will be located in the same general vicinity as Fermi 2, this same vegetation will help to provide seclusion for Fermi 3. Similar to Fermi 2, the most visually obtrusive structure under consideration for the new facility is the natural draft cooling tower. The height of the new natural draft cooling tower is approximately 600 ft. For visual comparison, the relative location of Fermi 3 and the new natural draft cooling tower is super-imposed on the photographs on Figure 3.1-2 through Figure 3.1-8. These photographs, including the oblique aerials, provide comparison of the seasonal effects on the visual impact. That is, the photographs on Figure 3.1-2 through Figure 3.1-8 are taken during the time of year when the vegetation has the minimal shielding effect. Due to increased amounts of vegetation cover, visual impacts during other times of the year would be less than those shown in these figures.

Because the Fermi site is already aesthetically altered by the presence of an existing nuclear power plant and construction impacts would be temporary, significant adverse impacts to visual aesthetics of the site and vicinity are not expected from the construction or operation of Fermi 3.

3.1.3 **References**

3.1-1 Detroit Edison, “Fermi Unit 2 Updated Safety Analysis Report,” Revision 14, November 2006.

3.1-2 Detroit Edison, “Fermi Unit 2 Environmental Report,” Supplement 5, January 1979.

3.1-3 GE-Hitachi Nuclear Energy, “ESBWR Design Control Document – Tier 2,” Revision 6, August 2009.

Figure 3.1-1 Aerial View of Fermi Site Looking North - Fermi 3 Superimposed

Figure 3.1-2 View of Fermi Site from Dixie Highway Looking East

Figure 3.1-3 View of Fermi Site from Dixie Highway Looking Southeast

Figure 3.1-4 View of Fermi Site from Post Road Looking Southeast

Figure 3.1-5 View of Fermi Site from Swan Creek Road Looking Southeast

Figure 3.1-6 View of Fermi Site from Toll Road Looking East

Figure 3.1-7 View of Fermi Site from Pointe Aux Peaux Road Looking North

Figure 3.1-8 View of Fermi Site Taken from Pointe Mouille Marsh State Game Area Approximately 6 Miles from Site*

* Location of Pointe Mouille Marsh State Game Area is shown on Figure 2.2-2.

3.2 Reactor Power Conversion System

3.2.1 Reactor Description

Fermi 3 will consist of one ESBWR and auxiliaries. The design of the ESBWR is supplied by General Electric. The architect engineer, principal vendors and contractors have not been selected, but are to be determined consistent with the construction milestones outlined in Section 1.1.

A description of the turbines and condensers is provided in DCD Chapter 10. The design condenser/heat exchanger duty is 2896 MWt (9.883x10^9 Btu/hr) and the rated power is 4500 MWt (core design power (ECCS design basis) 4590 MWt). The gross electrical rating of the ESBWR is 1605 ± 50 MWe. Fermi 3 power consumption is approximately 70 MWe resulting in a net electrical output of approximately 1535 ± 50 MWe.

The ESBWR core and fuel assembly designs are described in DCD Table 1.3-1 (Reference 3.2-1). For reload cores, the uranium enrichment is approximately 4.6 percent U-235 (Reference 3.2-1). The expected assembly average burnup of discharged fuel is approximately 46,000 MWd/MTU (metric tons of uranium) (Reference 3.2-2). The total quantity of uranium in the initial core load and annual core reload quantities are approximately 167 MTU and 68.2 MTU, respectively (Reference 3.2-2). Section 3.8 describes the comparison of the reactor design and performance data with the criteria of 10 CFR 51.52(a), subparagraphs (1), (2), and (3).

3.2.2 Engineered Safety Features

Engineered Safety Features (ESFs) are provided to mitigate the consequences of design basis or loss-of-coolant accidents, even though the occurrence of these accidents is very unlikely. The ESFs of the ESBWR are described in DCD Chapter 6 and consist of (1) fission product containment and containment cooling systems; (2) Emergency Core Cooling Systems (ECCS), and (3) control room habitability systems. Instrumentation and controls for the ESFs are described in DCD Section 7.3. DCD Tables 6.2-1 and 6.2-10 outline the containment and containment cooling design parameters. ECCS design parameters are outlined in DCD Table 6.3-1. DCD Table 6.4-1 outlines the control room habitability area HVAC system.

3.2.3 Power Conversion Systems

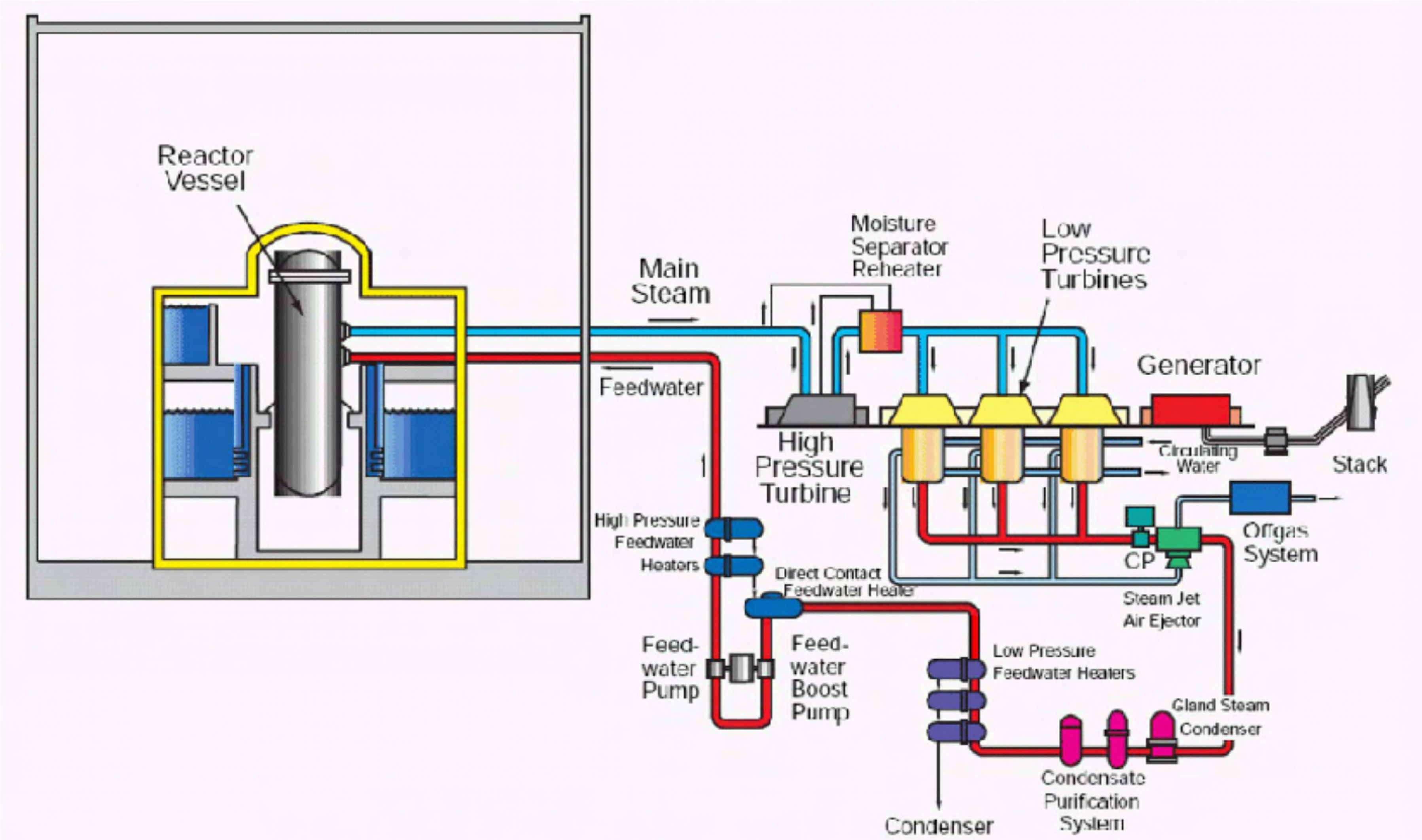
The ESBWR uses a steam turbine to convert heat energy to mechanical energy. Turbine exhaust is cooled through a condenser, and the waste heat is rejected to the atmosphere via a natural draft cooling tower. Fermi 3 will reject approximately 9.883x10^9 Btu/hr in waste heat. The tube material of the main condenser is selected based on circulating water chemistry. The material of the main condenser has not been selected at this time; however candidate materials are either stainless steel or titanium. The total surface area of the main condenser available for heat transfer is 1.61 x 10^6 ft^2. A complete description of the reactor power conversion system can be found in DCD Chapter 10. DCD Table 10.1-1 lists design features and performance characteristics for the major power conversion system components. The design data for the turbine generator are listed in DCD Table 10.3-1. Figure 3.2-1 provides a simplified depiction of the reactor power conversion system.

3.2.4 References

3.2-1 GE-Hitachi Nuclear Energy, "ESBWR Design Control Document – Tier 2," Revision 6, August 2009.

3.2-2 GE Energy, "Response to RFI GE-0024 – Fuel Information," GENS-SR4-2007-0051, June 8, 2007.

Figure 3.2-1 Simplified Flow Diagram of Reactor Power Conversion System



3.3 Plant Water Use

Fermi 3 requires water for cooling and operational uses. Lake Erie provides water for plant cooling, including the normal power heat sink (NPHS) and auxiliary heat sink (AHS).

Subsection 3.3.1 discusses water consumption and discharges by the various plant components and systems, including the NPHS, AHS, Ultimate Heat Sink (UHS), potable water and sanitary waste, demineralized water, and fire protection. Additionally, Figure 3.3-1 presents a water use diagram for Fermi 3 outlining normal plant power operating conditions as well as non-power/shutdown conditions.

Subsection 3.3.2 discusses methods of water treatment used in the plant and discharged back to the receiving water body (i.e., Lake Erie). Plant service water treatment is discussed in this subsection and also further discussed in FSAR Subsection 9.2.1. Makeup water is also discussed in this subsection, as well as in FSAR Subsection 9.2.3.

3.3.1 Water Consumption

Plant water systems discussed in this subsection include the CIRC, PSWS, Station Water System (SWS), Potable Water System (PWS), Sanitary Waste Discharge System (SWDS), demineralized system, and Fire Protection System (FPS). The CIRC, PSWS, SWS, and FPS share a common intake from Lake Erie. Potable water is being supplied for the demineralized system from the Frenchtown Township municipal water supply. The design of the intake structure is based on record low water levels for Lake Erie, thus even under these conditions plant operation is able to carry on normally. Under normal conditions, Lake Erie water levels remain relatively constant except during extreme seiche events. The intake structure is not designed for extreme seiche events. During extreme seiche events, the water supply to the SWS could be degraded and the unit operationally controlled to limit makeup requirements. The Ultimate Heat Sink (UHS) for Fermi 3, described in FSAR Subsection 9.2.5, contains a separate water supply for safety-related cooling. Lake Erie is not used for safety-related water withdrawal for Fermi 3. Therefore, a seiche event will not affect a safety-related water supply for Fermi 3. This is discussed further in Subsection 3.4.2.1. The SWS provides makeup water to the NPHS and AHS cooling tower basins, and the FPS. The SWS is further described in FSAR Subsection 9.2.10. Various drains in the plant produce effluent liquid radwaste. This flow can either be treated and discharged to Lake Erie, or recycled. Blowdown from several sources, including both NPHS and AHS cooling towers; optional treated liquid radwaste, including chemical waste is combined and shares a common discharge to Lake Erie. The demineralized water waste is discharged to the Fermi 3 SWDS.

3.3.1.1 Circulating Water System and Normal Power Heat Sink

The CIRC is used to remove the waste heat from the main condenser discharging to the NPHS. A more detailed description of the CIRC is presented in Subsection 3.4.1.1. During normal operation the NPHS may provide cooling to the AHS loads. Makeup water to the NPHS cooling tower replenishes water losses due to evaporation, drift, and blowdown. Figure 3.3-1 shows the water use (makeup, blowdown, evaporation, etc.) by the NPHS for Fermi 3. Figure 3.3-1 describes the flow rates for power and shutdown operations. Power operations are further subdivided into the maximum heat load (expected during summer months), minimum heat load (expected during the winter months), and the average heat load (expected during the spring and fall months). The maximum makeup water flow is approximately 34,000 gpm for the NPHS.

The maximum blowdown from the NPHS cooling tower is approximately 17,000 gpm, and the minimum blowdown is approximately 12,000 gpm. The annual average blowdown flow is approximately 14,000 gpm. The maximum blowdown value represents the design condition, at the warmest temperatures. The minimum value represents winter conditions under the coldest temperatures, which occur in the month of January. The average value represents the average of all monthly flows; this value would be representative of flows in the spring or fall months. Table 3.4-1 outlines the monthly variation in evaporation, blowdown and makeup flows. The blowdown is directed to an outfall that discharges into Lake Erie.

3.3.1.2 **Plant Service Water System and Auxiliary Heat Sink**

The PSWS provides nonsafety-related cooling to the Reactor Building and Turbine Building systems. During operation of Fermi 3, PSWS cooling is provided by either the NPHS cooling tower or the AHS cooling towers. While in shutdown condition, the PSWS is cooled by the AHS cooling towers. The AHS requires makeup water to replenish water losses due to evaporation, drift, and blowdown. Blowdown from the AHS is mixed with the NPHS cooling tower blowdown. The flow requirements for makeup flow for the PSWS are a maximum of approximately 1100 gpm. The makeup water requirements are included in the flow values stated in Subsection 3.3.1.1. A more detailed description of the PSWS is provided in Subsection 3.4.1.3.

3.3.1.3 **Ultimate Heat Sink**

The ESBWR design has no separate emergency water cooling system. The UHS function is provided by safety systems integral and interior to the reactor plant. These systems ultimately use the atmosphere as the eventual heat sink. These systems do not rely on cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant. (Reference 3.3-1)

3.3.1.4 **Potable Water and Sanitary Waste Discharge System**

The PWS and SWDS are designed to provide potable water supply and sewage treatment necessary for normal plant operation and shutdown periods. The source of the potable water supply is the Frenchtown Township municipal water system. The PWS is designed to supply up to 200 gpm of potable water during peak demand period with a monthly average usage of 35 gpm, as outlined on Figure 3.3-1. The Demineralized water waste and the effluent from the auxiliary boiler are routed to the Fermi 3 SWDS. Sanitary waste is routed to the Frenchtown Township Sewage Treatment Facility.

3.3.1.5 **Demineralized Water**

The required flow for makeup water to the demineralization subsystem when using the option of discharging liquid radwaste to Lake Erie, is expected to be a monthly average of 160 gpm, with short term maximum flow expected to be 639 gpm during outages. The required flow for makeup water to the demineralization subsystem when using the option of recycling liquid radwaste is bounded by the makeup flow with liquid radwaste discharged to Lake Erie. The option to operate with liquid radwaste recycled supports zero discharge of liquid radwaste. The makeup water is supplied from the Frenchtown Township water line as depicted on Figure 3.3-1. Flows for various modes of operation, as well as liquid radwaste effluent are also outlined on this figure.

3.3.1.6 Fire Protection

Fire protection water is provided to the FPS from onsite storage tanks that have makeup supplied from the SWS. After the FPS is initially filled, maximum usage is about 30 gpm for activities such as maintaining the system filled and pressurized and periodic testing.

3.3.2 Water Treatment

As outlined in Subsection 3.3.1, plant makeup water is taken from a common intake from Lake Erie. This intake is treated with sodium hypochlorite, a biocide/algaecide, thus disseminating to the appropriate water use systems. Sodium hypochlorite is used to eradicate the presence of biologicals in the systems, both in the form of plant life such as algae and animals such as zebra mussels and corbicula. During select periods in spring and fall, sodium hypochlorite levels are elevated to ensure the absence of zebra mussels.

The SWS supplies makeup water to the PSWS, CIRC, and FPS. There are viable treatment options for mussel control in these systems, which include: chlorination and thermal shock treatment. The chlorination option will consist of isolation of the PSWS and elevation of chlorine levels within the PSWS for a specific duration of time. This will cause the eradication of any zebra mussel population within the system. Upon returning the PSWS to service, the chlorinated PSWS water will be combined with the much larger portion of blowdown from the NPHS, thus diluting the chlorine to acceptable discharge levels. The thermal shock treatment option would consist of raising the temperature of the CIRC to greater than 95°F for at least 60 minutes. This method is less practical for the PSWS due to system thermal limitations.

3.3.2.1 Station Water System

The SWS draws water from Lake Erie as the source of makeup to the plant. The SWS is described in FSAR Subsection 9.2.10. Makeup water to the plant is treated with a biocide, sodium hypochlorite, as it enters through the SWS pump house intake. Water treatment chemistry is provided in Table 3.3-1.

3.3.2.2 Circulating Water

The CIRC provides cooling water for removal of the power cycle heat from the main condensers and transfers this heat to the NPHS. The CIRC is described in FSAR Section 10.4. Chemical additions are made to both influent and effluent flows. System chemistry control is provided by the incorporation of an injection system at the inlet to the condenser that introduces a biocide, corrosion inhibitor, and scale inhibitor. The necessity of using a biocide is outlined in Subsection 3.4.2.2. The corrosion inhibitor is needed in order to reduce the effects of corrosion on the piping and condenser. The scale inhibitor is needed to reduce the build-up of scaling that could affect the efficiency of the condenser. Quantities and identification of these various chemicals are shown in Table 3.3-1. Discharge must also be treated before exiting to Lake Erie. Dehalogenation must occur in order to maintain oxidant within reasonable discharge limits. As discussed in Section 1.2, permits, e.g., National Pollution Discharge Elimination System (NPDES) permit and Section 401 Water Quality Certification, will be obtained for the discharge from Fermi 3. Additionally, Section 5.2 provides a discussion on effluent limitations and permit conditions.

3.3.2.3 Plant Service Water System

PSWS chemistry control is maintained in a similar fashion to that of the CIRC, i.e., with the addition of biocide, corrosion inhibitor, scale inhibitor, as well as dispersant chemicals to break up sedimentation when lake water is highly turbid. Water treatment chemistry is provided in Table 3.3-1. There are no expected changes to water treatment operating procedures based on seasonal variations. The PSWS is described in FSAR Subsection 9.2.1.

3.3.2.4 Potable Water and Sanitary Waste

The potable water for the Fermi site is supplied from the Frenchtown Township municipal water system. This water supply does not require any additional chemical treatment or additives. The sanitary waste system effluent is discharged to the Frenchtown Township Sewage Treatment Facility without addition of chemical treatments. FSAR Subsection 9.2.4 provides further description of the PWS and SWDS.

3.3.3 References

3.3-1 GE-Hitachi Nuclear Energy, “ESBWR Design Control Document – Tier 2,” Revision 6, August 2009.

Table 3.3-1 Chemical Additives for Water Treatment

System/Injection Point	Chemical	Approximate Usage	
Circulating Water System/ Cooling tower basin/ Station Water System	Biocide/Algaecide – Sodium Hypochlorite (15%)	1200 gal/week	Normal Power Operating Conditions/ Shutdown Conditions
Circulating Water System/ Makeup water line discharge	Corrosion Inhibitor - Sodium Silicate	400 gal/day	Normal Power Operating Conditions/ Shutdown Conditions
Circulating Water System / Makeup water line discharge	Scale Inhibitor/Dispersant	220 gal/day	Normal Power Operating Conditions/ Shutdown Conditions
Circulating Water System blowdown	Dehalogenation – Sodium Bisulfite	175 gal/day	Normal Power Operating Conditions/ Shutdown Conditions

Figure 3.3-1 Water Use Diagram (Sheet 1 of 3)

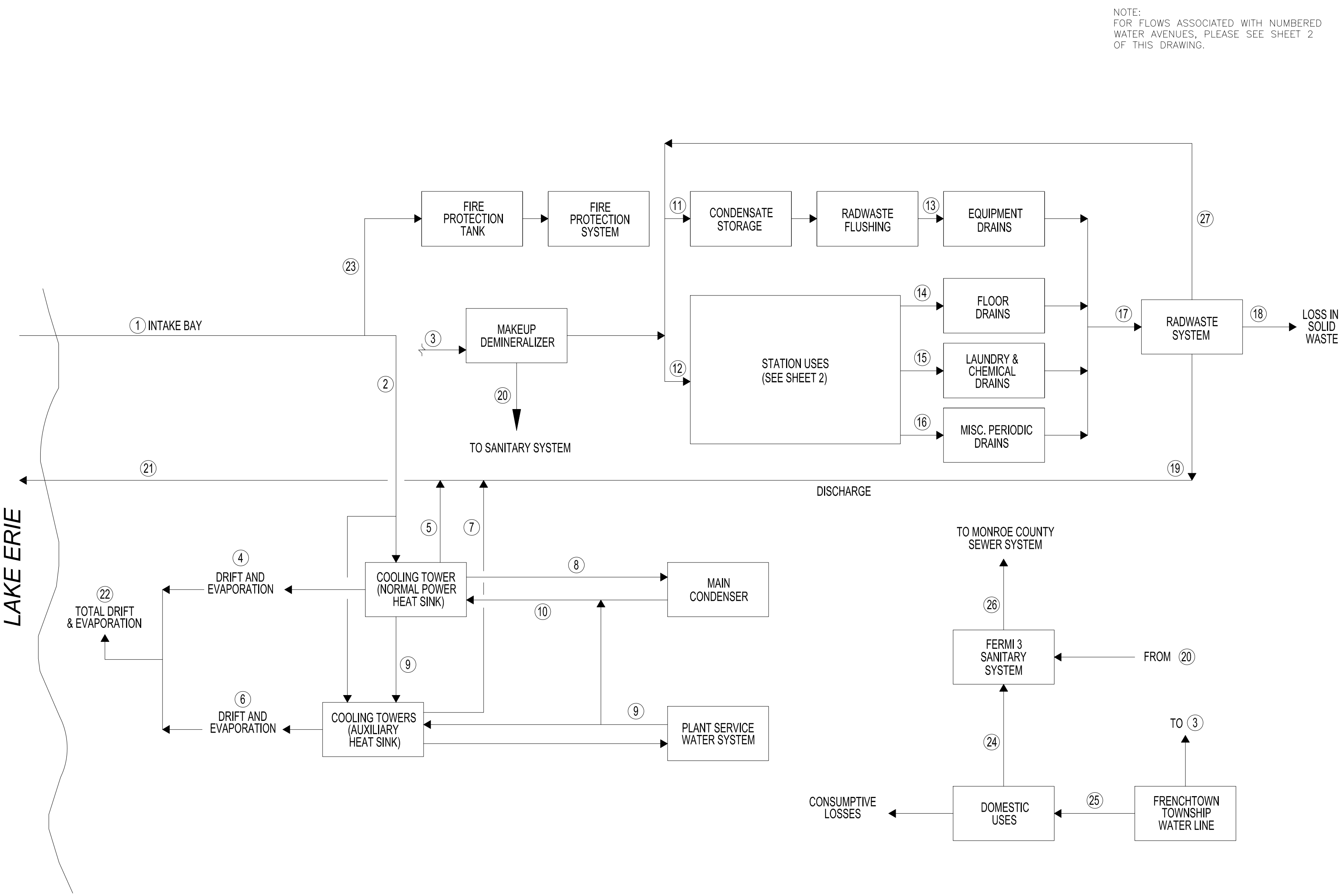


Figure 3.3-1 Water Use Diagram (Sheet 2 of 3)

Flow	Description	Value (gpm) Maximum Normal Power Operation[1] Discharged Radwaste	Value (gpm) Minimum Normal Power Operation[2] Discharged Radwaste	Value (gpm) Average Normal Power Operation[3] Discharged Radwaste	Value (gpm) Average Shutdown Operation Discharged Radwaste
1	Total Makeup Water Intake	34,264	23,780	28,993	1,166
2	Cooling Tower Makeup Water	34,234	23,750	28,963	1,136
3	Demineralizer Makeup Water	160	160	160	639
4	Normal Power Heat Sink Drift & Evaporation	17,124	11,882	14,488	0
5	Normal Power Heat Sink Discharge	17,110	11,868	14,474	0
6	Auxiliary Heat Sink Drift & Evaporation	0	0	0	569
7	Auxiliary Heat Sink Discharge	0	0	0	567
8	Inflow to Main Condenser	684,000	684,000	684,000	0
9	Total Plant Service Water System Flow	40,000	40,000	40,000	40,000
10	Total Circulating Water System Flow	724,000	724,000	724,000	0
11	Inflow to Condensate Storage	58	58	58	232
12	Inflow to Station Uses	49	49	49	196
13	Outflow to Equipment Drains	58	58	58	232
14	Outflow to Floor Drains	8	8	8	30
15	Outflow to Laundry & Chemical Drains	24	24	24	95
16	Outflow to Miscellaneous Periodic Drains	18	18	18	71
17	Inflow to the Radwaste System	107	107	107	428
18	Loss in Solid Radwaste	2	2	2	9
19	Radwaste Discharge (Liquid Radwaste Loss)	105	105	105	419
20	Makeup Demineralizer Blowdown	53	53	53	211
21	Total Discharge	17,215	11,973	14,579	987
22	Total Drift & Evaporation	17,124	11,882	14,488	569
23	Fire Protection Uses	30	30	30	30
24	Potable Water Discharge to Sewer	200	35	35	47
25	Domestic Uses	200	35	35	47
26	Total Discharge to Monroe County sewer system	253	88	88	258
27	Liquid Radwaste Recycled	0	0	0	0

Station Water Uses:

Standby Liquid Control System
Reactor Component Cooling Water System
Process Sampling System process use
HVAC system
Liquid Waste System chemical addition and line flushing
Turbine Component Cooling Water System
Auxiliary Boiler System
Isolation Condenser/Passive Containment Cooling Pool
Solid Waste System for line flushing
Chilled Water System
Post Accident Sampling station flushing

Figure 3.3-1 Water Use Diagram (Sheet 3 of 3)

Flow	Description	Value (gpm) Maximum Normal Power Operation[1] Recycled Radwaste	Value (gpm) Minimum Normal Power Operation[2] Recycled Radwaste	Value (gpm) Average Normal Power Operation[3] Recycled Radwaste	Value (gpm) Average Shutdown Operation Recycled Radwaste
1	Total Makeup Water Intake	34,264	23,780	28,993	1,166
2	Cooling Tower Makeup Water	34,234	23,750	28,963	1136
3	Demineralizer Makeup Water	3	3	3	13
4	Normal Power Heat Sink Drift & Evaporation	17,124	11,882	14,488	0
5	Normal Power Heat Sink Discharge	17,110	11,868	14,474	0
6	Auxiliary Heat Sink Drift & Evaporation	0	0	0	569
7	Auxiliary Heat Sink Discharge	0	0	0	567
8	Inflow to Main Condenser	684,000	684,000	684,000	0
9	Total Plant Service Water System Flow	40,000	40,000	40,000	40,000
10	Total Circulating Water System Flow	724,000	724,000	724,000	0
11	Inflow to Condensate Storage	58	58	58	232
12	Inflow to Station Uses	49	49	49	196
13	Outflow to Equipment Drains	58	58	58	232
14	Outflow to Floor Drains	8	8	8	30
15	Outflow to Laundry & Chemical Drains	24	24	24	95
16	Outflow to Miscellaneous Periodic Drains	18	18	18	71
17	Inflow to the Radwaste System	107	107	107	428
18	Loss in Solid Radwaste	2	2	2	9
19	Radwaste Discharge (Liquid Radwaste Loss)	0	0	0	0
20	Makeup Demineralizer Blowdown	1	1	1	4
21	Total Discharge	17,110	11,868	14,474	567
22	Total Drift & Evaporation	17,124	11,882	14,488	569
23	Fire Protection Uses	30	30	30	30
24	Potable Water Discharge to Sewer	200	35	35	47
25	Domestic Uses	200	35	35	47
26	Total Discharge to Monroe County sewer system	201	36	36	52
27	Liquid Radwaste Recycled	105	105	105	419

1. Summer months (Design/maximum)
2. Winter months (January/minimum)
3. Spring and fall months (Average)

3.4 Cooling System

Fermi 3 requires cooling water for the normal power heat sink in the CIRC and the auxiliary heat sink in the PSWS. Thermal energy is transferred via air or water through these heat sinks. Major system components include the intake and discharge portions.

Subsection 3.4.1 gives a description of the various cooling water systems and the operational modes for Fermi 3. The NPHS is discussed in this section, as well as in Section 3.3 and Subsection 5.3.2. Discharge to the air is also discussed in this section, as well as in Subsection 5.3.3.

Subsection 3.4.2 provides a description of the major components of the systems. Major components are contained within the intake structure and discharge piping. Further clarification of the intake structure is provided on Figure 3.4-1 and Figure 3.4-2. Additional discussion on the impacts of the discharge can be found in Subsection 5.3.2 and Subsection 5.3.3.

3.4.1 Description and Operational Modes

3.4.1.1 Circulating Water System

The CIRC provides cooling water during startup, normal plant operations, and hot shutdown for removal of power cycle heat from the main condensers and rejects this heat to the NPHS. The NPHS is comprised of a natural draft cooling tower. The main condensers contribute the majority of the heat to the NPHS with additional heat load introduced by the PSWS.

The main condenser rejects heat to the atmosphere at a rate of approximately 9.883×10^9 Btu/hr during normal full-power operation. Water from the NPHS basin is pumped through the main condenser and then back to the cooling tower where heat, transferred to the cooling water in the main condenser, is dissipated to the environment (the atmosphere) by evaporation.

As a result of the heat dissipation process, some water is evaporated. This results in an increase in the solids level in the NPHS cooling tower. To control solids levels or concentrations, a portion of the recirculated water is discharged. In addition to this blowdown from the CIRC, and evaporative losses, a small percentage of water in the form of droplets (drift) is lost from the cooling tower. Water pumped from Lake Erie via the intake structure is used to replace water lost by evaporation, drift and blowdown from the cooling tower. Blowdown water is returned to Lake Erie via an outfall into the lake (Subsection 3.4.2). A portion of the waste heat is thus dissipated to Lake Erie through the blowdown process.

The maximum, minimum and average Fermi 3 blowdown flow rates from the CIRC during normal full power operation are provided in Figure 3.3-1. Table 3.4-1 provides the monthly values for evaporation, blowdown, and makeup for the NPHS. The maximum temperature of the blowdown after passing through the NPHS is 86°F at the discharge to Lake Erie. The heat rejected to Lake Erie via blowdown is estimated based on these maximum blowdown flow and temperature conditions (Subsection 5.3.2). During other operating modes, heat dissipation to the environment is less than the bounding values for the normal full-power operational mode for the NPHS, except when the Turbine Bypass System (TBS) is in operation. In this condition, it is possible for the temperature of the discharge to rise to 96°F.

3.4.1.2 **Station Water System**

The SWS draws water from Lake Erie through an intake bay into the pump house located on the west shore of Lake Erie. The SWS provides makeup water to various plant systems. For example, the SWS provides makeup water to the NPHS cooling tower basin for the CIRC and to the AHS cooling tower basin for the PSWS. The pump configuration consists of three 50 percent capacity Plant Cooling Tower Makeup System (PCTMS) pumps that supply makeup to the cooling towers, and two 100 percent capacity Pretreated Water Supply System (PWSS) pumps. The PWSS pumps are capable of supplying makeup to the FPS as well as the AHS in shutdown conditions. The PCTMS pump configuration allows for one pump to be out of service and the other two maintaining design flow. This is also discussed in Subsection 3.4.2.1 and FSAR Subsection 9.2.10. The AHS can be used in conjunction with the NPHS during normal power operation. However during certain shutdown conditions, heat rejection is performed entirely with the AHS. The AHS operates during startup, hot shutdown, stable shutdown, cold shutdown, and refueling.

3.4.1.3 **Plant Service Water System**

The PSWS provides cooling water to the Turbine Component Cooling Water System (TCCWS) heat exchangers and the Reactor Component Cooling Water System (RCCWS) heat exchangers and rejects the heat back to the NPHS and/or the AHS during normal power operations. During shutdown conditions, the heat is rejected to the AHS. Further discussion of the PSWS can be found in FSAR Subsection 9.2.1. A simplified flow diagram is provided in FSAR Figure 9.2-205. Subsection 3.3.1.2 further discusses flows associated with PSWS, and Figure 3.3-1 outlines flow paths and values for maximum, minimum and average normal power conditions and average shutdown conditions. Chemical treatment of the PSWS is discussed in Subsection 3.3.2.3 and Table 3.3-1.

3.4.1.4 **Ultimate Heat Sink**

The Fermi 3 ESBWR design has no separate emergency water cooling system. The UHS function is provided by safety systems integral and interior to the reactor plant. This system ultimately uses the atmosphere as the eventual heat sink. These systems do not have cooling towers, basins, or cooling water intake/discharge structures external to the reactor plant.

3.4.1.5 **Discharges to Lake Erie**

Lake Erie is subject to liquid discharges during plant operation. Discharge from the heat dissipation system consists of blowdown from the CIRC and PSWS, as well as optional treated liquid radwaste. The thermal aspect of the discharge is covered in this subsection. Section 3.5 and Section 3.6 complete the description of the discharge characteristics.

The rate of discharge into Lake Erie is constant under normal full power operating conditions. The discharge is approximately 17,000 gpm (Figure 3.3-1), with a maximum temperature of 86°F. Table 3.4-1 contains a summary of the monthly discharge temperatures. A discussion of thermal plume predictions is contained in Subsection 5.3.2. The discharge pipe is fortified with riprap to reduce the effects of scouring; additional discussion of scouring can be found in Subsection 5.3.2.1.2. The current NPDES permit for Fermi 2 (Permit No. MI0037028) was renewed in 2005 with an expiration date in 2009. As discussed in Section 1.2, permits, e.g., NPDES permit and Section 401 Water Quality Certification, will be obtained for the discharge from Fermi 3. The discharge of chemicals that have been added to various systems as treatments such as biocide, corrosion inhibitor, and scale inhibitor are closely monitored in the NPDES permit, as well as the presence of metals and the temperature of effluent flow. Section 3.6 provides discussion and comparison to regulatory limitations on effluent flow from Fermi 3.

3.4.1.6 **Discharges to Air**

At the normal full-power design condition, the natural draft tower requires a maximum of 5.6 x 10^7 cfm of ambient air to dissipate about 10.72 x 10^9 Btu/hr of waste heat from the natural draft cooling tower at Fermi 3. Heat dissipated by the natural draft cooling tower includes contributions from the main condenser and the PSWS system. The heat load used for determining parameters associated with the natural draft cooling tower is conservative relative to the design heat loads (Reference 3.4-2).

The cooling tower used at Fermi 3 provides the only plant effluents with a potential for influencing local meteorology. The effluent types of concern are commonly described as visible plumes (fog) and cooling tower drift. Cooling tower drift is limited to no greater than 0.001 percent of the total tower water flow. Drift eliminators exist as a design feature of the natural draft cooling tower meant to reduce the volume of drift from the tower. These effluent types and their impacts on local weather are described in Subsection 5.3.3.

In addition to the heat discharged to the air, auditory discharges are considered. The noise from the NPHS is primarily the result of water splash. The sound level is estimated as being between 55 and 60 dBA at 1000 ft. Subsection 5.3.4 also discusses the estimated noise levels from the NPHS operation. The noise generated by the AHS is from water splash and fan motors. The sound level for the AHS is estimated at between 55 and 60 dBA at 1000 ft. (Reference 3.4-1)

3.4.1.7 **Operational Modes**

For the purposes of the design of the cooling systems, Fermi 3 is based on an estimated capacity factor of 96 percent (annualized). This considers a 24 month fuel cycle combined with an assumed 30-day refueling outage period. On a long term average, the heat load is 10.29 x 10^9 Btu/hr, which is 96 percent of the rated head load of 10.72 x 10^9 Btu/hr. There are six modes of plant operation; normal full-power operation, startup, hot shutdown, stable shutdown, cold shutdown and refueling. These can be generally grouped into two predominant modes, normal full power operation and shutdown operation. During normal full power operation, the NPHS, or a combination of the NPHS and the AHS, handle the heat dissipation to the atmosphere. Under normal full power operation, the heat load is rejected either entirely by the NPHS or by both the NPHS and the AHS. The AHS is capable of exchanging 2.98 x 10^8 Btu/hr. During shutdown operations, approximately 4 percent of plant operation annually, the AHS handles heat dissipation to the atmosphere.

3.4.2 Component Description

3.4.2.1 Intake System

The lake water intake and makeup water system is composed of two main parts: a wet pit pump house structure containing five vertical wet pit pumps, trash racks and traveling screens, and piping routed from the pump house structure to the cooling tower basin and the plant.

The SWS draws lake water via an intake bay (Figure 3.4-1 and Figure 3.4-2) from Lake Erie. This inlet bay is formed by two rock groins that extend 600 ft into Lake Erie. The intake bay is periodically dredged to maintain appropriate operating conditions.

At the inlet to the pump house structure a trash rack is positioned which is equipped with a trash rake. Trash collected from the trash racks is disposed of. There are three dual flow traveling screens arranged side by side to further prevent debris from entering the pump house. Aquatic organisms are first washed from the traveling screens using low pressure water spray. The remaining trash is then removed using high pressure wash sprays. Strainers are in place at the pump discharge and strainer backwash is directed back to Lake Erie. Strainer backwash is controlled to ensure that the limits of the applicable NPDES permit are adhered to.

The SWS pumps take suction from an intake bay through the makeup water pump house. The three PCTMS pumps supply makeup water to the cooling tower basins. Each pump has capacity to supply 50 percent of the total flow requirements. Two pumps are normally operated and the third is reserved for standby operation. This ensures makeup flow can be delivered in the event that one pump is out of service. The two operating pumps are capable of delivering the maximum cooling tower makeup water requirement of approximately 34,000 gpm, (Figure 3.3-1). The two PWSS pumps supply makeup water to the FPS under normal power operating conditions. They are 100 percent capacity pumps capable of supplying the necessary makeup water to the AHS and FPS in shutdown conditions.

The velocity of the water flowing through the dual flow intake traveling screens is approximately 0.5 fps at record low lake water levels, and no more than 0.5 fps under all operating conditions, as required by Section 316(b) of the Clean Water Act. The mesh size on each traveling screen is ⅜-inch. Each screen is capable of handling approximately 20,000 gpm of flow. The flow is designed to be sufficiently low that fish are not caught or trapped against the traveling screens. Fish which have entered the intake bay to this point are free to return to the lake in the same way they came. The pump house intake structure is sized such that the formation of vortices or other abnormal flow conditions that would interfere with the operation of the pumps is minimized. If fouling occurs, the screens are cleaned by backwashing. The formation of frazil ice on the screens is prevented by the low intake flow rate and by recirculating warmed water that has been rerouted from the discharge. A profile view of the intake screens and pumps suction is shown on Figure 3.4-2. This system is designed such that the intake structure has a minimal impact on the wildlife present in Lake Erie. This is consistent with good engineering design and environmental practices.

The addition of a biocide/algaecide, sodium hypochlorite, takes place as water enters the pump house structure. Once the water has passed through the trash rack and the traveling screens, a diffuser injects the biocide into the flow before the flow proceeds into the pump suction. Further chemical treatments are discussed in Subsection 3.3.2.

The elevation reference in use at Fermi is NAVD88. The elevation of the bottom of the intake bay at the entrance to the pump house is 559 ft. The record low level of Lake Erie water is 563’-11” and the record high level is 576’-6”. The elevation of the base of the bay at the location of the pump suction is 553 ft. This is more than 10 ft below the record low water level for Lake Erie, thus pump suction should not be a concern. Impacts to SWS pump suction due to seiche events are discussed in Subsection 3.3.1.

3.4.2.2 **Discharge System**

Dilution and dissipation of the discharge heat as well as other effluent constituents are affected by both the design of the discharge and the flow characteristics of the receiving water, in this case Lake Erie. Normal plant effluent flow from all sources (cooling tower blowdown, and optional treated liquid radwaste) is approximately 17,000 gpm. The NPHS cooling tower blowdown is the major contributor to the total flow, and its maximum return temperature is estimated at 86°F and the average temperature is 68°F. Table 3.4-1 contains the monthly discharge flow rates and the discharge temperatures (cold water temperature) to Lake Erie. Figure 3.4-4 and Figure 3.4-5 are used in the development of Table 3.4-1. The temperature rise across the main condenser is 31.2°F.

The 4-ft diameter discharge pipe is located approximately 1300 ft into Lake Erie to avoid recirculation. Another consideration in the length of the discharge pipe was to preclude the discharge plume from intruding on environmentally sensitive onsite areas (such as wetlands) during wind-driven rises in Lake Erie water level (seiche events). The pipe is buried in the bank as it is routed into Lake Erie where the discharge is located, below the water surface, see Figure 5.3-1. The pipe discharges through a diffuser, as described in Subsection 5.3.2.1.1.1. The analysis of the thermal plume that results from the discharge is discussed in Subsection 5.3.2.1. The analysis includes consideration of seiche events. As discussed in Subsection 3.3.1 and Subsection 5.3.2.1, due to potential for the water supply to the SWS to be degraded during extreme seiche events, the unit could be operationally controlled to limit makeup water requirements. These seiche events are relatively short-lived. As part of the operational controls in response to an extreme seiche event, the discharge could be reduced and or secured.

For a total discharge flow rate of approximately 17,000 gpm, the exit jet velocity is approximately 8.5 fps. The submerged jet mixes rapidly with the ambient lake water, accompanied by a reduction of momentum and kinetic energy through turbulent action. The environmental impact of discharged heat on Lake Erie is discussed in Subsection 5.3.2. The use of cooling towers for Fermi 3 provides good engineering design and represents the best technology available under Phase I of Section 316(a) of the Clean Water Act and also acts to greatly reduce the thermal loading to Lake Erie. Discharges from the AHS are directed to the CIRC basin. As shown in Figure 3.3-1, the discharge from the AHS is small in comparison to the NPHS discharge (less than 5 percent). When the

PSWS is operating without the CIRC operating, discharges from the AHS are controlled to ensure that the resultant thermal plume is bounded by the thermal plume from operating the NPHS.

3.4.2.3 **Heat Dissipation System**

The main source of heat dissipation is the NPHS. The NPHS is a natural draft cooling tower, as shown on Figure 3.4-3. The AHS consists of two mechanical draft cooling towers. The AHS is further discussed in FSAR Subsection 9.2.1.

Makeup flow to the NPHS cooling tower basin is supplied by the SWS through the intake structure located on Lake Erie. The NPHS is located approximately 2200 ft from the pump house intake structure. At the cooling tower basin, there are four CIRC pumps, each 25 percent capacity, which supply a total flow of 744,000 gpm. The flow is directed to the main condenser, and is then directed back to the cooling towers so that the heat can be rejected to the atmosphere. The cooling tower basin is located approximately 1100 ft from the main condenser.

The NPHS cooling tower discharges water to the basin, which receives makeup from Lake Erie. Intake water temperatures from Lake Erie can be seen in Subsection 2.3.1, and meteorological data can be found in Section 2.7. Cooling tower performance curves for wet bulb temperature and evaporation, as well as wet bulb and cold water temperature are seen on Figure 3.4-4 and Figure 3.4-5. The information in Table 3.4-1 is developed using these cooling tower performance curves. The design of the heat dissipation system does not present any major departures from acceptable cooling system design practices, nor does it contain any additional components for consideration, beyond the NPHS in the form of a natural draft cooling tower. This system is consistent with good engineering practices.

The PSWS and AHS are discussed in FSAR Section 9.2 and FSAR Table 9.2-201.

3.4.3 **References**

3.4-1 Edison Electric Institute, “Electric Power Plant Environmental Noise Guide,” New York, 1978.

3.4-2 GE-Hitachi Nuclear Energy, “ESBWR Design Control Document – Tier 2,” Revision 6, August 2009.

Table 3.4-1 Monthly Cooling Tower Temperatures and Flows

Month	Wet Bulb Temperature (˚F)	Cold Water Temperature (˚F) *	Evaporation Flow rate (gpm)	Drift Flow rate (gpm)	Blowdown Flow rate (gpm)	Makeup Flow rate (gpm)
January	23.7	53.8	11875	7.2	11867.8	23750
February	25.7	55.3	12200	7.2	12192.8	24400
March	32.3	59.4	13100	7.2	13092.8	26200
April	42.6	66	14300	7.2	14292.8	28600
May	52.7	72.7	15400	7.2	15392.8	30800
June	61.7	78.4	16300	7.2	16292.8	32600
July	65.9	81.5	16750	7.2	16742.8	33500
August	65	80.8	16700	7.2	16692.8	33400
September	58.1	76.3	16100	7.2	16092.8	32200
October	47	68.8	14800	7.2	14792.8	29600
November	37.5	62.7	13750	7.2	13742.8	27500
December	28	56.6	12500	7.2	12492.8	25000

* Cold Water temperatures are calculated based on ambient wet bulb temperatures, however the temperature of the discharge from the NPHS cooling tower basin will be maintained at 55˚F or above.

Figure 3.4-1 Station Water Intake Structure

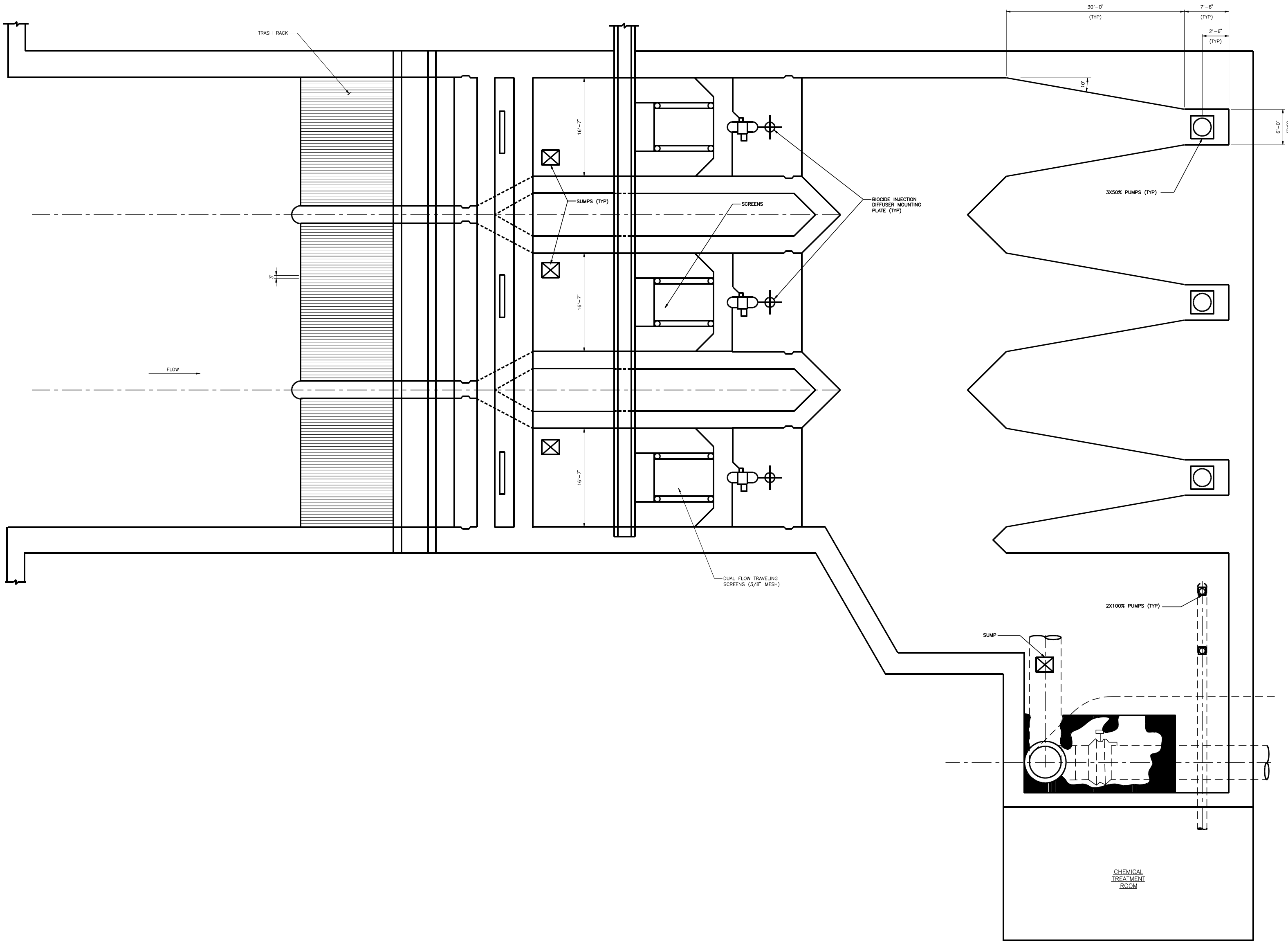


Figure 3.4-2 Station Water Intake Structure – Elevation View

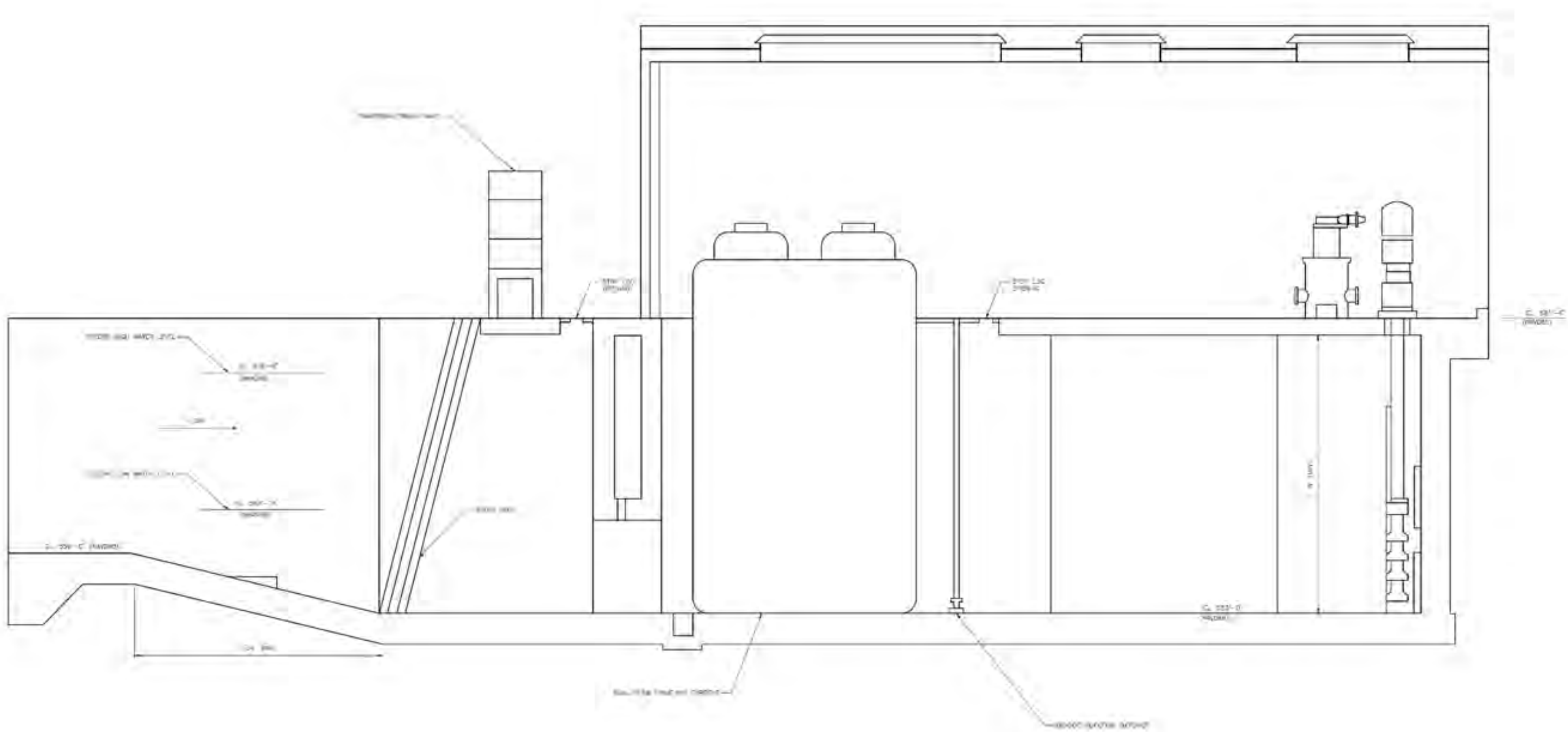


Figure 3.4-3 NPHS Cooling Tower

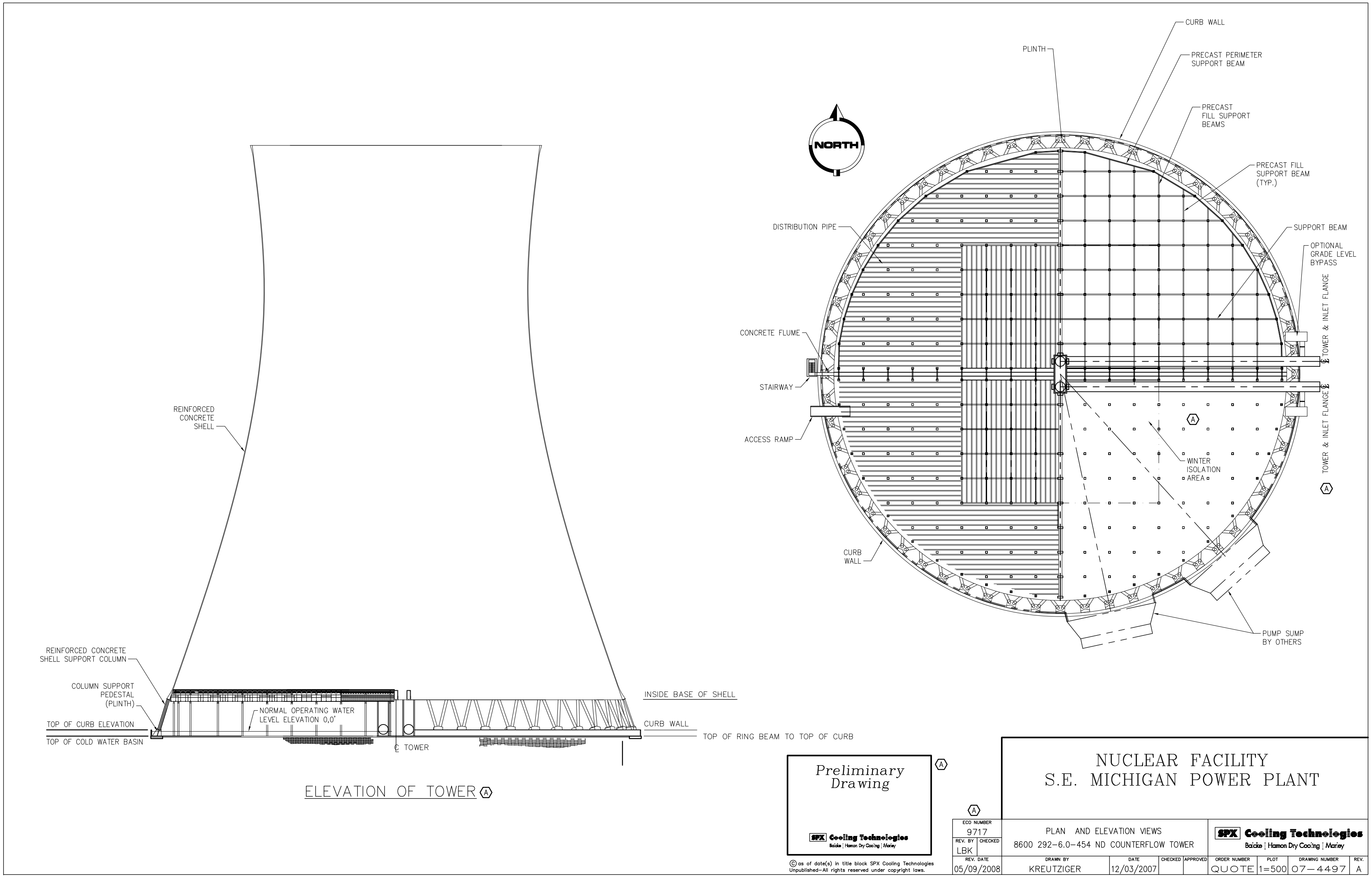


Figure 3.4-4 Cooling Tower Performance Curve

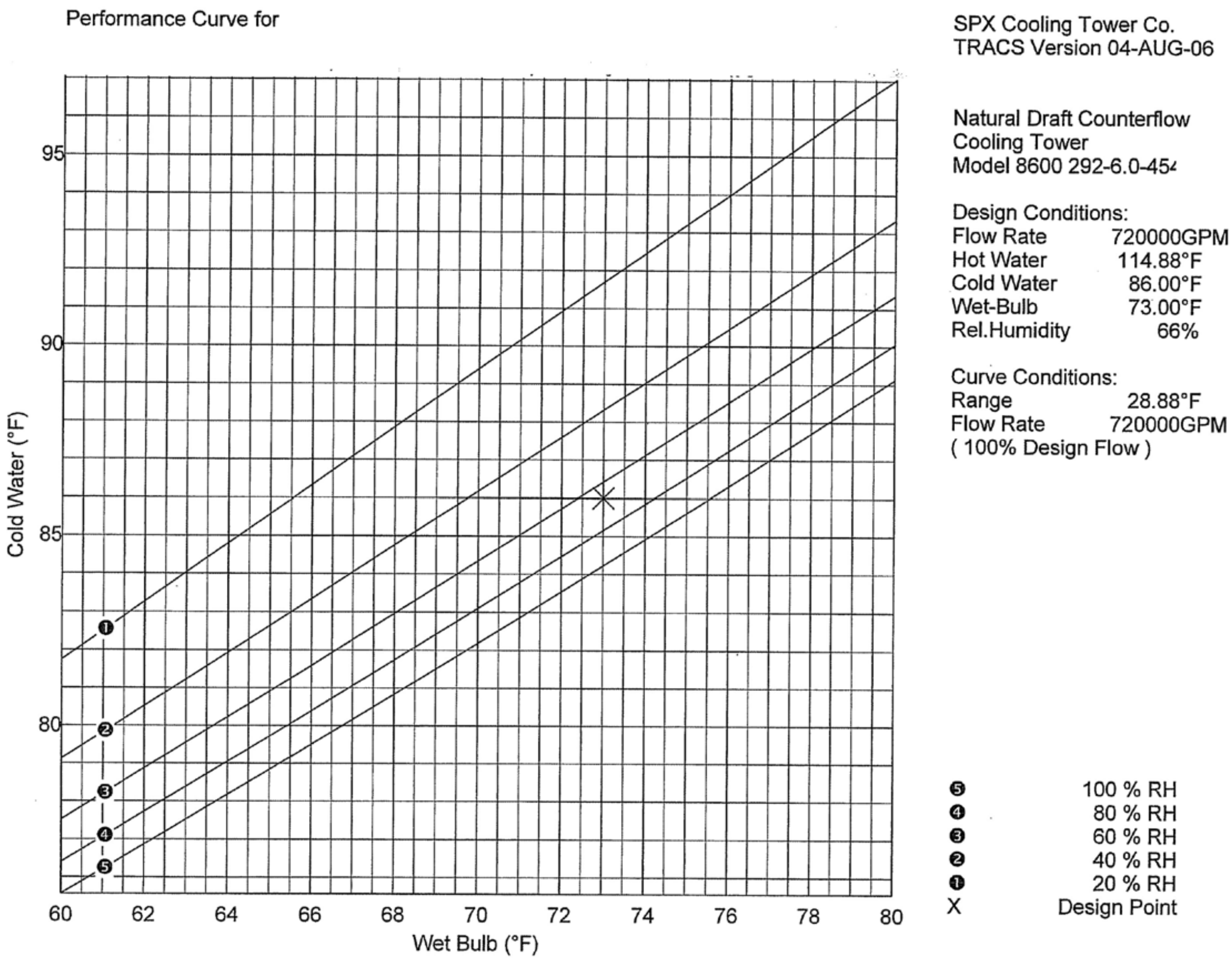


Figure 3.4-5 Cooling Tower Evaporation Curves

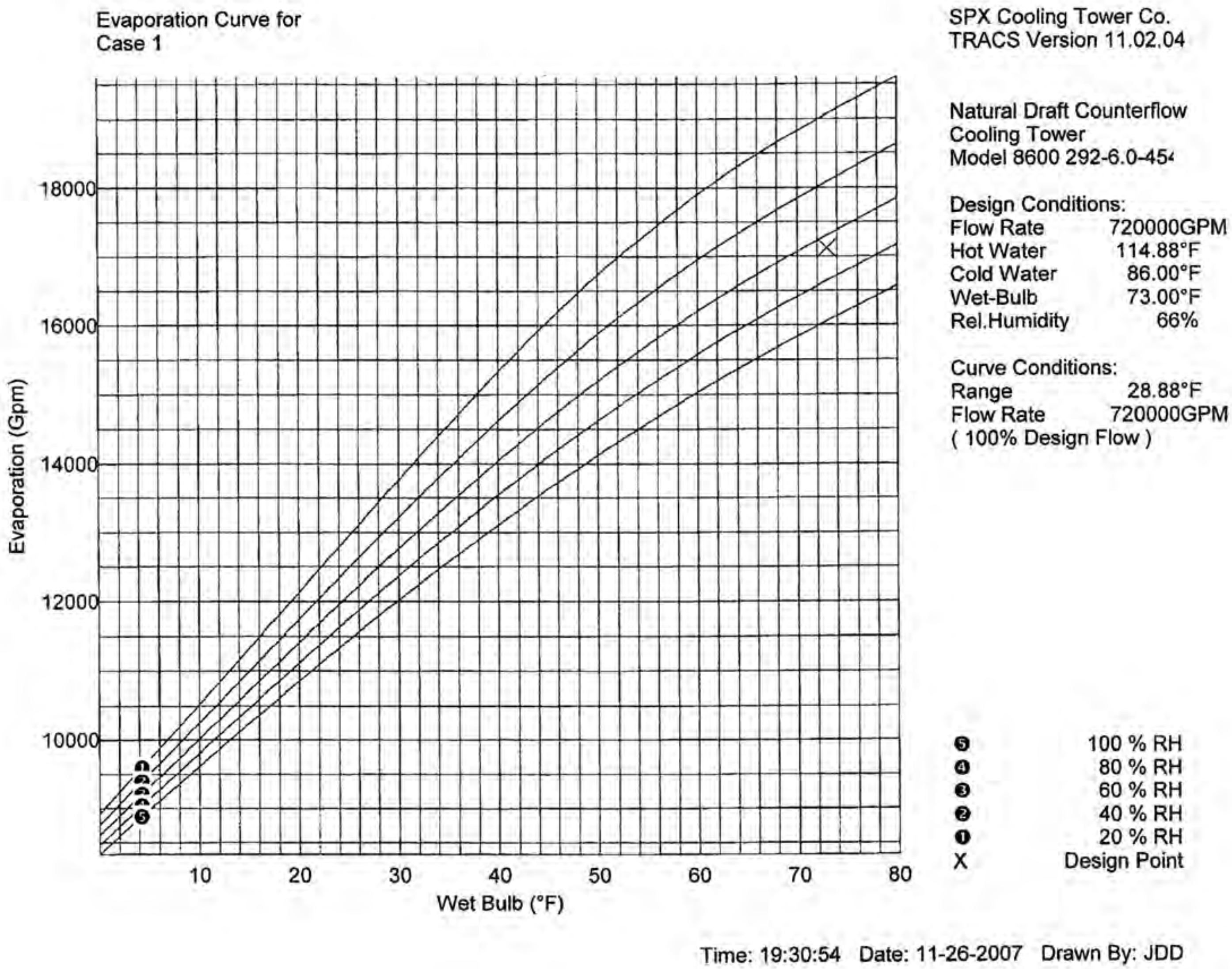
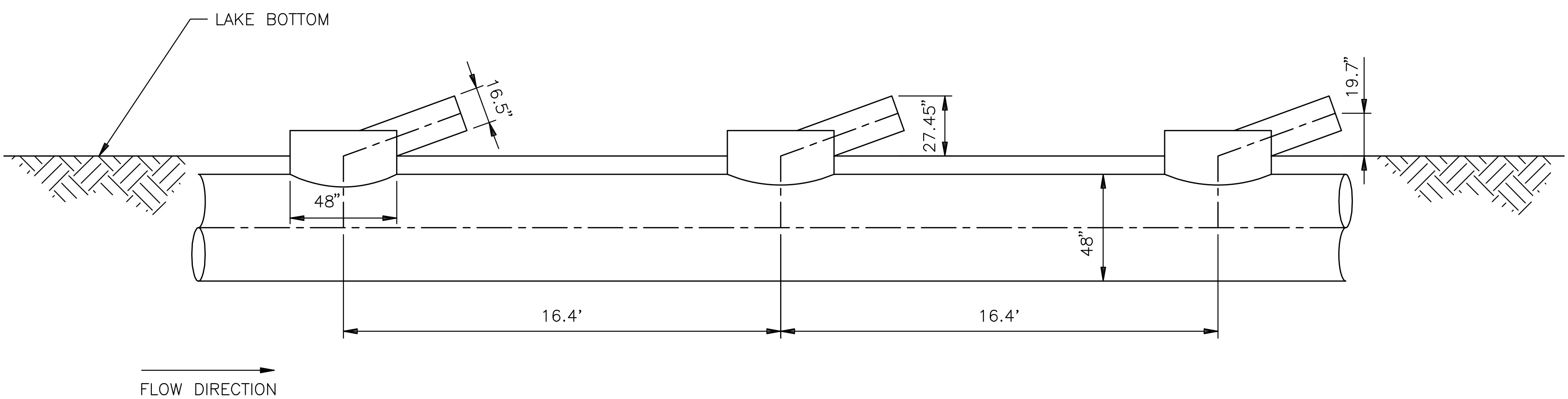


Figure 3.4-6 Outfall Diffuser Arrangement



3.5 Radioactive Waste Management System

This section describes the liquid, gaseous, and solid radioactive waste (radwaste) treatment systems and the instrumentation used to monitor the effluent release points. The information includes the origin, treatment, and disposal of all liquid, gaseous, and solid radioactive wastes generated by the station during normal operation including anticipated operational occurrences (e.g., refueling, purging, equipment downtime, maintenance). Low Level Mixed Waste is discussed in Subsection 3.6.3.4.

During normal operations of reactors, fission neutrons can activate nonradioactive materials normally present in the reactor coolant. Trace metals such as iron, cobalt, and manganese can become activated. Small amounts of fission-activated products within the fuel can enter the coolant by diffusing through the fuel cladding, or by escaping through fuel cladding leaks, if they occur. Thus, the reactor coolant normally carries materials with varying degrees of radioactivity. The sources of radioactivity and the source terms used for the design of the radioactive waste management systems are described in DCD Chapter 11 (Reference 3.5-1).

The radioactive waste management systems are designed to maintain releases of radioactive materials in effluents to "as low as reasonably achievable" levels in conformance with 10 CFR Parts 20 and 50, including the design objectives of 10 CFR 50 Appendix I. Brief descriptions of the radioactive waste management systems are provided in this section. More complete descriptions of the radioactive waste management systems design, including process flow diagrams, are included in DCD Sections 11.2, 11.3, and 11.4.

3.5.1 Source Terms

The sources of radioactivity that serve as input to the liquid, gaseous, and solid radioactive waste treatment systems for normal operation (including anticipated operational occurrences) are described in DCD Section 11.1. These sources include fission products (noble radiogas, radioiodines, and transuranic nuclides) and activation products (coolant, non-coolant, tritium, and Argon-41). FSAR Section 12.2 provides additional information on plant sources of radioactivity.

The calculation model used to determine the activity of each radionuclide in the primary containment is based on the ANSI/ANS 18.1 source terms (Reference 3.5-2) with appropriate adjustment factors applied. The details of the model, including the fission product noble gas release rate used, are provided in DCD Section 11.1.

Regulatory Guide 1.112, Appendix A, provides a listing of data needed for radioactive source term calculations for Boiling Water Reactors. General data needed for calculation of the radioactive source term is provided in DCD Sections 11.1, 11.2, and 11.3. Additional information on condensate demineralization and condensate and gland seal air removal systems is provided

in DCD Sections 10.4.6 and 10.4.3, respectively. The ESBWR DCD concluded that the ESBWR conforms to Regulatory Guide 1.112 as shown in DCD Table 1.9-21 (Reference 3.5-1). There are no site-specific parameters that change that conclusion.

3.5.2 Radioactive Waste Management Systems

3.5.2.1 Liquid Waste Management System

Liquid radioactive wastes originate from minor leaks or drainage of equipment containing water contaminated with radioactivity. The Liquid Waste Management System (LWMS) collects, processes, and disposes of liquid radioactive wastes; and collects and transfers to the Solid Waste Management System (SWMS) certain solid wastes that are produced during shutdown, startup, and normal plant operation. Inputs to the LWMS from operational occurrences are listed in DCD Table 11.2-4 and are depicted in a block diagram on DCD Figure 11.2-2. This diagram also provides cross-reference to DCD sections which discuss the systems generating the influent streams. Decontamination factors for the various subsystems of the LWMS are provided in DCD Table 11.2-3. Tank, pump, and mobile systems capacities of the LWMS are provided in DCD Tables 11.2-2a, 11.2-2b, and 11.2-2c. A process diagram of the LWMS is provided on DCD Figure 11.2-1. Piping and instrumentation diagrams are provided for the LWMS drainage subsystems on DCD Figures 11.2-1a, 11.2-1b, 11.2-3, and 11.2-4.

Radioactive releases from the LWMS are discharged to the CIRC. Prior to discharging to the environment, the contents of the tank being released are sampled and analyzed to ensure that the activity concentration is consistent with the discharge criteria of 10 CFR 20 and the dose commitment in 10 CFR 50, Appendix I are met. A radiation monitor provides an automatic closure signal to the discharge line isolation valve. The effluent is eventually released to the environment through blowdown of the CIRC. The CIRC blowdown is discharged to Lake Erie through a single outfall monitored for radioactivity. FSAR Section 11.5 describes the Process Radiation Monitoring System (PRMS) in further detail.

The bounding annualized liquid effluent release for Fermi 3 is shown in DCD Table 12.2-19b. The parameters used for determining the release characteristics are shown in DCD Table 12.2-19a. The resulting bounding annualized release was used in determining the radiological impacts of operation. This analysis, resulting impact determinations, and evaluation showing conformance with 10 CFR 50, Appendix I design objectives are described in more detail in Section 5.4.

3.5.2.2 Gaseous Waste Management System

Radioactive waste products in the form of gases or airborne particles can be released to the environment by the ventilation systems or by other waste gas processing and handling systems. The Gaseous Waste Management System (GWMS) processes and controls the release of gaseous radioactive effluents to the environs. The GWMS is described in DCD Section 11.3.

The two main sources of plant gaseous radioactive effluents are building heating, ventilation, and air conditioning (HVAC) systems, described in DCD Section 9.4, and the Offgas System (OGS), described in DCD Section 11.3.2 and DCD Figure 11.3-1. The Fuel Building, Radwaste Building, Turbine Building, and Reactor Building HVAC systems are potential sources of radioactive gaseous effluents. The wastes discharged to the OGS during normal operation include radiolytic hydrogen and oxygen, power cycle injected gases and air in-leakage, and radioactive isotopes of krypton, xenon, iodine, nitrogen, and oxygen.

DCD Section 9.4 describes the building HVAC systems servicing the Fuel Building, Turbine Building, Radwaste Building, and Reactor Building, and includes process diagrams for each system. Detailed discussion of the potential sources of airborne activity to each of these systems is provided in DCD Section 12.2.3. This includes information on airborne sources from the fuel pool resulting from refueling activities.

During periods of high radioactivity, the Reactor Building and Fuel Building HVAC systems may direct exhaust to the Reactor Building HVAC purge exhaust filter unit. The Reactor Building purge exhaust filter units are equipped with prefilters, high efficiency particulate air (HEPA) filters and carbon filters for mitigating and controlling gaseous effluents from the Reactor Building or Fuel Building. DCD Table 9.4-11 provides design information for the Reactor Building purge exhaust filter units. The exhaust air is monitored for radiation prior to discharge to atmosphere through the RB/FB stack.

The Radwaste Building HVAC system directs exhaust air to exhaust filtration units. The system uses HEPA filtration of the exhaust air from the building prior to discharge to the atmosphere. The exhaust air is monitored for radiation prior to discharge to atmosphere through the RW stack. DCD Table 9.4-7 provides design information for the Radwaste Building HVAC system.

The Turbine Building HVAC system directs building exhaust air to filtration units. Exhaust air from low potential contamination areas is exhausted to the TB stack, where it is monitored for radioactive contamination. Exhaust air from high potential contamination areas is filtered using HEPA filters before being exhausted to the TB stack. Areas with high potential contamination have exhaust subsystems equipped with HEPA filtration units for localized air cleanup prior to mixing with the main ventilation exhaust. The Turbine Building combined ventilation exhaust is monitored for halogens, particulates and noble gas releases. Turbine Building exhaust air is directed to the TB stack where it is monitored for radiation prior to being discharged to the atmosphere.

Process radiation monitoring is provided for the systems described above. FSAR Section 11.5 describes the PRMS in further detail.

The bounding annualized airborne radioactivity source terms for Fermi 3 are shown in DCD Table 12.2-16 as supplemented by FSARTable 12.2-206. The parameters used for determining the release characteristics are shown in FSAR Table 12.2-15R. The resulting bounding annualized release was used in determining the radiological impacts of operation. This analysis, resulting impact determinations, and evaluation showing conformance with 10 CFR 50, Appendix I design objectives are described in more detail in Section 5.4.

3.5.2.3 **Solid Waste Management System**

Certain amounts of radioactive materials are generated in solid form. The Solid Waste Management System (SWMS) collects, processes, packages, and temporarily stores these solid radioactive wastes for offsite shipment and permanent disposal.

The SWMS controls, collects, handles, processes, packages, and temporarily stores solid waste generated by the plant prior to shipping the waste offsite. These wastes include filter backwash sludge, reverse-osmosis concentrates, and bead resins generated by the LWMS, reactor water cleanup/shutdown cooling system, fuel and auxiliary pools cooling system and the condensate purification system. Contaminated solids such as HEPA and cartridge filters, rags, plastic, paper, clothing, tools, and equipment are also disposed of in the SWMS. Liquids generated by the SWMS are processed through the LWMS described in Subsection 3.5.2.1.

The SWMS processes and components are described in FSAR Section 11.4. FSAR Table 11.4-1R provides SWMS component capacities. FSAR Table 11.4-2R provides estimates of annual waste generation and shipped volumes of dry active, wet solid and mixed wastes. FSAR Figure 11.4-1R and FSAR Figure 11.4-2R and DCD Figure 11.4-3 provide process and instrumentation diagrams for the SWMS.

The SWMS provides storage space sized to hold the total combined volume of 3 months of packaged Class A and 10 years of packaged Class B/C low-level radioactive waste estimated to be generated during plant operations. Such waste is normally promptly disposed of at licensed offsite processing and disposal facilities. The only operating disposal sites that presently accept Class B and C waste are in Richland, Washington, and Barnwell, South Carolina. However, neither of these facilities currently accepts Class B and C waste from outside the Northwest, Rocky Mountain and Atlantic LLRW compacts. A recently-licensed site in Andrews County, Texas, if opened, will, at least initially, only accept waste from Texas and Vermont, which are members of a prearranged compact. Michigan is not currently affiliated with any compact.

Additional waste minimization measures could be implemented to reduce or eliminate the generation of Class B and C waste, with the potential to greatly extend the planned 10 year storage capacity to the entire volume of Class B/C low-level radioactive waste. These measures could include reducing the service run length for resin beds, short loading media volumes in ion exchange vessels, and other techniques discussed in the EPRI Class B/C Waste Reduction Guide (Nov. 2007) and EPRI Operational Strategies to Reduce Class B/C Wastes (April 2007). As noted above, without crediting these waste minimization measures, the Radwaste Building provides 10 years capacity for storing Class B and C waste. This provides time for offsite disposal capability to be developed or additional onsite capacity to be added. Continued storage of Class B and C waste in the SWMS would be in accordance with procedures that will maintain occupational exposures within permissible limits and result in no additional environmental impacts.

If additional storage capacity for Class B and C LLRW is required, Fermi 3 could elect to construct a new temporary storage facility. The facility would meet applicable NRC guidance, including Appendix 11.4-A of the Standard Review Plan, "Design Guidance for Temporary Storage of Low-Level Waste." Such a facility would be located in a previously disturbed area in the vicinity of the power block, and in a location that would not affect wetlands. The environmental impacts of constructing such a facility would be minimal. The operation of a storage facility meeting the standards in Appendix 11.4-A would provide appropriate protection against releases, maintain exposures to workers and the public below applicable limits, and result in no significant environmental impact.

In lieu of onsite storage, Fermi 3 could enter into a commercial agreement with a third-party contractor that will process, store, own, and ultimately dispose of low-level waste generated as a result of Fermi 3 operations. Activities associated with the transportation, processing, and ultimate disposal of low level waste by the third-party contractor would necessarily comply with all applicable laws and regulations in order to assure public health and safety and protection of the environment. In particular, the third-party contractor would conduct its operations consistent with applicable Agreement State or NRC regulations (e.g., 10 CFR Part 20), which will assure that the radiological impacts from these activities would be small. Environmental impacts resulting from management of low-level wastes are expected to be bounded by the NRC's findings in 10 CFR 51.51(b) (Table S-3). Table S-3 assumes that solid, low-level waste from reactors will be disposed of through shallow land burial, and concludes that this kind of disposal will not result in the release of any significant effluent to the environment.

3.5.2.4 **Population Doses**

Population doses offsite were determined for airborne and liquid release pathways. A detailed discussion of the calculation methods and inputs is provided in Section 5.4.

Results of the analysis and conformance with 10 CFR 20 and 10 CFR 50, including the design objectives of 10 CFR 50, Appendix I are provided in Section 5.4.

3.5.3 **References**

3.5-1 GE-Hitachi Nuclear Energy, "ESBWR Design Control Document – Tier 2," Rev 7, March 2010.

3.5-2 ANSI/ANS 18.1, "Source Term Specification," 1976.

3.5-3 EPRI Class B/C Waste Reduction Guide (November 2007).

3.5-4 EPRI Operational Strategies to Reduce Class B/C Wastes (April 2007).

3.6 Nonradioactive Waste Systems

The nonradioactive waste from Fermi 3 is discussed in this section. Subsection 3.6.1 describes effluent wastes expected from the CIRC, PSWS, PWS, various drains within the plant, and other miscellaneous gaseous, liquid and solid effluents. The effluent from the SWDS is discussed in Subsection 3.6.2. Subsection 3.6.3 discusses other effluent streams from Fermi 3, including gaseous effluents, stormwater, various plant drains, and other waste.

3.6.1 Effluents Containing Chemicals or Biocides

This subsection discusses the CIRC, PSWS, PWS, and other chemically treated systems, and for completeness, the FPS. The flows associated with these systems are outlined on Figure 3.3-1. Effluent flow from the Fermi site must remain within the limits outlined by the NPDES permit, or other appropriate limits as specified by the Michigan Department of Environmental Quality. As discussed in Section 1.2, permits, e.g., NPDES permit and Section 401 Water Quality Certification, will be obtained for the discharge from Fermi 3.

There are four categories of water treatment chemicals: biocide, algaecide, corrosion inhibitor, and scale inhibitor. Specific chemicals anticipated to be used are determined by site specific water conditions, based on a conservative determination. The amount of chemicals added per year in pounds is outlined in Table 3.6-1. Effluent chemical constituents from Fermi 3 are shown in Table 3.6-2. Values specified in the Fermi 2 NPDES permit include Total Suspended Solids (TSS) and Total Residual Chlorine (TRC). The TSS specified in the permit is 100 ppm as a daily maximum; the maximum concentration discharged from Fermi 3 (Table 3.6-2) is 15.9 ppm, well within acceptable permitting limits. The TRC specified in the NPDES permit is 38 ppb or less, the amount discharged from Fermi 3 is zero. The addition of sodium hypochlorite does introduce chlorine into the water; however the addition of sodium bisulfite nullifies the presence of the chlorine. Regardless of the water systems' sources or constituents, each constituent discharged to the environment would be limited (i.e., volume and concentration) by the NPDES permit as discussed in Section 6.6.

The main body of water that receives effluent from Fermi 3 is Lake Erie. There is one discharge from Fermi 3 that includes the blowdown from the CIRC and PSWS, as well as optional treated liquid radwaste discharge. Effluent from these sources is in liquid form; no sludge disposal is necessary from these systems. The location and other details pertaining to this discharge into Lake Erie are discussed in Subsection 3.4.2.2.

In addition to the liquid discharge paths, discharge of some chemical constituents will be entrained in the fallout from the spray from the CIRC and PSWS Cooling Towers. This effect is discussed in Subsection 5.3.3.1.

The current status of the water quality in Lake Erie, as well as other water sources in proximity to the plant, is discussed in Subsection 2.3.3. The ecology of Fermi 3 is discussed in Section 2.4. Ecology is of particular importance due to the prevalence of zebra mussels in Lake Erie. They present an additional need for the use of biocides such as sodium hypochlorite.

3.6.1.1 **Circulating Water System**

The chemical treatment of the CIRC is discussed in Subsection 3.3.2.2 and Table 3.3-1. This system is treated with a biocide, algaecide, corrosion inhibitor, and scale inhibitor. The blowdown from the CIRC is also treated with dehalogenation. The effluent from the CIRC is discharged to Lake Erie, as described in Subsection 3.4.2.2.

The CIRC operates on two cycles of concentration under normal full power operating conditions; additional operating parameters of the CIRC are discussed in Subsection 3.4.1.1. Effluent chemical constituents discharged in the blowdown from the CIRC are shown in Table 3.6-2.

3.6.1.2 **Plant Service Water System**

The chemical treatment of the PSWS is discussed in Subsection 3.3.2.3 and Table 3.3-1. This system is treated with a biocide, algaecide, corrosion inhibitor, and scale inhibitor. The effluent from the PSWS is discharged to Lake Erie. Chemical constituents discharged in the effluent from the PSWS are shown in Table 3.6-2.

3.6.1.3 **Potable Water System**

The operation of the PWS is designed to supply water for domestic use and human consumption to Fermi 3. The source of the PWS is the Frenchtown Township Municipal Water System, and any chemicals present in the water are those added by the Frenchtown Township Water Treatment Facility. The water is treated to meet applicable drinking water standards; no additional onsite treatment is provided. The water is discharged to the SWDS which is routed offsite to the Frenchtown Township Sewage Treatment Facility.

3.6.1.4 **Fire Protection System**

The FPS receives no additional chemical treatment (makeup to the FPS is discussed in Subsection 3.3.1.6) and does not normally discharge any liquid effluent.

3.6.2 **Sanitary System Effluents**

This subsection discusses the sanitary waste systems effluent, including quantities and treatment of the waste products, during construction and operation of the plant.

Sanitary waste systems needed at Fermi 3 during construction activities include portable toilets supplied and serviced by an offsite vendor. There is no sanitary waste system discharge into the effluent stream.

Permanent SWDS components at Fermi 3 include waste basin, wet well, septic tank, settling tank, wet well pumps, sewage discharge pumps and associated valves, piping, and controls. The SWDS is discussed in FSAR Subsection 9.2.4. The system is designed to accommodate 60 gallons/day/person for up to 840 people during normal power operation and 1140 people during shutdown operation. This design condition drives the flow values that are outlined on Figure 3.3-1.

In addition to sanitary waste generated by domestic uses, the demineralized water waste and effluent from the auxiliary boiler are also routed to the SWDS.

The effluent of the SWDS is sewage that is pumped from the septic tank to the Frenchtown Township Sewage Treatment Facility for ultimate disposal. The SWDS does not come into contact with any systems that may contain radioactive waste; however measures are in place to ensure that no radioactive waste could be transmitted offsite. Since the effluent from the SWDS is routed to a waste treatment facility, and not discharged to the environment, it is not necessary for the effluent to meet NPDES permit requirements. It is, however, necessary to meet the limits outlined in the Industrial/Non-domestic User Discharge permit with the Frenchtown Township Sewage Treatment Facility. Chemical treatments applied to the waste are those within the Frenchtown Township Sewage Treatment Facility, in keeping with the municipal sewage treatment standards. Further discussion of the chemical treatment of the SWDS can be found in Subsection 3.3.2.4.

3.6.3 **Other Effluents**

This subsection discusses miscellaneous solid, liquid and gaseous effluents not addressed in Subsection 3.6.1 or Subsection 3.6.2. Gaseous effluents consist of exhaust from diesel generators, diesel-driven fire pumps, and the auxiliary boiler system (Aux Boiler). Stormwater, various plant drains, and other wastes are also discussed in the following subsections.

3.6.3.1 **Gaseous Effluents**

There are four main sources of gaseous nonradioactive effluent at Fermi 3, the standby diesel generators (SDG), ancillary diesel generators (ADG), Aux Boiler, and the diesel-driven fire pumps. The applicable regulations, permits, and consultation required by Federal, State, regional, and potentially affected Native American tribal agencies are addressed in Section 1.2. Proper maintenance and operating procedures, described in FSAR Section 13.5, assure that emissions are controlled consistent with system design to meet the standards from Section 1.2.

There are two 17.1 MW SDGs that are expected to operate approximately four hours per month for each engine. The proposed SDG for Fermi 3 will meet emission standards for owners and operators listed in 40 CFR 60.4205 at the time of purchase. Emission standards for stationary compression ignition internal combustion engines with a cylinder displacement greater than 30 liters per cylinder are displayed in Table 3.6-3. The non-road diesel fuel used to operate the two SDGs will also be required by 40 CFR 80.510 to meet sulfur content levels of 15 ppm effective June 1, 2010.

There are two 1650 kW ADGs that are expected to operate for approximately two hours every three months, for an annual total of 8 hours of operation for each engine. The manufacturers of the ADGs proposed for Fermi 3 will be required to meet emission standards listed in Table 1 of 40 CFR 1039.101 at the time of purchase. Tier 4 emission standards for compression ignition internal combustion engines manufactured after the model year 2014 with a rating greater than 560 kW are displayed in Table 3.6-4. The non-road diesel fuel used to operate the two ADGs will also be required by 40 CFR 80.510 to meet sulfur content levels of 15 ppm effective June 1, 2010.

Fermi 3 has one package Aux Boiler, rated at 50 tons of steam per hour (112 MBTU/hr or about 33 MW). The maximum expected operation on an annual basis is 30 days. Emissions are shown in Table 3.6-5, based on ASTM D-975 No. 2 fuel oil (Reference 3.6-1).

The fourth source of emissions at Fermi 3 are the two diesel-driven fire pumps. Each pump is approximately 200 kW and is expected to operate approximately 48 hours annually. The manufacturers of diesel-driven fire pumps proposed for Fermi 3 will be required to meet emission standards listed in Table 4 to Subpart IIII of Part 60.4202(d) at the time of purchase. Emission standards for stationary compression ignition internal combustion engines that are fire pumps with a maximum engine rating of 200 kW manufactured after 2009 are displayed in Table 3.6-6. The non-road diesel fuel used to operate the two fire pumps will also be required by 40 CFR 80.510 to meet sulfur content levels of 15 ppm effective on June 1, 2010.

In addition to the gaseous effluents emitted from the aforementioned combustion sources, a natural draft cooling tower (NDCT) and two 4-cell mechanical draft cooling towers (MDCT) will emit solid particulates. The emission estimates of particulate matter for particle sizes of 10 and 2.5 microns (PM_{10} and $PM_{2.5}$) from the operation of the proposed NDCT and 4-cell MDCTs are displayed in Table 3.6-7 along with design parameters that were used to derive the emission estimates. It is conservatively assumed that the $PM_{2.5}$ emissions are the same as the PM_{10} emissions from the cooling towers. The drift rates for the NDCT and 4-cell MDCTs are based on the values provided by the associated manufacturers of each cooling tower. The water flow rate to the NDCT, as specified in Figure 3.3-1, will be supplied at a maximum rate of 724,000 gallons per minute (gpm). The water from the basin of the NDCT will supply the makeup water to the 4-cell MDCTs at a maximum flow rate of 40,000 gpm. Section 5.3.3.1 states that the makeup water for the NDCT is expected to have a total dissolved solids (TDS) concentration of 420 parts per million (ppm) or 0.00042 grams of salt per gram of solution. The makeup water for the 4-cell MDCTs will be supplied from the NDCT basin; therefore, the TDS concentration for the 4-cell MDCTs is also expected to be 420 ppm. The emission rate (lb/hr) for particulates emitted from the cooling towers can be calculated by taking the product of the water flow rate, weight of one gallon of water, drift rate, and TDS concentration.

For the purpose of providing a maximum bounded value for the emissions of particulates from the cooling towers, the calculations in Table 3.6-7 were developed for the operation of both the NDCT and 4-cell MDCTs simultaneously for an entire year at the maximum water flow rate. While this likely overestimates the emissions of PM_{10} and $PM_{2.5}$ from the operation of the NDCT and 4-cell MDCTs, it provides a maximum value for the assessment of impacts from the operation of the cooling towers. Therefore, the maximum hourly and annual emissions of PM_{10} and $PM_{2.5}$ from the simultaneous operation of the NDCT and 4-cell MDCTs are expected to be 1.93 lb/hr and 8.47 tons/year, respectively.

Stationary combustion sources proposed for the operation of Fermi 3 will emit carbon dioxide (CO_2). The following provides the estimated CO_2 emissions and calculation methodology for the proposed standby diesel generators, ancillary diesel generators, diesel-driven fire pumps, and auxiliary boiler.

Standby and Ancillary Diesel Generators and Diesel-Driven Fire Pumps

In order to estimate the annual emissions of CO_2 for the proposed standby diesel generators, ancillary diesel generators, and diesel-driven fire pumps, emission factors were obtained from Tables 3.3-1 and Table 3.4-1 of Reference 3.6-2. The total annual emissions of CO_2 emitted from the standby diesel generators, ancillary diesel generators, and diesel-driven fire pumps is calculated by taking the product of the emission factor, number of units, annual operating hours, and engine power rating.

Auxiliary Boiler

The estimated annual emissions of CO_2 from the proposed auxiliary boiler is calculated by taking the product of the emission factor, heat input, and the annual operating hours. The CO_2 emission factor for the auxiliary boiler is 22,300 lb/10^3 gal as displayed in Table 1.3-12 of Reference 3.6-2. Dividing the emission factor (22,300 lb/10^3 gal) by the heating value of fuel oil (140 MBtu/10^3 gal), the emission factor becomes 159.29 lb/MBtu. The heat input of the boiler is 112 MBtu/hr.

Table 3.6-6-(A) provides the emission rates and estimated annual emissions of CO_2 for each stationary source proposed for Fermi 3. Therefore, the estimated annual emission of CO_2 from stationary sources during the operation of Fermi 3 is 7,734 tons per year.

3.6.3.2 Stormwater

Stormwater, specifically flood and probable maximum flood (PMF) are discussed in FSAR Subsection 2.4.2 and FSAR Subsection 2.4.3. Stormwater from the Fermi 3 site drains to the North and South Lagoons, which are located north and south of the site respectively. Stormwater construction and operational impacts are discussed in Chapter 4 and Chapter 5.

3.6.3.3 Various Plant Drains

There are several drains at Fermi 3 including: equipment drains, floor drains, laundry and chemical drains, and other miscellaneous periodic drains. These drains are treated and the treated effluent joins the discharge from the CIRC and PSWS to be discharged to Lake Erie. Waste from the various plant drains that cannot be treated for onsite discharge are routed for handling as hazardous waste.

3.6.3.4 Other Waste

Low level mixed waste (LLMW) contains hazardous waste and a low-level radioactive source, special nuclear, or byproduct material. Hazardous waste is not necessarily LLMW; LLMW only includes hazardous waste that has been exposed to radioactive contamination. Section 5.5 provides a more detailed discussion of the environmental impacts that could result from the operation of the non-radioactive waste systems and the storage and disposal of mixed wastes.

A summary of the hazardous waste generated at Fermi 2 for several years is shown in Table 3.6-8. Some examples of LLMW generated at Fermi 2 include:

- Industrial oils and laboratory waste
- Rags/wipes
- Lead products
- Mercury products

Federal regulations governing generation, management, handling, storage, treatment, disposal and protection requirements concerning LLMW are contained in 10 CFR 10 and 10 CFR 40. Additional discussion of guidelines and standards pertaining to waste disposal is found in Section 1.2. Treatment of LLMW from Fermi 3 is handled in a similar manner as that of Fermi 2, with eventual offsite transportation and disposal by properly licensed organizations. Fermi 2 is a Small Quantity Generator, as Fermi 3 will likely be. Further discussion of LLMW is provided in Section 5.5.

Universal waste is also disposed of properly at Fermi 3. Universal waste includes:

- Batteries
- Light bulbs
- Computer monitors and equipment

Handling of universal waste is done in accordance with State of Michigan regulations, with eventual offsite disposal by a properly permitted organization. Additional discussion of guidelines and standards pertaining to waste disposal is found in Section 1.2. When possible, materials are recycled with the proper facilities.

Fermi 2 practices recycling when possible; Fermi 3 also recycles. Examples of items recycled from the Fermi site include:

- Batteries
- Circuit Boards
- Recyclable lead

Used oil is also recycled. The used oil program in use at Fermi 2 will be similarly implemented with Fermi 3. In this program the used oil from site is sent to St. Clair power station for power generation.

In addition to mixed waste and universal waste, another form of waste that must be handled at Fermi 3 is the waste that is disposed of from trash racks and traveling water screens. The trash racks and traveling water screens of the SWS pumps are discussed in Subsection 3.4.2.1. Once the racks and screens are cleaned and the trash is present in the trash cart or trash basket, it is necessary to dispose of the waste. This waste is disposed of offsite.

3.6.4 **References**

3.6-1 “Standard Specification for Diesel Fuel Oils,” ASTM D 975, American Society of Testing and Materials, Philadelphia, PA, 2007.

3.6-2 U.S. Environmental Protection Agency (USEPA), “Compilation of Air Pollutant Emission Factors (AP-42),” Fifth Edition, Vol. I., Tables 1.3-1, 1.3-12, 3.3-1, and 3.4-1, October 1996.

Table 3.6-1 Chemicals Added to Liquid Effluent Streams

System	Chemical	Maximum Amount	Average Amount	Frequency of Use	Concentration in Waste Streams
CIRC/ SWS	Biocide/Algaecide - Sodium Hypochlorite (15%)	620,000 lb/year	620,000 lb/year	Approximately 4.5 hour/week	Non-detectable, neutralized by sodium bisulfite TRC < 38ppb*
CIRC	Corrosion Inhibitor – Sodium Silicate	1,700,000 lb/year	1,400,000 lb/year	Continuous	Non-detectable, dissociates in system
CIRC	Scale Inhibitor/Dispersant	830,000 lb/year	700,000 lb/year	Continuous	Non-detectable, dissociates in system
CIRC	Dehalogenation – Sodium Bisulfite	650,000 lb/year	550,000 lb/year	Continuous	Non-detectable, neutralizes sodium hypochlorite

*Fermi 2 NPDES permit

Table 3.6-2 Effluent Chemical Constituents*

Ion/Chemical	As	Max Conc. (ppm)	Avg Conc. (ppm)
Sodium	Na	46.6	34.3
Calcium	Ca	71.9	71.9
Magnesium	Mg	17.4	17.4
Silica	SiO_2	19.9	19.5
Chloride	Cl	61.3	42.5
Sulphate	SO_4	38.5	38.5
Potassium	K	3.6	3.6
Scale Inhibitor/Dispersant	Chemical	11.6	11.6
Bicarbonate Alk.	$CaCO_3$	167.8	167.7
TDS	-	428.5	397.4
TSS	-	16.0	16.0

*Based on 2 cycles of concentration

Table 3.6-3 Standby Diesel Generators

	Emission per SDG* (g/kWh)	Annual Emissions per SDG (lb)
Particulates	0.15	271.4
Sulfur dioxide**		
Nitrogen oxides	1.6	2895.3

*Emission standards listed in 40 CFR60.4205

**Sulfur dioxide emissions will be controlled by the use of diesel fuel that meets CFR 80.510

Table 3.6-4 Ancillary Diesel Generators

	Emission per ADG* (g/kWh)	Annual Emissions per ADG (lb)
Particulates	0.03	0.87
Sulfur dioxide**		
Carbon monoxide	3.5	101.9
Hydrocarbons	0.19	5.5
Nitrogen oxides	0.67	19.5

*Emission standards listed in Table 1 of 40 CFR 1039.101

**Sulfur dioxide emissions will be controlled by the use of diesel fuel that meets 40 CFR 80.510

Table 3.6-5 Auxiliary Boiler System Emissions<

	Emission Factor (lb/MBtu)[(A)]	Annual Emissions (lb/year)
Particulates	0.014	1152
Sulfur Dioxide	0.002	136
Carbon Monoxide	0.036	2880
Hydrocarbons	0.002	145
Nitrogen Oxides	0.171	13824

Source A: Reference 3.6-2

Table 3.6-6 Diesel-Driven Fire Pump Emissions

	Emissions per Fire Pump* (g/kWh)	Annual Emissions per Fire Pump (lb)
Particulates	0.2	4.2
Sulfur Dioxide		
Carbon monoxide	3.5	74.1
Hydrocarbons+Nitrogen oxides	4.0	84.7

*Emission standards listed in Table 4 to Subpart IIII of Part 60 - Emission Standards for Stationary Fire Pump Engines referred in 40 CFR 60.4202(d)

**Sulfur dioxide emissions will be controlled by the use of diesel fuel that meets 40 CFR 80.510

Table 3.6-6-(A)Estimated Emissions of CO_2 from Operation of the Proposed Fermi 3 Stationary Sources

	Emission Factor Per Diesel Generator(A)	Annual Emissions (tons/year)
Standby Diesel Generators	705.28 g/kWh	1276.2
Ancillary Diesel Generators	705.28 g/kWh	20.5
Diesel Driven Fire Pumps	699.20 g/kWh	14.8
Auxiliary Boiler	159.29 lb/MBtu	6422.4
Total Estimated Emissions from Stationary Sources		7733.9

Source A: Reference 3.6-2

Table 3.6-7 Estimated Emissions of PM_{10} and $PM_{2.5}$ from Operation of the Proposed Femi 3 NDCT and 4-Cell MDCTs

	NDCT	4-Cell MDCTs
Drift Rate (%)	0.001	0.005
Water Flow Rate (gpm)	724,000	40,000
TDS Concentration (ppm)	420	420
Annual Hours of Operation	8760	8760
PM_{10}/$PM_{2.5}$ EmissionRate (lb/hr)	1.51	0.42
PM_{10}/$PM_{2.5}$ TotalAnnual Emissions (tons/year)	6.63	1.84

Table 3.6-8 Hazardous Waste Management (Fermi 2)

Hazardous Waste	2007 (lbs)	2006 (lbs)	2005 (lbs)
Paint Related Materials	43	1782	387
Oil /Solvent Waste	103	20	506
Fiber Wound Parts-Cleaner Filters	7	0	309
Vehicle Antifreeze - used	600	0	20
Munge-Blanchard & surface grinder/marble saw (B01-110)	180	0	210
Lead Paint/Contaminated Mat	0	80	120
Lead Contaminated rags/debris	45	0	405
Aerosol cans	692	70	1167
Leaking Lead-acid battery	0	75	0
Cutting Fluids	0	80	0
Sand Blast Grit	0	1222	0
Parts Cleaner Solvent	0	32	0
Total	**1670**	**3361**	**3136**

3.7 Power Transmission System

The Fermi 3 switchyard will be connected to the International Transmission Company (ITC*Transmission*) system by three 345 kV transmission lines. This new switchyard will be separate from the 345 kV and 120 kV switchyards feeding Fermi 2. The ITC*Transmission* system transfers power from power plants to local distribution systems. The ITC*Transmission* system also carries power resulting from transfers from power plants to loads across the Eastern Interconnection. (Reference 3.7-1) The 345 kV transmission system and associated corridors including the proposed route for Fermi 3 will be owned and operated by ITC*Transmission*. The applicant has no control over the construction or operation of the transmission system. The interconnection point is between Fermi 3 and the switchyard.

ITC*Transmission* operates within the Midwest Independent System Operator (Midwest ISO) regional reliability area, a Federal Energy Regulatory Commission (FERC) -approved regional transmission organization. As part of the Midwest ISO interconnection process, various studies and analyses are performed including feasibility and system impact studies. For the ITC*Transmission* service area, the Midwest ISO typically has ITC*Transmission* perform the studies and analyses. As part of these work activities, the Midwest ISO and ITC*Transmission* determine necessary upgrades to the transmission system. This process has been followed for the proposed connection of Fermi 3 to the ITC*Transmission* system.

ITC*Transmission* follows the applicable regulatory processes and approvals in order to implement changes to the transmission system. As discussed above, the interconnection studies are performed by ITC*Transmission*, including determining the routing for these new transmission lines. As part of this process, Detroit Edison is not involved in the evaluation or decision making for proposed changes to the transmission system or possible design. Accordingly, Detroit Edison cannot reasonably provide the transmission system detailed design information considered by ITC*Transmission*.

3.7.1 **Power Transmission System Configuration**

The output of Fermi 3 will be delivered to the switchyard through the unit main step-up transformers as described in FSAR Section 8.2 and Section 8.3. Fermi 3 will be connected to the switchyard by two overhead conductor circuits, one—the normal preferred power supply—feeds the unit's two unit auxiliary transformers (UAT) and the other—the alternate preferred power supply—feeds the unit's two reserve auxiliary transformers (RAT). The switchyard will be connected to ITC*Transmission* by three 345 kV transmission lines which are in turn connected to the Milan substation.

3.7.2 **Design Parameters**

Three new transmission lines and a separate switchyard will be needed for Fermi 3 per System Impact Study Report (MISO G867) performed by ITC*Transmission* (Reference 3.7-1). This study evaluated the connection of an additional 1563 MW to the system at the Fermi site. The new transmission lines and switchyard will be designed to prevent a common failure mode for all reasonable, postulated hazards. Without the new transmission lines, the study indicates that the full output of Fermi 3 contributes to post contingency overloads on the system, most notably at the points of interconnection on the 345 kV, 230 kV, and 120 kV portions of the system. The study also finds if Fermi 2 and Fermi 3 have switchyards tied together, that unstable conditions may arise. In addition to the new transmission lines and switchyard, upgrades to existing transmission (and possibly subtransmission) lines will be needed to facilitate the new generation on the system.

Transmission line and switchyard design will meet or exceed the requirements established in the National Electrical Safety Code (NESC) (Reference 3.7-2), which provides rules for electrical safety, electrical clearances, structural design loadings, and material strength factors. Modifications to the existing system will comply with relevant local, state, and industry standards including NESC and various American National Standards Institute/Institute of Electrical and Electronic Engineers, Inc. standards. The standards include the rules in Sections 23, 25, and 26 of the NESC.

3.7.3 **Construction Methods**

The Fermi 3 switchyard will be located approximately 3000 ft. to the west of the Fermi 3 reactor, and will be separate from the existing 345 kV and 120 kV switchyards utilized by Fermi 2.

The new transmission lines from the Fermi 3 switchyard will be 345 kV lines and will be located in existing corridors to the Milan substation.

The study performed by ITC*Transmission* indicated the use of towers, steel poles and/or combinations of these structures will be used in the construction of the new transmission lines. (Reference 3.7-1) The three 345 kV lines for Fermi 3 will run in a common corridor, with transmission lines for Fermi 2, to a point just east of I-75. From the intersection of this Fermi site corridor and I-75, the three Fermi-Milan lines will run west and north for approximately 12 miles in a corridor shared with other non-Fermi lines. From this point, all non-Fermi lines turn north and continue on to their respective destinations and the three Fermi-Milan lines will continue west for approximately 10 miles to the Milan substation.

3.7.4 **Transmission Line Noise**

There are two categories of electrical noise effects of power transmission lines: corona effect caused by electrical stresses at the conductor surface resulting in air ionization noise, and field effects caused by induction to objects in proximity to the conductors. The audible noise produced by corona effect and ground level electric field effect are the primary concerns.

Audible noise is typically at its maximum during or following rain or during fog. The maximum noise level is kept below the level which would result in a number of complaints (approximately 52.5 dB(A) per Reference 3.7-3) through the use of typical design standards to properly size conductors and specify corona-free hardware.

Ground level electric field effects of overhead power transmission lines relate to the possibility of exposure to electric discharges from objects in the line’s field. The likely range of maximum vertical electric field is 4-6 kV/m (Reference 3.7-3) for a 345 kV transmission line.

3.7.5 References

3.7-1 ITC*Transmission*, "System Impact Study Report (MISO G867)," Generation Interconnection in Monroe County, MI, July 21, 2008.

3.7-2 National Electric Safety Code, Institute of Electrical and Electronic Engineers, Inc., 2007.

3.7-3 Fink, D.G., and H.W. Beaty, eds., "Standard Handbook for Electrical Engineers," 13th ed., McGraw-Hill, New York, 1993.

3.8 Transportation of Radioactive Materials

This section addresses the transportation of radioactive materials associated with Fermi 3. Postulated accidents as a result of transporting radioactive materials are discussed in this section and in Section 7.4.

As required by 10 CFR 51.52, an environmental report prepared for the combined license stage of a light-water-cooled nuclear power reactor (LWR), and submitted after February 4, 1975, shall utilize Table S-4, "Environmental Impact of Transportation of Fuel and Waste To and From One Light-Water-Cooled Nuclear Power Reactor," and contain a statement concerning transportation of fuel and radioactive wastes to and from the reactor.

Table S-4 (as provided in 10 CFR 51.52(c) and repeated herein as Table 3.8-1) is a summary impact statement concerning transportation of fuel and radioactive wastes to and from a reactor. The table is divided into two categories of environmental considerations: normal conditions of transport and accidents in transport. The normal conditions of transport considerations are further divided into environmental impact, exposed population, and range of doses to exposed individuals per reference-reactor year. These conditions describe the environmental impacts of the heat of the fuel cask in transit, weight, and traffic density. Also the number and range of radioactive doses to transport workers and the general public are described.

The accidents in transport consideration are concerned with environmental risk from radiological effects and common nonradiological causes such as fatal and nonfatal injuries.

To indicate that Table S-4 adequately describes the environmental effects of the transportation of fuel and waste to and from the reactor, the reactor licensee must state that the reactor and this transportation either meet all of the conditions in paragraph (a) of 10 CFR 51.52 or all of the conditions in paragraph (b) of 10 CFR 51.52. Subparagraphs 10 CFR 51.52(a)(1) through (5) delineate specific conditions the reactor must meet to use Table S-4 as part of its environmental report. These conditions are reactor core thermal power, fuel form, fuel enrichment, fuel encapsulation, average fuel irradiation, time after discharge of irradiated fuel before shipment, mode of transport of unirradiated fuel, mode of transport for irradiated fuel, and mode of transport for radioactive waste other than irradiated fuel. There are two other conditions in Table S-4 that require that radioactive waste, with the exception of irradiated fuel, be packaged and in solid form. Table 3.8-2 was prepared to succinctly show the reference conditions along with the bounding values for the ESBWR reactor technology. Subparagraph 10 CFR 51.52(a)(6) states, "The environmental impacts of transportation of fuel and waste to and from the reactor, with respect to normal conditions of transport and possible accidents in transport, are as set forth in Summary Table S-4 in paragraph (c) of this section; and the values in the table represent the contribution of the transportation to the environmental costs of licensing the reactor."

Paragraph 10 CFR 51.52(b) states that reactors not meeting the conditions of 10 CFR 51.52(a) shall make a full description and detailed analysis of the environmental impacts for their reactor.

The ESBWR reactor design exceeds the conditions prescribed in 10 CFR 51.52 in three areas: 1) reactor power level; 2) fuel enrichment; and 3) average burnup.

3.8.1 Transportation of Unirradiated Fuel

In this subsection, the number and characteristics of shipments of unirradiated fuel to Fermi 3 are compared to the conditions described in 10 CFR 51.52. The details of the container designs, shipping procedures, and transportation routings would be in accordance with DOT (49 CFR 173 and 178) and NRC (10 CFR 71) regulations and depend on the requirements of the suppliers providing the fuel fabrication services.

The conditions specified in 10 CFR 51.52(a) that apply to unirradiated fuel include the following:

1. 1.The reactor has a core thermal power level not exceeding 3800 MWt;
2. The reactor fuel is in the form of sintered uranium dioxide pellets having a uranium 235 enrichment not exceeding 4 percent by weight, and the pellets are encapsulated in Zircaloy rods;
3. Unirradiated fuel is shipped to the reactor by truck.

Conditions (1) and (2) are not met by the ESBWR reactor design, while condition (3) is met since Fermi 3 plans to ship unirradiated fuel by truck. Since the ESBWR reactor design has a core thermal power of 4500 MWt and a fuel enrichment of 4.6 percent U-235, both exceeding the conditions specified in 10 CFR 51.52(a), a full description and detailed analysis is required.

Table 3.8-3 summarizes the number of truck shipments of unirradiated fuel. The table also normalizes the number of shipments to the electrical output for the reference reactor analyzed in WASH-1238. When normalized for electrical output, the number of truck shipments of unirradiated fuel for the ESBWR is less than the number of truck shipments estimated for the reference LWR.

In addition, 10 CFR 51.52(c) includes a condition that the truck shipments not exceed 73,000 lbs, as governed by Federal or State gross vehicle weight restrictions. All of the advanced reactor designs (including ESBWR) would meet this weight restriction for unirradiated fuel (Reference 3.8-2). Truck shipments from Fermi 3 will not exceed a gross vehicle weight of 73,000 lbs.

Finally, Table S-4 includes conditions related to radiological doses to transport workers and members of the public along transport routes. These doses are a function of the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time in transit (including travel time and stop time), and the number of shipments to which the individuals are exposed. Radiological impacts of transportation of unirradiated fuel are discussed in Subsection 3.8.5.

3.8.2 Transportation of Irradiated Fuel

In this subsection, the impact of transporting irradiated fuel from Fermi 3 to a potential high-level waste repository at Yucca Mountain, Nevada is considered. Radiological impacts of transportation of irradiated fuel are discusssed in Section 3.8.6 and Section 3.8.7.

3.8.2.1 **Core Thermal Power**

Paragraph 10 CFR 51.52(a)(1) requires that the reactor have a core thermal power level not exceeding 3800 megawatts. The ESBWR reactor power level is 4500 MWt. The higher rated core power level would typically indicate the need for more fuel and therefore more fuel shipments. This is not the case for the ESBWR due to the higher unit capacity and higher burnup for the reactors with the increased power level.

3.8.2.2 **Fuel Form**

Paragraph 10 CFR 51.52(a)(2) requires that the reactor fuel be in the form of sintered uranium dioxide (UO_2) pellets. The ESBWR technology utilizes the sintered UO_2 pellet fuel form. See DCD (Reference 3.8-3) for a description of the ESBWR fuel assembly.

3.8.2.3 **Fuel Enrichment**

Paragraph 10 CFR 51.52(a)(2) requires that the reactor fuel have a uranium-235 enrichment not exceeding 4 percent by weight. The ESBWR reactor design has a fuel enrichment of 4.6 percent U-235, which exceeds this requirement.

3.8.2.4 **Fuel Encapsulation**

Paragraph 10 CFR 51.52(a)(2) requires that the reactor fuel pellets be encapsulated in Zircaloy rods. The fuel design utilized in the ESBWR technology uses Zircaloy rods.

3.8.2.5 **Fuel Irradiation**

Paragraph 10 CFR 51.52(a)(3) requires that the average burnup is not to exceed 33,000 MWd/MTU. The ESBWR reactor design has an expected average burnup of 46,000 MWd/MTU, exceeding this requirement.

3.8.2.6 **Time after Discharge of Irradiated Fuel before Shipment**

Paragraph 10 CFR 51.52(a)(3) requires that no irradiated fuel assembly be shipped until at least 90 days after it is discharged from the reactor. Table S-4 assumes 150 days of decay time prior to shipment of any irradiated fuel assemblies. Five years is the minimum decay time expected before shipment of irradiated fuel assemblies, supported by two current practices. One is per contract with DOE, who has ultimate responsibility for the spent fuel. Five years is the minimum cooling time specified in 10 CFR 961, Appendix E. The other practice is that the NRC specifies five years as the minimum cooling period when they issue certificates of compliance for casks used for shipment of power reactor fuel (NUREG-1437, Addendum 1, pp 26). The ESBWR Fuel Building spent fuel storage pool is designed for a maximum storage capacity to accommodate the total number of irradiated fuel assemblies resulting from 10 calendar years of plant operation plus one full core offload of fuel assemblies (Reference 3.8-3).

Detailed information for the specific cask to be used for transportation of spent fuel from Fermi 3 is not available at this time because a specific design has not been selected. The heat load expected can be estimated using general information available in the literature. The INEEL evaluation (INEEL 2003, Reference 3.8-4) provides a range of decay heat values from 18 to 22 kW / MTU. The upper bound of this range is selected for the analysis as a bounding value. The heat load per cask is 1.8 MTU based on information developed by DOE (DOE 2002) For comparison, the value used in WASH-1238 for spent fuel loading was 0.5 MTU.

The estimated heat load for a shipping cask is calculated to be
39.6 kW / cask = 135,155 BTU/hr / cask

The 10 CFR 51.52 Table S-4 value for heat per cask in transit is less than 250,000 BTU/hr. The expected cask heat load for the Fermi spent fuel transportation of 135,155 BTU/hr meets the Table S-4 limit.

3.8.2.7 **Shipment of Irradiated Fuel**

Paragraph 10 CFR 51.52(a)(5) allows for truck, rail, or barge transport of irradiated fuel. The ESBWR vendor states either rail or truck shipment will be used. Detroit Edison plans to ship irradiated fuel by either rail or truck. Packaging of the fuel for offsite shipment would comply with applicable DOT (49 CFR 173 and 178) and NRC (10 CFR 71) regulations for transportation of radioactive material. The newer spent fuel shipping cask capacities are up to 1.8 MTU/shipment (Reference 3.8-2).

Table 3.8-4 summarizes the number of truck shipments of irradiated fuel. The table also normalizes the number of shipments to the electrical output for the reference reactor analyzed in WASH-1238.

3.8.3 **Transportation of Radioactive Waste**

As described in Subsection 3.5.2.3, low-level radioactive waste will be packaged using the SWMS to meet transportation and disposal site acceptance requirements. Radwaste processing systems operation procedures, which includes packaging of solid radwaste, are developed as discussed in FSAR Subsection 13.5.2.2.5. Packaging of waste for offsite shipment will comply with applicable DOT (49 CFR 173 and 178) and NRC (10 CFR 71) regulations for transportation of radioactive material. As described in Subsection 3.5.2.3 and FSAR Section 11.4, the packaged waste will be stored onsite on an interim basis before being shipped offsite to a licensed volume reduction facility or disposal site. As stated in 10 CFR 51.52(a)(4), “with the exception of irradiated fuel, all radioactive waste shipped from the reactor is packaged and in a solid form.”

Paragraph 10 CFR 51.52(a)(5) requires that the mode of transport of low-level radioactive waste is either truck or rail. Detroit Edison plans to ship low-level radioactive waste by rail or truck.

Truck shipments of radwaste are evaluated with a capacity of approximately 2.34 cubic meters per shipment for consistency with the Reference LWR evaluation. Table 3.8-5 presents estimates of annual waste volumes and numbers of truck shipments. The values are normalized to the reference LWR analyzed in WASH-1238.

Radioactive waste shipments are subject to a weight limitation of 73,000 pounds per truck and 100 tons per cask per rail car. Radioactive waste will be shipped in compliance with federal or state weight restrictions.

3.8.4 Non-radiological Transportation Impacts

Nonradiological impacts are calculated using accident, injury, and fatality rates from published sources. The rates (that is, impacts per vehicle-km traveled) are then multiplied by estimated travel distances for workers and materials. The general formula for calculating nonradiological impacts is as follows:

Impacts = (unit rate) x (round-trip shipping distance) x (annual number of shipments)

In this formula, impacts are presented in units of the number of accidents, number of injuries, and number of fatalities per year. Corresponding unit rates (impacts per vehicle-km traveled) are used in the calculations.

The general approach used in this document to calculate nonradiological impacts of unirradiated and spent fuel shipments is based on state-level accident, injury, and fatality statistics developed by Saricks and Tompkins (1999, Reference 3.8-5). The round-trip distances between the proposed Fermi 3 site and the fuel fabrication facility (assumed to be located in Wilmington, NC) and Yucca Mountain, Nevada provided the data for the last part of the equation. State-by-state shipping distances were obtained from the Web-TRAGIS (Johnson 2003, Reference 3.8-6) output file and combined with the annual number of shipments and accident, injury, and fatality rates by state (Reference 3.8-5), to calculate nonradiological impacts. For radioactive waste (non-fuel) a round trip distance of 1600 km was used, consistent with WASH-1238, along with national median accident, injury, and fatality rates. The round trip distances and accident, injury, and fatality rates per shipment are shown in Table 3.8-6. The results on an annual basis are shown in Table 3.8-7. The values presented in Table 3.8-7 were calculated from the values reported in Table 3.8-6 multiplied by the applicable number of shipments for unirradiated and spent fuel and for radioactive waste. Table 3.8-7 values were then compared to those reported in Table S-4 of 10 CFR 51.52. As shown in Table 3.8-7 the impacts are less than those from 10 CFR 51.52 Table S-4.

3.8.5 Transportation of Unirradiated Fuel – Incident Free Radiological Impacts

Table S-4 of 10 CFR 51.52 includes conditions related to radiological doses to transport workers and members of the public along transport routes. These doses, based on calculations in WASH-1238, are a function of the radiation dose rate emitted from the unirradiated fuel shipments, the number of exposed individuals and their locations relative to the shipment, the time of transit (including travel and stop times), and the number of shipments to which the individuals are exposed.

Calculation of worker and public doses associated with annual shipments of unirradiated fuel were performed using the RADTRAN 5 computer code (Sand 2008, Reference 3.8-7). One of the key assumptions in WASH-1238 for the reference LWR unirradiated fuel shipments is that the radiation dose rate at 1 meter from the transport vehicle is about 0.1 millirem/hr. This assumption is reasonable for the ESBWR because the fuel materials will be low-dose rate uranium radionuclides and will be packaged similarly (Reference 3.8-4). For unirradiated fuel shipments, highway routes were analyzed using the routing computer code TRAGIS Version 4.6.2 (Reference 3.8-6) and 2000 census data.

Routes were estimated by minimizing, as much as possible considering materials being transported, the total impedance of a route, which is a function of distance and driving time between the origin and destination. The TRAGIS computer code also can estimate routes that maximize the use of interstate highways. For unirradiated fuel the commercial route setting was used to generate highway routes generally used by commercial trucks. However, the routes chosen may not be the actual routes used in the future. The population summary module of the TRAGIS computer code was used to determine the exposed populations within 800 m (i.e., 0.5 mi, either side) of the route.

Unirradiated fuel was assumed to be shipped from Wilimington, NC. Summary data produced by the TRAGIS computer code are provided in Table 3.8-8 for unirradiated fuel. Other input parameters used in the radiation dose analysis for the ESBWR unirradiated fuel shipments are summarized in Table 3.8-8. The results for the unirradiated fuel shipment based on the RADTRAN 5 analyses are provided in Table 3.8-9.

Based on the parameters used in the analysis, these per-shipment doses are expected to conservatively estimate the impacts for fuel shipments. The per trip dose values were combined with the average annual number of shipments of unirradiated fuel to calculate annual doses to the public and workers for comparison to Table S-4 dose values.

The numbers of unirradiated fuel shipments were normalized to the reference reactor analyzed in WASH-1238. The numbers of shipments per year were obtained from Table 3.8-3. As shown in Table 3.8-9, the calculated radiation doses for transporting unirradiated fuel to the Fermi 3 site is bounded by Reference LWR dose values except for the crew annual dose. The radiological impacts from transportation of unirradiated fuel are less than the values in 10 CFR 51.52, Table S-4.

3.8.6 Transportation of Spent Fuel – Incident Free Radiological Impacts

This section provides the environmental impacts of transporting spent fuel from Fermi 3 (or alternative sites) to a spent fuel disposal facility using Yucca Mountain, Nevada as a possible location for a geologic repository. The impacts of the transportation of spent fuel to a possible repository in Nevada provides a reasonable bounding estimate of the transportation impacts to a monitored retrievable storage facility because of the distances involved and the representative exposure of members of the public in urban, suburban, and rural areas (NUREG-1817).

Incident-free transportation refers to transportation activities in which the shipments reach their destination without releasing any radioactive cargo to the environment. Impacts from these shipments will be from the low levels of radiation that penetrate the heavily shielded spent fuel shipping cask. Radiation doses will occur to (1) persons residing along the transportation corridors between Fermi 3 (or alternative sites) and the proposed repository; (2) persons in vehicles passing a spent fuel shipment; (3) persons at vehicle stops for refueling, rest, and vehicle inspections; and (4) transportation crew workers. The radiation doses are a function of many parameters, including vehicle speed, traffic count, dose rate at 1 m from the vehicle, packaging dimensions, number in the truck crew, stop time, and population density at stops.

This analysis is based on shipment of spent fuel by legal-weight trucks in casks with characteristics similar to casks currently available (i.e., massive, heavily shielded, cylindrical metal pressure vessels). Each shipment is assumed to consist of a single shipping cask loaded on a modified trailer.

The transportation route selected for a shipment determines the total potentially exposed population and the expected frequency of transportation-related accidents. For truck transportation, the route characteristics most important to the risk assessment include the total shipping distance between each origin-destination pair of sites and the population density along the route.

Routing and population data used in RADTRAN 5 for truck shipments were obtained from the TRAGIS computer code routing module (Reference 3.8-6). The population data in the TRAGIS computer code were based on the 2000 census. All spent fuel shipments will be transported by legal weight trucks to the potential Yucca Mountain site over designated highway route-controlled quantity (HRCQ) routes.

Representative shipment routes for Fermi 3 (or alternative sites) were identified using the TRAGIS computer code routing model (Reference 3.8-6) for the truck shipments. The Highway data network in the TRAGIS computer code is a computerized road atlas that includes a complete description of the interstate highway system and of all U.S. highways.

Other input parameters used in the radiation dose analysis for the ESBWR spent nuclear fuel shipments are summarized in Table 3.8-10. The results for the incident free spent fuel shipments are presented in Table 3.8-11.

The normalized annual shipments values from Table 3.8-4 and corresponding population dose estimates per reactor-year are presented in Table 3.8-11. The population doses were calculated by multiplying the number of spent fuel shipments per year by the per-shipment doses. The population doses based on normalized annual shipments are compared to Table S-4 limits in Table 3.8-11.

As shown in Table 3.8-11, and similar to the evaluation in NUREG-1817, population doses to the crew and onlookers for the ESBWR exceed Table S-4 values. One of the key reasons for these higher population doses relative to Table S-4 is the shipping distances assumed for these analyses relative to the assumptions used in WASH-1238. The analyses in WASH-1238 used a "typical" distance for a spent fuel shipment of 1609 km (1000 mi). The shipping distance used in this assessment was 3614 km.

As noted in NUREG-1817, another key reason for the higher population doses relative to Table S-4 are the higher number of fuel shipments assumed based on a shipment capacity of 0.5 MTU based on shorter-cooled fuel assemblies. Newer cask designs are based on longer-cooled spent fuel (5 years out of the reactor) and have larger capacities than those used in this evaluation. DOE (Reference 3.8-2) spent fuel shipping-cask capacities were approximately 1.8 MTU per shipment. Use of the newer shipping-cask designs will reduce the number of spent fuel shipments and the associated impacts.

Similar to NUREG-1817, other conservative assumptions in the spent fuel transportation impacts calculation include:

- The shipping casks assumed in the Yucca Mountain EIS transportation analyses were designed for spent fuel that has cooled for 5 years (Reference 3.8-2). In reality, most spent fuel will have cooled for much longer than 5 years before it is shipped to a possible geologic repository. The NRC developed a probabilistic distribution of dose rates based on fuel cooling times that indicates that approximately three-fourths of the spent fuel to be transported to a possible geologic repository will have dose rates less than half of the regulatory limit (Reference 3.8-8). Consequently, the estimated doses in Table 3.8-11 could be divided in half if more realistic dose rate projections are used for spent fuel shipments from the Fermi 3.
- Use of 30 minutes as the average time at a truck stop in the calculations is conservative. Many stops made for actual spent fuel shipments are short duration stops (i.e., 10 minutes or less) for brief visual inspections of the cargo (checking the cask tie-downs). Based on data for actual truck stops, the NRC concluded that the assumption of a 30 minute stop for every 4 hours of driving time used to evaluate other potential ESP sites will overestimate public doses at stops by at least a factor of two (NUREG-1817).

If the population doses were adjusted for the longer shipping distance and larger shipping cask capacity, the population doses from incident-free spent fuel transportation from the Fermi 3 and the alternative sites will fall within Table S-4 requirements.

The impact of accident free transportation of unirradiated and spent fuel will be SMALL and does not warrant additional mitigation.

3.8.7 Transportation of Spent Fuel – Accident Radiological Impacts

The RADTRAN 5 (Sand 2008) computer code is used to estimate impacts of transportation accidents involving spent fuel shipments from Fermi 3. RADTRAN 5 considers a spectrum of potential transportation accidents, ranging from those with high frequencies and low consequences to those with low frequencies and high consequences (i.e., accidents in which the shipping container is exposed to severe mechanical and thermal conditions). This analysis utilized 19 severity categories and their associated severity fractions and release fractions from NUREG-1817, Table H-12.

The NRC conducted a screening analysis on the inventories reported in an Idaho National Engineering and Environmental Laboratory document entitled, “Early Site Permit ER Sections and Supporting Documentation,” to select the dominant contributors to accident risks to simplify the RADTRAN 5 calculations (INEEL 2003). The screening identified the radionuclides that would contribute more than 99.999 percent of the dose from inhalation and the results are reported in NUREG-1817.

Radionuclide inventories are important parameters in the calculation of accident risks. The radionuclide inventories used in this analysis were provided by GEH and are represented in Table 3.8-12. The radionuclides selected for input to RADTRAN are consistent with those screened and used in NUREG-1817. Note that the values used in this analysis differ slightly than those used in NUREG-1817 but were provided in 2007 and are more recent than the INEEL 2003 information.

Transportation distances for spent fuel were developed using TRAGIS and are the same as those used for the evaluation of incident free transportation.

Massive shipping casks are used to transport spent fuel because of the radiation shielding and accident resistance required by 10 CFR 71. Spent fuel shipping casks must be certified Type B packaging systems. This requires that the cask be designed to withstand a series of severe hypothetical accident conditions with essentially no loss of containment or shielding capability.

According to Sprung et al. (NUREG/CR-6672), the probability of encountering accident conditions that would lead to shipping cask failure is less than 0.01 percent (i.e., more than 99.99 percent of all accidents would result in no release of radioactive material from the shipping cask). Shipping casks for advanced LWR spent fuel would provide equivalent mechanical and thermal protection of the spent fuel cargo as assumed in WASH-1238 because the shipping casks will be designed to meet the requirements of 10 CFR 71.

Consistent with NUREG-1817, using RADTRAN 5, the population dose from the released radioactive material was based on five possible exposure pathways:

1 External dose from exposure to the passing cloud of radioactive material.

2 External dose from the radionuclides deposited on the ground by the passing plume (this radiation exposure pathway is included even though the area surrounding a potential accidental release would be evacuated and decontaminated, thus preventing long-term exposures from this pathway).

3 Internal dose from inhalation of airborne radioactive contaminants.

4 Internal dose from resuspension of radioactive materials that were deposited on the ground (the radiation exposures from this pathway are included even though evacuation and decontamination of the area surrounding a potential accidental release would prevent long-term exposures).

5 Internal dose from ingestion of contaminated food (this pathway was not included because interdiction of foodstuffs and evacuation after an accident is assumed so no internal dose due to ingestion of contaminated foods was calculated).

A sixth pathway, external doses from increased radiation fields surrounding a shipping cask with damaged shielding, was considered but not included in the analysis. It is possible that shielding materials incorporated into the cask structures could become damaged as a result of an accident. However, the loss of shielding events is not included because this contribution to spent fuel transportation risk is much smaller than the dispersal accident risks from the pathways listed above.

The environmental consequences of transportation accidents due to shipping spent fuel from Fermi 3 to a spent fuel repository assumed to be at Yucca Mountain, Nevada were calculated. The shipping distances and population distribution information for the routes were the same as those used for the "incident-free" transportation impacts analysis.

Table 3.8-13 presents the accident risks associated with transportation of spent fuel from the proposed Fermi 3 site to the proposed Yucca Mountain repository. The accident risks are provided in the form of a unit collective population dose (i.e., person-rem per reactor year). The table also presents estimates of accident risk in terms of population dose per reactor year.

From NUREG-1817,

> Although radiation may cause cancers at high doses and high dose rates, currently there are no data that unequivocally establish the occurrence of cancer following exposure to low doses below about 100 mSv (10,000 mrem) and at low dose rates. However, radiation protection experts conservatively assume that any amount of radiation may pose some risk of causing cancer or a severe hereditary effect, and that the risk is higher for higher radiation exposures. Therefore, a linear, no-threshold dose response model is used to describe the relationship between radiation dose and detriments such as cancer induction. A recent report (National Research Council 2006), the BEIR VII report, supports the linear, no-threshold dose response theory. Simply put, this theory states that any increase in dose, no matter how small, results in an incremental increase in health risk. This theory is accepted by the NRC as a conservative model for estimating health risks from radiation exposure, recognizing that the model probably overestimates those risks.
>
> Based on this model, the staff estimates the risk to the public from radiation exposure using the nominal probability coefficient for total detriment – 730 fatal cancers, nonfatal cancers, and severe hereditary effects per 10,000 person-Sv (1,000,000 person-rem) – from International Commission on Radiological Protection Publication 60 (ICRP 1991).

The population dose presented in Table 3.8-13 is less than 1 x 10-3 person-rem per reference reactor year. Therefore, the total detriment estimates associated would be less than 1 x 10-6 fatal cancers, nonfatal cancers, and severe hereditary effects per reference reactor year. These risks are quite small compared to the fatal cancers, nonfatal cancers, and severe hereditary effects that would be expected to occur annually in the same population from exposure to natural sources of radiation.

3.8.8 **Alternate Sites**

The TRAGIS software was used to develop specific routes for the candidate sites identified in the Environmental Report, Section 9.3. Table 3.8-14 and Table 3.8-15 show the weighted population density and distances for each of the sites for unirradiated and irradiated fuel for comparison to the proposed site location.

The results show that the total population along the route for the alternative sites for unirradiated and spent fuel is greater for all of the alternative sites primarily due to the longer distances and the population around the Detroit metropolitan area. It is therefore reasonable to conclude that, given all other input parameters are the same, the radiological and accident impacts would be similar to the impacts identified for the selected Fermi-3 site or that impacts for alternate sites could be mitigated by avoiding the higher population areas around the Detroit metropolitan area.

3.8.9 **Conclusion**

The NRC evaluated the environmental impact and risk effects of transportation of fuel and waste for LWRs in WASH-1238, and in Supplement 1 of NUREG-75/038, Environmental Survey of

Transportation of Radioactive Materials to and from Nuclear Power Plants; and found the impacts to be small. These NRC analyses provided the basis for Table S-4 in 10 CFR 51.52.

The total truck traffic density for shipments of unirradiated fuel, irradiated fuel, and radioactive waste is the number of normalized annual shipments times two to account for incoming andoutgoing trucks. Based on the results presented in Table 3.8-3, Table 3.8-4, and Table 3.8-5, the annual normalized volume of trucks is expected to be 318 trucks annually (0.87 per day) and the traffic density is less than 1 truck per day. For comparison to the Reference LWR the Table S-4 traffic density is less than 1 truck per day.

The bounding cumulative doses to the exposed population, as given in Table S-4 of 10 CFR 51.52(c), are 0.04 person-Sv per reference-reactor year to transport workers, and 0.03 person-Sv per reference-reactor year to the general public (i.e., onlookers and persons along the route).

A site specific analysis was performed for the Fermi and alternate sites to evaluate the radiological and non-radiological impacts of transportation of radioactive materials. The overall transportation accident risks associated with unirradiated and spent fuel shipments are consistent with the transportation risks from current generation reactors presented in Table S-4 of 10 CFR 51.52. The conclusion given in Table S-4 that the radiological impacts associated with the transport of unirradiated fuel, irradiated fuel, and radioactive waste, is SMALL is also true for the transportation impacts from the Fermi 3 site or the alternative sites.

3.8.10 **References**

3.8-1 U.S. Nuclear Regulatory Commission, “Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants,” WASH-1238, December 1972.

3.8-2 U.S. Department of Energy, “Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada,” DOE/EIS-0250, Office of Civilian Radioactive Waste Management, Washington, D.C, 2002, http://www.ocrwm.doe.gov/ym_repository/seis/index.shtml, accessed 24 August 2008.

3.8-3 GE-Hitachi Nuclear Energy, “ESBWR Design Control Document – Tier 2,” Revision 6, August 2009.

3.8-4 Idaho National Engineering and Environmental Laboratory, “Early Site Permit ER Sections and Supporting Documentation,” INEEL Engineering Design File 3747, Revision 1, July 2003

3.8-5 Argonne National Laboratory Center for Transportation Research, “State-Level Accident Rates of Surface Freight Transportation: A Reexamination,” Saricks & Tompkins, ANL/ESD/TM-150, April 1999

3.8-6 Oak Ridge National Laboratories, “Transportation Routing Analysis Geographic Information System (TRAGIS) User’s Manual,” ORNL/NTRC-006, Revision 0, June 2003

3.8-7 Sandia National Laboratories, “RADCAT 2.3 User Guide,” SAND2006-6315, Revision 1, April 2008

3.8-8 U.S. Nuclear Regulatory Commission, “Reexamination of Spent Fuel Shipment Risk Estimates,” Sprung, et. al.,NUREG/CR-6672, 2000

Table 3.8-1 Summary Table S-4 – Environmental Impact of Transportation of Fuel and Waste To and From One Light-Water-Cooled Nuclear Power Reactor[1]

Normal Conditions of Transport

Condition	Value
Heat (per irradiated fuel cask in transit)	250,000 Btu/hr
Weight (governed by Federal or State restrictions)	73,000 lbs Per truck 100 tons per cask per rail car
Traffic density:	
Truck	Less than 1 per day
Rail	Less than 3 per month

Exposed Population	Estimated Number of Persons Exposed	Range of Doses to Exposed Individuals [2] (per reactor year)	Cumulative Dose to Exposed Population (per reactor year) [3]
Transport workers	200	0.01 to 300 millirem	4 man-rem
General public:			
Onlookers	1100	0.003 to 1.3 millirem	3 man-rem
Along Route	600,000	0.0001 to 0.06 millirem	

Accidents in Transport

Types of Effects	Environmental Risk
Radiological effects	Small [4]
Common (nonradiological) causes	1 fatal injury in 100 reactor years; 1 nonfatal injury in 10 reactor years; $475 property damage per reactor year

Notes:

1. Data supporting this table are given in the Commission's "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants," WASH-1238, December 1972, and Supp. 1 NUREG-75/038 April 1975.
2. The Federal Radiation Council has recommended that the radiation doses from all sources of radiation other than natural background and medical exposures should be limited to 5000 millirem per year for individuals as a result of occupational exposure and should be limited to 500 millirem per year for individuals in the general population. The dose to individuals due to average natural background radiation is about 130 millirem per year.
3. Man-rem is an expression for the summation of whole body doses to individuals in a group. Thus, if each member of a population group of 1000 people were to receive a dose of 0.001 rem (1 millirem), or if 2 people were to receive a dose of 0.5 rem (500 millirem) each, the total man-rem dose in each case would be 1 man-rem.

4. Although the environmental risk of radiological effects stemming from transportation accidents is currently incapable of being numerically quantified, the risk remains small regardless of whether it is being applied to a single reactor or a multi-reactor site.

Table 3.8-2 ESBWR Transportation Worksheet

Parameters	Table S-4 Condition (Reference Reactor) [1]	ESBWR (Single unit) (1500 MWe)
Reactor Characteristic:		
Reactor Power Level	Not exceeding 3800 MWt per reactor	4500 MWt
Fuel Form	Sintered UO_2 pellets	Sintered UO_2 pellets
U-235 Enrichment	Not exceeding 4%	Initial Core < 3.5%; Reload average < 4.6%
Fuel Rod Cladding	Zircaloy rods; 10 CFR 50.44 allows use of ZIRLO	Zircaloy
Average Burnup	Not exceeding 33,000 MWd	46,000 MWd/MTU
Unirradiated Fuel:		
Transport Mode	Truck	Truck
Irradiated Fuel:		
Transport Mode	Truck, rail or barge	Truck, rail
Decay Time Prior To Shipment	Not less than 90 days is a condition for use of Table S-4; 5 years is per contract with DOE	Five years
Radioactive Waste:		
Transport Mode	Truck or Rail	Truck
Waste Form	Solid	Solid
Packaged	Yes	Yes

Notes:

1. The Reference Reactor refers to a typical 1100 MWe light-water-cooled nuclear reactor as described in WASH-1238.

Table 3.8-3 Number of Truck Shipments of Unirradiated Fuel

Reactor Type	**Initial Core[(a)]**	**Annual reload**	**Total[(b)]**	**Unit electric Generation (MWe)[(c)]**	**Capacity Factor[(c)]**	**Normalized Shipments Total[(d)]**	**Normalized shipments Annual[(e)]**
Reference LWR	18[(f)]	6.0	252	1100	0.8	252	6.3
ESBWR	38[(g)]	7.91[(g)]	346	1594	0.93	205	5.1

Notes:

a. Shipments of the initial core have been rounded up to the next highest whole number.

b. Total shipments of unirradiated fuel over 40-year plant lifetime (initial core plus 39 years of average annual reload quantities).

c. Unit generating capacities from the ESBWR DCD and an assumed capacity factor consistent with ER 5.7.

d. Normalized to electric output for WASH-1238 reference plant (1100-MWe plant at 80 percent or an electrical output of 880 MWe).

e. Annual average for 40-year plant lifetime.

f. The initial core load for the reference boiling water reactor in WASH-1238 was 150 metric tons of uranium (MTU). The initial core load for the reference pressurized water reactor was 100 MTU. Both types result in 18 truck shipments of fresh fuel per reactor.

g. Initial core load of 1132 assemblies required and 474 assemblies per 2 years for refueling. Number of assemblies per shipment is 30.

Table 3.8-4 Number of Truck Shipments of Irradiated Fuel

Reactor Type	Annual Reload MTU	Annual Shipments [b]	Unit Electric Generation (MWe)[c]	Capacity Factor[c]	Normalized Shipments Annual[d]
Reference LWR	30	60	1100	0.8	60
ESBWR	34.1[a]	68.2	1594	0.93	39.5

Notes:

a. Based on reload of 68.197 MTU every two years.

b. Total shipments of irradiated fuel over 40-year plant lifetime (39 years of average annual reload quantities), 0.5 MTU per shipment.

c. Unit generating capacities from the ESBWR DCD and an assumed capacity factor consistent with ER 5.7.

d. Normalized to electric output for WASH-1238 reference plant (1100-MWe plant at 80 percent or an electrical output of 880 MWe).

Table 3.8-5 Number of Truck Shipments of Radioactive Waste

Reactor Type	**Annual Waste Shipped, m^3**	**Annual Shipments**[b]	**Unit Electric Generation (MWe)**[c]	**Capacity Factor**[c]	**Normalized Shipments Annual**[d]
Reference LWR	107.6	46	1100	0.8	46
ESBWR	448.8[a]	192	1594	0.93	114

Notes:

a. ESBWR DCD, Section 11.4, is 363 m^3 of dry active waste and 85.8 m^3 of wet solid waste.

b. WASH-1238, Table 8 reports 3800 ft^3/yr of solid wastes and a total of 46 shipments per year for solid waste. Amount per shipment is 82.61 ft^3 or 2.34 m^3.

c. Unit generating capacities from the DCD and an assumed capacity factor consistent with ER 5.7.

d. Normalized to electric output for WASH-1238 reference plant (1100-MWe plant at 80 percent or an electrical output of 880 MWe).

Table 3.8-6 Non-radiological Transportation Impacts - Accidents, Injuries, and Fatalities per Shipment, Round Trip

	Distance (km)	Accidents	Injuries	Fatalities
Unirradiated Fuel	2796	7.13E-04	6.07E-04	3.35E-05
Irradiated Fuel	7228	2.44E-03	1.50E-03	8.32E-05
Radioactive Waste	1600	5.34E-04	3.52E-04	2.08E-05

Table 3.8-7 Non-radiological Transportation Impacts - Accidents, Injuries, and Fatalities Annually

	Number of Trips (normalized)	Accidents/yr	Accident Cost/yr[(a)]	Injuries/yr	Fatalities/yr
Unirradiated Fuel	5.1	3.64E-03	$6.55	3.10E-03	1.71E-04
Irradiated Fuel	39.5	9.64E-02	$174	5.93E-02	3.29E-03
Radioactive Waste	114	6.09E-02	$110	4.01E-02	2.37E-03
Table S-4	-	-	$475	1.00E-01	1.00E-02

Notes:

a. Accident cost per year based on WASH-1238 cost per accident of $1800.

Table 3.8-8 RADTRAN 5 Input Parameters for Analysis of Unirradiated Fuel Shipments (Sheet 1 of 2)

Parameter	Parameter Value	Comments and Reference
Package		
Package Dimension – New Fuel Shipment	7.3 m	NUREG-1817, Table H-4
Radiation dose at 1 m from package	0.1 mrem/hr	WASH-1238
Fraction of emitted radiation that is gamma	1	Assumed the same as for spent nuclear fuel (conservative)
Crew		
Number of crew	2	WASH-1238 and DOE 2002
Crew Distance	2 m	Assumed minimum distance (Sand 2008)
Crew Shielding Factor	1	No shielding – analytical Assumption
Route-specific parameters		
Vehicle speed (rural, suburban, and urban)	88 km/hr	Conservative in-transit speed of 55 mph (88 km/hr) assumed (predominantly interstate highways used)
Number of persons per vehicle sharing route	2	The bureau of transportation services suggests a value of 1.2 persons per vehicle. 2 persons per vehicle chosen based on direction in RADTRAN manual (Reference 3.8-7)
Vehicle Density (vehicles/hr) Rural Suburban Urban	1155 2414 5490	National average from RADTRAN manual for interstate highways
Truck Stop Parameters		
Minimum and Maximum radius of annular area surrounding truck stop	10 m to 800 m	NUREG-1817, Table H-7
Population Density at truck stop	30,000 persons/km^2	NUREG-1817, Table H-7
Population Density Surrounding Truck Stop (outside of 800 m radius)	340 persons/km^2	NUREG-1817, Table H-7
Shielding Factor for Population at Truck stop (10 m to 800 m radius)	1	NUREG-1817, Table H-7
Shielding Factor for Population Surrounding Truck Stop (outside of 800 m radius)	0.2	NUREG-1817, Table H-7
Stop time	30 minutes per 4 hours of driving time	NUREG-1817
Distances (km)		
Rural Suburban Urban	795.7 554.5 47.9	WebTRAGIS generated values

Table 3.8-8 RADTRAN 5 Input Parameters for Analysis of Unirradiated Fuel Shipments (Sheet 2 of 2)

Parameter	Parameter Value	Comments and Reference
Population densities (persons per km^2)		
Rural	17.9	WebTRAGIS generated values using 2000 U.S. census data
Suburban	336.5	
Urban	2198.9	

Table 3.8-9 Annual Radiological Impacts of Transporting Unirradiated Fuel

	Number of Shipments[a]	Exposed Population	Dose Person-rem/ shipment	Cumulative Annual Dose, person-rem per reference reactor year	Table S-4 Limit per reference reactor year, person-rem
Fermi 3	5.1	Crew	4.05E-03	2.07E-02	4
		Onlookers	1.46E-03	7.46E-03	3
		Along route	6.39E-05	3.26E-04	3
Reference LWR[b]	6.3	Crew	-	1.10E-02	4
		Onlookers	-	4.20E-02	3
		Along route	-	1.00E-03	3

Notes:

a. Normalized to electric output for WASH-1238 reference plant (1100-MWe plant at 80 percent or an electrical output of 880 MWe).

b. NUREG-1817, Table 6-5

Table 3.8-10 RADTRAN 5 Input Parameters for Analysis of Spent Fuel Shipments (Sheet 1 of 2)

Parameter	Parameter Value	Comments and Reference
Package		
Package Dimension – Spent Fuel Shipment	5.2 m	DOE 2002 (Reference 3.8-2)
Radiation dose at 1 m from package	14 mrem/hr	RADTRAN input selected to limit dose rate to 10 mrem/hr limit at 2 meters (Reference 3.8-7)
Fraction of emitted radiation that is gamma	1.0	Escape probability is higher for gamma (conservative)
Crew		
Number of crew	2	WASH-1238 and DOE 2002 (Reference 3.8-2)
Crew Distance	3.1 m	DOE 2002 (Reference 3.8-2)
Dose rate to crew	2.0 mrem/hr	49 CFR 173.441
Route-specific parameters		
Vehicle speed (rural, suburban, and urban)	88 km/hr	Conservative in-transit speed of 55 mph (88 km/hr) assumed (predominantly interstate highways used)
Number of persons per vehicle sharing route	2	The bureau of transportation services suggests a value of 1.2 persons per vehicle. 2 persons per vehicle chosen based on direction in RADTRAN manual (Reference 3.8-7)
Vehicle Density (vehicles/hr) Rural Suburban Urban	 1155 2414 5490	National average from RADTRAN manual for interstate highways (Reference 3.8-7)
Truck Stop Parameters		
Minimum and Maximum radius of annular area surrounding truck stop	10 m to 800 m	NUREG-1817, Table H-7
Population Density at truck stop	30,000 persons/km^2	NUREG-1817, Table H-7
Population Density Surrounding Truck Stop (outside of 800 m radius)	340 persons/km^2	NUREG-1817, Table H-7
Shielding Factor for Population at Truck stop (10 m to 800 m radius)	1	NUREG-1817, Table H-7
Shielding Factor for Population Surrounding Truck Stop (outside of 800 m radius)	0.2	NUREG-1817, Table H-7
Stop time	30 minutes per 4 hours of driving time	NUREG-1817

Table 3.8-10 RADTRAN 5 Input Parameters for Analysis of Spent Fuel Shipments (Sheet 2 of 2)

Parameter	Parameter Value	Comments and Reference
Distances (km)		
Rural Suburban Urban	3064.3 488.1 61.2	WebTRAGIS generated values (Reference 3.8-6)
Population densities (persons per km^2)		
Rural Suburban Urban	8.5 309.6 2341.2	WebTRAGIS generated values using 2000 U.S. census data (Reference 3.8-6)

Table 3.8-11 Annual Radiological Impacts of Transporting Spent Fuel

	Number of Shipments[a]	Exposed Population	Dose Person-rem/ shipment	Cumulative Annual Dose, person-rem per reference reactor year	Table S-4 Limit per reference reactor year, person-rem
Fermi 3	39.5	Crew	1.66E-01	6.6	4
		Onlookers	3.75E-01	14.8	3
		Along route	5.48E-03	0.2	3
Reference LWR[b]	60	Crew	-	1.2	4
		Onlookers	-	0.8	3
		Along route	-	1.0	3

Notes:

a. Normalized to electric output for WASH-1238 reference plant (1100-MWe plant at 80 percent or an electrical output of 880 MWe).

b. NUREG-1817, Table 6-5

Table 3.8-12 Spent Fuel Radionuclides for ESBWR

Radionuclide	Ci/MTU
Am-241	1.30E+03
Am-242m	2.79E+01
Am-243	3.26E+01
Ce-144	1.35E+04
Cm-242	4.86E+01
Cm-243	3.47E+01
Cm-244	4.96E+03
Cm-245	6.75E-01
Co-60	2.86E+03
Cs-134	5.19E+04
Cs-137	1.27E+05
Eu-154	1.04E+04
Eu-155	5.40E+03
I-129	4.24E-02
Kr-85	9.27E+03
Pm-147	3.53E+04
Pu-238	6.15E+03
Pu-239	3.86E+02
Pu-240	6.22E+02
Pu-241	1.22E+05
Pu-242	2.24E+00
Ru-106	1.86E+04
Sb-125	4.81E+03
Sr-90	9.08E+04
Y-90	9.09E+04

Table 3.8-13 Annual Spent Fuel Transportation Accident Radiological Impacts

	Unit Population Dose (person-rem)[(a)]	Number of Shipments[(b)]	Population Dose person-rem per reference reactor year
Fermi 3	5.90E-08	39.5	2.33E-06
Table S-4	-	-	SMALL

Notes:

a. The RADTRAN output was adjusted for 0.5 MTU per shipment for the unit population dose.

b. Normalized to electric output for WASH-1238 reference plant (1100-MWe plant at 80 percent or an electrical output of 880 MWe).

Table 3.8-14 Distances and Population Densities for Transportation of Unirradiated Fuel to Alternate Sites

	Distance (km)			Population Density		
Site	**Rural**	**Suburban**	**Urban**	**Rural**	**Suburban**	**Urban**
Fermi Site	795.7	554.5	47.9	17.9	336.5	2198.9
Site A – Monroe County	805.4	557.5	50.6	18.0	337.3	2205.6
Site C – Lenawee County	805.4	557.5	50.6	18.0	337.3	2205.6
Site F – St. Clair County	837.1	645.8	83.2	18.1	351.2	2314.4
Site N – St. Clair County	812.9	609.1	75.9	18.0	348.3	2289.3
Site W1 – Huron County	960.0	717.3	80.1	17.6	352.6	2262.0
Site W2 – Huron County	960.0	717.3	80.1	17.6	352.6	2262.0
Site W3 – Huron County	960.0	717.3	80.1	17.6	352.6	2262.0

Table 3.8-15 Distances and Population Densities for Transportation of Irradiated Fuel to Alternate Sites

	Distance (km)			Population Density		
Site	**Rural**	**Suburban**	**Urban**	**Rural**	**Suburban**	**Urban**
Fermi Site	3064.3	488.1	61.2	8.5	309.6	2341.2
Site A – Monroe County	3074.1	493.2	63.9	8.6	310.8	2340.3
Site C – Lenawee County	3074.1	493.2	63.9	8.6	310.8	2340.3
Site F – St. Clair County	3082.3	561.5	56.6	8.8	304.1	2308.0
Site N – St. Clair County	3019.8	554.7	78.6	8.6	322.4	2345.6
Site W1 – Huron County	3145.0	577.8	59.2	8.7	313.2	2290.9
Site W2 – Huron County	3145.0	577.8	59.2	8.7	313.2	2290.9
Site W3 – Huron County	3145.0	577.8	59.2	8.7	313.2	2290.9

Chapter 4 Environmental Impacts of Construction

Chapter 4 presents the potential environmental impacts of construction of Fermi 3. Impacts are analyzed, and a single significance level of potential impact to each resource (i.e., SMALL, MODERATE, or LARGE) is assigned consistent with the criteria that the Nuclear Regulatory Commission (NRC) established in 10 CFR 51, Appendix B, Table B-1, Footnote 3. Unless the significance level is identified as beneficial, the impact is adverse, or in the case of SMALL, may be negligible. The NRC definitions of significance are as follows:

SMALL Environmental effects are not detectable or are so minor that they neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.

MODERATE Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

This chapter is divided into seven sections:

- Land-Use Impacts (Section 4.1)
- Water-Related Impacts (Section 4.2)
- Ecological Impacts (Section 4.3)
- Socioeconomic Impacts (Section 4.4)
- Radiation Exposure to Construction Workers (Section 4.5)
- Measures and Controls to Limit Adverse Impacts during Construction (Section 4.6)
- Cumulative Impacts Related to Construction Activities (Section 4.7)
- Summary of Construction and Pre-Construction Activities (Section 4.8)

These sections present potential ways to avoid, minimize, or mitigate adverse impacts of construction to the maximum extent practical. For the purposes of this chapter, the site, vicinity, and region are defined in Chapter 2.

The construction activities discussed in this chapter encompass two phases. The first phase involves Fermi 2 and Fermi 1 activities that have independent utility to the Fermi 2 site, even if the Fermi 3 plant was not built. This phase is not directly associated with Fermi 3 pre-construction, but may occur prior to or concurrently with Fermi 3 construction, and is therefore evaluated in this chapter from the standpoint of potentially having a cumulative impact. New facilities will be constructed to replace some Fermi 2 facilities being removed or retired. Certain preparation activities will occur onsite to ensure that Fermi 2 personnel and functions will be separated from

Fermi 3 construction activities. A new Fermi Drive will be constructed parallel to and north of the existing Fermi Drive to provide separation between Fermi 2 operations traffic and Fermi 3 construction traffic. The buildings remaining onsite from decommissioned Fermi 1 will be disassembled and removed so that the former Fermi 1 area will be available for use.

The second phase involves the construction of Fermi 3 structures, systems, and components (SSCs). The first structural concrete is expected to be poured in 2013, at the earliest. The second phase will also include the following:

- Subsurface preparation
- Placement of backfill, concrete, or permanent retaining walls within an excavation
- Foundation installation
- In-place assembly, erection, fabrication, or testing
- Construction of main power block building/structures
- Construction of station water intake structure and pump house for Fermi 3
- Construction of Fermi 3 cooling tower and associated structures

For the purposes of Chapter 4 evaluation of construction impacts, initial site preparation is expected to begin in 2011. Construction is projected to be completed in 2020, which coincides with commercial operation.

The Limited Work Authorization rulemaking (LWA Rule) became effective on November 8, 2007. Among other things, it established a bifurcated structure for assessing nuclear plant construction consisting of “Pre-Construction” (activities for which the NRC has no jurisdictional authority), and “Construction” (activities controlled by the NRC under the Atomic Energy Act, as amended).

Pre-Construction activities include the following general types of activities:

- Preparation of the site for facility construction (including site exploration, logging, clearing of land, grading, and construction of temporary access roads and spoil areas)
- Installation of temporary construction support facilities (including such items as warehouse and shop facilities, utilities, concrete mixing plans, docking and unloading facilities, and construction support buildings
- Excavation for any structure (including dewatering for concrete placement)
- Construction of service facilities (including such facilities as roadways, paving, railroad spurs, fencing, exterior utility and lighting systems, transmission lines, and sanitary sewage treatment facilities
- Fabrication of reactor system modules, if fabricated outside the power block
- Construction of SSCs that do not prevent or mitigate the consequences of postulated accidents that could cause undue risk to the health and safety of the public. This could

include such items as cooling tower structures, nonsafety-related circulating water lines, nonsafety-related fire protection lines, the new switchyard, and onsite interconnections

Construction activities include the following general types of activities:

- Driving of piles
- Subsurface preparation
- Installation of foundations
- Placement of backfill, concrete, or permanent retaining walls within an excavation
- In-place assembly, erection, fabrication, or testing

This applies to any of the following SSCs and facilities:

- Safety-related SSCs, as defined in 10 CFR 50.2
- SSCs relied upon to mitigate accidents or transients or used in plant emergency operating procedures
- SSCs whose failure could prevent safety-related SSCs from fulfilling their safety-related function
- SSCs whose failure could cause a reactor scram or actuation of a safety-related function
- SSCs necessary to comply with 10 CFR 73
- SSCs necessary to comply with 10 CFR 50.48 and Criterion 3 of 10 CFR 50, Appendix A
- Onsite emergency facilities, i.e., technical support and operations support centers that are necessary to comply with 10 CFR 50.47 and 10 CFR 50, Appendix E

The development of this chapter predated promulgation of Interim Staff Guidance which provided implementation guidance for the LWA Rule. Accordingly, the chapter sections do not individually distinguish between Pre-construction and Construction impacts. However, Section 4.8 provides a tabular binning of these impacts.

Various acreage values are presented throughout the Environmental Report (primarily in Chapter 4). Acreage values are primarily determined from two perspectives: 1) land use and terrestrial ecology impacts and 2) construction affected areas. Acreage values for land use and terrestrial ecology may vary from those presented for construction affected area impacts. Figure 4.2-1 shows the construction affected areas. Areas highlighted on Figure 4.2-1 include Unit 3 New Construction Affected Areas (Permanent Impact), Unit 3 New Construction (Temporary Impact), and Previously Affected Areas and Unit 3 Construction Affected Areas (Permanent Impact). These designations allow for determination of the permanent and temporary impacts from Fermi 3 to newly impacted areas and previously affected areas. Figure 4.2-1 shows approximately 302 acres used for construction and operation of Fermi 3 (total permanent and temporary impacts). This total impact acreage can be separated into the following categories:

- Unit 3 new construction affected areas (permanent impact) — approximately 43 acres

- Previously affected areas and Unit 3 construction affected areas (permanent impact) — approximately 112 acres
- Unit 3 new construction (temporary impact) — approximately 147 acres

Figure 4.3-1 shows the Fermi 3 ecological impacts to developed and undeveloped areas. There are differences between the undeveloped areas and the areas that were not previously affected as shown on Figure 4.3-1 and Figure 4.2-1, respectively. Some of the areas identified as being previously impacted on Figure 4.2-1 have subsequently been re-vegetated and would now be considered undeveloped areas. Acreage values in Table 4.3-1 are determined based on the terrestrial ecology impacts shown in Figure 4.3-1 and are used in the land use and terrestrial ecology impact evaluations.

Table 2.4-1 provides approximate areas per plant community on the Fermi site. The description for each area is provided in Section 2.4.1. Undeveloped land can be defined as either pristine or successional. Pristine is a natural area that has not been degraded by human disturbance or intervention characterized as a self-sustaining native-dominated plant and wildlife community. Successional is an undeveloped area that has experienced human or natural disturbance and is characterized as a successional plant community that is predominantly native or non-native species tolerant of the disturbance or plant species representing an early or a secondary successional stage rather than a climax community. Succession is the progression of one type of plant community to another, usually ending in a stable, long-term plant community that changes little over long periods of time. It can provide clues about the state of a given tract, based on plant species composition and known or observed disturbance factors. Typically, areas that previously supported a plant community but which have been disturbed go through changes in plant species composition and soil, temperature or light conditions. Undisturbed areas generally tend to be more stable, with similar plant composition over long periods, slowly moving towards a climax plant community. By consideration of plant community composition, an evaluation of the ecological state, whether undisturbed or disturbed, can be made.

An ecological review of the Fermi site with succession in mind reviews that most of the site has been disturbed, some areas more recently than others, but that there are no undisturbed or pristine habitats present. As a result, the plant species composition, and the wildlife using the vegetation present, represents relatively common species tolerant of different levels of disturbance, while plant and wildlife species requiring stable, undisturbed conditions are relatively rare to uncommon.

4.1 Land-Use Impacts

This section describes the effects of site preparation and construction of Fermi 3 and the impacts on land use from construction. Subsection 4.1.1 describes construction impacts on land use of the site and vicinity. Subsection 4.1.2 describes construction impacts on land use along transmission lines and within transmission access corridors. Subsection 4.1.3 describes construction impacts on historic and cultural resources in the site and vicinity, along transmission corridors, and in offsite areas. The Chapter 4 introduction provides an overview of the Fermi 3 construction schedule and key construction activities.

4.1.1 **The Site and Vicinity**

Construction impacts on land use at the Fermi site and vicinity are discussed in this subsection. The Fermi site is located in Monroe County, Michigan, with a property boundary that encompasses 1260 acres. For purposes of the land use analysis, the Fermi 3 site is considered the same as the entire Fermi property. The vicinity is the 7.5-mile area surrounding the Fermi site, which includes mostly Monroe County, a small portion of Wayne County, and Lake Erie. The vicinity includes both United States and Canadian waters. Monroe County comprises the majority of the vicinity; therefore, it is the focus of the vicinity land use impact discussions included in this subsection.

The total new construction area anticipated to be disturbed for onsite construction activities is approximately 190 acres. Impacts will be confined to designated areas as outlined on Figure 2.1-4. About 43 acres permanent impact areas (new impact) will be lost to other uses until after decommissioning of Fermi 3. The remaining 147 acres will be disturbed on a short-term, temporary basis. Most of the land that will be occupied by Fermi 3 and associated facilities was disturbed during construction of Fermi 1 and Fermi 2; however, some construction will occur in areas that have been undisturbed for longer periods of time. Figure 2.1-4 indicates the areas proposed for use during Fermi 3 construction.

The conversion of 19 acres of the Lagoona Beach Unit of the Detroit River International Wildlife Refuge (DRIWR) from wetland and forest to developed use for Fermi 3 and associated structures constitutes the main irreversible and irretrievable land use impact for Fermi 3 construction. More than 90 percent of Lake Erie coastal wetlands have been lost to development in Monroe County, emphasizing the importance of the remaining land uses of this type (Reference 4.1-1).

4.1.1.1 **Site and Vicinity Land Use Impacts**

Construction of Fermi 3 will result in alterations to onsite land use. Some of these alterations are unavoidable and irreversible; others are unavoidable, but are temporary. As noted above, some of the areas designated for Fermi 3 were prepared or altered during the construction and the operation of Fermi 1 and Fermi 2.

Table 2.2-1 and Table 2.2-2 list land uses on the Fermi site and in the vicinity before construction of Fermi 3. During construction of Fermi 3, there will be a reduction (approximately 13 acres) in wetland and forested areas and a corresponding increase in the developed area acreage attributable to permanent impacts of construction activities on the Fermi site.

The various areas potentially affected by construction of Fermi 3 and the acreage within each area are provided in Table 4.1-1; these areas are also depicted on Figure 2.1-4. The site preparation and construction activities that will involve major impacts are clearing, grading, excavation, and dewatering. Explosives may be used during excavation work for Fermi 3 construction. The major types of construction impact that could result from these activities are alteration of existing vegetation, alteration of topography, and alteration of site drainage patterns and water quality.

The planned removal of the structures formerly used for Fermi 1 will free approximately 7 acres for use during Fermi 3 construction. Note - Fermi 1 disassembly may be carried out independently or in conjunction with activities related to Fermi 3. This acreage is adjacent to the area where the Fermi 3 water intake and barge slip would be constructed.

New construction for Fermi 3 would have an impact in the construction areas because forest and wetland areas that are part of the DRIWR would be cleared for construction of several facilities and construction areas associated with Fermi 3 and the relocation of the Fermi 2 parking and warehouse area. Note - These Fermi 2 relocations may be carried out independently or in conjunction with activities related to Fermi 3.

Of the approximately 302 total acres estimated to be disturbed for the construction of Fermi 3, approximately 112 acres overlap currently developed or previously altered areas. It is estimated that approximately 12 acres would contain the permanent structure footprint associated with Fermi 3 (primarily the power block area, cooling tower area, intake area, and auxiliary structures, as shown in Figure 2.1-4). Approximately 125 acres of the Fermi site will be permanently occupied by facilities associated with Fermi 3. Acreage not containing permanent structures would be reclaimed after construction to the maximum extent possible and, where practicable, would be replanted or allowed to revegetate naturally. The combined Fermi 2 and Fermi 3 projected acreage for permanently affected areas (excluding temporary impacts) is approximately 259 acres. The 302 total acres of impact onsite from Fermi 3 construction and the 19 acres of land use (that would permanently change from wildlife refuge to high density development) are both substantially less than the 1235 acre threshold that the NRC considers a SMALL impact (refer to NUREG-1555, Section 4.1.1). It can therefore be concluded that the Fermi 3 land use impact during construction would be SMALL, and would not require mitigation.

As stated in Section 2.6, construction activities in support of Fermi 3 are not anticipated to adversely affect the geology of the site. Accordingly, the geological effects would be SMALL, and no mitigation measures would be needed.

4.1.1.2 **Land Use Plan and Zoning Compliance**

4.1.1.2.1 **Local Monroe County and Frenchtown Township Land Use**

The construction of Fermi 3 will comply with Monroe County and Frenchtown Township land use plans and policies and will comply with county zoning regulations and their specified uses. Monroe County land use planning documents, including the 1985 Comprehensive Plan (which is undergoing an update) emphasize county goals of retaining agricultural land uses while encouraging a strong economy. Development of the Fermi site has been consistent with county goals, leaving large portions of the natural wetland areas onsite intact while developing a power plant that provides economic benefits to the county and surrounding communities. The updated Monroe County Comprehensive Plan will not include changes to the planned use of the Fermi site or its immediate surroundings.

Michigan's local governmental structure involves land use planning and zoning authority that can be exercised by various entities. Counties, townships, cities, and villages work together and sometimes have overlapping jurisdictions concerning land use matters, as explained in

Subsection 2.5.2. This is the case for the Fermi site, where the authorities of Frenchtown Township and Monroe County both apply.

As described in Section 2.2, according to Frenchtown Township zoning and existing land use maps included in the Frenchtown Township Master Plan, the Fermi site is included in an area zoned Public Service (PS) and used for utility purposes. The Monroe County Planning Department is aware of periodic proposals for industrial businesses on a vacant property in the area north of the Fermi site; however, development of this property has not materialized. If industrial development did occur in the area just north of the site, Fermi 3 would be compatible with that development. It would also be consistent with current and planned land use as well as the property zoning designation, as Fermi 3 will comply with local land use plans and zoning. No rezoning would be required at the Fermi site for Fermi 3 because the Frenchtown Township has zoned the site for Public Service use. Surrounding properties have varied zoning, with the property off the north side of the Fermi site zoned Lake Erie Marina (adjacent to Swan Creek), the southeast and southwest adjacent properties zoned Single Family Residential, and most of the rest of the surrounding area zoned Agricultural. The area to the southwest of the Fermi site near Lake Erie has multiple residential and commercial zoning designations that begin just south of the Fermi site and follow Dixie Highway to the Monroe Power Plant area just east-southeast of the city of Monroe.

Fermi 3 may have a positive economic impact on land use in the county by encouraging industrial and economic development. Fermi 3 could be an incentive for other industries to locate in the area, which could eventually spur a land use change from Agricultural to Developed, Medium Intensity or Developed, High Intensity industrial areas in the vicinity. This same effect could also be perceived as a negative impact on the part of those wanting to maintain agricultural land uses in the vicinity of Fermi 3. An effort to retain agriculture as the predominant land use in Monroe County is underway as part of the Monroe County Comprehensive Plan update. It is unlikely that construction of Fermi 3 would cause a change in land use in the area in light of the guidance expected to be forthcoming in the updated Monroe County Comprehensive Plan.

No impacts to land use planning in Monroe County or Frenchtown Township are expected as a result of Fermi 3 construction because it will comply with all applicable land use and zoning regulations of Monroe County and Frenchtown Township; therefore, this impact would be SMALL, and no mitigation measures would be needed.

4.1.1.2.2 **Agricultural and Soil Issues**

Construction activities associated with Fermi 3 would require a construction stormwater discharge permit and Soil Erosion and Sedimentation Control (SESC) permit under National Pollutant Discharge Elimination System (NPDES) regulations. As part of the SESC permit, a detailed SESC Plan would be developed. The construction stormwater discharge permit and SESC permit and plan are discussed in more detail in Subsection 4.2.1. During construction activities, in compliance with the stormwater discharge permit and the SESC Plan, erosion control measures would be used to contain eroded soil onsite and remove sediment from stormwater prior to the water leaving the site. Design measures would be incorporated to avoid concentrated flow that has a high potential to transport sediment. Regular visual inspections of erosion control measures would be incorporated into the project to monitor the effectiveness of the control measures and to aid in determining if other mitigation measures are necessary. Mitigation measures would be incorporated into the requirements of the SESC Plan.

For some of the impacts related to construction activities, preventive measures that would be applied are referred to as best management practices (BMP). BMPs are designed to address the specific types of activities that are to be performed. Candidate BMPs used in conjunction with the SESC Plan include appropriate use of run-on flow diversion, stormwater collection ponds, silt fences, seeding, revegetation plans, and use of other surface stabilization techniques. BMPs that are used will be consistent with the practices discussed in Guidebook of Best Management Practices for Michigan Watersheds (Reference 4.1-5). As part of Reference 4.1-5, BMPs are categorized into one of eight categories:

- Construction Site Preparation
- Housekeeping
- Managerial
- Runoff Conveyance and Outlets
- Runoff Storage
- Sedimentation Control Structures
- Vegetative Establishment
- Wetlands

Each of these categories contains several BMPs that will be implemented as the conditions warrant. For each of the BMPs, Reference 4.1-5 provides more detailed information including a description of the BMP, the basis for implementing the BMP, the application of the BMP, relationship with other BMPs and how other BMPs can be used to compliment each other, considerations during the planning phase, considerations during the implementation phase and post construction considerations.

Protection of existing runoff drains from sediment loss is part of the planning process. Some stabilization and restoration methods that may be used include recontouring using heavy construction equipment; mulching, seeding, and planting; natural revegetation; pavement, rock, or gravel permanent stabilization; and installation of temporary or permanent stormwater management and erosion and sedimentation control measures.

During construction activities, disturbances to the existing ground surface would potentially increase the current sediment load through runoff to Lake Erie via the onsite wetlands, dredge disposal area, or Swan Creek. Site grading and drainage during construction would be designed to avoid erosion during the construction period and in compliance with the SESC Plan. Construction activities would be properly controlled and monitored so that erosion from improperly graded areas does not lead to the runoff of sediments offsite or to nearby surface waters. Final stabilization would consist of restoration or revegetation at final grade conditions as practical.

In addition, as described in Section 4.2, several different structural controls may be used to avoid degradation of the quality of the stormwater runoff to Swan Creek, onsite wetlands, and Lake Erie during construction activities. The final location of these controls would be based on site conditions prior to and during construction activities.

With the use of construction equipment at the site, there is the potential for spills of gasoline, oil, and other fluids from various possible pollutant sources such as vehicle fueling stations, loading and unloading areas, vehicle equipment maintenance activities, and material storage and handling. Spill prevention, control, and response measures will be implemented as part of the Pollution Incident Prevention Plan (PIPP) for Fermi 3. A more detailed discussion of the PIPP is provided in Subsection 4.2.1. Accordingly, the impacts of hazardous material spills are expected to be SMALL, and no mitigative measures are needed.

Soil compaction will occur as construction machinery traverses the construction areas. However, many of the areas where compaction would occur will eventually be covered with permanent structures or will become areas maintained with grass cover. Those areas used temporarily and allowed to revegetate after construction completion would recover more slowly, but would be able to regenerate vegetation and forest cover despite the soil compaction. Detroit Edison plans to restore as many impacted areas as possible to the natural state they were in before construction of Fermi 3.

Aggregate and equipment storage may be located in the possible laydown area shown on Figure 2.1-4.

The excavated material from the power block and circulating water pipe runs will be processed and used as backfill and structural fill for the cooling tower and circulating water pipe run area. Other than these excavated areas, no onsite borrow pit is anticipated to be used for Fermi 3 construction. An estimated quantity of 265,000 yd^3 of excavated material is expected to be excess, which will be disposed of in onsite construction laydown and parking areas and used for filling in canals. The use of an onsite construction landfill is not anticipated.

Therefore, it is anticipated that the land use impact from excavated material will be SMALL due to the relatively small net excess of spoils materials disposed and the availability of disposal areas.

Dredged material excavated during water intake structure and barge slip or dock construction is expected to be returned to the Spoils Disposal Pond encircled by Boomerang Road, as shown on Figure 2.1-4.

According to the Natural Resources Conservation Service (NRCS), soil types that are considered prime farmland are present on the Fermi site, as discussed in Section 2.2. NRCS online soil survey data and maps show several small areas of prime farmland (Subsection 2.2.1.2.3.1) that may be temporarily affected by Fermi 3 construction (Reference 4.1-2). These small areas of prime farmland are currently on agricultural land in the west-southwest portion of the site. The agricultural land in the west-southwest portion of the site will be used for Fermi 3 construction laydown (as a surface to store construction materials). The land would be usable as agricultural cropland again after construction of Fermi 3 is complete. Land use in this area of the site would temporarily change for the duration of construction (about five years), but would then revert to agricultural use.

Besides the agricultural field in the southwest corner of the site, prime farmland likely also existed on the Fermi site previous to construction of Fermi 1 and Fermi 2. Portions of the site were farmed in the 1940s and 1950s, as is evident from historical photographs. Irreversible conversion of unique agricultural lands by Fermi 3 construction onsite would not occur because the impact to designated prime farmland areas would be temporary and reversible. Prime farmland will not be significantly impacted by construction of Fermi 3, and similar quality farmland is available throughout the vicinity.

There are four soil map units covering approximately 30 percent of the Fermi site that the NRCS categorizes as Land Capability Class II. Class II soils have moderate limitations on their use that reduce the suitable vegetation choices and require moderate conservation practices. Land Capability Class I soil, the most favorable class of soil that has few limitations on its use, is not present on the Fermi site (Reference 4.1-2).

Productivity of the land in the vicinity is high. However, the land on the Fermi site is occupied mostly by forest, wetland, and developed areas and is not productive in the agricultural sense. The farmed parcel in the southwest corner of the site contains prime farmland and may be temporarily impacted by construction laydown activities. Approximately five years of production could be lost from this parcel during construction. The farmland parcel would be able to return to productive agricultural use after the construction period (Reference 4.1-2).

Overall impacts to soils and agricultural land use are expected to be SMALL, and no mitigation measures are needed.

4.1.1.2.3 **Federal, Regional, and State Land Use Plans**

The DRIWR Lagoona Beach Unit comprises 656 acres of the 1260 acre Fermi site. The U.S. Fish and Wildlife Service (USFWS) manages the DRIWR and has published a Comprehensive Conservation Plan for the refuge (Reference 4.1-3). The Comprehensive Conservation Plan states that there are several options for acquisition of land for the refuge other than outright purchase of land. One of these alternative methods, a cooperative agreement, was used for acquisition of the Lagoona Beach Unit of the DRIWR on Fermi property (Reference 4.1-3). Detroit Edison has a 2003 Cooperative Agreement with the USFWS for the onsite portion of the DRIWR that allows Detroit Edison and the USFWS to share management of the refuge areas, but that allows Detroit Edison to retain ownership and control of those areas. The agreement allows Detroit Edison to withdraw from or revise the agreement at any time. Detroit Edison expects to revise the agreement to reflect the approximately 637 acres expected to be available for inclusion in the refuge after construction. This revision in the size of the Lagoona Beach Unit of the DRIWR is consistent with the 2003 Cooperative Agreement, the Comprehensive Conservation Plan, and land acquisition procedures for the refuge. Even though Fermi 3 will reduce the acreage that can be included in the DRIWR, Fermi 3 construction would be compatible with the plans and agreements governing the DRIWR. Therefore, construction impacts on land use plans would be SMALL, and no mitigation measures are needed.

The Coastal Zone Management Act authorizes states like Michigan to develop Coastal Zone Management Plans to protect and ensure the reasonable use of coastal areas. As stated in Section 2.2 and shown on Figure 2.1-2, the Fermi site and part of the vicinity are in the coastal zone. A coastal zone consistency determination from the Michigan Department of Environmental Quality (MDEQ) will be obtained for Fermi 3 construction work in conjunction with other permits and authorizations from MDEQ, as listed in Section 1.2. Construction of Fermi 3 would impact a very small portion of the coastal zone in Monroe County and the surrounding areas, and many of the impacted areas would be restored to natural vegetation after construction. Restoration and the re-establishment of vegetation in these areas of the Fermi site would assist in protecting coastal lands from erosion and pollution concerns. Therefore, construction impacts on the Lake Erie coastal zone are expected to be SMALL, and no mitigation measures are needed.

As described in Section 2.8, no current or proposed Federal projects are expected in the region. As stated in Section 2.2, Native American land use plans do not apply to the Fermi site or the vicinity.

Regional and state land use plans do not contain measures that apply specifically to the Fermi site, and these plans would not be affected by Fermi 3 construction. Fermi 3 construction would occur in compliance with all applicable land use plans.

4.1.1.3 **Transportation and Rights-of-Way**

Existing onsite roads would be used for construction traffic along with a new access road that will be constructed onsite (new Fermi Drive). It is anticipated that the new Fermi Drive (parallel and just north of the existing Fermi Drive) will be constructed from Dixie Highway to the west Fermi property boundary. The new road will continue through the site to the new personnel access gate as shown on Figure 2.1-4. Construction of the new Fermi Drive would occur during the early stages of Fermi 3 construction. Land use impacts along the new Fermi Drive corridor would be small enough that the land use acreages would not significantly change. Land use changes in the vicinity would be minimal, as Fermi 3 construction is not expected to impact any offsite areas.

To reduce the potential for erosion and siltation from road use by heavy construction vehicles, pavement may be widened or additional surface layers added to roads to support construction traffic. Otherwise, roads are not expected to need reconditioning to handle the loads from Fermi 3 construction. Subsection 4.4.2 describes the potential for increased traffic congestion during Fermi 3 construction. However, because this traffic increase is localized and centered around discrete time periods (shift changes); the effects on land use would be negligible.

Rail transport is available for the construction of Fermi 3 as needed, as described in Section 2.2. Since there are many adequate existing rail lines serving the Fermi vicinity, no construction or modification of rail lines is anticipated.

Overall, transportation impacts to land use from the construction of Fermi 3 are expected to be SMALL, and no mitigation measures are required.

4.1.1.4 **Site Restoration and Management Actions**

Preventive measures implemented to reduce construction activity impacts would be targeted toward erosion control, controlled access roads for personnel and vehicular traffic, and restricted construction zones. The site preparation work would be completed in two stages, the first of which would consist of stripping, excavating, and backfilling the areas needed for structures and roadways. The second stage would entail developing the site with the necessary facilities to support construction, such as construction offices, warehouses, trackwork, large unloading facilities, water wells, construction power, construction drainage, and similar facilities. In addition, temporary structures would be razed and holes would be filled. Grading and drainage work would be designed and executed with the goal of avoiding and minimizing erosion during the construction period.

The Fermi 3 site surface and subsurface features would be stabilized and restored in accordance with permit requirements and conditions after completion of construction activities. Disturbed areas would be restored consistent with existing and native vegetation. A Site Redress Plan that addresses site restoration is not required for Fermi 3 because Detroit Edison will not seek a safety-related Limited Work Authorization (LWA-2) permit. Permanently disturbed locations would be stabilized and contoured to blend with the surrounding area in accordance with design specifications. Revegetation of disturbed areas would be compliant with site maintenance and safety requirements, and stabilization and restoration methods would comply with applicable laws, regulations, permit requirements and conditions, good engineering and construction practices, and recognized environmental best management practices.

4.1.2 **Transmission Corridors and Offsite Areas**

As stated in NUREG-1555, Section 4.1.2:

> In some cases transmission lines may be constructed and operated by an entity other than the applicant. In such cases, impact information may be limited and the reviewer should proceed with the assessment using the information that can be obtained.

The 345 kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. The Applicant has no control over the construction or operation of the transmission system. Accordingly, the construction impacts are based on publicly available information, and reasonable expectations of the configurations and practices that ITC*Transmission* would likely follow based on standard industry practice. However, the information described in this subsection does not imply commitments made by ITC*Transmission* or Detroit Edison, unless specifically noted.

As discussed in Subsection 2.2.2, three new 345 kV transmission lines are proposed to serve Fermi 3. A study completed by ITC*Transmission* and Midwest ISO concluded that the existing transmission system from Fermi to the electric grid would need additional lines to sufficiently transport power produced at Fermi 3 without overloading the transmission system in the Fermi area.

<u>Onsite</u>

The approximate route and impact areas associated with the short length of new transmission corridor that would be constructed within the Fermi site is shown on Figure 2.1-4 and described in Subsection 2.2.2.2.

In the onsite portion of the 345 kV transmission corridor, the Fermi 2 transmission lines are owned by ITC*Transmission*, while the Fermi 3 transmission lines will be owned by Detroit Edison up to the point of their interconnection with the new Fermi 3 switchyard. Outward from the Fermi 3 switchyard interconnection, ITC*Transmission* will own the lines and other transmission system equipment. Detroit Edison will maintain ownership and control of the land in the new onsite transmission corridor; however, it is expected that Detroit Edison would contract with ITC*Transmission* to maintain the transmission towers and lines located on Detroit Edison property.

Construction of the Fermi 3 switchyard, clearing of the onsite transmission line ROW, construction of the transmission towers, and stringing of the transmission lines will all be accomplished using methods that minimize impacts to wetlands and forest vegetation. The drainage area within this portion of the Fermi site will be spanned by the transmission lines; however, impacts to the drainage area are expected to be minimal because construction activities associated with the transmission structure installation are not expected to occur within the drainage area. The Fermi 3 switchyard will be constructed in the prairie restoration area at the intersection of Fermi Drive and Toll Road. The switchyard will permanently convert approximately 10 acres of the DRIWR from restored native grass vegetation to a developed use. The onsite transmission corridor will convert approximately an additional 6 acres of the DRIWR from woodlot forest, forested wetlands, and thicket to a developed use.

The onsite transmission line ROW and associated access pathways will have a combined temporary and permanent impact of approximately 8 acres (approximately 5.7 acres of permanent impacts to forested areas, and approximately 2.3 acres of temporary impacts to scrub-shrub and emergent wetland vegetation near the drainage area). Within the 4.7 acre forested area of the ROW near Toll Road, there will be approximately 1.53 acres of permanent impact to a forested wetland. Impacts to wetlands will be minimized as much as possible in this area through placement of the transmission line ROW adjacent to the Toll Road ROW so that the narrowest possible portion of the forested wetland would be impacted. Complete avoidance of wetland impacts in this area was not practicable because of the need for transmission lines to travel from the Fermi 3 power block to the Fermi 3 switchyard without impacting existing structures or other areas required for Fermi 3 construction (refer to Figure 2.1-4).

During construction of the transmission system, forest clearing will be limited to the 170-foot wide ROW to minimize impacts to existing vegetation and wildlife habitat. To the extent feasible, the transmission towers will be placed in locations outside forested areas and outside the central portion of the drainage area so that inundation of the transmission structures with water would be less likely. The drainage area holds water at varying levels depending on the amount of recent precipitation in the surrounding area and any seiche events that may occur in Lake Erie. The temporary access pathways to the transmission tower locations will approach the towers from both the southeast and northwest directions so equipment will not cross the drainage area. During construction, when these temporary access pathways to the transmission tower locations are used, matting will be laid over the pathways as necessary to minimize impacts to underlying emergent wetland vegetation (largely phragmites and cattails). Transmission lines will also be strung onto the towers without equipment crossing the drainage. When construction within the area is complete, the matting will be removed and the area will be allowed to recover. The areas around the towers will be revegetated through seeding or natural regrowth.

Each of the eight transmission towers outside the forested areas along the onsite transmission corridor would temporarily impact an approximately 0.2 acre area around the tower to accommodate construction vehicles and activities. The permanent impact for each tower along the route would be approximately 0.03 acre to accommodate the tower and foundation locations.

Refer to Subsections 4.4.1.1 and 4.4.2.4.5 for descriptions of construction-related noise and visual impacts on the Fermi site.

Preventive measures implemented to reduce onsite transmission corridor construction impacts would be targeted toward erosion control, minimizing the chances of spills, minimizing temporary access pathway impacts, and restricting construction within forested and wetland areas, near the drainage area, and around each transmission tower.

Transmission tower foundation excavation work and other construction activities will be designed and executed using Best Management Practices (BMPs) with the goal of avoiding and minimizing erosion. The Soil Erosion and Sedimentation Control Plan for Fermi 3 construction activities will be implemented throughout construction on all areas of the site, including the onsite transmission line corridor. Spill prevention, control, and response measures will also be implemented as part of the Pollution Incident Prevention Plan (PIPP) for Fermi 3.

Disturbed areas will be restored consistent with existing and native vegetation as soon as practical after completion of construction in each area of the transmission corridor. Revegetation of disturbed forest areas would be compliant with site maintenance and ITC*Transmission* safety standards, and stabilization and restoration methods would comply with applicable laws, regulations, permit requirements and conditions, good engineering and construction practices, and recognized environmental best management practices.

In light of the measures described above that will be taken to avoid and minimize impacts from construction of the onsite transmission corridor, impacts to land use on the Fermi site are expected to be minimal.

<u>Offsite</u>

Land use impacts resulting from the construction of the new 345 kV transmission lines are expected to be SMALL because the 29.4-mile route would use 18.6 miles of an established and developed portion running along a combination of corridors already used for transmission structures and lines, and would convert a short (10.8-mile) tract of an established and undeveloped section, along the route to the Milan Substation, previously characterized for utility use. Assuming a nominal 300-foot width along the entire proposed transmission corridor, a total of approximately 1069 acres could potentially be disturbed for construction activities. Laydown and other areas potentially located outside the corridors may be defined by ITC*Transmission* at a time closer to construction of the lines. Existing roads are expected to be used for access and construction traffic as much as possible, and no new access roads would be anticipated because the topography of the area is flat.

The land use impacts of construction along the proposed 345 kV transmission route are expected to be minimized by the use of existing corridors and adjacent areas, line design, and inspection and maintenance policies. Impacts to land use should be reversible, as the structures could be removed and the corridors could be restored to native vegetation or farmland at the end of the useful life of the transmission system. Agricultural activities may be allowed to continue during operation of the line, as described in Subsection 5.1.2.

Impacts of adding transmission lines in existing transmission line corridors are generally minimal. The use of available existing rights-of-way (ROW) for the new route rather than the use of a route that would convert open space to transmission use is typically the approach selected, which serves to minimize environmental impacts of new transmission development. Construction work within the assumed 300-foot wide ROW area along the undeveloped 10.8 mile portion of the route nearest to the Milan Substation is expected to be monitored by ITC*Transmission* to ensure SMALL land use impacts.

It is likely that any additionally required ROWs would be purchased, and the land then leased to the original owners at a nominal fee for productive use such as farming. Accordingly, it is anticipated that only the land around the tower bases (approximately 25 feet on each side) would be lost from productive use. The corridor areas under construction may be fenced to prevent other land uses during the construction period. New access roads should not be necessary, and existing road infrastructure is expected to be used as much as possible to access the new route. Construction of the new transmission route may result in the following potential impacts to land use:

- vegetation removal and brush piles
- soil disturbance and erosion, and
- damage to culverts, driveways, and roadways.

Land use impacts from constructing the new transmission lines are anticipated to be SMALL due to the placement of the new transmission lines and structures largely through land already used or planned for transmission and utility use. There could be impacts to forest, agricultural lands, wetlands and streams, residences, undeveloped land, and recreational uses within the assumed 300-foot corridor ROW. These construction impacts are expected to be alleviated to the extent practicable through the use of environmental stewardship, best management and industry practices, and conformance with applicable laws and regulations pertaining to ground-disturbing activities, such as forest and wetlands protection and stormwater controls. Based on the description in Subsection 2.2.2, the transmission corridors are expected to have SMALL impacts on urban areas, state parks, and federally regulated wetland areas. The new transmission route does not cross federal lands. The land use for 0.5 miles around all transmission corridors, including the newly developed portion, is shown on Figure 2.2-3. On the figure, the new section and the 0.5-mile area around it are outlined in blue to distinguish the newly developed lines from the previously developed lines serving Fermi.

Construction practices used for construction of the new transmission lines to Milan Substation are expected to comply with, or use practices that go beyond, the requirements of local, State, and Federal environmental regulations. It is also anticipated that the best environmental practices would be observed, including continual and responsible management of wastes and chemicals to prevent and avoid pollution. It is expected that the use of chemicals and creation of wastes would be minimized as much as possible during transmission line work (Reference 4.1-4).

After completion of construction, the transmission corridor is anticipated to be restored using the following or similar techniques:

- Land restoration including discing, fertilizing, seeding, and installing erosion control devices (filter fences, hay or straw bales, mulch).
- Cleanup and proper disposal of construction debris.
- Property damage repaired to its original condition and to landowner satisfaction.

The Fermi 3 switchyard will be separate from the Fermi 2 switchyard. The location of the Fermi 3 switchyard is shown on Figure 2.1-4.

It is expected that many new towers and/or steel poles will be needed to support the three new 345 kV transmission lines to Milan Substation along the 10.8-mile portion of the route where there are no existing structures. Methods of new tower/steel pole construction and conductoring are expected to be in accordance with ITC*Transmission* construction standards, as well as applicable regulatory and industry standards.

Approximate acreages of land use categories located within 0.5-mile of the 345 kV transmission corridors (established and undeveloped) are reported in Table 2.2-6. Land use impacts of construction are expected to be mitigated within the assumed 300-foot wide corridor, through the use of existing access roads, implementation of measures in the associated SESC Plan and PIPP, use of best management practices, consultation with landowners along the route, and adherence to all applicable Federal, State, and local laws and regulations governing the construction of transmission lines.

Overall, transmission construction impacts to land use in the vicinity of Fermi 3 and the new transmission route are expected to be SMALL because of the use of existing and maintained corridors already dedicated to transmission use and the short-term nature of construction impacts typically seen along the corridor. Land uses present in the assumed ROW area before clearing would be restored in large part after construction completion. Examples of the preventive measures that may be implemented are limiting construction work to the assumed 300-foot wide ROW area, placing gravel on access roads as needed and using existing access roads to the degree possible, establishing vegetation cover in disturbed areas, limiting machinery access points to reduce erosion, compensation for farmers with land damaged by the corridor work, and use of measures similar to those used in the associated SESC Plan and PIPP to avoid erosion, siltation, and potential spills.

4.1.2.1 **Planning and Zoning**

The new transmission route travels through and is compatible with the land use planning and zoning designations for Monroe, Wayne, and Washtenaw Counties, as described in Subsection 2.2.2.

Along its 29.4-mile length, the new transmission route will cross mostly areas that are used for agriculture, open space, and some rural residential properties, as well as various sized pockets of forested land. The new transmission lines will be constructed in areas where electrical infrastructure may be viewed as an acceptable use and where transmission use complies with local planning policies. During the planning process for the new transmission lines, county and city offices are expected to be contacted by ITC*Transmission* to determine necessary measures for compliance to zoning and planning regulations or guidance in place at that time for each county, township, or city that the route crosses.

Construction work for the new transmission route to the Milan Substation will occur largely outside the boundaries of the Fermi site. The new lines will impact mostly agricultural and forested land along the route. It is probable that adjacent farmland could continue to be used as pasture and cropland, with possible short-term, temporary disruptions of use to the portions of croplands closest to the transmission corridors during the construction work. These areas would be able to revert to agricultural use after transmission line construction is completed. Forested and other areas along the newly developed 10.8 mile portion of the corridor could be cleared to accommodate the assumed 300-foot width of the ROW. This area comprises approximately 160 acres of the 393 acres potentially affected along the newly developed 10.8 mile portion of the route, which is considered to be a minor impact in accordance with the guidance in NUREG-1555, Section 4.1.1. Therefore, the construction of transmission lines to serve Fermi 3 is expected to have a SMALL, temporary impact on agriculture in the vicinity.

Potential control actions during construction that could restrict land use along the new transmission route may include fencing the area where work is being performed. Signs indicating the presence of high voltage transmission lines may be posted along the fenced area to alert the public to electrical safety hazards that could be caused by contact with the lines.

4.1.2.2 **Transportation and Rights-of-Way**

Because of its length, the new transmission route will cross multiple road and railroad intersections as well as traverse a number of previously established transmission corridors and could have minor impacts on road traffic flow during the construction period. Rail traffic is less likely to be affected because of its periodic nature. Impacts will be minimal, localized, and temporary because affected intersections and transmission corridors would be used as normal after transmission line construction is completed. Subsection 2.2.2 describes some of the features crossed by the new transmission line.

Spill prevention and response are expected to be addressed the same way along the new transmission route as they are on the Fermi site, through observance of preventive measures in the associated PIPP. It is expected that extra care will be taken during construction to avoid spills of transformer oils and fluids.

The new transmission route is likely to cross multiple pipelines carrying various materials such as petroleum and natural gas. It is expected that care will be taken to locate and avoid pipelines before excavation work is undertaken for placement of towers to support the new transmission line. Because natural gas and petroleum pipelines are underground and the new transmission line will be above ground, impacts to access or maintenance of pipelines are expected to be SMALL, and no mitigative measures are anticipated. Impacts to land use from pipelines during construction is expected to be SMALL, and no mitigative measures are expected.

4.1.2.3 **Agricultural and Soil Issues**

Agricultural land use is prevalent along the new transmission route and comprises about 57 percent of the area within 0.5 mile of the route while forested areas comprise approximately 23 percent of the route environment. Activities performed to construct the transmission lines may disturb the use of small portions of adjacent properties for a short time until work on the corridor is complete. Potential impacts given in this subsection focus on the 10.8-mile portion of the corridor that has no existing transmission towers or lines. That portion would likely be subject to the greater adverse impacts as compared to the 18.6-mile portion of the corridor that uses existing towers and that has been impacted to a greater extent in the past.

The newly developed section of the route will impact, to a large extent, agricultural land along with small portions of land with various other uses. Compared to the available acreages of agricultural land available for cultivation within the counties along the new transmission route, the route itself will affect a very small portion. Although dimensions of prime farmland along the route vary, prime farmland soils and soils of local agricultural importance are present within some areas of the new transmission route (Reference 4.1-2). The new transmission route impacts could be minimized by keeping the clearing and construction within the assumed 300-foot wide corridor. However, it is expected that observance and implementation of BMPs to those described in the associated SESC Plan, use of existing access roads to the extent possible for the new route, and limiting the area disturbed to the minimum dimensions necessary will keep impacts to agriculture and soils SMALL, and no mitigative measures are anticipated.

There are several soil map units covering approximately 23 percent of the area including and around the new transmission route to Milan that the NRCS categorizes as Land Capability Class II. Class II soils have moderate limitations on their use that reduce the suitable vegetation choices and require moderate conservation practices. Most soils in the area of the undeveloped 10.8-mile portion of the transmission line have Land Capability Class ratings of either III, IV, or V, which are the lower ratings with the most limitations on soil uses. Land Capability Class I soil, the most favorable class of soil that has few limitations on its use, is not present along the 10.8-mile portion of the transmission route (Reference 4.1-2).

Productivity of the land in the area of the affected corridors is high. The land is agriculturally productive; however, production would not be permanently lost as a result of construction activities in the new transmission route because agricultural activities could resume under the new lines and new towers/steel poles once they are constructed. The multiple areas of prime farmland and farmland of local importance in the area of the new transmission line could be temporarily impacted by construction laydown activities if these activities take place outside the assumed 300-foot corridor (Reference 4.1-2). Agricultural lands along the transmission route are typical of the area, which features many similar high quality agricultural lands.

4.1.2.4 **Corridor Restoration and Management Actions**

Measures to prevent erosion and revegetate construction areas along the new transmission route are likely to be very similar to measures taken on the Fermi site, and may primarily involve recontouring of the construction area and establishment of permanent vegetative cover. Anticipated maintenance during operation is discussed in Subsection 5.1.2.

In the event that construction on the new transmission route is begun and at some point the decision made to stop construction and restore the land, disturbed areas are expected to be restored consistent with existing and native vegetation and to the contours that existed prior to transmission line construction.

In summary, impacts to land use in the transmission corridors are expected to be SMALL, and no mitigative measures are expected.

4.1.3 **Historic Properties**

This subsection addresses the effect of Fermi 3 construction activities on historic resources within the project area and within a 10-mile radius of the project area. Cultural resources investigations for the Fermi 3 project were carried out pursuant to Section 106 of the National Historic Preservation Act, as amended (P.L. 89-665, October 15, 1966; 16 U.S.C. 470) and its implementing regulations (36 CFR 800), which require Federal agencies to take into account their activities on historic resources that may be impacted as a result of project activities. Historic resources are those that are listed in the National Register of Historic Places (NRHP) or those that are eligible for listing in the NRHP. When assessing a resource's eligibility for NRHP listing, seven areas of integrity are considered: location; design; setting; materials; workmanship; feeling; and association. Any activity that changes any one or combination of these areas alters the historic integrity of a resource and is classified as an impact. Impacts are further classified as adverse or not adverse. In assessing impacts, the extent of the activities is considered, as is the element that will be impacted.

The value of an archaeological resource lies with its ability to contribute information on the prehistory or history of an area, i.e., to provide answers to research questions. Impacts to archaeological resources are most often assessed with regard to direct damage to a site or site element. Impacts to archaeological sites, i.e., below-ground resources, focus almost exclusively on the impacts associated with ground-disturbing activities in locations such as excavation areas, access roads, and laydown areas.

Above-ground resources are assessed on a wider variety of impacts. Construction activities that introduce ephemeral visual or noise-related elements into the environment are often assessed as indirect effects, while demolition of all or part of an above-ground resource constitutes a direct impact. These effects are further assessed as to their severity and longevity. Construction activities such as demolition that permanently alter or destroy the historic elements of an above-ground resource are considered adverse impacts. Noise-related impacts, especially noise-related impacts to resources at some distance from the construction site, are most often classified as not adverse.

The number and location of archaeological and above-ground resources identified as a result of the cultural resources investigations are presented in Subsection 2.5.3. Subsection 2.5.3.3 discusses the consultations that have been made with the Michigan State Historic Preservation Office.

4.1.3.1 **Site and Vicinity**

Construction activities will occur only within the Fermi 3 project area. The archaeological area of potential effect (APE) is situated entirely within the project area and, thus, construction impacts to archaeological resources would occur only within the archaeological APE. The above-ground resources APE includes the entire Fermi 3 project area and cultural resources identified outside of the site boundary; therefore, construction impacts are possible both within and without the Fermi 3 project area boundary. Impacts to resources within the Fermi 3 project area could be subjected to both direct and indirect impacts as a result of construction activities. Impacts to resources outside of the Fermi 3 project area would be limited to indirect impacts such as noise-related and visual impacts.

4.1.3.1.1 **Archaeological Sites**

The archaeological survey discussed in Subsection 2.5.3.4 resulted in the identification of seven archaeological sites (4 prehistoric, 2 historic, 1 multi-component [prehistoric/historic]) within the Fermi site and vicinity. All seven sites that we identified are located within the archaeological APE. Only two are located on Fermi-owned property. Two sites are located within the fenced portion of the Fermi 3 site, and five of the sites are located outside of that area. None of these sites is recommended eligible for listing in the NRHP.

The natural ground encountered at the Fermi 3 project site generally consists of poorly drained clay loams that are partially inundated or saturated with runoff from the higher ground to the west or from overflow from high water episodes of Lake Erie on the east. This low-lying, marshy environment reduces the overall potential for archaeological sites to be located within the Fermi 3 project area. Naturally occurring rises or open beachfront zones provide the highest probability for containing prehistoric and historic sites. Within the Fermi 3 project area, only one site was identified in the state site files, 20MR702. This site is listed simply as a prehistoric lithic scatter along the Lake Erie shore.

Subsection 2.5.3 describes the archaeological findings on the site. Since no NHRP-eleigible archaeological resources are evident on the site, the expected construction impacts would be SMALL, with no mitigative measures needed.

Site files maintained at the Office of the State Archaeologist (OSA) were consulted to identify previously recorded sites that contained or had the potential to contain human remains. In addition, historic maps and atlases were reviewed to locate cemeteries and other features that had the potential to contain human remains (e.g., church properties). The Fermi 3 project APE has been historically low and wet; and, therefore, considered to exhibit a low potential for containing human remains. Nonetheless, Detroit Edison considers it prudent that controls be implemented during construction excavation to ensure compliance with the Native American Graves Protection and Repatriation Act.

4.1.3.1.2 **Above-Ground Resources Sites**

No above-ground resources within the Fermi 3 project area have been assessed as to NRHP eligibility; therefore, Fermi 3 construction activities would have no impact on resources that are listed in the NRHP or that have been determined eligible for listing in the NRHP. Section 2.5.3.5 states: An assessment is in progress to determine Fermi 1 NRHP eligibility. The plan to deconstruct Fermi 1 as part of the Phase 1 construction activities is dependent, in part, upon a decision by the SHPO as to whether Fermi 1 is NRHP eligible (see Subsection 2.5.3.5)

Thirteen NRHP-listed and nine NRHP-eligible above-ground resources occur within a 10-mile radius of the Fermi 3 project area. In addition, the above-ground resources survey identified one four-building district and 19 individual properties within the above-ground resources APE that are possibly eligible for listing on the NRHP. One NRHP-eligible property, the house at 5046 Williams Road, Frenchtown Township, is located within the above-ground resources APE. The construction activities associated with Fermi 3 that would impact these sites are limited to the introduction of a permanent visual element, the cooling tower, into the viewshed. Since two cooling towers currently exist within the viewshed, this impact would not substantively alter any of these characteristics that contribute to the eligibility of any of these resources for the NRHP; therefore, impacts to historic above-ground resources within a 10-mile radius of Fermi 3 are considered SMALL, and no mitigation is required.

4.1.3.2 **Transmission Corridors and Offsite Areas**

Preliminary investigations of the transmission line route from the Sumpter-Post Road junction (near Haggerty and Arkona Roads) to the Milan Substation indicate a moderate to high potential for encountering archaeological resources. Any further fieldwork and evaluation to make a determination of NRHP eligibility would be the responsibility of ITC*Transmission*.

The preliminary field view of the built environment along the transmission line route revealed few above-ground resources that meet the minimum age requirement for listing on the NRHP or that retain enough integrity for listing. The significance of the area above-ground resources remains unevaluated, and further investigations may be conducted by ITC*Transmission* in accordance with applicable regulatory and industry standards to assess impacts.

ITC*Transmission* practices, policies, and standards with regard to cultural resources are not created by, implemented by, or monitored by the Applicant. However, it would be anticipated that

ITC*Transmission* would conduct applicable cultural resource surveys consistent with applicable State and Federal regulatory requirements.

4.1.4 **References**

4.1-1 U.S. Fish and Wildlife Service, Midwest Region, Detroit River International Wildlife Refuge, “65 Acres at the Mouth of Swan Creek Added to Detroit River International Wildlife Refuge,” press release, http://www.fws.gov/midwest/detroitriver/documents/FixRelease2007.pdf, accessed 8 October 2007.

4.1-2 U.S. Department of Agriculture, Natural Resources Conservation Service, Web Soil Survey, http://websoilsurvey.nrcs.usda.gov/app/, accessed 14 April 2008.

4.1-3 U.S. Fish and Wildlife Service, Division of Conservation Planning, “Detroit River International Wildlife Refuge Comprehensive Conservation Plan,” Appendix K, 2005, http://www.fws.gov/midwest/planning/detroitriver/, accessed 14 April 2008.

4.1-4 International Transmission Company (ITC*Transmission*), Environmental, http://www.itctransco.com/app.php?id=19, accessed 29 April 2008.

4.1-5 Michigan Department of Environmental Quality, Technical Manuals, MDEQ – BMP Design Manuals, http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-118554--,00.html, accessed 29 April 2008.

Table 4.1-1 Acreage Affected by Various Facilities Associated with Fermi 3

	Area Acres
Total Site	1260[2]
Current Fermi 2 Total Developed Area	209
Nuclear Training Center and Nuclear Operations Center	1.5
Spoils Area (surrounded by Boomerang Road)	12
Decommissioned Fermi 1 Area	7
Transmission Line Corridors (onsite 345 kV and 120 KV)	30 (to western site boundary)
(all lines offsite along Fermi Drive to Dixie Highway)	54 (western site boundary east to Dixie Highway)
New Construction Areas Affected	
Fermi 3 Power Block (Cooling Tower, Fabrication Area, Construction Offices, and Batch Plant included in this area)	87
Fermi 2 New Parking, Warehouse, and Access Infrastructure	23
Fermi 3 Construction Areas (Laydown, Access, Other)	143
Fermi 3 Switchyard	10
Newly Developed Onsite Transmission Areas	8
Fermi 3 Meteorological Tower and Access Road	6
Fermi 3 Simulator, Administrative Building	7
Total Onsite New Construction Areas Affected (not including Fermi 2 developed area)	190
Newly Developed Offsite Transmission Corridor[3]	1069

Notes:
1. Acreages given are approximate based on Figure 2.1-4.
2. Acreages in this table do not total 1260 because most of the remaining acreage is occupied by the undeveloped areas of the Detroit River International Wildlife Refuge.
3. New offsite transmission line acreage overestimated by assuming a 300-foot corridor would be impacted along the entire 29.4 mile route. Actual impacts are likely to be much less because 18.6 miles of the new corridor will largely use existing structures.

4.2 Water-Related Impacts

This section describes site preparation activities, plant water supply, hydrological alterations that could result from Fermi 3 construction activities, and the physical effects of hydrological alterations on other water users. Subsection 4.2.1 addresses hydrologic alterations, and Subsection 4.2.2 addresses water use impacts of construction activities and impacts to water quality. The Chapter 4 introduction provides an overview of the Fermi 3 construction schedule and key construction activities.

4.2.1 Hydrologic Alterations

This subsection identifies and describes the hydrologic alterations that could result from the construction of Fermi 3.

Water-related impacts from the construction of a nuclear power plant are similar to those from any large construction project. Large construction projects can, if not properly planned, result in impacts to groundwater, physical alterations of local streams and wetlands, and impacts to downstream water quality as a result of erosion and sedimentation, or spills of fuel and lubricants used in construction equipment. Because construction activities have the potential to harm surface water and groundwater resources, a number of permits must be acquired, and site-specific pollution prevention/spill control plans developed prior to initiating construction. Effluent discharged during construction activities is monitored under the National Pollutant Discharge Elimination System (NPDES) requirements.

Detroit Edison will comply with hydrological mitigation standards, regulations, and industry practices during construction of Fermi 3. The U.S. Army Corps of Engineers (USACE), the MDEQ, and other appropriate agencies will be consulted, and permits and approvals will be obtained, as necessary.

The State of Michigan Construction Stormwater Program requires industrial facilities that discharge water from construction activities that would disturb more than 5 acres of land to obtain an NPDES Stormwater Construction Permit governed by Rule 323.2190. In order to obtain an NPDES Stormwater Construction Permit, Detroit Edison will obtain a Soil Erosion and Sedimentation Control (SESC) permit and submit a notice of coverage. As part of the application of the SESC permit, Detroit Edison will also prepare and submit a copy of the SESC Plan. The SESC Plan will be one component of the overall site plan. The SESC Plan considers physical characteristics of the site and determines the best approach(es) to minimize and control erosion and sedimentation. At a minimum the SESC Plan will include:

- Site location,
- Proximity to lakes, streams, wetlands and other predominant land features,
- Description of site soils,
- Existing and proposed elevations including slope description,
- Physical limits of earth changes,

- Description of existing and proposed drainage and dewatering facilities,
- Timing and Sequencing of earth change activities and implementation of SESC measures,
- Description and location of proposed temporary and permanent SESC control measures,
- Proposal for continued maintenance of permanent SESC measures,

Proposed temporary and permanent SESC control measures will be selected based on providing effective means to minimize erosion and offsite sedimentation. Inspections will be performed to ensure that control measures are installed and maintained per the approved SESC Plan.

In addition to the SESC Plan and permit, Detroit Edison will also develop a Pollution Incident Prevention Plan (PIPP) pursuant to Part 5 administrative rules pursuant of Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act. At a minimum, the PIPP will include:

- Information regarding polluting materials stored or used onsite in quantities exceeding prescribed limits, including chemical name, product name, and Material Safety Data Sheets (MSDS).
- Appropriate information shown on Site Plans regarding polluting materials stored or used onsite in quantities exceeding prescribed limits, including location of tanks, drainage paths, loading and unloading areas, sumps, onsite water supply, containment structures.
- Specific information regarding secondary containment structures for liquid polluting materials in quantities exceeding prescribed limits, including design and construction data, how spilled materials will be captured and removed, provisions for physical security (signage, gates and fences, barriers, other), precipitation management, and inspections and maintenance procedures.
- Spill response procedures, including notification procedures to outside entities, spill control and clean-up procedures (inventory and location of spill control and clean-up equipment, spill response and clean-up and procedures for characterization and disposal of recovered materials).

Inspections will be performed to ensure that control measures are installed and maintained per the PIPP.

4.2.1.1 **Surface Water Bodies and Groundwater Aquifers**

Subsection 2.3.1 describes the physical characteristics of the surface water bodies and groundwater aquifers in the vicinity of the site, which are further summarized in this section.

The most prominent body of water in the environs of Fermi 3 is Lake Erie. Rivers and streams entering Lake Erie within a 7.5-mile radius of the site are shown on Figure 2.1-2. The Fermi site lies between Swan Creek to the north and Stony Creek to the south. In addition, there are four existing minor water bodies on the site, as shown on Figure 4.2-1. The site also contains the Quarry Lakes, located approximately 0.6 miles southwest of Fermi 3, that were established following rock quarry operations in support of site development activities for construction of Fermi 2. There are no significant impoundments, reservoirs, estuaries, or oceans located in the region that need to be considered when analyzing the water impacts on the construction of Fermi 3. The North and South Lagoons are discussed in Subsection 4.2.1.4.

The uppermost hydrogeologic unit present at the site is the shallow overburden. Several different geologic materials with varying properties comprise the overburden, and the groundwater is unconfined. The bedrock aquifer lies beneath the overburden at the site, and is generally confined. The upper bedrock unit at the site is the Bass Islands Group, which is underlain by the Salina Group. There are no sole source aquifers on the site or in the vicinity.

4.2.1.2 **Construction Activities**

This section identifies construction activities that could result in impacts to the hydrology at the Fermi 3 site. Fermi 3 construction is anticipated to disturb approximately 302 acres, which includes the Fermi 2 developed area. Figure 4.2-1 shows the various areas that will be affected by construction. The following construction activities are identified:

- Clearing additional land at the project site and constructing infrastructure such as roads and stormwater drainage systems
- Construction of new buildings (reactor containment structures, turbine building, cooling tower, electrical substation, and other related structures)
- Construction of additional parking lots and roads that will support the construction and operation of Fermi 3
- Construction of both the station water intake structure for water withdrawn from Lake Erie and the discharge pipe for water discharged to Lake Erie
- Construction of docking facilities for barges/vessels that will be used to bring in materials and machines
- Temporary disturbance of existing vegetated areas to establish construction laydown areas, concrete batch plants, sand/soil/gravel stockpiles, and construction worker parking areas
- Backfilling of onsite water bodies with excavation materials or materials brought in from offsite
- Dewatering of foundation excavations during construction
- Installation of underground piping such as sanitary, stormwater, and fire protection piping
- Installation of underground piping to the cooling tower, the discharge piping from the cooling tower to the intake groins area, and makeup water piping from the intake to the circulating water system

4.2.1.3 **Construction Water Sources**

The main water source utilized during construction will be Lake Erie. Due to its large volume, it will have sufficient capacity to meet construction water needs. Construction activities at Fermi 3 are expected to require water amounts of approximately 350,000 to 600,000 gallons per day for concrete batch plant operation, dust suppression, and sanitary needs. Due to Lake Erie's vast capacity, the withdrawal of construction water will have a SMALL impact on the water level of the lake. Minor use of groundwater may occur during construction, as described in Subsection 4.2.2.3.

4.2.1.4 **Water Bodies Receiving Construction Effluents**

Figure 2.1-3 and Figure 2.1-4 show the post-construction conditions of the local water bodies impacted by the construction of Fermi 3. Lake Erie will be the main water body to receive construction effluent for Fermi 3. The Spoil Disposal Pond, currently used by Fermi 2, will handle construction related effluents prior to discharge into Lake Erie. Effluents from the Spoil Disposal Pond are monitored under NPDES Permit No. MI0037028. The discharge is limited to a maximum of 450 million gallons per year. Total suspended solids (intake, discharge, and net discharge) and pH are also monitored. During construction of the station water intake structure, a local portion of the Lake Erie shoreline will have a cofferdam installed. The cooling tower outfall area shown on Figure 4.2-1 will also require dredging prior to construction of the discharge pipeline for the Fermi 3 cooling tower. Water and dredge material are expected to be diverted to the Spoil Disposal Pond where sedimentation will occur prior to discharge into Lake Erie. Approximately 200 gallons per minute of flow from dredge material is anticipated from construction efforts at the location of intake structure. Due to the sedimentation capacity of the Spoil Disposal Pond, discharges resulting from construction will have SMALL impacts on Lake Erie, and no mitigative measures are needed.

Four waterbodies are shown on Figure 4.2-1: the overflow canal, two onsite ponds, and the south canal. These waterbodies receive stormwater from onsite surface runoff. The northern onsite pond and the overflow canal are currently planned to be completely dewatered and backfilled. The south canal will be partially dewatered and backfilled in accordance with the final construction grading plan for Fermi 3. The southern pond will not be affected. They will be filled either partially or completely with excess fill waste material or with fill hauled in from offsite. Backfilling these onsite water bodies may impact stormwater runoff flowing to the North and South Lagoons, potentially causing a small increase of sediment loading into Lake Erie. The NPDES Stormwater Construction Permit will be implemented during construction. As discussed above, as part of the NPDES Stormwater Construction Permit, a Soil Erosion and Sedimentation Control (SESC) Plan will be implemented. As part of the SESC Plan, actions will be implemented to alleviate the potential of increased sediment loading. Therefore, backfilling the four water bodies will have a SMALL impact on Lake Erie sediment loading, and no mitigative measures are needed. Apart from its environmental impact, the backfilling of these four water bodies poses the most significant hydrological alteration resulting from construction of Fermi 3.

Fermi 2 currently releases stormwater discharge via the North Lagoon to the mouth of Swan Creek. Swan Creek, due to its location, has the potential for elevated sediment loading caused by increased runoff during construction. As discussed above, the only potential impact on Swan Creek from the construction of Fermi 3 is the backfilling of onsite water bodies, which may impact stormwater runoff. As discussed above, as part of the SESC Plan measures will be implemented to alleviate the potential for increased sedimentation in Swan Creek (and other nearby rivers and streams). Therefore, the potential impact of increased sediment loading on Swan Creek (and other nearby rivers and streams) is SMALL, and no mitigation measures will be needed.

Water used for construction is not heated or cooled. The temperature and velocity of construction effluents to water bodies are dependent on the temperature of Lake Erie and the precipitation received at the site during construction activities. Runoff from precipitation events occurring during construction activities is discharged and managed under the SESC Plan. Because precipitation events can not be predicted, it is not possible to precisely determine the temperature and/or velocity of the resulting runoff that is discharged to receiving water bodies. However, it is expected that the temperature impacts will be SMALL, and no mitigative measures are needed.

Swan Creek, due to its location, has the potential for elevated sediment loading caused by increased runoff during construction. Accordingly, the SESC Plan will alleviate the potential for increased sedimentation in Swan Creek and other nearby rivers and streams. Therefore, the potential impact of increased sediment loading on Swan Creek and other nearby rivers and streams is SMALL, and no mitigation measures are needed.

The specifics of the dewatering plan will be determined during final geotechnical design of the site. Groundwater removed during dewatering will not be utilized for any onsite purpose. The effluent from dewatering wells at the perimeter of the construction area will be discharged to the overflow canal located north of the Fermi 3 site. Detroit Edison plans to discharge the dewatering effluent under Michigan's Dredging Dewatering General Permit Number MIG690000 (Reference 4.2-6). Accordingly, the handling of removed groundwater will have a SMALL environmental impact, and no mitigative measures are needed.

4.2.1.5 **Effects of Dewatering**

The geology and hydrogeology of Fermi 3 are addressed in Section 2.3 and Section 2.6. The Fermi 3 dewatering approach will use barriers to minimize the flow of water entering the excavation. Water in the shallow fill layer is excluded from the excavation by barriers such as reinforced diaphragm concrete walls, sheet piles, or freeze walls extending through the imported fill to the top of the glacial till. Groundwater flow from the Bass Islands Group aquifer into the excavation will be minimized using methods such as:

1. A reinforced diaphragm concrete wall at the perimeter of the excavation combined with a grouting program below the excavation. The reinforced diaphragm concrete wall extends from the ground surface to below the base of the excavation.
2. A grout curtain in the bedrock at the perimeter of the excavation combined with a grouting program below the excavation. The grout curtain extends from the top of the bedrock to below the base of the excavation.
3. A freeze wall in the bedrock at the perimeter of the excavation combined with a grouting program below the excavation. The freeze wall extends from the ground surface to below the base of the excavation

It is anticipated that by using approaches such as these, groundwater inflow into the excavation will be sufficiently minimized to allow dewatering to be performed using sumps within the excavation.

The dewatering impact of the Fermi 3 excavation was evaluated using a published U.S. Geological Survey (USGS) MODFLOW (Reference 4.2-3 and Reference 4.2-4) regional steady-state groundwater model. Modifications to the model incorporated the Fermi 3 excavation and the hydraulic barrier options. The Groundwater Modeling System software (Reference 4.2-5) was used to simulate groundwater flow with the barrier alternatives. For the purpose of the model, it was assumed that the hydraulic barrier conditions of the grout curtain and freeze wall (Options 2 and 3 above) would be similar; therefore, these two options were represented with a single simulation. The reinforced diaphragm concrete wall option will provide a more impermeable barrier; consequently, it was represented with a unique simulation.

Groundwater within the imported rock fill and glacial till will be effectively cut-off using a reinforced diaphragm concrete wall or equivalent technique as discussed above. Therefore, dewatering impacts are primarily confined to the Bass Islands Group aquifer. Modeled drawdown contours in the Bass Islands Group aquifer associated with construction dewatering using Option 1 and combined Options 2/3 are shown on Figure 4.2-2 and Figure 4.2-3, respectively. The area of influence, as defined by the 1-foot drawdown contour, is greater for the Option 2/3 simulation, because these barrier types tend to allow more water to pass through compared with a reinforced diaphragm concrete wall.

Figure 4.2-2 and Figure 4.2-3 show locations of wells registered with the MDEQ as of October 2007. The largest drawdown of the potentiometric surface in an offsite well for any of the modeled simulations is approximately 2 ft. In comparison, the annual variation of the potentiometric surface in the Bass Islands Group aquifer is generally on the order of 4 ft, based on the hydrograph for USGS Well G-16, located approximately 3.2 miles west-southwest of the project site (Figure 4.2-4). The Fermi site wells have displayed similar magnitudes of seasonal water level fluctuations. Therefore, the maximum water level decline of offsite wells associated with temporary construction dewatering will be less than the typical annual potentiometric head variation. Accordingly, the impact on nearby wells due to dewatering will be SMALL, and does not warrant mitigative measures. Water level monitoring will continue during construction. If local well users are affected during Fermi 3 construction, Detroit Edison will ensure that water is supplied to meet the well users' needs.

The Quarry Lakes, located southwest of the project site, are excavated through the overlying shallow overburden zone into the Bass Island Group; therefore, the water levels in these bodies of water may be impacted by the decreased potentiometric surface associated with construction dewatering. Under the Option 1 simulation, the aquifer water levels beneath the Quarry Lakes will be lowered less than 1 ft (0.3 m). Under the Option 2/3 simulation, the water levels beneath the Quarry Lakes will be lowered approximately 2 ft. This drawdown is also less than the typical annual potentiometric head variation and will therefore cause a SMALL impact to the Quarry Lakes.

The USGS regional groundwater model does not explicitly represent the glacial deposits. Accordingly, this model was not used to evaluate wetland impacts. Figure 2.4-19 delineates the wetland areas on the Fermi site. The hydrology of the palustrine emergent marsh areas is controlled primarily by the elevation of surface water in Swan Creek and Lake Erie. The surface water in Swan Creek to the north and Lake Erie to the south of the existing units is directly connected to the palustrine emergent marsh areas on the Fermi site. Additionally, there are four sets of large diameter culverts that connect the majority of the inland palustrine emergent marsh areas west of Doxy Road with the palustrine emergent marsh areas that are directly connected with Swan Creek and Lake Erie. These culverts allow free flow of surface water throughout the interconnected palustrine emergent marsh areas. Therefore, the surface water level in the majority of the palustrine emergent marsh areas is directly controlled by the surface water elevation of Lake Erie and Swan Creek, rather than groundwater levels, so dewatering will not impact the palustrine emergent marsh areas.

Palustrine forested and palustrine shrub-scrub areas on the Fermi site are for the most part contiguous with the palustrine emergent marsh areas. Therefore, these areas are hydraulically connected with the palustrine emergent marshs, so the groundwater level in these areas is influenced by the surface water levels in Swan Creek and Lake Erie.

Figure 2.3-36 provides hydrographs from June 2007 to May 2008 for monitoring wells and piezometers at the Fermi site. Monitoring Wells MW-381S, MW-388S, and MW-393S monitor the groundwater in the overburden and are located away from the palustrine emergent marsh areas near the palustrine forested and shrub-scrub areas. At MW-381S and MW-393S the groundwater level in the shallow wells varied approximately 5 to 7 feet, while at MW-388S the groundwater level varied approximately 4 feet over the year of measurements, with all three wells showing the same fluctuation trend. During this time no improvement or deterioration in the palustrine forested and shrub-scrub areas was reported. This 4 to 7 foot natural variation in the groundwater level in the overburden indicates that groundwater level variations do not negatively impact the palustrine forested and shrub-scrub areas, rather precipitation is likely the dominant water component for the palustrine forested and shrub-scrub areas.

The modeled estimated drawdowns in the bedrock aquifer potentiometric surface beneath the palustrine forested and shrub-scrub areas range from less than 1 foot to approximately 3 feet, as shown on Figures 2.3-41 and 2.3-42. A slug test in clay at Piezometer P-389 yielded a horizontal hydraulic conductivity estimate of 0.13 feet/day. Laboratory test results for (vertical) hydraulic conductivity in samples of clay collected from P-385S, MW-387S, and MW-384S are 5.8E-5 feet/day, 6.2E-5 feet/day, and 3.7E-5 feet/day, respectively. These vertical hydraulic conductivity values for the clay overburden are lower than the hydraulic conductivity in the bedrock. It is anticipated that the lower hydraulic conductivity glacial/lacustrine soils will buffer any drawdown within the bedrock aquifer, resulting in less drawdown in the overburden than in the bedrock. The lowered potentiometric level in the bedrock aquifer in the wetland areas will result in more surface water infiltration to the bedrock than would otherwise occur; however, based on earlier discussion, any groundwater impacts associated with dewatering are not anticipated to significantly impact the wetlands. Accordingly, impacts to wetlands in the site vicinity will be SMALL, and no mitigative measures are needed.

4.2.1.6 **Transmission Facilities**

<u>Onsite</u>

Within the Fermi site, there will be a short length of new transmission corridor as described in Subsection 2.2.2.2. Hydrological impacts of this construction will be confined to designated areas as outlined on Figure 2.1-4. Onsite transmission construction activities result in approximately 5.7 acres of permanent impacts and 2.3 acres of temporary impacts.

Subsection 3.7 describes the three new 345 kV transmission lines proposed to serve Fermi 3. The 29.4-mile route of the new 345 kV transmission lines would use 18.6 miles of an existing route running along a corridor already used for transmission structures and lines. Additionally, a short (10.8-mile) tract of an existing undeveloped corridor would be used along the route to the Milan substation. Assuming a nominal 300-foot width along the entire proposed transmission corridor, a total of approximately 1069 acres could potentially be disturbed for construction activities. Laydown and other areas potentially located outside the corridor may be defined by ITC*Transmisssion* at a time closer to construction of the lines. Use of existing roads are expected for access and construction traffic as much as possible, and no new access roads are anticipated because the topography of the area is flat.

Table 2.2-6 shows the land uses within 0.5 miles of Fermi associated with the existing corridors, including the proposed transmission routes. Table 4.3-4 shows the vegetation communities along the 10.8 mile undeveloped portion of the route to the Milan substation, including the impacted areas. These tables show that open water and wetland areas comprise a relatively small portion of the total area both within the transmission corridors and within the impacted areas.

Due to the minimal acreage of open water and wetlands along the proposed route, hydrological impacts resulting from the new transmission line route are expected to be minimal. ITC*Transmission* plans to use available existing rights-of-way (ROW) for the new route rather than using a route that would convert open space to transmission use. This plan will aid in minimizing the environmental impacts of the proposed new transmission infrastructure.

4.2.1.7 **Floodplains and Wetlands**

Figure 2.3-16 shows the Federal Emergency Management Agency (FEMA) flood map for the Fermi site. As shown, the location for Fermi 3 is located in Zone X, which represents areas outside the 500-year flood zone. As shown in Table 2.3-1, based on the IGLD 1985 datum, the 10-year flood level is 576.3 feet, the 50-year flood level is 577.4 feet, the 100-year flood level is 577.9 feet and the 500-year flood level is 578.8 feet. All of these flood levels are less than the current site grade elevation of approximately 581.5 feet. Therefore, based on design and configuration, the site is adequately protected from flooding during construction.

Wetlands and Open Waters comprise approximately 60 percent of the area within the Fermi site (see Figure 2.4-19). The majority of the Fermi site that is not developed is included as part of the DRIWR at the time of this COL application. The DRIWR encompasses a 656 acre portion of the site. Of the 7.5 mile vicinity, about four percent is comprised of wetlands. Figure 2.2-1 depicts land use of the vicinity.

Dewatering is confined to the confined Bass Islands Group aquifer and will, therefore, have a minimal effect on wetlands, as described in Subsection 4.2.1.5. Appropriate permits and procedures will be used per State and Federal guidelines and regulations, as required, for specific construction activities affecting wetlands.

4.2.1.8 **Groundwater and Surface water Users**

During construction, potable water is planned to be supplied by the Frenchtown Township water supply system. Water for temporary fire protection, concrete batching, and other construction uses is expected to be withdrawn from Lake Erie. Minor use of groundwater may occur during construction, as described in Subsection 4.2.2.3.

Consumptive surface water use is discussed in Subsection 2.3.2. The Great Lakes Basin has nine main sectors of water consumption: Public Water Supply, Self-Supply Domestic, Self-Supply Irrigation, Self-Supply Livestock, Self-Supply Industrial, Self-Supply Thermoelectric (Fossil Fuel), Self-Supply Thermoelectric (Nuclear), Hydroelectric, and Self-Supply Other. Consumptive use for each sector is listed in Table 2.3-29. According to the MDEQ, the main sectors of water consumption regarding the region of influence from the construction and operation of Fermi 3 are the following: Power Generation (Nuclear), Power Generation (Fossil Fuel), Public Water Supply, Agricultural Irrigation, Self-Supply Industrial, and Golf Course Irrigation. Flow rates and total water use concerning these sectors is provided in Table 2.3-34. Yearly consumptions and water withdrawals for the entire Lake Erie is listed in Table 2.3-30 through Table 2.3-33. Given its vast size, construction water withdrawal will have a SMALL impact on the availability of water from Lake Erie for consumptive use.

Fermi 2 will be the only surface water user potentially impacted by the construction of Fermi 3. A portion of the intake area used by Fermi 2 will be disturbed during construction; however, the degree of disturbance will not affect Fermi 2 operations. The area of this impact is shown on Figure 4.2-1.

Figure 4.2-2 and Figure 4.2-3 show well locations near the Fermi site, including those in the area of influence of dewatering. These wells are classified as household wells, irrigation wells, unclassified wells, or other wells. The drawdown expected in these wells will be minor, especially when compared to the normal potentiometric head variation shown on Figure 4.2-4. Consequently, as discussed in Subsection 4.2.1.5, groundwater users of these wells will be subjected only to SMALL capacity impacts due to the construction of Fermi 3.

A recommended planning number for potable water consumption for workers in hot climates is 3 gallons per day for each worker. Based on the maximum estimated construction worker population of approximately 2900 workers, about 8700 gallons per day of drinking water will be consumed. Potable water for Fermi 3 will be distributed from the Frenchtown Township Water supply, which has a capacity of 4 million gallons per day. Accordingly, the impact to municipal water supply users is expected to be SMALL, and no mitigative measures are required.

4.2.1.9 **Hydrologic Alteration Best Management Practices and Measures**

This section describes BMPs and measures to minimize potential impacts of hydrologic alterations or effluent discharges. These activities are in compliance with hydrologic regulations, standards, and practices of the proper state agencies. These practices also comply with Michigan Department of Environmental Quality BMPs (Reference 4.2-1 and Reference 4.2-2).

Impacts from construction of Fermi 3 will be minimized by the following practices, as appropriate:

- Hand-clearing of trees and brush located within approximately 100 feet of a stream or ditch with running water discharging to Lake Erie
- Removing material approximately three inches and above in diameter from the buffer zone and leaving material less than three inches undisturbed
- Limiting the disturbance of soil within an approximate 100-foot buffer zone around streams and ditches
- Crossing creeks and streams at right angles in one location on the corridor using culverts, temporary bridges, or larger aggregate stone
- Performing work related to stream crossings in accordance with state standards and specifications
- Removing materials from temporary stream crossings at the completion of the project
- Removing logs, trimmings, or brush form ditches, creeks, and drains

In addition, impacts from the construction of structural foundations and structure erection activities will be alleviated by the following measures:

- Evaluation of the site with respect to earth disturbance and erosion potential
- Stabilization of the work site prior to moving to the next location
- Restoration of areas damaged during foundation construction and structural erection activities to approximate original grade, and installation of erosion and sedimentation control measures
- Maintaining temporary erosion and sedimentation controls until permanent stabilization is achieved

4.2.2 **Water-Use Impacts**

This subsection describes the water-use impacts on the surface water and groundwater environments during the construction phase of the project. Measures to eliminate or reduce construction impacts are discussed in Subsection 4.2.1.9.

4.2.2.1 **Construction Activities Potentially Impacting Water Use**

Subsection 4.2.1.2 lists the proposed construction activities that have the potential to affect nearby surface water and groundwater. Subsection 4.2.1.4 and Subsection 4.2.1.5 describe the principal hydrologic alterations that will occur. The western basin of Lake Erie is the main water body that could potentially be affected by these construction-related hydrologic alterations. In addition to the impacts described in those sections, construction of the intake structure will involve dredging which may temporarily result in increased turbidity in Lake Erie. As discussed in Subsection 4.2.1.5 and Subsection 4.2.1.8, dewatering during excavation may impact nearby wells and the two Quarry Lakes. Also, as discussed in Subsection 4.2.1.4, backfilling of onsite water bodies will impact stormwater runoff to Swan Creek.

A primary concern with runoff from a construction site is the loss of soil and the impact of soil on water quality. Lake Erie has the greatest potential to experience runoff effects due to its shoreline being approximately 1300 feet away from Fermi 3. The SESC Plan will address practices to minimize this concern. MDEQ and NPDES guidelines for the installation of the discharge pipe will be followed during construction. Additionally, construction of the intake structure and associated dredging operations have potential to impact surface water quality. Details about these issues are described in Subsection 4.2.1.

4.2.2.2 **Water Quality of Bodies Receiving Construction Effluents**

The physical impacts from construction activity effluents are considered to be SMALL, as concluded in Subsection 4.2.1. Water is withdrawn from Lake Erie in sufficient quantities to produce concrete, provide dust suppression water for roads, and provide for other construction activities as needed. The water withdrawn is essentially consumed with no free-flowing streams or runoff generated from these activities.

Backfilling the onsite water bodies, as described in Subsection 4.2.1.4, may impact stormwater runoff. Slight increases in stormwater runoff are to be expected from new impervious areas at Fermi 3. This impact is minimal due to the relatively small area of the Fermi 3 developed area within the Swan Creek Watershed. Although a small increase in sediment loading into Lake Erie through Swan Creek's discharge is expected from filling-in the onsite water bodies, the implementation of the SESC Plan will prevent sediment loading from becoming a problem during construction.

Water and dredge materials from Lake Erie are expected to be diverted to the Spoil Disposal Pond for settling prior to discharge back to Lake Erie. Water discharges will be monitored in accordance with applicable NPDES requirements and State water quality standards at the time of construction.

Applicable permitting required by Federal, State and local regulations will be obtained prior to the commencement of construction. Appropriate regulatory permits are obtained for construction in wetland areas. In 1984, Michigan received authorization from the federal government to administer Section 404 of the Clean Water Act in most areas of the state. A State administered 404 program must be consistent with the requirements of the Federal Clean Water Act and associated regulations set forth in the Section 404(b)(1) guidelines. Contrary to other states, where users must apply to the USACE and a state agency for wetland permits, applicants in Michigan generally submit only one wetland permit application to the MDEQ.

In sum, the impact on water quality of waters receiving construction effluents (Lake Erie and Swan Creek) is expected to be SMALL, and no mitigative measures are needed.

4.2.2.3 **Water Quantity Used and Quantity Available to Other Users**

Subsection 4.2.1.8 describes the surface water and groundwater users potentially impacted by the Fermi 3 hydrologic alterations. The amount of water needed during construction does not affect water levels in Lake Erie or existing or future water rights and allocations and does not require rationing of any existing water uses. Primary water needs for construction of Fermi 3 are for concrete batch plant operations, watering of roads for dust suppression, and watering of disturbed areas to establish new cover vegetation. Because most of the water needed for construction is expected to be withdrawn from Lake Erie, there should be no effects to the water quality or detrimental impacts that would affect any other user's consumption. Accordingly, these impacts are projected to be SMALL, and no mitigative measures are needed.

There are no current plans to use groundwater for construction. However, it is possible that groundwater may be supplied to certain outbuildings as potable water. This water use would be expected to be minimal, thus the only impact on nearby wells from construction activities will be due to dewatering of the excavation. The drawdown experienced by nearby wells due to dewatering activities is minor and is not expected to affect nearby users of groundwater. As discussed in Subsection 4.2.1.5, the impacts to groundwater are projected to be SMALL, with no mitigative measures needed.

4.2.2.4 **Water Quality Changes Due to Substratum Exposure**

Subsection 2.3.3 provides a summary of the existing water quality of Lake Erie and the surrounding surface water and groundwater. The U.S. Environmental Protection Agency (EPA) has conducted extensive domestic and aquatic ecosystem studies on Lake Erie. Data is stored in the Great Lakes Environmental Database (GLENDA). The EPA continues to monitor the ecological health of the water within Lake Erie, including the area around Fermi 3.

The NPDES permit addresses discharge limits from the Spoil Disposal Pond for water quality. Construction impacts to the intake and discharge areas are local and transient. Large areas are not expected to be affected, and the locally affected areas are expected to recover rapidly. Measures to eliminate or reduce construction impacts are discussed in Subsection 4.2.1.9.

The Pollution Incident Prevention Plan (PIPP) will provide approved measures to prevent fuel, oil, and other chemicals associated with construction from contaminating the surface water or the groundwater. The PIPP is described in more detail in Subsection 4.2.1. In sum, only very localized and transient impacts due to substratum exposure are anticipated and are considered SMALL, and no mitigative measures are needed.

4.2.2.5 **Effects of Alterations on Other Water Users**

Consumptive surface water use is discussed in Subsection 2.3.2. According to the MDEQ, the main sectors of water consumption regarding the region of influence from the construction and operation of Fermi 3 are the following: Power Generation (Nuclear), Power Generation (Fossil Fuel), Public Water Supply, Agricultural Irrigation, Self-Supply Industrial, and Golf Course Irrigation. Flow rates and total water use concerning these sectors is provided in Table 2.3-34. Yearly consumptions and water withdrawals for the entire Lake Erie can also be viewed on Table 2.3-30 through Table 2.3-33. Construction activities for Fermi 3 are anticipated to have negligible, if any, impacts on water quality or its current uses. Short-term increases in turbidity from new construction at the Fermi 3 site are not expected to impact water supplies for these uses. Accordingly, the effects on consumptive water use are expected to be SMALL, and no mitigative measures are needed.

Figure 4.2-2 and Figure 4.2-3 show well locations near the Fermi site, including those in the area of influence of dewatering. These wells are classified as household wells, irrigation wells, unclassified wells, or other wells. The drawdown expected in these wells will be minor, especially when compared to the normal potentiometric head variation shown on Figure 4.2-4. Consequently, groundwater users of these wells will be subjected only to SMALL impacts due to the construction of Fermi 3.

4.2.2.6 Proposed Practices to Control Water-Use Impacts

The use of proven construction methods, exercising minimal land disturbances for new construction activities, and developing and implementing BMPs associated with the site-specific SESC Plan, PIPP, and NPDES permit requirements should eliminate or reduce the potential for any water-use impacts. Measures to eliminate or reduce construction impacts are discussed in Subsection 4.2.1.9.

4.2.3 References

4.2-1 Michigan Department of Transportation, “Chapter 9, Stormwater Best Management Practices,” Revised January 2006, http://www.michigan.gov/documents/MDOT_MS4_Chap_91740_7._09_Drainage_Manual.pdf, accessed 28 April 2008.

4.2-2 Michigan Department of Environmental Quality, Technical Manuals, MDEQ – BMP Design Manuals, http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-118554--,00.html, accessed 29 April 2008.

4.2-3 McDonald, M., and A. Harbaugh, “A Modular Three-Dimensional Finite-Difference Ground-Water Flow Model,” Techniques of Water-Resources Investigations of the United States Geological Survey, Book 6, Chapter A1, 1988.

4.2-4 Harbaugh, A.W., E.R. Banta, M.C. Hill, and M.G. McDonald, “MODFLOW-2000, The U.S. Geological Survey Modular Ground-Water Model – User Guide to Modularization Concepts and the Ground-Water Flow Processes,” U.S. Geological Survey Open-File Report 00-92, Reston, Virginia, 2000.

4.2-5 Brigham Young University Environmental Modeling Research Laboratory, “Groundwater Modeling System Tutorials,” Version 6.0, Vols. I, II, and III, October 20, 2005.

4.2-6 State of Michigan Department of Environmental Quality, NPDES, “Dredging Dewatering Water,” Permit No. MIG690000, (9 October 2006), http://www.deq.state.mi.us/documents/deq-water-npdes-generalpermit-MIG690000.pdf, accessed 16 May 2008.

Figure 4.2-1 Construction Affected Areas

Figure 4.2-2 Dewatering Bass Islands Group: Potentiometric Surface Contours – Reinforced Cement Slurry Wall with Grouted Base Combination

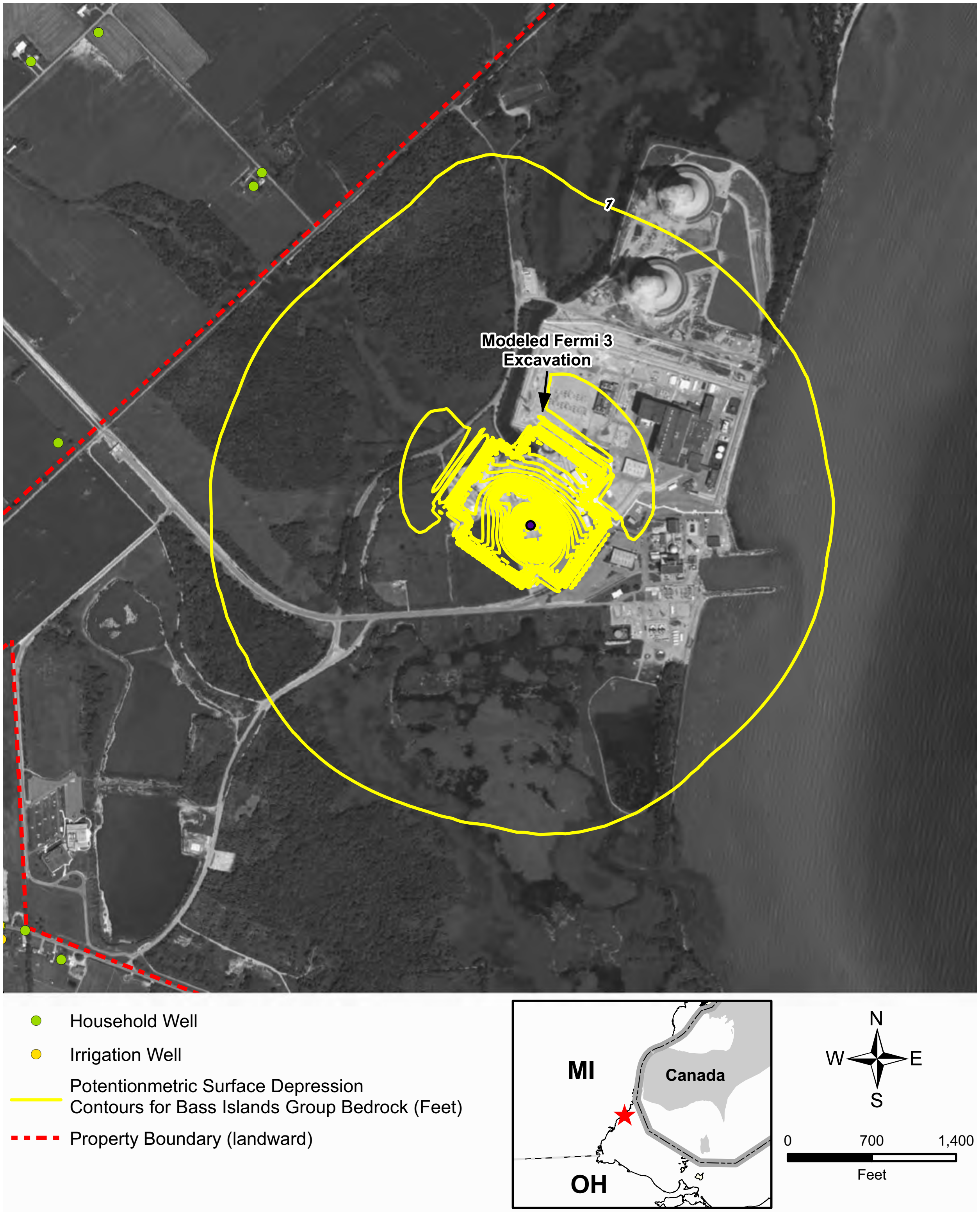


Figure 4.2-3 Dewatering Bass Islands Group: Potentiometric Surface Contours – Grouted Base with a Grout Curtain or Freeze Wall Combination

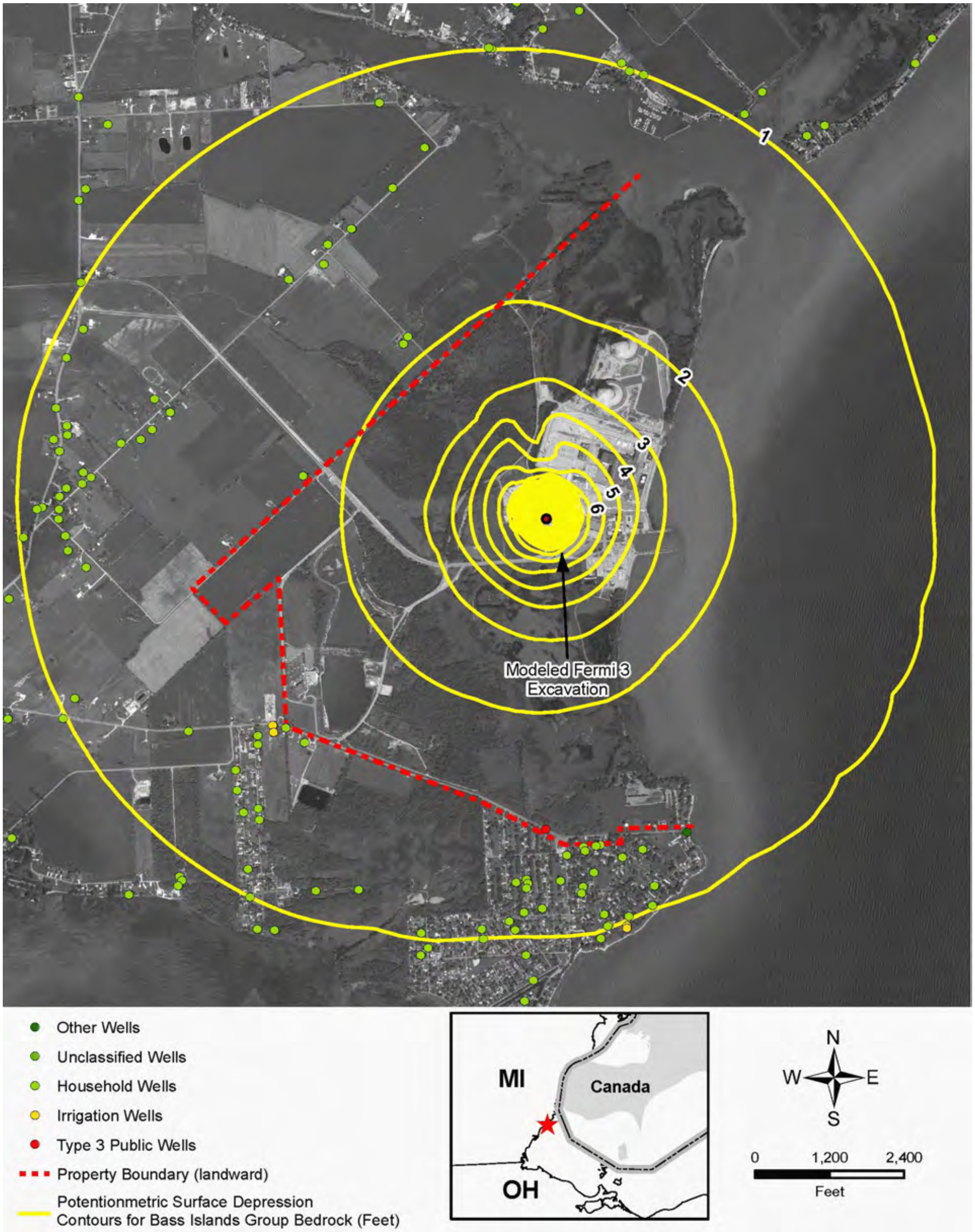
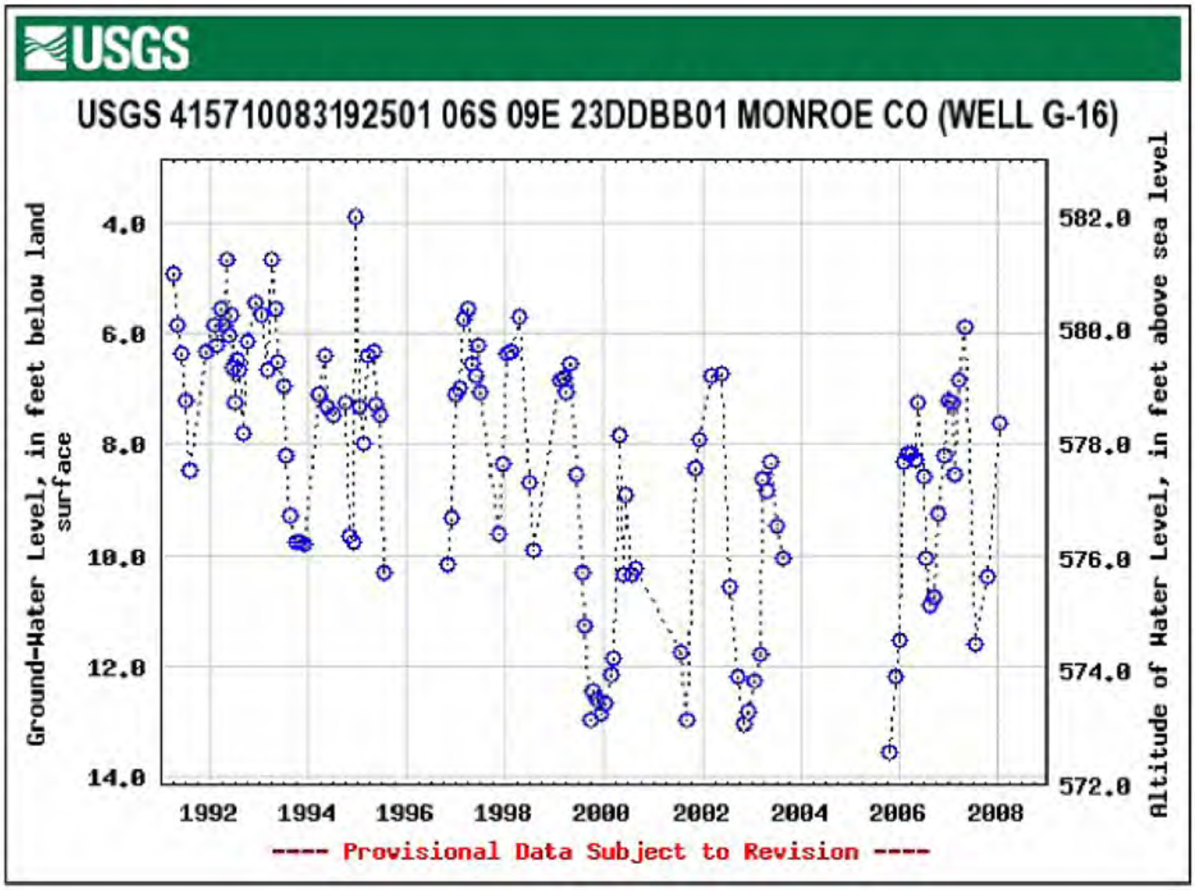


Figure 4.2-4 USGS Well G-16 Hydrograph



4.3 Ecological Impacts of Construction

This section describes the potential impacts from the construction of Fermi 3 on the ecological resources at the Fermi site and in the vicinity and those associated with the transmission corridor construction activities. The vicinity considered includes a 7.5 mile radius area around the Fermi site (Figure 2.2-1). The section is divided into two subsections: Terrestrial Ecosystems and Aquatic Ecosystems. For purposes of characterization, wetlands are principally described as terrestrial ecosystems. The subsections summarize relevant information from field studies and other existing data in accordance with the guidance in NUREG-1555 and Regulatory Guide 4.2, Revision 2. The Chapter 4 introduction provides an overview of the Fermi 3 construction schedule and key construction activities.

During construction, several activities will be directed at protecting the terrestrial and aquatic environment, including using BMPs to reduce the risk of stormwater runoff, erosion, and pollutant spills, as outlined in the SESC Plan and the PIPP for the Fermi 3 site. The requirements for the SESC Plan and the PIPP are described in more detail in Subsection 4.2.1. BMPs that are used will be consistent with the practices discussed in Guidebook of Best Management Practices for Michigan Watersheds (Reference 4.3-1). As part of Reference 4.3-1, BMPs are categorized into one of eight categories:

- Construction Site Preparation
- Housekeeping
- Managerial
- Runoff Conveyance and Outlets
- Runoff Storage
- Sedimentation Control Structures
- Vegetative Establishment
- Wetlands

Each of these categories contains several BMPs that will be implemented as the conditions warrant. For each of the BMPs, Reference 4.3-1 provides more detailed information including a description of the BMP, the basis for implementing the BMP, the application of the BMP, relationship with other BMPs and how other BMPs can be used to compliment each other, considerations during the planning phase, considerations during the implementation phase and post-construction considerations.

4.3.1 Terrestrial Ecosystems

This subsection describes the impacts of construction on the existing terrestrial ecosystem as described in Subsection 2.4.1. Figure 4.3-1 shows the undeveloped areas that would be impacted by the construction of Fermi 3. The site layout for Fermi 3 is shown in Figure 2.1-4. The total impact area for Fermi 3 is 302 acres, which includes the aquatic area impacts, as discussed in Subsection 4.3.2. Fermi 3 construction would disturb approximately 200 acres of terrestrial habitat on the Fermi site. The terrestrial habitats impacted are illustrated in Figure 4.3-2. Of this 200 acre area, permanent impacts are expected to occur to approximately 53 acres and temporary impacts to approximately 147 acres. Temporarily disturbed sites are to be replanted following completion of construction.

The Fermi 3 site layout has been designed to minimize terrestrial ecosystem impacts to the greatest extent possible. Currently developed and previously disturbed grounds are used wherever possible. Unavoidable impacts to wetlands are anticipated, but have been minimized as much as possible. No Federally-listed threatened or endangered species under the Endangered Species Act would be impacted. Four Michigan-listed species, two plants and two animals, may be affected, and preventative measures are provided to ensure the continued existence of these species in the state (see Subsection 4.3.1.2.1).

4.3.1.1 **Terrestrial Communities**

The following sections discuss the potential impacts to vegetation and wildlife related to construction of Fermi 3.

4.3.1.1.1 **Vegetation on the Site and in the Vicinity**

Construction activities would result in the permanent clearing and grubbing of portions of the impact area shown in Figure 4.3-1. No impacts are expected in the site vicinity, with the exception of those areas associated with the offsite transmission system, as discussed in Subsection 4.3.1.5. Permanent and temporary impacts to plant communities on the Fermi site are summarized in Table 4.3-1. New development would affect approximately 200 acres of undeveloped land; 53 acres would be permanently impacted and 147 acres would be temporarily impacted. The overall and cumulative impacts of Fermi 3 construction activities to terrestrial vegetative communities are considered SMALL, and no further mitigation measures are warranted.

Notwithstanding the above conclusion, it is Detroit Edison's intention that about 74 percent, or approximately 147 acres, would be restored by re-vegetation using species native to the Fermi vicinity. Areas available for restoration are shown in Figure 4.3-2 and labeled as temporary impact areas. The restoration would alleviate any adverse impacts to these communities by planting species native to the region and appropriate for the area being re-vegetated. The restored habitat is expected to provide improved species composition in the plant communities and enhanced wildlife habitat by providing both improved forage and shelter for wildlife in the area. Other activities directed at protecting the environment will include using BMPs to reduce the risk of stormwater runoff, erosion, and pollutant spills, as outlined in the SESC Plan and the PIPP for the Fermi 3 site. The requirements for the SESC Plan and the PIPP are described in more detail in Subsection 4.2.1.

Following is a brief discussion of each terrestrial community that would be impacted, based on the information provided in Subsection 2.4.1.

Coastal Emergent Wetland (Vegetated)

Approximately 1.7 acres of this community would be permanently impacted. This represents less than one percent of the 238 acres of the community present onsite and 0.1 percent of the 1550 acres found in the vicinity. Most of these areas are associated with the onsite transmission corridor. The boundaries of these areas are identified on Figure 2.4-19. Whenever possible, construction activities will be restricted in these areas to further minimize permanent impacts to these important habitats. The project impacts to this community are considered SMALL, and no mitigative measures are needed.

Grassland: Right-of-Way

This community includes 29 acres located on the Fermi site, of which 9.6 acres (switchyard) will be permanently impacted and 13.5 acres (construction area) will be temporarily impacted by use as construction worker parking during Fermi 3 construction. The permanent impact area represents slightly less than 1 percent of the 1209 acres present in the project vicinity. Although the area includes mostly native plant species, the area is artificial in the sense that it was planted, as discussed in Subsection 2.4.1.1.1. The temporary impact area will be restored. Because this is a planted area and the area is small compared to what is present in the vicinity, the project impacts to this community are considered SMALL, and no mitigative measures are needed.

Grassland: Idle/Old Field/Planted

Approximately 43 acres of this community present onsite would be impacted, 25.7 acres permanently and 17.6 acres temporarily. Onsite there are about 75 acres of this community present. The majority of the permanent impacts are associated with the power block and cooling tower construction. Temporary impacts are primarily associated with the Fermi 3 construction parking and laydown areas and will be re-vegetated following construction. As discussed in Subsection 2.4.1.1.1, these grassland habitats occupy mostly land that was previously disturbed and are composed of early succession and often non-native plant species. In addition, these grasslands provide poor quality wildlife habitat, primarily due to a lack of forage species. About 6,932 acres of this community occurs in the vicinity. The permanent loss of 25.7 acres represents about 0.4 percent of the community in the vicinity. The project impacts to this community are considered SMALL, and no mitigative measures are needed.

Grassland: Row Crop

Approximately 64 acres of this community present onsite would be impacted, representing less than one-half of one percent of the 23,465 acres present in the vicinity. About 1 acre in the vicinity of the meteorological tower will be permanently impacted. Portions of the area would be graveled for parking or equipment and materials storage during construction. Following construction, the area could be used once again for crop production. Since this impact is temporary, effects on a project basis are considered SMALL, and no mitigative measures are needed.

Shrubland

Approximately 35 percent of this community present onsite would be impacted, approximately two acres permanently and 38.5 acres temporarily. This is an early succession community that has developed on lands that were previously disturbed (cleared or filled) during the construction of Fermi 2 as discussed in Subsection 2.4.1.1.1. While some wildlife utilizes the area for shelter, other habitats in the immediate and surrounding vicinity provide opportunities for shelter and perhaps better foraging. On the Fermi site, 113 acres of this community were mapped during site visits. The onsite acreage of Shrubland habitat is unclear because of inconsistencies between USGS data and onsite observations. USGS data indicate 95 acres of Shrubland in the vicinity (refer to Table 2.2-2), which is less than the observed habitat (113 acres). One possible explanation is that USGS data were collected before subsequent expansion of Shrubland had occurred, resulting in the recent larger estimate. However, because this is an early succession community, the project impacts to the community are considered SMALL, and no mitigation measures are needed.

Thicket

Approximately 7 percent of the 23 acres (i.e., 1.7 acres) of this community present onsite would be permanently impacted. This is an early succession community that has developed on lands that were previously disturbed (cleared or filled) during the construction of Fermi 2 as discussed in Subsection 2.4.1.1.1. Wildlife use of the area is mostly for shelter. Due to the small area of permanent loss and early succession character of this community, the project impacts to the community are considered SMALL, and no mitigative measures are needed.

Forest: Lowland Hardwood

Approximately 4.8 acres of this community present onsite would be temporarily impacted. As described in Subsection 2.4.1.1.1, this is a natural community and probably represents the most mature plant community on the Fermi site. Wildlife use the community for shelter, and some foraging is available due to the presence of mast producing species, mostly oaks. The area to be temporarily impacted is associated with the construction laydown areas. This same area will be re-vegetated following construction. The temporary loss to the community from the project is considered SMALL based on the amount of similar community in the vicinity, and no mitigative measures are needed.

Forest: Woodlot

Approximately 117 acres of this community are present onsite. Of this total, approximately 5 percent (i.e., approximately 8.4 acres) would be permanently affected by Fermi 3 construction. There will be 6.3 acres of temporary impacts. As described in Subsection 2.4.1.1.1, this community occurs entirely on previously cleared and/or filled land. The plant species present are mostly not representative of native forested areas in the region but local wildlife do utilize the area for shelter and limited foraging. The temporarily impacted areas, those associated with the Fermi 3 construction parking area, would be re-vegetated following construction. Due to the early succession character of this community, the project impacts to the community are considered SMALL, and no mitigative measures are needed.

Forest: Coastal Shoreline

The Coastal Shoreline Forest plant community encompasses about 47 acres of land or 3.7 percent of the Fermi site. One acre near the meteorological tower will be permanently impacted. This is a dynamic plant community composed of opportunistic, early succession (pioneer) species. The area is dominated by cottonwoods and willow, some quite large. Shrub growth varies from dense to sparse depending on lake exposure and the extent of ponding that occurs. The habitat value of the area is primarily limited to roosting or nesting by birds, notably bald eagles. Because of the nesting eagles, measures to avoid disturbance near this habitat during April to June, including excessive noise, will be used to limit impacts to bald eagles. Because only a small portion of this habitat will be affected directly and preventive measures to avoid indirect impacts will be in effect, the project impacts to the community are considered SMALL, and no mitigation measures are needed.

4.3.1.1.2 **Wildlife on the Site and in the Vicinity**

The footprint for Fermi 3 is designed to utilize developed and previously disturbed areas to minimize the impact to wildlife. Potential impacts to wildlife from construction activities could include:

- Takes or displacement of wildlife
- Fugitive dust and equipment emissions
- Bird collisions with elevated construction equipment
- Pollutant spills
- Noise

Takes or Displacement of Wildlife

The normal movement of equipment, clearing and excavation are expected to result in some takes of small wildlife but mostly the displacement of certain wildlife. To benefit wildlife, Detroit Edison will adhere to permit conditions that may restrict the timing of certain construction activities, such as avoiding primary nesting periods for birds, such as the bald eagle that is discussed in Subsection 4.3.1.2.1. Mortality is expected to be limited to the least mobile wildlife, such as small mammals and reptiles. Larger mammals and birds will leave the area when there is disturbance. The wildlife disturbed is expected to be primarily common species that readily adapt to changing environments, such as raccoon (*Procyon lotor*), opossum (*Didelphis virginiana*), and skunk (*Mephitis mephitis*). The wildlife is expected to move outward from the impact area to neighboring habitats both onsite and offsite, making the impact to wildlife SMALL with no mitigative measures needed.

Fugitive Dust and Equipment Emissions

The impact of fugitive dust is expected to be negligible as access roads and construction sites will be watered as necessary. Emissions from heavy equipment are expected to be minimal because of regularly scheduled maintenance procedures and therefore, the impacts to terrestrial wildlife is SMALL, and no mitigative measures are needed.

Bird Collisions with Elevated Construction Equipment

There is limited published literature regarding bird collisions with elevated construction equipment, such as cranes. However, the NRC states in Section 4.3.5.2 of NUREG-1555, in reference to cooling towers, that "the significance of the [bird] mortality ….is determined by examining the actual numbers and species of birds killed and comparing this mortality to the total avian mortality resulting from other man-made objects and with the abundance of bird populations near the towers." With regard to elevated construction equipment, there is no available data, and therefore, no direct comparisons are possible. The lack of data suggests that an impact of this type during construction has not been a significant issue in the past and is probably not a significant issue at present. NUREG Section 4.3.5.2 further states that avian mortality resulting from collisions with cooling towers is of small significance. This considered, it is reasonable to extrapolate that if significance is small for a fixed and permanent object like a cooling tower, then the presence of elevated construction equipment for a short term would also be considered of SMALL significance, and no mitigative measures are warranted. Bird collisions with permanent elevated structures (e.g., cooling towers) during operation of the facility, are discussed in Subsection 5.3.3.

Pollutant Spills

Pollutant spills associated with construction activities could impact terrestrial wildlife but is of a greater concern to aquatic organisms as discussed in Subsection 4.3.2. As discussed in Subsection 4.2.1, a PIPP will be implemented, which addresses actions to be taken in the event of such spills. Accordingly, impacts from a spill occurrence are expected to be SMALL, and no mitigative measures are needed.

Noise

Noise generated by construction activities, including workers and equipment, can affect wildlife. Effects may include physiological changes, abandonment of nests or dens, curtailed use of foraging areas, and other behavioral modifications. Since most of the noise associated with the construction is in close proximity to the existing Fermi structures, most of the wildlife in the area will have presumably already adapted to facility noise levels. It is therefore expected that the overall impact of construction noise on wildlife is SMALL, and no mitigative measures are needed. Potential effects on the bald eagle, which is a State threatened species, are discussed in Subsection 4.3.1.2.1.

4.3.1.2 **Important Terrestrial Species and Habitats**

Subsection 2.4.1 describes the important terrestrial species and habitats located within the Fermi 3 site and vicinity, and transmission corridors. No Federally protected plant or animal species or designated critical habitat listed by the USFWS under the Endangered Species Act (Reference 4.3-2) would be impacted. The Michigan Department of Natural Resources (MDNR) stated that while there are no occurrence records for these species in the vicinity, terrestrial species may occur in the vicinity. Field studies in 2007 identified one animal and one plant that are State listed that occur on the Fermi site. Table 4.3-2 provides a list of the protected species occurring or potentially occurring on the Fermi site. Following are discussions of the State protected species and important habitats.

4.3.1.2.1 **Important Species**

Bald Eagle

The bald eagle is a Michigan threatened species. Three nests occurred on the Fermi site in the winter of 2007-2008 in the Coastal Shoreline Forest immediately adjacent to Lake Erie. Two nests were located north of Fermi 2, and one nest was south of Fermi 2. Normally one pair of eagles will occupy one of the three nests each winter. In May 2008, the nest south of Fermi 2 was gone, apparently blown out of the tree during winter storms. One nest, approximately 750 feet east of the Fermi 2 cooling towers, was occupied.

Formerly listed as an endangered species, the bald eagle nationwide (except in parts of Arizona) was federally de-listed in 2007, but continues to be protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. MDNR eagle management guidelines impose activity restrictions within a one-quarter mile radius around active nests from mid-March to the end of June, if young are in the nest. However, because bald eagles are abundant in Michigan, the MDNR is in the process of de-listing the species for Michigan. When the state de-listing process is complete, the MDNR will follow USFWS guidelines for bald eagle management. These guidelines suggest a radius of 660 feet around the nest during the breeding season (Reference 4.3-4). The restricted area is imposed because bald eagles are extremely sensitive to human activity during the first 12 weeks of the breeding season. These guideline limitations will be adhered to during Fermi 3 construction.

American Lotus

The American lotus (a Michigan threatened species) is a wetland plant common in moderately shallow areas of the South and North Lagoons and the south canal on the Fermi site. Although the species reaches a northern limit of its distribution in southeast Michigan, healthy populations are scattered throughout this portion of the state. American lotus grows from thick and creeping underground tubers that make it impossible to determine how many plants are actually present in a given area. The plants, however, are hardy and relatively easy to transplant.

Construction activities in the south canal are expected to affect the American lotus. Because state populations of American lotus are healthy, MDNR endangered species specialists have indicated that plants expected to be impacted by Fermi 3 construction activities should be transplanted to other areas of the lagoons on the Fermi site.

Arrowhead

The arrowhead (a Michigan threatened species) has not been observed on the Fermi property. Subsection 2.4.1.2.2.2 provides life history and distribution information about the species. Most of the habitat that might have been suitable for the species has been invaded by common reed (*Phragmites australis*). Therefore, impacts from Fermi 3 activities are anticipated to be SMALL, and no mitigative measures are needed.

Eastern Fox Snake

The eastern fox snake (a Michigan threatened species) was sighted two times on the Fermi property, in June 2008. The Michigan Natural Features Inventory has recorded nine occurrences for Monroe County, with the most recent report in 2007 (Reference 4.3-5). The snake was found along the cattail marshes or wetland shorelines around woody debris. The life history of the eastern fox snake is discussed in Subsection 2.4.1.2.2.1. Detroit Edison has prepared a mitigation plan for eastern fox snakes to be used during the construction phase of the project (Reference 4.3-8). The primary goal of this plan is to minimize the impacts to resident fox snakes. Detroit Edison has also committed to developing a procedure which will be used during the operation of Fermi 3 to minimize the impact to fox snakes. [START: COM ER-2.4-016] Detroit Edison will develop a procedure to be used during the operation of Fermi 3 to mitigate impacts to eastern fox snakes on-site. [END: COM ER-2.4-016]

4.3.1.2.2 **Important Habitats**

Important habitats for the Fermi site are described in Subsection 2.4.1.2.3 and include the DRIWR and areas of wetlands as discussed below.

Detroit River International Wildlife Refuge

The DRIWR Lagoona Beach Unit is located entirely within the Fermi property and includes a total of 656.4 acres (Figure 2.4-6). The Fermi 3 construction impact area includes approximately 45 acres, or about 7 percent of the Lagoona Beach Unit as illustrated in Figure 4.3-3; 18.5 acres would be permanent impacts and 26.2 acres temporary impacts. The area of each section of the Lagoona Beach Unit and the area of that unit to be impacted is provided in Table 4.3-3. The agreement between Detroit Edison and the USFWS that established the wildlife refuge allows for modifications to the agreement (such as Fermi 3) by either party at any time (Reference 4.3-6). The construction impacts of reducing the effective area of the DRIWR are principally land-use impacts, which discussed in Subsection 4.1.1.1. The importance of DRIWR as an ecological habitat is principally due to it being a wetlands area. Accordingly, the construction impacts are bounded by the overall wetlands impacts, as discussed below.

Wetlands

Detroit Edison conducted a wetlands investigation to delineate wetland boundaries and assess functions and values of the wetlands present on the Fermi property. The 2008 wetland investigation report was provided to MDEQ and USACE in the fall of 2008 with a request for review and a jurisdictional determination. Jurisdictional determination letters were provided by the now MDNRE in November 2008 (Reference 4.3-9) and March 2009 (Reference 4.3-10) and by USACE in November 2010 (Reference 4.3-11). The wetland delineation boundaries were updated in response to the jurisdictional determination letters. Additional updates to the wetland delineation were based on site visits and verbal and written feedback from MDNRE and USACE during 2010. The results of the wetland investigation are summarized in Subsection 2.4.1.2.3. Impacts to approximately 38.27 acres of wetland and open water habitat regulated by the MDEQ and USACE are anticipated within the construction impact area at the Fermi property (see Figure 4.3-5). This acreage includes

20.89 acres of emergent marsh (PEM), 6.84 acres of forested wetland (PFO), 5.28 acres of scrub-shrub wetland (PSS), and 5.26 acres of open water. Of this acreage, approximately 23.75 acres (62 percent) are temporary impacts that would be restored following construction. Characteristics of these wetlands are discussed in Subsection 2.4.1.2.3. In sum, the construction impacts are projected to be MODERATE. Accordingly, Detroit Edison will prepare a mitigation plan for Fermi construction activities that will be submitted to the MDEQ and USACE.

Impacts to wetlands as part of Fermi 3 construction activities are a matter that must be carefully considered due to the importance of these habitats. Measures are taken to first avoid impacts and when that is not possible, impacts are minimized to the greatest extent possible. Work in areas adjacent to wetlands, such as the parking lot construction, would utilize silt fencing to protect the wetland from siltation and entry by construction equipment. Other BMPs would apply as appropriate. Wherever possible, disturbed areas would be revegetated as soon as possible following disturbance to avoid impacts from stormwater runoff. Plantings will be of tree species or seed mixes of grasses and forbs appropriate for the Fermi region.

4.3.1.3 **Other Projects within the Area with Potential Impacts**

No major projects have been identified in the vicinity that would add cumulatively to the impacts associated with the construction of Fermi 3. This includes consideration of terrestrial communities, important species and habitats, and other terrestrial resources considered in Subsection 4.3.1.

4.3.1.4 **Regulatory Consultation**

Affected Federal and State agencies were contacted or consulted regarding potential impacts to the terrestrial ecosystem resulting from the construction of Fermi 3. The USFWS, the MDNR Natural Heritage Program (Reference 4.3-2), and the Michigan State University Extension Michigan Natural Features Inventory program (Reference 4.3-7) were consulted in 2007 regarding Federal and State protected species and sensitive habitats.

The MDEQ and USACE have been consulted regarding wetlands. A wetland investigation, including a wetland delineation was completed for the Fermi property in May and June 2008. A summary of the wetland delineation is provided in Subsection 2.4.1.2.3. The updated wetland delineation and jurisdictional determinations will be the basis from which impacts to wetlands and the need for mitigation will be determined. Federal and State permit applications for working in wetlands will be submitted to these agencies at a later date, but prior to any construction activities.

4.3.1.5 **Transmission Corridors and Other Offsite Areas**

<u>Onsite</u>

The layout and construction plan associated with the onsite transmission line is discussed in Subsection 4.1.2.

As discussed, the construction of the transmission line onsite will include the Fermi 3 switchyard, clearing of onsite transmission line ROW, construction of towers, and stringing of the transmission lines. Direct impacts to terrestrial habitats will be minimized to the extent possible, but are expected to result in permanent impacts to 15.5 acres (Grassland: Row Crop 9.6 acres; Thicket 1.7 acres;

Forest: Woodlot 3.9 acres, and Coastal Emergent Wetland (vegetated) 0.3 acre). Temporary impacts would occur to 2.2 acres of Coastal Emergent Wetland (vegetated). Impacts to the terrestrial habitats on the Fermi site from activities associated with construction of the onsite transmission corridor are expected to be SMALL.

Offsite

As stated in NUREG-1555, Section 4.1.2:

> In some cases transmission lines may be constructed and operated by an entity other than the applicant. In such cases, impact information may be limited and the reviewer should proceed with the assessment using the information that can be obtained.

The 345 kV transmission system and associated corridors are exclusively owned and operated by ITC*Transmission*. The Applicant has no control over the construction or operation of the transmission system. Accordingly, the construction impacts are based on publicly available information, and reasonable expectations of the configurations and practices that ITC*Transmission* would likely follow based on standard industry practice. However, the information described in this subsection does not imply commitments made by ITC*Transmission* or Detroit Edison, unless specifically noted.

Transmission corridor construction activities includes the installation of three new transmission lines in an assumed 300-foot wide corridor 29.4 miles long between the Fermi site and the Milan Substation, located near Milan, MI. The route is illustrated and described in Subsection 2.4.1.9. The three 345 kV lines for Fermi 3 will run in a common corridor, with transmission lines for Fermi 2, to a point just east of I-75. From the intersection of this Fermi site corridor and I-75, the three Fermi-Milan lines will run west and north for approximately 12 miles in a corridor shared with other non-Fermi lines within the assumed 300-foot wide right-of-way (ROW) in which the vegetation has been managed to exclude tall woody vegetation. The western 10.8 miles of the corridor is currently undeveloped, and no transmission infrastructure exists. Where vegetation is present, the maintenance has been minimal, except to keep tall woody vegetation removed. It is assumed that the Milan Substation may expand from its current size of 350 by 500 feet to an area of approximately 1,000 by 1,000 feet to accommodate the new transmission lines to Fermi 3. There are no other offsite areas associated with Fermi 3 construction.

Construction impacts in the existing eastern 18.6 miles of corridor are expected to be minimal, since the reconfiguration of existing conductors would largely allow for the use of existing infrastructure to create the new lines, access for installing additional lines is good, and the ROW is maintained. Impacts from construction are primarily limited to the western 10.8 miles of the corridor where both tower and steel pole installation could occur and some clearing will be required.

4.3.1.5.1 **Vegetation**

Vegetation communities occurring along the transmission corridor are illustrated and tabulated in Subsection 2.4.1.9.1. Impacts to vegetation in the eastern section of the corridor is expected to be negligible, since construction access is currently adequate and there are no expectations that the current maintenance practices will change. The level of vegetative maintenance within the western 10.8 miles of the corridor will likely increase due to the installation of transmission structures. Access is sufficient throughout this section that the construction of new access roads should be minimal, and only if deemed necessary. Clearing will likely be necessary in areas of Deciduous Forest and Forested Wetlands. Shrub/Scrub and open communities should remain in their existing condition. Table 4.3-4 provides an accounting of the vegetative communities/land use within the 10.8 mile undeveloped portiion of the corridor. Table 4.3-4 also provides a comparison of the quantity of the community types within the 10.8 mile undeveloped portion that would be impacted by the transmission line to that found within the region (50 mile radius around Fermi). Since ITC*Transmsission* will determine the type of structures used (as well as quantity) at a time closer to construction of the new lines, the placement is not known at this time. Therefore, the type of habitats impacted cannot reasonably be determined. However, since the habitats along the western portion of the corridor are mostly previously disturbed, impacts to vegetation are expected to be SMALL when compared to cover types existing in the region (Table 2.4-17), and no mitigative measures are expected.

4.3.1.5.2 **Wildlife**

Wildlife occurring in the vicinity of the transmission corridor is similar to that discussed in Subsection 2.4.1.9.2 and the impacts to these similar to that discussed in Subsection 4.3.1.1.2. Construction in the eastern portion of the route is expected to have negligible effect on wildlife as this area contains existing transmission infrastructure. The western portion of the route follows a minimally maintained ROW that will require some clearing to accommodate the anticipated tower and steel pole construction. Habitat along this section is dominated by disturbed vegetative communities, cropland, and developed areas. Most wildlife present is expected to be sufficiently mobile and will move to avoid construction activity. Because of existing levels of activity in the area, wildlife is expected to return to the ROW and adjacent lands following construction. The impact to terrestrial wildlife resources from transmission system construction is considered SMALL, and no mitigative measures are anticipated.

4.3.1.5.3 **Important Terrestrial Species**

Important species potentially occurring in or along the transmission corridor are considered in Subsection 2.4.1.2 and Subsection 2.4.1.9.3. No Federal protected plant or animal species or designated critical habitat listed by the USFWS will be impacted. There are no known occurrences of State-listed species but potential exists for the occurrence of the eastern fox snake which is discussed in Subsection 4.3.1.2.1. The impact to important terrestrial species from transmission system construction is considered SMALL, and no mitigative measures are expected.

4.3.1.5.4 **Important Habitats**

Important habitats are defined in Subsection 2.4.1.2 and discussed for the transmission system in Subsection 2.4.1.9.4. Wetlands are the only resource considered an important habitat that is found within the transmission ROW. The locality of these wetlands is illustrated in Figure 2.4-8. No wetlands will be impacted in the eastern section of the route, since towers to accommodate new lines are already present. No wetlands are present at the Milan Substation site. The western section could require the placement of towers in wetlands that are longer than 900 feet and cannot be spanned. The total potential permanent impact to wetlands from installation of the towers is expected to be approximately 0.5 acres. Clearing ROW wetlands is discussed in Subsection 4.3.1.5.1. The impacts to wetlands from the construction of the transmission system are considered SMALL. Any mitigation required for the impacts are expected to be determined by ITC*Transmission* in consultation with applicable regulatory agencies, including the USACE, at the time permit applications are submitted.

4.3.1.5.5 **Other Projects within the Area with Potential Impacts**

No major projects have been identified in the vicinity of the transmission corridor that would add cumulatively to the impacts associated with the construction of Fermi 3. This includes consideration of terrestrial communities, important species and habitats and other terrestrial resources.

4.3.1.5.6 **Regulatory Consultation**

Regulatory consultation with USFWS and MDNR is noted in Subsection 4.3.1.4. These agencies as well as the MDNR Natural Heritage Program and Michigan State university Extension Natural Features Inventory program were consulted in 2007 and 2008 regarding Federal and State protect species and sensitive habitats.

4.3.2 **Aquatic Ecosystems**

This subsection provides an assessment of the potential temporary and permanent impacts that Fermi 3 construction activities will have on the aquatic ecosystems associated with Lake Erie, onsite impoundments, and streams adjacent to and within the Fermi site (see Figure 2.4-3 and Figure 2.4-4).

As described in Subsection 2.3.1 the following surface water bodies are located adjacent to and within the Fermi site:

- Man-made overflow and drainage canals, circulating water reservoir, and drainage ditches
- The Quarry Lakes and other water bodies and wetlands within the DRIWR
- Swan Creek
- Stony Creek
- Lake Erie and its associated bays

Permanent loss of aquatic habitat is limited to the areas affected by the construction of the station water intake structure, barge slip, parking garage, and the EF2/EF3 common warehouse (Figure 4.3-4). The station water intake structure is located within the existing intake bay for Fermi 2 and will require additional dredging and construction of bulkheads within the intake bay resulting in potential loss of aquatic habitat. The barge slip will also be constructed within the existing intake bay for Fermi 2. However, the area does not support established aquatic habitat (i.e. vegetation, structure) and species diversity within the area is generally low; therefore, impacts will be small.Additional construction impacts to aquatic habitats will result from dredging of the existing barge slip and station water intake embayments. Dredging of the barge slip and intake structure embayment will result in the temporary loss of benthic biota due to disturbance of substrate, physical impacts to individuals, as well as short-term declines in phytoplankton productivity and zooplankton density due to increased turbidity. Additional discussion of these impacts is provided in Subsection 4.3.2.2.

Construction of the parking garage and the EF2/EF3 common warehouses will include completely filling in the isolated central canal, the north canal, and portions of the south canals. While portions of the canals will be filled, hydrologic connectivity with the lagoons will be maintained through the installation of culverts. Impacts from filling in these areas will result in the loss of aquatic communities and aquatic organisms that currently reside in these areas. These include the loss of fringing wetland habitats, aquatic vegetation, fish and benthic species as well as reptile and amphibians. Impacts to the isolated central canal are considered SMALL due to the isolated nature of aquatic organisms living there. This system has no hydrological connection with the other on-site waterbodies and supports a low diversity and low abundance of organisms. The filling of the north canal and the partial filling of the south canal systems will result in mostly habitat loss along the canal banks. Loss of aquatic organisms will be SMALL due to their ability to leave the affected areas during dewatering and backfilling. Movement of aquatic species into other portions of the north and south canals, Swan Creek and the southern lagoon is expected.

Indirect impacts to aquatic systems, such as increases in sedimentation and water flow throughout onsite and adjacent water bodies are also expected. These indirect impacts are accounted for in the temporary impacts identified on Figure 4.3-4. These effects could cause temporary losses to benthic habitat and biota due to siltation, as well as short-term declines in phytoplankton productivity and zooplankton densities in the immediate area affected by construction.

Recolonization of affected water bodies is expected. These water bodies are expected to be colonized by native species common to the surrounding habitats. These common species are further discussed in Subsection 2.4.2.

To reduce sediment loading and effluent runoff into onsite water bodies, a construction SESC plan and PIPP will be developed and in place prior to the start of construction. All applicable BMPs will be incorporated into appropriate construction plans and procedures.

4.3.2.1 **Impacts to Impoundments and Streams**

The greatest potential for adverse impacts to fisheries resources during construction comes from increased sedimentation and turbidity due to construction-related erosion and temporary discharges that will potentially impact important aquatic habitats. Activities that contribute to increased sediment/silt loads into onsite impoundments, surface drainages, and to adjacent streams include increased road traffic (dust from traffic settling into water bodies; increased traffic causing minor road erosion), site clearing and grading, loss of vegetated buffer zones that trap sediment and silt, and site dewatering which collectively lead to increased sedimentation and siltation of the water bodies.

Siltation caused by increased sedimentation could result in the temporary loss of benthic habitats and biota associated with the onsite drainage systems and canals. Increased turbidity from the runoff could limit phytoplankton productivity and decrease zooplankton densities within these water bodies, as well. While this may temporarily reduce food resources for forage fish species, these effects will be limited in duration and temporary in nature, terminating upon the completion of Fermi 3 construction.

Vegetation, associated with the onsite drainage systems, canals, and wetlands, functions as filters and barriers that trap silt and sediment (refer to Subsection 4.3.1 for vegetation listing). Plants growing in these types of habitats thrive in high nutrient conditions, making these areas ideal buffer zones for sediment and silt runoff. The filtering capacity of these plants also aids in the removal of potentially harmful nutrients from construction effluents and run-off. Effects to the aquatics of the onsite drainage systems and canals would be similar to those naturally occurring to this system during periods of heavy inundation and flooding, and therefore impacts would be expected to be SMALL.

Wetland and coastal habitats, such as those identified within the DRIWR, routinely experience habitat changes associated with heavy rains and flooding events. These episodic events are representative of those expected as a result of surrounding construction activities (erosion, increased sedimentation and turbidity). The aquatic biota found in these types of habitats are highly adapted to survive in dynamic aquatic regimes, and therefore can be expected to recover from these effects quickly without significant decreases in overall health and sustainability. Wetlands are further discussed in Subsection 4.3.1.2.2.

Historically, onsite aquatic resources have been subjected to heavy sediment deposition associated with clearing of adjacent lands for agricultural purposes as well as with the construction of Fermi 2. Increased erosion and turbidity in and around the identified water bodies likely occurred as a result of these activities. The presence of established aquatic communities in these water bodies (described in Subsection 2.4.2) demonstrates the ability of these resources to recover from such perturbation. Because of the highly adaptive nature of the onsite aquatic system, impacts to aquatic resources at the Fermi site due to construction activities are expected to be SMALL.

Construction activities associated with Fermi 3 Construction as well as transferal of Fermi 2 structures will permanently impact approximately 9.34 acres of wetland and 5.18 acres of open water habitats (see Figure 4.3-5). This acreage includes 5.77 acres of emergent marsh (PEM), and 3.57 acres of forested wetland (PFO) In addition, construction may lead to soil erosion and sedimentation into onsite drainage systems, canals, Swan Creek, and other waters within the DRIWR. Erosion and sedimentation may cause some temporary disruption and modification of the onsite drainage systems and may provide a surface conveyance of silt and sediment to aquatic habitats. This input of materials will be minimized and controlled through the use of BMPs established in the SESC Plan. BMPs include the utilization of silt fencing, hay bales, turbidity curtains, and sediment traps. BMPs are discussed in more detail in Section 4.3. These measures will be installed prior to the start of construction activities and will be maintained on a routine basis. Accordingly, impacts to these habitats will be SMALL, Excess material excavated during construction will be placed in a designated spoils area. Stormwater runoff from the spoils area and other areas of disturbed soil will be controlled by BMPs established in the SESC Plan. These practices may include use of silt fences and hay bales to prevent silted runoff from indirectly impacting the onsite drainage systems and canals. Areas subjected to sediment deposition during local precipitation periods will likely return to pre-construction conditions upon completion of construction.

Permanent construction–related losses to aquatic biota are expected to be limited to portions of the DRIWR associated with construction of the NDCT and filling in of certain onsite water bodies (Central Canal, South Canal, and the North Canal). Construction impacts on the DRIWR are discussed in Subsection 4.3.1.2.2.

4.3.2.2 **Impacts to Lake Erie**

The western basin of Lake Erie is characterized by shallow water, wind driven seiche currents, and varied substrates. Relatively warm water temperatures and shallow depths make it a highly productive biological system.

These same characteristics also make the western Lake Erie system particularly susceptible to variations associated with wind and current patterns that change habitats, as well as dynamic conditions resulting from nutrient runoff and accelerated eutrophication. Such conditions require a diverse and resilient assemblage of aquatic organisms with the ability to adapt and survive such perturbations. Since the 1950s, Lake Erie has experienced numerous environmental events that have been detrimental to the overall health and stability of aquatic populations. The most infamous of these events was the increased eutrophication and anoxia prevalent in the lake from the 1950s through the 1970s. This period was characterized by fish kills, significant losses in mayfly populations, and increased algal blooms, particularly cladophora. In the 1980s and 1990s, the zebra and quagga mussels, as well as round and tubenose gobies, were introduced into the lake system via ship ballast water, causing significant habitat changes, alteration of the natural food chain, and competition with many native species. In the mid 1990s, increased levels of cyanobacteria were documented, and carbon and nitrogen were identified as limiting factors in ecosystem health in Lake Erie. Recently, there has been a transition toward improvement in the Lake Erie system. Important indicator species, such as the mayfly and walleye, have been recovering, and are currently documented to have fair to good status. Current environmental regulations that limit nutrient runoff into Lake Erie are believed to have been responsible for the system's recovery and will be a significant contributor to the increased health and future stability of Lake Erie.

Construction activities associated with Fermi 3 will be restricted almost entirely to the existing plant property. However, the construction of the Fermi 3 intake structure, the barge slip, and discharge line to Lake Erie will require (1) temporary construction dredging and operational maintenance dredging of the existing water intake bay and (2) construction of the intake structure and associated components. Construction of the intake structure and barge facility will benefit from ongoing maintenance dredging of the area between the groins. No dredging in addition to that which is routinely completed is anticipated for installation of those structures. Construction of the discharge pipeline will extend approximately 200 feet beyond the area routinely dredged for Fermi 2 maintenance. Therefore, construction of the above structures will result in a minimal permanent loss of benthic habitat associated with the intake structure. Impacts to other aquatic species associated with the station water intake structure are considered to be SMALL.

Dredging activities for the barge slip and the intake embayment are expected to be performed as part of ongoing operations and maintenance (O&M)[1] dredging activities utilized to maintain the existing intake embayment under an existing USACE permit and include increased turbidity, siltation, and temporary loss of benthic habitat and associated biota (see Subsection 2.4.2 for benthic biota speciation). Therefore, impacts to the biota are expected to be temporary, consistent with activities to which local populations of organisms have adapted.

Dewatering associated with the construction of Fermi 3 includes dewatering the excavation site for the reactor unit including portions of the onsite canals. The Groundwater Modeling System software (Reference 4.2-5) was used to simulate groundwater flow with two barrier alternatives. Option 1 is a reinforced diaphragm concrete wall, and Option 2 represents a grout curtain or freeze wall. Under the Option 1 simulation, the aquifer water levels beneath the Quarry Lakes will be lowered less than 1 ft. Under the Option 2 simulation, the water levels beneath the Quarry Lakes will be lowered approximately 2 ft (Subsection 4.2.1.5).

Construction activities conducted on Lake Erie are not expected to significantly impact surface water biota (see Subsection 4.3.2.4.2).

4.3.2.3 **Impact to the Transmission Corridors**

Onsite

The layout and construction plan associated with the on-site transmission line is discussed in Subsection 4.1.2.

As discussed the construction of the transmission line will include Fermi 3 switch yard, clearing of on-site transmission line ROW, construction of towers, and stringing of the transmission lines. Direct impacts to aquatic habitats will be avoided during construction. Indirect impacts may occur during construction of temporary access pathways to the towers. Temporary matting will be utilized to minimize these impacts.

Construction measures will be utilized to avoid and minimize impacts for the construction of the on-site transmission corridor. Impacts to the aquatic habitats at the Fermi site are expected to be SMALL.

Offsite

Transmission corridor construction activities are expected to include the installation of three transmission lines in an assumed 300-foot wide corridor, 29.4 miles long between the Fermi site

1. Maintenance dredging for the Fermi 2 intake embayment has been performed every 4 years. Approximately 22,000 yd^3 of material is removed from the intake embayment during these activities (permit allows for removal of up to 25,000 yd^3 of material each year for five years).

and the Milan Substation, located near Milan, MI. The route is illustrated and described in Subsection 2.4.1.9. Vegetative communities and land use along the corridor are illustrated in Figure 2.2-3. ITC*Transmission*, which owns and operates the transmission system in southeastern Michigan, will be responsible for the construction and maintenance of the new transmission infrastructure. The three 345 kV lines for Fermi 3 will run in a common corridor, with transmission lines for Fermi 2, to a point just east of I-75. From the intersection of this Fermi site corridor and I-75, the three Fermi-Milan lines will run west and north for approximately 12 miles in the corridor shared with other non-Fermi lines within an assumed 300-foot wide right-of way (ROW). The western 10.8 miles of the ROW is undeveloped, with no lines or towers erected. Where vegetation is present, the maintenance has been minimal, except to keep tall woody vegetation removed. It is assumed that the Milan Substation may require an expansion from its current size of 350 by 500 feet to an area approximately 1,000 by 1,000 feet to accommodate the three new transmission lines from Fermi 3. There are no aquatic resources in this assumed expansion area.

Construction impacts to aquatic resources along the eastern 18.6 miles of the transmission corridor are expected to be SMALL, since the reconfiguration of existing conductors would largely allow for the use of existing infrastructure to create the new lines, and access for installing additional lines is good (as the plant life has been managed to exclude tall woody vegetation). Existing aquatic habitats in this portion of the corridor will be spanned and best management practices will be used to protect aquatic habitats crossed by the new lines. This includes, but is not limited to, the use of silt fencing, hay bails and similar practices to ensure the protection of aquatic habitats in close proximity to construction activity.

The western 10.8 miles of the transmission corridor is undeveloped. Potential impacts to aquatic resources in this portion of the corridor are discussed in the subsections that follow.

4.3.2.3.1 **Aquatic Communities and Principal Aquatic Species**

Aquatic communities and principal aquatic species are described in Subsection 2.4.2.9. Construction impacts to aquatic communities and principal aquatic species described in Subsection 2.4.2.9 are expected to be SMALL. The creeks and ditches occurring in the western corridor are mostly narrow and could be avoided by using tower spans of 700-900 feet. Numerous roads in the vicinity are expected to provide sufficient access to this region of the corridor without the need for construction of new access roads.

4.3.2.3.2 **Important Aquatic Species**

Important aquatic species potentially occurring in or along the transmission corridor are considered in Subsection 2.4.2.9.2. No Federal or State protected species or designated critical habitat listed by the USFWS will be impacted. Therefore, SMALL impacts to important aquatic species are expected from the transmission system construction, and no mitigative measures are expected.

4.3.2.3.3 **Important Habitats**

Important habitats are defined in Subsection 2.4.1.2 and discussed for the transmission system in Subsection 2.4.1.9.4. Wetlands are the only resource considered an important habitat that is found within the transmission ROW. Wetlands are discussed in Subsection 4.3.1.5.4. The impacts to wetlands from the construction of the transmission system are considered SMALL.

4.3.2.3.4 **Other Projects within the Area with Potential Impacts**

No major projects have been identified in the vicinity of the transmission corridor that would add cumulatively to the impacts associated with the construction of Fermi 3, including the transmission system. This includes consideration of aquatic communities, important species and habitats, and other aquatic resources.

4.3.2.3.5 **Regulatory Consultation**

Regulatory consultation with USFWS and MDNR is noted in Subsection 4.3.1.4. These agencies as well as the MDNR Natural Heritage Program and Michigan State University Extension Natural Features Inventory program were consulted in 2007 and 2008 regarding Federal and State protect species and sensitive habitats. It is expected that ITC*Transmission* will consult with these and other appropriate agencies prior to initiating construction of the transmission system.

4.3.2.4 **Impact on Important Aquatic Species**

4.3.2.4.1 **Threatened and Endangered Species**

A general review of threatened and endangered species located in Michigan, Ohio, and Ontario, Canada identified a number of species as having the potential to occur near the Fermi site. More in-depth discussions of life history and habitat utilization of each of these species can be found in Subsection 2.4.2 and Table 2.4-15.

No threatened and endangered aquatic species have been observed or recorded as being located onsite. However, the presence of the American lotus is a specific case. The American lotus is a hydrophilic plant growing in open water areas on the site. Although the American lotus is listed as a threatened species by the State of Michigan, it is prevalent throughout much of the United States, and even considered an invasive weed in some areas. However, because it's roots require soil, the American lotus is being treated as a terrestrial species and impacts associated with this species are addressed in detail in Subsection 4.3.1. In summary, the impacts to threatened and endangered aquatic species are expected to be SMALL.

4.3.2.4.2 **Commercial and Recreational Aquatic Species**

Potential impacts from construction activities at the Fermi site to commercial and recreational species (as referenced in Subsection 2.4.2) are minimal due to limited presence of these species within the site. Incidental impacts may occur indirectly due to interruption of fish migration and spawning and fish mortality related to accidental toxic spills. However, such events are unlikely to occur due to implementation of the appropriate spill prevention measures detailed in the PIPP. Notwithstanding, the impacts to Lake Erie commercial and recreational species are expected to be SMALL.

While it is not expected that migratory pathways would be physically barricaded during construction, increased turbidity can act to inhibit migratory cues in some fish species.

Contaminants in construction effluents can also act as chemical barriers inhibiting fish migratory behavior. With the implementation of construction runoff and spill control measures detailed in the PIPP, it is unlikely that such contaminants would be present at levels that would significantly impact fish migration behavior, at least on a long-term basis.

4.3.2.4.3 **Other Important Species**

Water quality indicator organisms, such as mayflies, prefer to live in areas with softer sediments, which often harbor higher concentrations of pollutants in contaminated regions. These pollution-sensitive species are most abundant in shallow, productive lakes with soft, organically-rich sediment.

Construction activities may cause a temporary decline in mayfly populations in western Lake Erie and its tributaries due to a minimal increase in turbidity and the physical impacts to benthic habitat and immobile or slow-moving organisms during in-lake construction activities. Due to the temporary nature of the aforementioned construction impacts and resulting turbidity, no long-term effects on the population number and structure are anticipated.

National Oceanic & Atmospheric Administration Fisheries, regional Fishery Management Councils, and Federal and State agencies identify Essential Fish Habitat (EFH) for federally managed fish species and develop conservation measures to protect and enhance these habitats. Currently, EFH and associated species have only been identified in marine habitats and are not expected to be applicable to the aquatic ecology of Lake Erie and other habitats surrounding the Fermi site.

Accordingly, the environmental impacts on other important species are expected to be SMALL.

4.3.2.5 **Summary**

Construction activities that may cause erosion that could lead to deposition in aquatic water bodies would be of short duration, permitted and overseen by state and federal regulators, and guided by an SESC Plan. Any small spills of construction-related hazardous fluid would be mitigated according to the PIPP. Impacts to aquatic communities from construction activities are expected to be SMALL.

4.3.3 **References**

4.3-1 Michigan Department of Environmental Quality, Technical Manuals, MDEQ – BMP Design Manuals, http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3714-118554--,00.html, accessed 29 April 2008.

4.3-2 Michigan Department of Natural Resources, Natural Heritage Program, http://www.michigan.gov/dnr/0,1607,7-153-30301_31154_31260-54441--,00.html, accessed 5 March 2008.

4.3-3 State of Michigan, “Natural Resources and Environmental Protection Act (Act 451 of the Michigan Public Acts of 1994),” Part 365 Endangered Species Act, http://www.legislature.mi.gov/(S(k3qiry55fgux1yywldqkm345))/mileg.aspx?page=getobject&objectname=mcl-451-1994-iii-1-endangered-species-365, accessed 21 March 2008.

4.3-4 U.S. Fish and Wildlife Service, "National Bald Eagle Management Guidelines," May 2007, http://www.fws.gov/migratorybirds/issues/BaldEagle/NationalBaldEagleManagementGuidelines.pdf, accessed 21 March 2008.

4.3-5 Michigan State University Extension, Michigan Natural Features Inventory, Rare Species Explorer, "Pantherophis gloydi, Eastern Fox Snake," http://web4.msue.msu.edu/mnfi/explorer/species.cfm?id=11505, accessed 30 April 2008.

4.3-6 Establishment of the Lagoona Beach Unit of the Detroit River International Wildlife Refuge, "Cooperative Agreement Between Detroit Edison and U.S. Fish and Wildlife Service," September 25, 2003.

4.3-7 Michigan State University Extension, Michigan Natural Features Inventory, Monroe County, http://web4.msue.msu.edu/mnfi/data/cnty_dat.cfm?county=Monroe, accessed 7 February 2008.

4.3-8 "Habitat and Species Conservation Plan, Eastern Fox Snake (Elaphe gloydi)" provided to the NRC in Detroit Edison letter NRC3-10-0048, dated October 29, 2010, in RAI TE4.3.1-9.

4.3-9 Michigan Department of Environmental Quality, Wetland Identification Report, Wetland Identification File Number 08-58-0003-W, November 7, 2008.

4.3-10 Michigan Department of Environmental Quality, Wetland Identification Report, Modified Wetland Identification File Number 08-58-0003-WA, March 30, 2009.

4.3-11 U.S. Army Corps of Engineers, Detroit District, Engineering & Technical Services, Regulatory Office, File No. LRE-2008-00443-1, November 9, 2010.

Table 4.3-1 Potential Impacts to Terrestrial Communities on the Fermi Site from Construction of Fermi 3

Plant Community	Permanent Impacts (acres)	Temporary Impacts (acres)	Total Area of Community Onsite (acres)	Total Area of Community in Vicinity[1] (7.5 mile radius) (acres)	Percent of Community in Vicinity Permanently Impacted
Coastal Emergent Wetland (CEW) Open Water	0	0	35	66,520	0
Coastal Emergent Wetland (CEW) Vegetated	1.7	2.2	238	1550	0.1
Grassland: Right-of-Way (GRW)	9.6	13.5	29	1209	0.8
Grassland: Idle/Old Field/Planted (GOF)	25.7	17.6	75	6932	0.4
Grassland: Row Crop (GRC)	1	63	64	23,465	<0.1
Shrubland (SHB)	2.0	38.5	113	95 *(Note a)*	*Note a*
Thicket (TKT)	1.7	0	23	*Note b*	--
Forest: Coastal Shoreline (FCS)	1.0	0	47	*Note c*	--
Forest: Lowland Hardwood (FLH)	0	4.8	92	3331	0
Forest: Woodlot (FWL)	8.4	6.3	117	3318	0.2
Lakes, Ponds, Rivers (LPR)	2.4	0.9	44	*Note d*	--
Lake Erie (main body)	*Note e*	*Note e*	171	*Note d*	--
Totals	53.5	146.8			
Total Impacts (Permanent + Temporary) = 200 acres					

1. Figures taken from Subsection 2.2.1.2.3

Notes:

a. Table 2.2-7 indicates 95 acres of Shrubland in the vicinity, while 113 acres were mapped just on the Fermi site. Based on visual observations in 2007 that many acres of this disturbed or early succession habitat are present in the vicinity but it is uncertain how the study used to produce Table 2.2-7 Table 2.2-7 categorized the community recognized herein as Shrubland. Therefore, no percent of the regional community impacted is provided.

b. Included in Shrubland based on land use breakdown in Subsection 2.2.1.2.3.

c. Included in Forest: Lowland Hardwood based on land use breakdown in Subsection 2.2.1.2.3.

d. Included in Coastal Emergent Wetland (Open Water) based on land use breakdown in Subsection 2.2.1.2.3.

e. Impacts to aquatic ecosystem are addressed in Subsection 4.3.2, therefore not included here.

Table 4.3-2 Important Terrestrial Species Potentially Impacted by Fermi 3 Construction Activities

Species	Protected Status		Comments
	Federal[1]	State[2]	
Bald eagle *Haliaeetus leucocephalus*	None	Threatened	Three nests onsite in January 2008; one occupied adjacent to cooling towers in March 2008
American lotus *Nelumbo lutea*	None	Threatened	Common in south lagoon and scattered colonies in north lagoon

Notes:

1. Listed under Endangered Species Act of 1973, 16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984 and 1988 (Reference 4.3-2).
2. Listed under the Endangered Species Act of the State of Michigan, Part 365 of PA 451, 1994 Michigan Natural Resources and Environmental Protection Act (Reference 4.3-3)

Table 4.3-3 Acreage of Detroit River International Wildlife Refuge, Lagoona Beach Unit, Impacted by Fermi 3

Refuge Unit	Area Size (acres)	Area Impacted (acres)	
		Permanent	Temporary
NE	161.7	0	0
NW	161.1	15.9	22.7
SE	311.2	2.6	3.5
SW	22.4	0	0
Totals	656.4	18.5	26.2

Table 4.3-4 Vegetation Communities Occurring along the Transmission Corridor[1]

Plant Community	Acres in Corridor	Percentage of Acres in Region Impacted	Acres in Region[2]
United States			
Open Water	0	0	725,910
Developed	11	0.001	1,089,795
Barren Land	0	0	10,346
Deciduous Forest	170	0.06	282,046
Evergreen Forest	0	0	6717
Mixed Forest	0	0	5765
Shrub/Scrub	6	0.19	3179
Grassland/Herbaceous	10	0.02	41,308
Pasture/Hay	45	0.02	219,241
Cultivated Crops	90	0.007	1,217,689
Woody Wetlands	74	0.06	128,090
Emergent Herbaceous Wetland	9	0.02	56,711
Canada			
Open Water	0	0	678,492
Urban	0	0	60,749
Woodlot	0	0	22,173
Agriculture	0	0	413,285
Wetlands	0	0	6826

Notes:

1. Information within Table 4.3-4 uses estimated acreages based on GIS land cover data and is specific to the 10.8 mile tract of existing undeveloped corridor along the route to the Milan substation.
2. The plant communities and acreages of communities present in the 50-mile radius (region) of the Fermi site in this table is taken from Table 2.2-7.

Figure 4.3-1 Fermi 3 Impacts to Undeveloped Areas (yellow lines) on Fermi Site (red line)

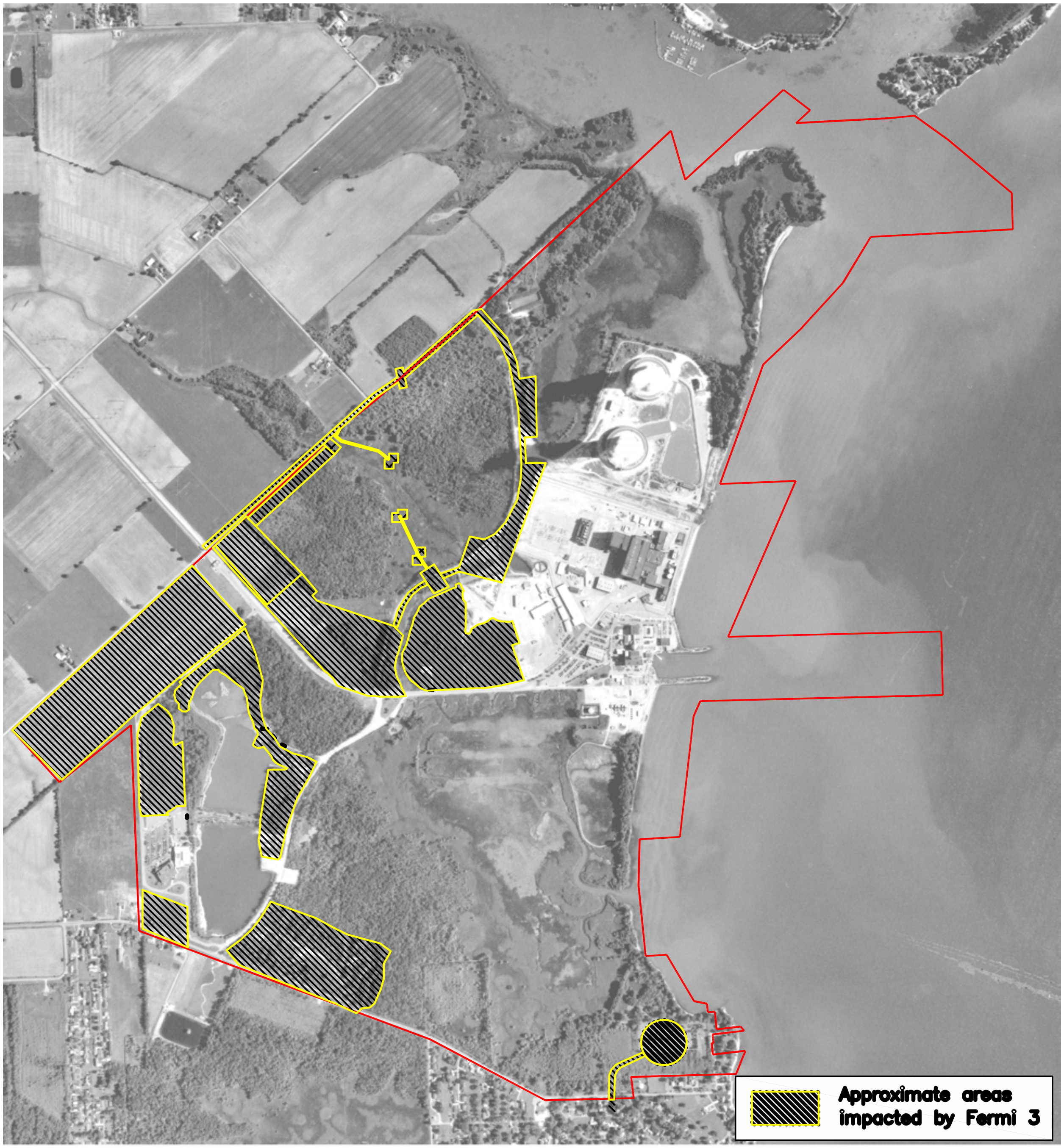


Figure 4.3-2 Permanent and Temporary Impacts to Undeveloped Areas from Fermi 3 Construction Overlaid on Existing Terrestrial Communities

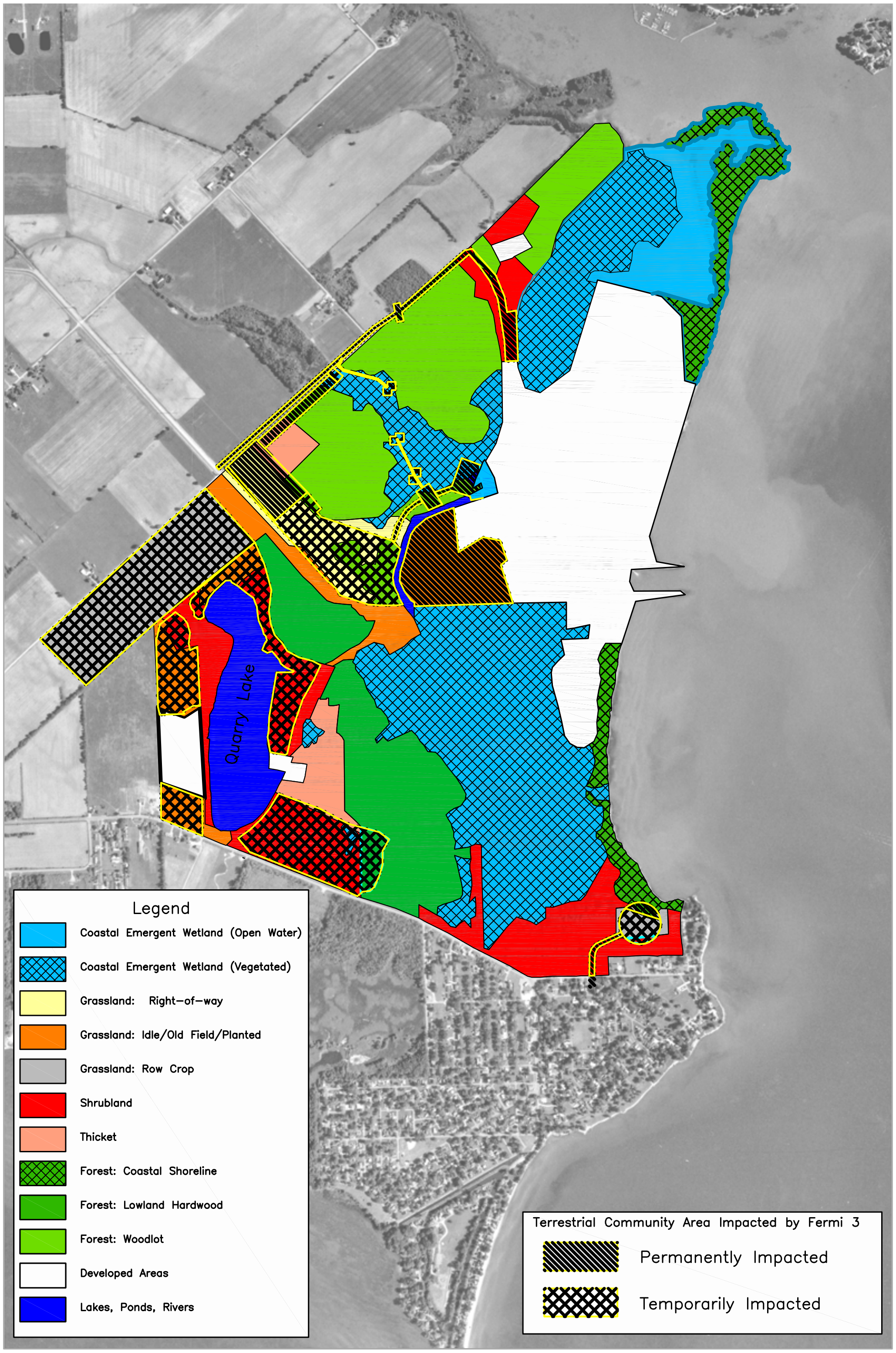


Figure 4.3-3 Permanent and Temporary Impacts to DRIWR, Lagoona Beach Unit from Fermi 3 Construction Overlaid on Existing Terrestrial Communities

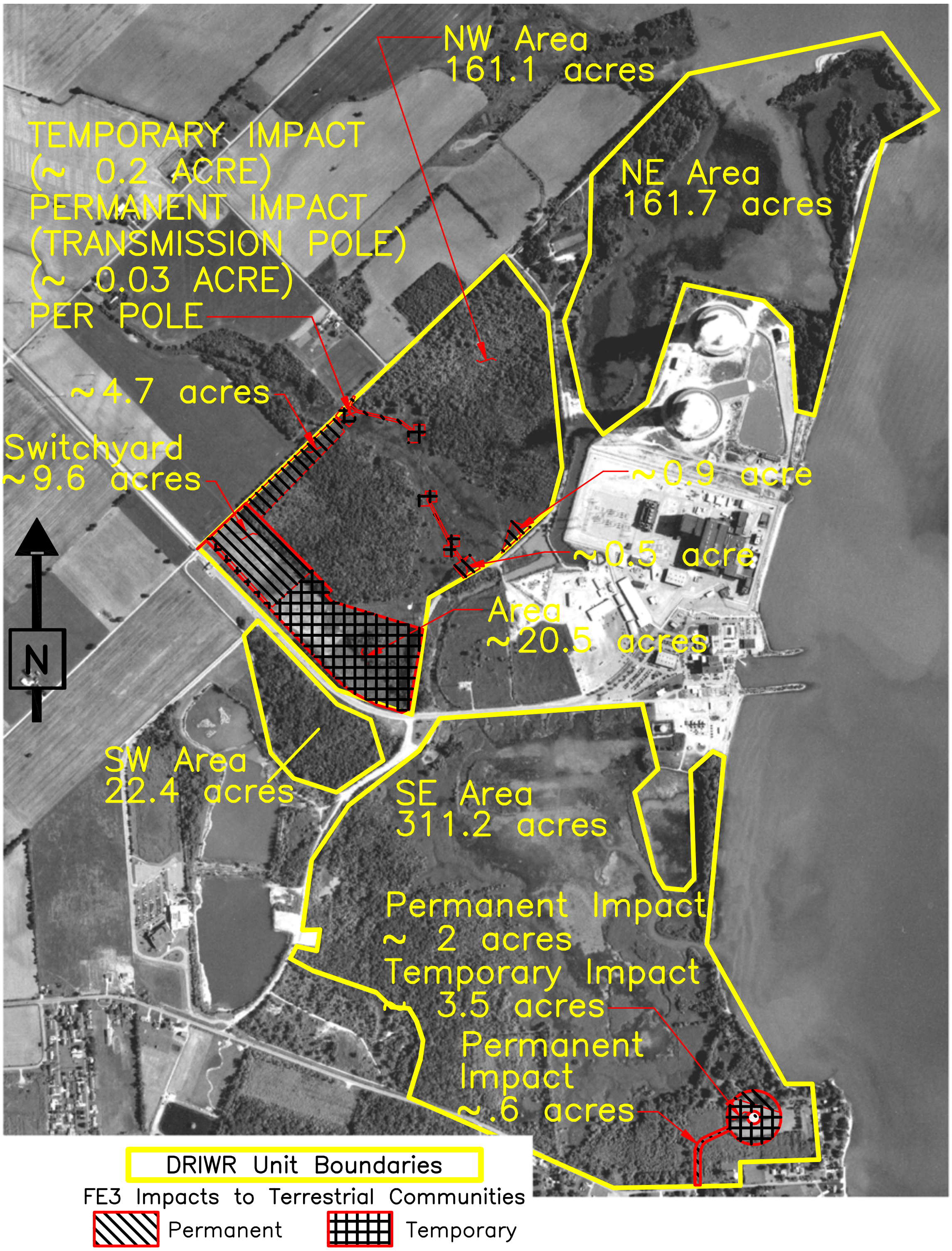
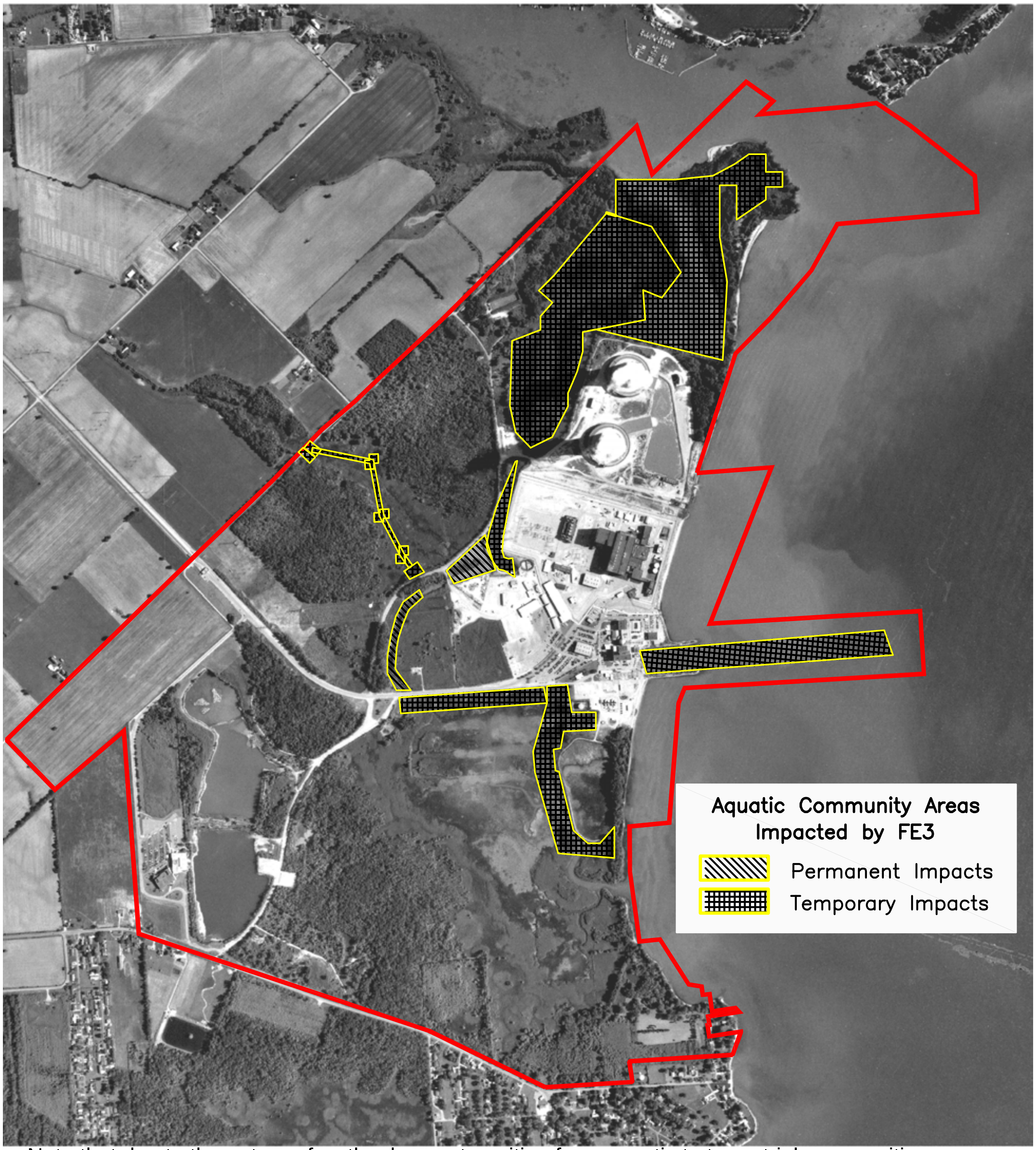
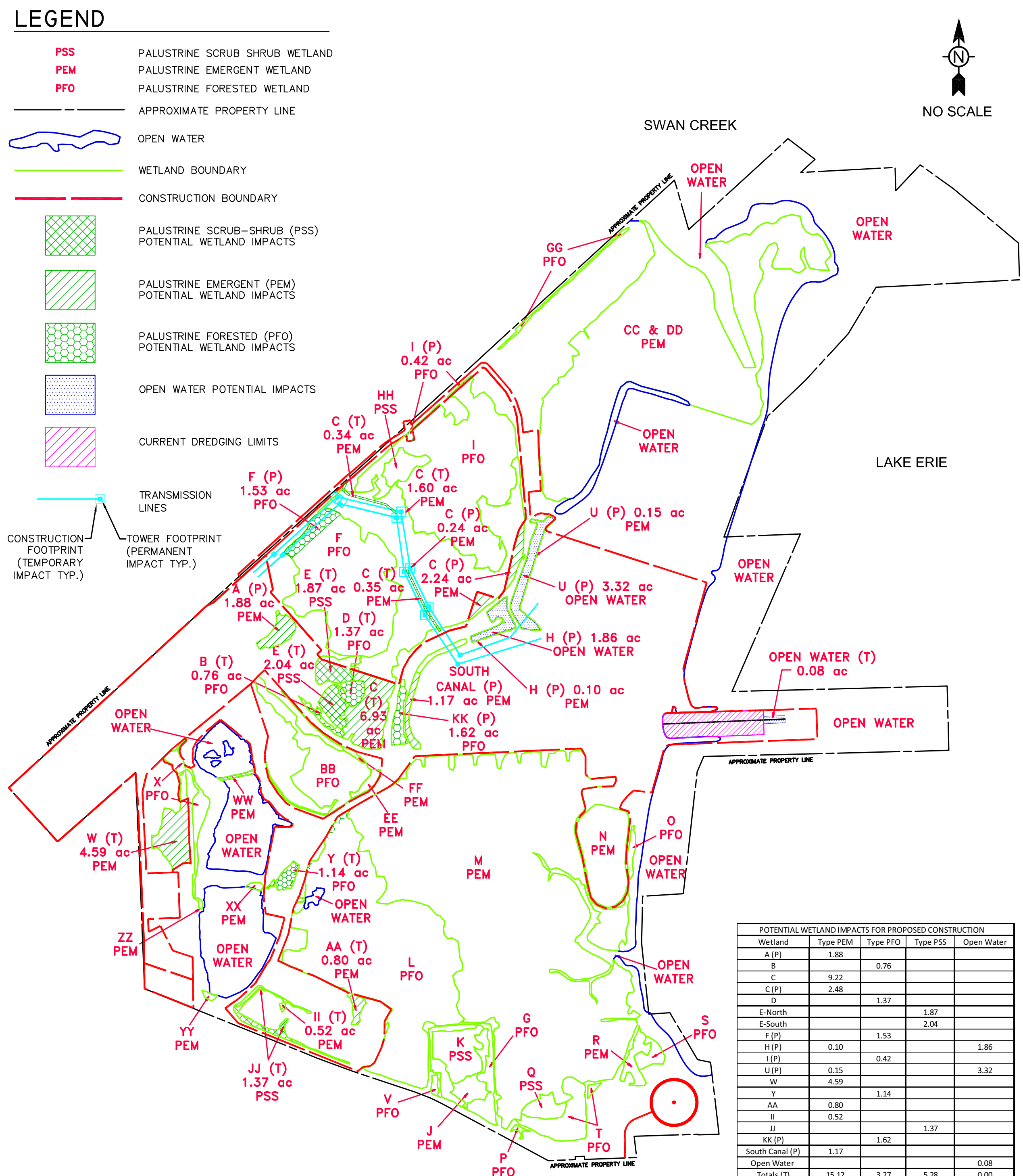


Figure 4.3-4 Permanent and Temporary Impacts to Undeveloped Areas of the Fermi Property (red line) Overlaid on Existing Aquatic Communities



* Note that due to the nature of wetlands as a transition from aquatic to terrestrial communities, some impacted areas outlined on this figure overlap with those in Figure 4.3-2.

Figure 4.3-5 Potential Wetlands Construction Impacts



POTENTIAL WETLAND IMPACTS FOR PROPOSED CONSTRUCTION				
Wetland	Type PEM	Type PFO	Type PSS	Open Water
A (P)	1.88			
B		0.76		
C	9.22			
C (P)	2.48			
D		1.37		
E-North			1.87	
E-South			2.04	
F (P)		1.53		
H (P)	0.10			1.86
I (P)		0.42		
U (P)	0.15			3.32
W	4.59			
Y		1.14		
AA	0.80			
II	0.52			
JJ			1.37	
KK (P)		1.62		
South Canal (P)	1.17			
Open Water				0.08
Totals (T)	15.12	3.27	5.28	0.00
Totals (P)	5.77	3.57	0.00	5.18

4.4 Socioeconomic Impacts

This section discusses the potential for socioeconomic impacts resulting from the construction of Fermi 3. The information is organized as follows: Subsection 4.4.1 describes the physical impacts of construction on the area, Subsection 4.4.2 describes the social and economic impacts of construction, and Subsection 4.4.3 describes environmental justice issues within the region. Refer to Subsection 2.5.1, Subsection 2.5.2, and Subsection 2.5.4 for the baseline socioeconomic information upon which these construction impact assessments are made.

Generally, the social and economic impacts of power plant construction are a function of the size of the construction workforce, wages paid, and the number of relocating workers relative to the available community facilities and services. While precise estimates of these key variables are not yet available, reasonable assumptions appropriate for evaluating the socioeconomic impacts on the region can be made and are described below.

The construction duration will be lengthy and, including the relocation of certain facilities related to Fermi 2, should last approximately 10 years. For purposes of this analysis, the assumed construction dates are 2011 through 2020, with the peak construction employment occurring in 2017. The Chapter 4 introduction provides an overview of the Fermi 3 construction schedule and key construction activities.

4.4.1 Physical Impacts

Construction activities can cause temporary and localized physical impacts such as noise, odors, vehicle exhaust, fugitive dust, and vibration and shock from blasting. This section addresses these potential physical construction impacts that may affect people and buildings. Impacts on roads, aesthetics, and recreational opportunities are discussed in Subsection 4.4.2.

4.4.1.1 Noise

4.4.1.1.1 Applicable Regulations and Criteria

Fermi 3 is located in unincorporated Frenchtown Township, in Monroe County. There are no extant city, county, or state regulations regarding construction noise emissions. Detroit Edison intends to comply with NRC and EPA guidance for implementing the Noise Control Act of 1972, as amended, and the Quiet Communities Act of 1978.

Human response to sound is highly individualized. Annoyance is the most common issue regarding community noise. The percentage of people claiming to be annoyed by noise will generally increase as environmental sound levels increase. Various references (Reference 4.4-1 through Reference 4.4-4) discuss the subjectivity of changes in sound level. Based on these, a 3 dB change in a continuous broadband noise is generally considered "just barely perceptible" to the average listener. A 5 dB change is generally considered "clearly noticeable" and a 10 dB change is generally considered a doubling (or halving) of the apparent loudness.

4.4.1.1.2 **Construction Activities**

Major construction phases will consist of site preparation, excavation and foundation construction, building and equipment erection, and site clean-up/facility start-up. Noise emissions will vary with each phase of construction depending on the construction activity and the associated construction equipment required for each phase. Site preparation will require the use of heavy diesel-powered earth moving equipment. Examples of this equipment include bulldozers, scrapers, dump trucks, graders, and front end loaders. Noise emissions during site preparation will be dominated by the diesel engine noise. Foundation construction primarily will involve concrete handling equipment such as concrete trucks, mixers, vibrators, pumps, and pile driving equipment. Some earth moving equipment will also be required to backfill the foundations. Foundation construction activities will primarily be centered at the power block equipment area. The equipment and building installation will involve diesel-powered earth moving equipment, mobile cranes, equipment delivery, impact wrenches, saws, drills, and air compressors. Again, these activities will primarily be centered at the power block equipment area. Site cleanup and facility startup will generally result in lower noise emissions than the preceding construction phases.

4.4.1.1.3 **Construction Equipment Noise Emissions**

The variable nature of construction noise is best represented by an average sound level. The average sound levels account for the type and quantity of equipment, the typical usage of each piece of equipment, and typical sound levels of the equipment used during each phase of construction. The typical types of equipment, equipment usage, and equipment noise emissions (at a distance of 50 feet) for each phase of construction are listed in Table 4.4-1. Estimates of the construction equipment usage and noise levels are based on information provided in Reference 4.4-5 through Reference 4.4-7.

4.4.1.1.4 **Potential Impacts**

The variable nature of construction activity makes it difficult to predict construction noise emissions. While the average noise level is representative of construction activities, certain activities will produce temporary elevations in the noise level. Contrastingly, decreased noise emissions will occur during reduced construction activities. The closest distance between site construction areas along the west boundary of the facility and the nearest noise-sensitive receptors is approximately 1000 feet. The estimated sound levels from construction equipment at a distance of 1000 feet are provided in Table 4.4-1.

The estimated overall average sound level (excluding pile driving noise) and the maximum sound level (including pile driving noise) are also included in Table 4.4-1. The overall average and maximum sound levels are based on the conservative assumption that all the equipment listed in Table 4.4-1 is operating simultaneously at a distance of 1000 feet from the nearest receptor. Simultaneous operation of all equipment listed in the Table 4.4-1 would be an infrequent occurrence. Additionally, many major areas of construction, such as the reactor building area and the NDCT area, are located at distances greater than 1000 feet from the nearest receptor. Construction sound levels at the nearest receptor on a typical construction day would be expected to be below 64 dBA.

Although the cumulative sound level of construction activities has the potential to cause an adverse impact, not all of the noisiest activities listed in Subsection 4.4.1.1.2 will take place in the construction areas closest to noise-sensitive receptors. Moreover, noisier activities are expected to be limited to daytime hours to minimize the noise impact. Accordingly, it is concluded that while there will be certain periods during construction that MODERATE impacts to the nearest noise-sensitive receptors to the site would be expected, the net noise impact during the course of construction is anticipated to be SMALL.

In the area of noise control, standard control measures for construction equipment, such as the use of silencers on diesel powered equipment exhausts, are expected to be employed to limit the noise emissions from station construction. Additionally, administrative measures will be employed to mitigate construction noise impacts. These administrative measures include limiting the types of construction activities during nighttime and weekend hours, notifying all affected neighbors of planned activities, and establishing a construction noise monitoring program.

The overall noise impacts on the surrounding areas (including effects on people and buildings) due to Fermi 3 construction activities will be temporary and are expected to be SMALL.

4.4.1.1.5 **Blasting**

As explained in FSAR Subsection 2.5.4.5.3.2, controlled blasting will be used onsite. Methods will include cushion blasting, pre-splitting and line drilling. Blasting techniques are designed and controlled (by use of blasting curtains, for example) to prevent damage to existing structures, equipment, and freshly poured concrete.

4.4.1.1.6 **Buildings**

Construction activities would not impact any offsite buildings because of distance to any such structures. The nearest full-time residence is approximately 660 feet from the Exclusion Area Boundary (EAB). In the event that pile-driving is necessary, the building(s) most vulnerable to shock and vibration would be those within the Fermi site boundary. Onsite buildings have been constructed to safely withstand possible impacts, including shock and vibration, from construction activities associated with the proposed activity.

Table 4.4-1 presents data on attenuated noise levels expected from operation of construction equipment. Applying the inverse-square law to the highest level listed in Table 4.4-1 (89 dBA at 50 feet) for the heavy construction to be performed in the power block, a decrease in noise levels of over 30 decibels would be expected at the EAB. Noise at this level does not adversely affect building structures.

As discussed in Subsection 2.5.3, there are cultural resources located within the 10-mile radius of the site, but none are located adjacent to the Fermi site. Also, there are no listings on the NHRP occurring on the Fermi site, and no impacts on historical landmarks due to vibration or shocks from construction activities would be expected.

The effects of physical impacts to buildings from construction activities would be SMALL, and would not warrant mitigation.

4.4.1.2 **Air Quality**

The Fermi site is located in the northeastern part of Monroe County and along the western shoreline of Lake Erie. Air quality at the Fermi site is heavily influenced by the Detroit and Toledo metropolitan areas and surrounding emission sources. The MDEQ evaluates the air quality in the Detroit metropolitan area with a network of monitors mostly located in Wayne County, north of the Fermi site. The MDEQ routinely monitors the USEPA criteria pollutants of NO_2, SO_2, CO, $PM_{2.5}$, PM_{10}, and ozone. Monroe County and the counties that include the Detroit metropolitan area are designated by USEPA as a non-attainment areas for annual $PM_{2.5}$ standard and a maintenance area for the 8-hour ozone standards (Reference 4.4-8). The USEPA, as of March 12, 2008, strengthened the definition of ozone non-attainment areas as those that record a 3-year average of the fourth highest daily maximum 8-hour average ozone concentration levels of 0.075 ppm or higher (Reference 4.4-9). For PM2.5 the USEPA considers areas in violation of the standard when the 3-year average of the weighted annual mean $PM_{2.5}$ concentration is equal to or exceeds 15 $\mu g/m^3$. Subsection 2.7.2 provides further details about the historical air quality in the Fermi vicinity.

Some increase in air pollution from criteria pollutants will arise during construction due to construction activities, including engine exhaust from worker vehicles and machinery. The vehicles and machinery will comply with applicable government standards during construction, including the Clean Air Act and the National Emission Standards for Hazardous Air Pollutants for Source Categories in 40 CFR 63. Detroit Edison will also obtain all air quality approvals necessary to allow for the construction of Fermi 3 from the MDEQ. The MDEQ has been delegated authority by the EPA to implement the aforementioned federal rules which are designed to be protective of air quality. Given the relatively isolated nature of the construction area from the offsite residences and facilities, the emissions during construction activities will not only have little effect on the nearby ozone maintenance and $PM_{2.5}$ non-attainment areas, but will have minimal impact on the local and regional air quality as well. The net impact on air quality during construction is projected to be SMALL, and no mitigative measures are needed.

Additionally, the various types of construction activities and equipment will also emit carbon dioxide (CO_2) during construction of Fermi 3. The expected construction activities include those from worker vehicles, heavy duty construction equipment, locomotive engines, marine engines, and operation of other miscellaneous mobile fossil-fuel combustion sources such as generators. The total estimate of CO_2 emissions resulting from Fermi 3 construction activities is 18,931 tons/year.

4.4.1.3 **Dust**

The State of Michigan has adopted regulatory code that provides typical control methods of fugitive emissions including dust. Portions of Rule 336.1372 are provided here that deal with dust producing activities and their typical control methods.

§Rule 336.1372

3. All of the following provisions apply to the transporting of bulk materials as a source of fugitive dust:

(b) Typical control methods for controlling fugitive emissions resulting from the transporting of bulk materials by truck may include, but are not limited to, the following:

(i) Completely covering open-bodied trucks.

(ii) Cleaning the wheels and the body of each truck to remove spilled materials after the truck has been loaded.

(iii) Use of completely enclosed trucks.

(iv) Tarping the truck when operating empty if residue has not been completely removed after emptying.

(v) Cleaning the residue from the inside of the truck after emptying.

(vi) Loading trucks so that no part of the load making contact with any sideboard, side panel, or rear part of the load enclosure comes within 6 inches of the top part of the enclosure.

(vii) Maintaining tight truck bodies so that leakages within the body will be eliminated and future leakages prevented.

(viii) Spraying the material being transported in a vehicle with a dust suppressant. The frequency of spraying shall be specified in the control program.

(ix) Restricting the speed of the vehicle which transports the material. The speed of the vehicle shall be specified in the control program.

5. The following provisions apply to roads and lots as sources of fugitive dust:

(b) Typical control methods for controlling fugitive emissions resulting from roads and lots located within industrial, commercial, and government-owned facilities may include, but are not limited to, the following:

(i) Paving roads and parking lots with a hard material, such as concrete, asphalt, or an equivalent which is approved by the department.

(ii) Mechanically cleaning paved surfaces by vacuum sweeping, wet sweeping, or flushing. The frequency of cleaning shall be specified in the control program.

(iii) Washing the wheels of every truck leaving the plant premises.

(iv) Treating the roads and lots with oil or a dust-suppressant compound which is approved by the department. The frequency of application shall be specified in the control program.

(v) Periodically maintaining off-road surfaces with gravel where trucks have frequent access. The frequency of maintenance shall be specified in the control program.

8. The following provisions apply to fugitive dust emissions from construction, renovation, or demolition activities:

   (b) Typical control methods for controlling fugitive dust emissions from construction, renovation, or demolition activities may include, but are not limited to, the following:

      (i) Spraying of all work areas with water or other dust-suppressant compound which is approved by the department.

      (ii) Completely covering the debris, excavated earth, or other airborne materials with tarpaulin or any other material which is approved by the department.

      (iii) Any other method acceptable to the department.

Construction practices for dust control will be consistent with the state requirements. In general, the amount of dust created from construction activities will be manageable due to the existence of paved roads that will lead to the parking turn-off areas, and the absence of large scale clearing and leveling of areas. Dust control measures may be appropriate in the laydown area, parking areas, site roads, or construction areas during dry weather periods, and this would be achieved through the use of a water truck sprayer. Additional dust control may also be required during the initial stages of construction as the result of any necessary site leveling and dirt work. As lay down and other areas are no longer needed as construction progresses, the areas will be re-seeded to ensure that on-going dust creation does not occur. With these preventive construction practices, the dust impacts are expected to be SMALL.

It is likely that the onsite concrete batch plant may create the largest amount of dust. However, the plant will be equipped with a dust-control system that would be checked and maintained on a routine basis, and offsite impacts should be negligible. Given the isolated nature of the plant, the location of the concrete batch plant onsite will likely result in less offsite dust impacts than if concrete were produced offsite and trucked to the construction area. Therefore, with the recommended preventive actions the impacts of the operation of a concrete batch plant is expected to be SMALL, with no mitigation measures required.

4.4.1.4 Burning controls

The MDEQ in Rule 336.1310 states that: “A person shall not cause or permit open burning of refuse, garbage, or any other waste materials.” Construction of Fermi 3 will be compliant with the applicable regulations and requirements, and waste will be taken to the nearest suitable landfill for disposal.

4.4.2 Social and Economic Impacts

The social and economic impacts associated with Fermi 3 construction are discussed in this subsection. Generally, new investment in a major construction project has a number of positive economic impacts that are driven by employment and income creation, plus increased tax revenues. If negative impacts arise, the primary categories of concern usually include short-term traffic impacts and impacts that could arise if a large workforce relocates to a region that has limited availability of housing or inadequate community facilities and services. The key information to make this determination is the size of the relocating construction workforce relative to the availability of housing and community facilities and services.

Construction employment at the Fermi 3 site will vary significantly over the project. It is anticipated that during Phase 1, the peak employment level will be 150 workers in the second year of activity. During the two-year Phase 1 duration, an average workforce of 100 is assumed. During the Phase 2 activities, the initial workforce will be approximately 200 workers and will gradually increase to an assumed peak construction workforce of approximately 2900.

The Phase 2 construction period can be further divided into three time periods. During the early portion of the Phase 2 activities, which should last approximately 18 to 24 months, up to 90 percent of the onsite craft workforce will consist of civil and structural trades, which include laborers, carpenters, iron workers, cement masons and equipment operating engineers. The balance will consist of mechanical and electrical workers. During the mid-portion of the project, which will last from 18 months to 3.5 years, depending on the number of shifts and scheduling, approximately 50 percent of the craft workforce will consist of the mechanical trades that include boilermakers, pipe fitters, sheet metal workers, and millwrights. The remaining 50 percent of the craft workers during this phase should be divided between electrical workers and civil/structural workers. During the late stage of construction, which could last 3.5 to 4.5 years, approximately 70 percent of the craft workforce will be electrical, 10 percent will be civil and structural, 15 percent will be mechanical, and 5 percent of the craft workforce will be insulators and painters.

In addition to the craft labor, there will also be a non-craft component of the Fermi 3 workforce. The non-craft labor component consists of craft supervision, site indirect labor, quality control inspectors, nuclear steam supply vendor and subcontractor's staff, EPC contractor's managers, engineers and schedulers, owners' O&M staff, start-up personnel, and NRC inspectors.

Wages paid during construction will be linked to the prevailing wage rate for each type of skill needed. An approximate estimate of total wages to be paid can be derived using publicly available data from the U.S. Department of Energy (DOE) publication *Nuclear Power Plant Construction Infrastructure Assessment* (Reference 4.4-10). Based on the semi-annual manpower requirements projected in this DOE publication, adjusted for the anticipated peak labor requirements of 2900 at the Fermi 3 site, it is estimated that the average onsite labor (craft plus non-craft) during the 8-year construction period will be approximately 1000 workers (Reference 4.4-10). Adding for the additional labor required during the 2-year Phase 1 work (100 workers, on average, for two years are assumed), the total man-hour requirements for the Fermi 3 project are estimated to be approximately 17 million man-hours, or 8173 man-years of employment. It is assumed that the general monthly manpower loading pattern for all construction-related workers plus the Fermi 3 operations and maintenance staff will have the general shape shown in Figure 4.4-1. Figure 4.4-2 and Figure 4.4-3 further break down this total manpower requirement into the month-by-month Fermi 3 operations and maintenance staff, and the construction-related manpower requirements less the Fermi 3 O&M staff. All three figures show the loading over the 120 month (10-year) Phase 1 plus Phase 2 total construction length.

Based on labor union surveys, it is assumed in the impact analysis that the average direct construction wage for craft workers will be $31.37 per hour and that the estimated average direct wage for non-craft workers will be $48.00 per hour (both in 2008 dollars). It is assumed that craft workers will comprise approximately two-thirds of the construction hours and that non-craft workers will comprise approximately one-third of the construction hours. As a result of these wage and hour assumptions, the total direct wages for all construction workers is estimated to be $627 million. Of this amount, and based on the assumptions set forth in Section 4.4.2.1, approximately $533 million will be earned by workers residing in the region. These estimates include direct wages only and do not include fringe benefits accruing to the construction workforce. According to surveys of labor halls, these fringe benefits can constitute from 45 percent to 65 percent of the direct wage.

A key to projecting socioeconomic impacts is to forecast the number of relocating construction workers. Although forecasting methods are inexact, there are industry studies that can be useful in developing reasonable projections even though some date to the last period of multiple nuclear construction projects in the late 1970s and early 1980s. The studies referenced for the construction impact analysis in this section are listed below, and the abbreviated name of the study used for reference in the remainder of this section is listed in parenthesis.

- *Socioeconomic Impacts of Power Plants*, Prepared by Denver Research Institute for the Electric Power Research Institute, February 1982 (the EPRI study) (Reference 4.4-12)
- *Impacts of Nuclear Generating Plants on Local Areas*, J. Pijawka and J. Chalmers, Economic Geography, Vol. 59, No. 1, January 1983 (the Pijawka study) (Reference 4.4-13)
- *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*, Final Report, U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, NUREG-1437 Vol. 1, May 1996 (the GEIS) (Reference 4.4-18)
- *Migration and Residential Location of Workers at Nuclear Power Plant Construction Sites*, S. Malhotra and D. Manninen, Vol. 1 and 2, April 30, 1981 (the Malhotra study) (Reference 4.4-14)

4.4.2.1 **Demographics and Economics**

Estimating the number of Fermi 3 construction workers that will likely relocate from distant areas to within the region is a function of the availability of qualified construction workers that could commute to the site from their existing residences. An extremely conservative estimate, but one consistent with the definition of the Fermi 3 region, is that construction workers would be willing to commute to the site without relocating provided they reside within 50 miles of the site. On the other hand, the EPRI study of 12 large coal-fired, nuclear, and oil-fired power plant projects found that whole groups (not just a few individuals) of power plant construction workers often commute to a site even if they live more than 70 miles away (Reference 4.4-12). If this maximum distance is assumed, it results in a larger number of construction workers who could work on the project without relocating, and lessens the possibility of negative socioeconomic impacts related to housing and the demand for community facilities and services. To be conservative and yet cover the range of possible impacts, the following assessment presents results using two different commuting assumptions. The first assumes that construction workers within a 70-mile radius would be willing to work at the Fermi 3 site without relocating closer to the project site, and the second conservatively assumes a 50-mile maximum commuting distance. Both assessments include only U.S. workers.

The LandView® 6 software was used to determine the number of construction workers within 70 miles and 50 miles of the Fermi 3 site. Results in Table 4.4-2 indicate that a total of 166,473 construction workers lived within a 70-mile radius in 2000. At the 50-mile distance, there were 120,470 construction workers in 2000. As indicated in Table 2.5-26, the number of construction workers in the Detroit MSA is projected to increase by 7.7 percent from 2004 through 2014, an average annual growth rate of 0.75 percent. If this rate of annual average growth rate is applied to the number of construction workers in the 70-mile radius in 2000, then a construction workforce of 189,021 would be expected within the 70-mile radius in 2017, the assumed peak construction period. At the 50-mile radius, the construction workforce would be 136,787 in 2017.

Table 4.4-2 also indicates the percentage of the 70-mile and 50-mile construction workforce required during the peak construction period. The peak workforce of 2900 would be equal to 1.5 percent of the projected 2017 construction workforce within the 70-mile radius and 2.1 percent of the projected 2017 construction workforce within the 50-mile radius.

The percentage of the regional workforce required for Fermi 3 construction is relatively low considering the industry unemployment rate and the elasticity of the construction industry workforce (see below), yet it is probable that the existing regional workforce will not provide all project labor and that some relocation of construction workers will occur to fill positions requiring specialized skills and training. In addition, a portion of the construction management, inspector, and owner's engineer staff listed in Table 4.4-2 peak employment projection will also likely relocate to the region during construction.

The Pijawka and Malhotra studies can help bracket the percentage of the Fermi 3 construction workforce that may relocate to the primary impact area counties of Monroe, Wayne, and Lucas. The Pijawka study evaluated 12 nuclear power construction projects and quantified the percentage of the construction workforce according to those who were existing residents of the study area, those who moved into the study area for the project, and those who commuted to the plant site from beyond the study area. The study found that, on average, 17.6 percent of the peak construction workforce consisted of movers, 14.7 percent consisted of non-mover residents of the study area, and 67.7 percent were commuters from beyond the study area. (Reference 4.4-13)

The Pijawka study found that the key factor influencing the percentage of in-migrants was the location of nuclear projects within commuting distance of large metropolitan areas having a population of 50,000 or more. On average, the distance from the power plant sites to the nearest city of 50,000 or more was only 40 miles, and this proximity provided both a place for in-migrating labor to reside without significantly increasing the demand for facilities and services, as well as a source for construction labor. (Reference 4.4-13) Likewise, the EPRI study determined that "[w]here one or more significant population concentrations (communities of 25,000 or more residents) exist within 60 to 70 miles of a power plant site, such concentrations will influence the extent of the impact area. In effect, such communities are likely to be the source of significant numbers of construction workers." (Reference 4.4-13)

The Malhotra study involved 28 surveys at 13 nuclear power plant sites and covered 49,000 workers. The study also allows an estimate of the percentage of in-migrating plant construction workers for Fermi 3. In this study, a mover was defined as a construction worker who moved in order to work at the site. Results of the study indicated that the percentage of construction workers moving for work ranged from 15 to 35 percent. (Reference 4.4-14)

The Malhotra study found a higher percentage of relocating workers (a 25 percent mid-point) than the Pijawka study (average of 17.6 percent). This difference is primarily because the Pijawka study classified a relocating worker residing outside the study area as a commuter, and limited movers to those workers who relocated to within the defined study area, which was fairly small in some studies. Conversely, the Malhotra study classified all relocating construction workers as movers.

In the case of Fermi 3, the issue is to determine an appropriate estimate of the percentage of workers that would relocate to work at the Fermi 3 site. The three county primary impact area is large both geographically and from a population standpoint. These features favor the adoption of an assumption at the lower end of the Malhotra study. For example, of the 13 sites studied in the Malhotra study, five did not have a city with a population of 25,000 or larger within a 25-mile radius of the site, and the average distance to the central city of a standard metropolitan statistical area was 45 miles (Reference 4.4-14). In a similar pattern, the combined Detroit and Toledo population is larger than all of the nearby cities identified in Pijawka's study of 12 power projects. The 12 projects studied by Pijawka were also an average of 40 miles from the nearest city having a population of 50,000 or more. (Reference 4.4-13)

For purposes of the impact analysis, it is assumed that 15 percent of the Fermi 3 workers at construction peak will relocate to work at the site and 85 percent will be hired from within commuting distance. This percentage is equal to the lower range found in the Malhotra study. Based on a peak construction workforce of 2900, the 15 percent relocating assumption means that 435 construction workers would be expected to have relocated to the region at the time of peak construction, and that 2465 construction workers at peak would be hired from within the region. As indicated in Table 4.4-2, 2465 workers represents 1.2 percent of the 70-mile construction workforce projected for 2017 and 1.8 percent of the projected 50-mile construction workforce.

The employment benefits arising from the construction of Fermi 3 should have no more than minor inflationary impacts in the overall construction market, owing to the size of the construction labor force in the region and the nature of the construction industry. For example, the average unemployment rate in all Michigan industries was 6.7 percent from 2001 through 2007 (Reference 4.4-15). This unemployment rate was slightly above the 5.2 average rate for all industries nationally. In the construction industry, the national average was 8.0 percent, or 2.8 percentage points above the overall 2001 through 2007 unemployment level (Reference 4.4-16). Assuming that the relationship in Michigan and the region between the overall unemployment rate and the construction industry unemployment rate is similar to the national average, the region would have had an average construction industry unemployment rate of more than nine percent during the 2001 to 2007 time frame. If the long-term, average construction industry unemployment rate in the state and region remains even within 3 or 4 percentage points of these historical levels, then the construction industry could easily accommodate the Fermi 3 workforce requirements without initiating significant inflationary impacts on regional construction costs and without labor shortages.

The other consideration is that the size of the construction labor force has the ability to increase quickly in response to the demand for labor. For example, the average annual size of the national construction labor force (employed plus unemployed workers) in 2000 was 8.13 million, but within the year, the size of the construction labor force varied from a high of 8.63 million to a low of 7.67 million workers. This is a difference of 958,000 workers, which represents 11.8 percent of the annual average figure. From 2000 through 2006, this variation averaged 8.3 percent for the construction industry labor force, compared to 2.1 percent for the nation's overall labor force. (Reference 4.4-17) This phenomenon occurs because not only is there significant seasonal variation in employment opportunities in the industry, but construction jobs are relatively high paying and when the demand for construction labor increases, there is a tendency for qualified workers in other industries to respond by entering the construction workforce. Thus, the elasticity of the construction industry workforce would have a softening impact on any inflationary impacts that may be created from a significant increase in demand for construction workers in the region.

The final major workforce assumption concerns the location of residence for the assumed 435 relocated workers at peak construction. A common assumption is that the settlement pattern of power plant construction workers will mirror that of the existing operating staff. The current Fermi 2 operations workforce is widely scattered and workers reside primarily in the Michigan counties of Monroe (58 percent), Wayne (19 percent), Washtenaw (3 percent), Oakland (3 percent) and Lenawee (1 percent), plus the Ohio counties of Lucas (10 percent), and Wood (2 percent). Another four percent are disbursed throughout multiple regional counties. For purposes of this analysis, it is assumed that the relocating workforce would similarly follow a disbursed settlement pattern, but will be concentrated primarily in the three counties of Monroe (45 percent of relocating workers), Wayne (25 percent), and Lucas (20 percent), with the remaining workers disbursed among other regional counties.

The counties of Monroe, Wayne, and Lucas are expected to be the selected counties of residence for most relocating workers, as the counties offer the easiest access to the site, ample housing opportunities, and will position workers to obtain follow on work after their employment at Fermi 3 is completed. Within these three counties, relatively fewer construction workers are projected to locate in Monroe County and relatively more are projected to locate in Wayne and Lucas counties compared to the Fermi 2 operating staff, based on the expectation that workers will locate, not just giving consideration to the distance of the Fermi site, but with an eye to probable follow-on job opportunities when their work at Fermi is complete. This consideration is important as the Malhotra study reported that 40 to 50 percent of a relocating construction workforce plans to remain in the area following the completion of a power plant. (Reference 4.4-14) Workers allowing for this possibility, in particular, will tend to select a residence located in or within likely commuting distance of the larger cities of Detroit or Toledo.

This expectation that the construction workforce would be more concentrated near the larger cities and would be willing to commute a longer distance than the operational workforce is supported by the EPRI study that found a difference in settlement patterns between operating and construction workers. The study noted that “the geographic extent of the impact area for permanent workers is typically much more restricted than for construction workers who appear to be willing to commute much further distances.” (Reference 4.4-12). This expected relocation pattern is also supported by Pijawka’s study of 12 nuclear power plants that found, for projects located less than 50 miles from a city of at least 50,000 “a dispersed settlement pattern of movers was observed” as the larger cities became the selected residence for a large percentage of the workforce. (Reference 4.4-13)

The result of the assumed relocating percentages of Fermi 3 construction workers is that Monroe County would be expected to accommodate 196 workers, followed by Wayne County (109 workers) and Lucas County (65 workers). The remaining 65 relocating workers would be disbursed among other regional counties including Washtenaw, Lenawee, Oakland, and Wood counties.

4.4.2.2 **Local Housing**

While housing impacts will occur as a result of worker relocation, being that the plant will be constructed on an existing site, no families or households are likely to be displaced. Therefore, the relocation impacts include added tenants, renters, and buyers for housing units for rent or for sale. This process has the potential for both positive and negative impacts. On the positive side, the added demand for housing will have a beneficial income generating impact to the current owners of housing properties. On the negative side, a significant increase in the demand for housing could, other things being equal, tend to increase the price for housing, especially the cost of short-term rental properties.

Table 4.4-3 lists the number of vacant housing units in the three county primary impact area in 2000. The table indicates that out of 1,078,875 housing units, a total of 73,816 housing units were vacant. Thus, if each of the 435 projected relocating workers rented or purchased a vacant unit in the primary impact area, it would represent less than one percent (0.04 percent) of the total housing stock in 2000, and approximately 0.5 percent of vacant housing units in 2000, although not all vacant units would be expected to be suitable for sale or rent. The percentage share could be further reduced given the growth in the number of housing units that will occur over time.

The 2000 data tends to mask an unhealthy economic trend in the housing market that has been occurring in the Detroit MSA and, to a lesser extent, in Toledo over the past several years. As seen in Table 2.5-41, the number of vacant units in Wayne County doubled from 57,705 in 2000 to 124,280 in 2006 while, in Lucas County, the number of vacant units increased from 13,412 in 2000 to 22,938 in 2006 (in Monroe County the number of vacant units increased from 2699 to 4685 vacant units). While a vacancy rate of several percent is consistent with a healthy housing market and helps avoid demand-side pressure on housing prices, prolonged and high vacancy rates in urban areas can lead to multiple socioeconomic problems such as a negative impact on housing values, an increase in crime and vandalism, and lowered property tax revenues. Given the trends and 2006 vacancy rates in Wayne County (14.8 percent vacancy rate) and Lucas County (11.3

percent vacancy), these areas would benefit from the influx of additional householders as this could help stabilize the housing market.

The conclusion from the above is that any negative housing market impacts in the primary impact area caused by construction worker relocation would, at most, be SMALL, and temporary. What negative impacts may arise during the construction period would be expected to be primarily in Monroe County, and would most likely result from the short-term impact of major maintenance workers relocating for Fermi 2 refueling and other outages while Fermi 3 is being constructed. Again, however, workers needing to relocate will have opportunities to reside in Detroit and Toledo if the temporary lodging in Monroe County becomes relatively scarce.

The expectation that the major metropolitan areas of Detroit and Toledo will help lessen the impacts of construction and temporary maintenance workers is supported by the EPRI study, which found that a “key variable affecting housing impacts is the proximity of the impacted area to a major metropolitan area.” Where a relatively large city was nearby, workers largely chose to “live in cities and commute daily to work, rather than moving to towns in the immediate vicinity of the plant” and “housing markets in the small towns closest to the plants…were not seriously affected, while the larger cities easily absorbed the increased demand for housing.” (Reference 4.4-12) Similarly, the Pijawka study reported that “[i]mpacts on the housing sector in terms of price and overcrowding were temporary and relatively unimportant.” In the 12 case studies leading to Pijawka’s conclusion, the demand for local housing ranged from 1.2 percent to over 25 percent of the total housing stock, a significantly higher percentage than is anticipated for Fermi 3 construction. The Pijawka study also summarized two additional studies stating that they “support the conclusion that adverse housing impacts were either short-lived or not an important issue in the host communities.” (Reference 4.4-13)

The GEIS stated that “moderate and large impacts are possible at sites located in rural and remote areas, at sites located in areas that have experienced extremely slow population growth (and thus slow or not growth in housing), or where growth control measures that limit housing development are in existence or have recently been lifted.” However, of the seven case studies reviewed, the GEIS concluded that “in most cases, project-related housing demand was so small or the local and regional housing markets were so large that no large impacts resulted.” Of the seven projects evaluated, the two projects having a moderate impact on housing required 6.25 percent and 2.7 percent of the total number of housing units in the study area, and the project having large impacts required 18 percent of the total number of housing units in the study area. (Reference 4.4-18)

In sum, any adverse impacts on the regional housing due to Fermi 3 construction are projected to be SMALL, and no mitigative measures are needed.

4.4.2.3 **Regional Tax**

Regional taxes will be generated in several tax categories due to the construction of Fermi 3. These tax categories include: a) federal and state income taxes on worker incomes, b) state sales taxes on worker expenditures, as well as additional income and sales taxes arising through the re-spending of income in the form of direct expenditures on goods and services by construction workers, c) state sales taxes on goods and services purchased in the state or region by the

Applicant, and d) local property taxes or payments in lieu of taxes based on the incremental increase in the value of Fermi 3 during construction.

As discussed in Subsection 4.4.2, it is assumed that there will be an average of approximately 1000 workers on site during the 8 year construction period. According to Table 2.5-36, Michigan residents paid $19.63 in state individual income taxes per $1000 of income in 2004 (Ohio residents paid $34.15 per $1000 of personal income). Using the Michigan number as a conservative estimate of the state individual income tax and applying this to the $533 million that will be earned by workers residing in the region, there would be a total of approximately $10.5 million in state (Michigan and Ohio) income tax generated from the local workforce alone.

In addition to income taxes generated by the construction workforce there will also be a stream of sales tax revenues created directly by expenditures on materials and supplies during construction and indirectly via expenditures by the construction workforce. Currently no specific information is available about direct expenditures on materials and supplies expected to occur locally during the construction period, but the *DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment* estimates that the construction of a single nuclear unit would utilize the materials and approximate quantities indicated in Table 4.4-3-(A). Also listed are approximate unit costs and total costs for the quantities listed, based on current pricing information for these materials.

It is not known how many of the materials listed above will come from local suppliers, and the DOE NP2010 states "a significant portion of the large bore pipe would be brought to the site in prefabricated modules and as prefabricated large bore pipe spool pieces. A portion of the small bore pipe, cable tray, conduit, and tubing would also be brought to the site in prefabricated modules." On the other hand, a large portion of other materials such as concrete, fencing, conduit, and wire could potentially be sourced from the region.

In addition to the material mentioned above, other non-reactor work will require the use of goods and services that could be sourced from the region. The list includes but is not limited to the following:

- Road work and parking—developing new roads for the constriction area, a new access road and gate, new administration building parking lot and roads, and construction parking and lay down.
- Buildings—construction of a new administration building, new warehouse, new shops, and a new simulator wing.
- Excavation—excavating the power block and other construction sites.
- Water Systems—the development of the station water system, the circulating water system, and the circulating water blow down outfall.

The indirect sales tax generated through the employment of the construction labor force is estimated based on the Applicant's information regarding indirect sales taxes generated by the labor employed during operation and maintenance of Fermi 2. As discussed in Subsection 2.5.2.2.2 approximately $62.1 million dollars in wages created $2.2 million in indirect sales tax (or approximately 3.5 percent of wages paid). Applying this percentage to the assumed $533 million in wages paid to local construction workers over the construction period, approximately $18.7 million in indirect sales taxes would be generated.

Lastly, Fermi 3 would generate an incremental increase in property tax revenue as the construction phase progresses. Although no specific information is available at this time regarding the incremental value of the Fermi 3 plant each year during construction, it is certain that the assessed value of the project will increase and is therefore likely to result in significant increased property taxes during this phase.

4.4.2.4 **Local Public Services**

There is the potential for a number of local public services in the primary impact area to be impacted by construction of Fermi 3. Key categories of impacts to be evaluated include schools, transportation, local taxes, public services, and public utilities. Given that the estimated 1131 relocating workers and families (435 Fermi 3 construction workers multiplied by 2.6 persons per household within the region) would represent an extremely small percentage of the 50-mile radius population (0.019 percent) of the 5.4 million regional 2000 population, a detailed assessment of the potential impact on the entire region is not provided. Instead, the following discussion is limited to the impacts likely to occur in the three primary impact area counties of Monroe, Wayne, and Lucas. The primary focus is on Monroe County given the small impacts expected on the larger counties of Wayne and Lucas.

Generally, an increase in the employment and population base from a large construction project will increase taxes and user fees for the funding of continued facilities and services. However, the potential for negative impacts is also present, and could occur if the relocation of workers was rapid and outpaced the area’s ability to provide for the sudden increase in demand for such services. There could also be a mismatch of timing between when negative impacts are experienced and when added revenues are realized by local community governments. The potential for such impacts is evaluated below. First, however, it is useful to understand the general findings of previous studies of nuclear and large power plant construction projects.

In general, previous studies have concluded that the degree of impact on local community facilities and services is strongly linked to the geographic location of the project. When projects are located near a large city and allow for both the local hiring of a significant percentage of the project workforce and the disbursement relocating workers, negative impacts are relatively minor, though benefits are also widely distributed.

For example, the Pijawka study found that, due to the dispersed settlement patterns of in-migrants for plants located near large cities, “such locational characteristics had the effect of reducing the level of mover in-migration, thus diminishing potential adverse effects both on the provision and level of public services and on the social structure of the host community.” (Reference 4.4-13) The Pijawka study further concluded:

> Of the four major public service areas examined - education, transportation, public safety, and social services - the study found that there had been little demand for project-related

> expansion in public safety and social services. Traffic congestion, however, was found to be a serious problem at most sites. Project-related demands on the school system occurred at some of the sites, but in all these cases successful adjustments were made to absorb the students without deleterious effects on educational quality…of total pupil enrollment at the 12 sites, an average of only 2.9 percent was attributable to the nuclear plants. It should be noted, however, that at the taxpaying sites, plant-generated revenues contributed to an average of 40 percent of total school district revenues. (Reference 4.4-13)

Summarizing another study of the impact of TVA nuclear plants and the Pilgram Nuclear Plant in Massachusetts, Pijawka states that "because nuclear plants are located near areas having large labor pools, mass in-migration to the host communities was avoided and, consequently, few adverse effects occurred to community services." (Reference 4.4-13)

The GEIS reviewed the impact of the construction of seven nuclear power plants. The summary of socioeconomic impacts stated:

> The significance of any given nuclear power plant to its host area will depend to a large degree on its location, with the effects generally being most concentrated in those communities closest to the plant. Major influences on the local communities include the plants effects on employment, taxes, housing, offsite land use, economic structure, and public services…Nuclear power plants can have a significant positive effect on their community environment. These effects are stable and long term. Because these socioeconomic effects generally enhance the economic structure of the local community, nuclear power plants are accepted by the community, and indeed, become a major positive contributor to the local environs. (Reference 4.4-18)

The EPRI study was more pessimistic about the impact on local services as the study included a number of power plants that were distant from larger communities. In such circumstances, small local communities tended to be saddled with a relatively large number of relocating construction workers, and the impacts on public schools, water and sewer facilities, streets and highways, parks and recreation, public safety, and fiscal resources were often a significant and negative factor. This was particularly an issue in the 5 of 12 plants studied that produced no associated property tax revenues due to the exempt status of the owner or prohibitive state or local laws. The EPRI study also noted that local impacts often preceded the receipt of the revenue benefits, and this mismatch tended to cause a temporary degradation in the provision of community services. (Reference 4.4-12)

With this background, the following subsections evaluate the potential for impacts of the Fermi 3 workforce on the primary impact area counties. The first area of discussion is the impact on education.

4.4.2.4.1 **Education**

Based on the methodology discussed in Subsection 4.4.2, it is estimated that 196 construction workers and families may relocate to Monroe County, 109 may relocate to Wayne County, and 65 may relocate to Lucas County. The potential impact on the educational system in these counties is largely a function of the average number of school age children per construction household, and the change in the pupil to teacher ratio that additional pupils may create. A district's physical ability to accommodate additional students without the need to construct new schools is also a key indicator of the potential for impacts.

The number of additional students expected in the primary impact area counties from relocating Fermi 3 construction workers is estimated by taking the number of relocating worker households assumed for each county times the number of students per occupied housing unit. From Table 2.5-43, there were 25,963 students in the 55 schools in Monroe County in 2005-2006. There were also 58,376 occupied housing units in 2006, resulting in 0.44 students per occupied housing unit. If 196 construction workers were to relocate in Monroe County, with 0.44 students per newly occupied unit, a total of 86 new students would be expected. Compared to 2005-2006 enrollment levels, this would result in a 0.33 percent increase. This increase is well within the long-term historical growth rate of population in the county (0.94 percent from 1990 through 2007).

As seen in Table 4.4-4 for Wayne County, the impact of the addition of 109 workers and 55 new students (based on 0.5 students per occupied housing unit for the county in 2006) would hardly be noticeable given the total enrollment of 359,643 students among 700 schools in 2005-2006. Given the decrease in population and employment plus the increase in vacant housing experienced since 2000, the largest concern for Wayne County school districts may be whether some schools will need to be closed due to declining enrollment, and the small increase in students associated with Fermi 3 construction will be a stabilizing benefit.

In Lucas County, the 87 additional workers and 35 students (based on 0.4 students per occupied housing unit for the county in 2006) would likewise present an insignificant increase in the number of students in the 140 schools that had a 2005-2006 enrollment of 73,146 students.

Regarding the capacity of existing schools to accommodate new students, contact was made with the superintendents of Monroe Public Schools and Jefferson Public Schools in Monroe County. Both indicated that their districts should be able to absorb new students joining the system. While some advance planning and coordination could be required, there were no reservations that the districts would be able to accommodate additional students. Given the large number of districts in Lucas and Wayne counties, the insignificant increase in students projected for these counties, and the length of time until the peak construction period in 2017, no districts in these counties were contacted. In summary, the construction impacts on existing schools in Monroe, Wayne, Lucas Counties is expected to be SMALL, and no mitigative measures are needed.

4.4.2.4.2 **Transportation**

Transportation to the Fermi 3 site will include workers and deliveries during the 10-year construction period. These trips will be in addition to the operation staff and deliveries at Fermi 2 that include 800 operational staff, 150 contract supplemental employees, and maintenance workers traveling to the site for scheduled and unscheduled outages. The number of maintenance workers can peak at 1200 to 1500 workers during Fermi 2 refueling, which occurs approximately every 18 months. Thus, in a worst case scenario, should refueling of Fermi 2 coincide with peak Fermi 3 construction employment level of 2900 workers, the total onsite population could reach as high as approximately 5000 personnel, not including deliveries.

With up to 5000 workers commuting to the Fermi site at the time of peak Fermi 3 construction employment, there is the potential for large traffic impacts near the plant entrance, though a number of factors will serve to reduce the number of vehicles entering the site at any one time. First, based on data presented in Table 2.5-56, it is reasonable to expect that at least 10 percent of the workers will carpool. Also, the Fermi 2 operational workforce will be distributed among 24-hour shifts, and it is very possible - as an obvious preventive measure - that shift start times between the Fermi 2 and Fermi 3 work force will be staggered. Another major factor influencing the traffic flow near the site will be the number of Fermi 3 construction shifts. It is possible that multiple shifts will be used at Fermi 3, which would be ideal from a traffic flow standpoint.

According to MDOT's document *Traffic and Safety Note 607A*, "a traffic impact study is required for any proposed development expected to generate over one hundred (100) peak hour directional trips or at the discretion of the Region/ TSA Traffic & Safety Engineer." (Reference 4.4-19) In order to analyze the effects that the construction of Fermi 3 would have on area traffic patterns, Detroit Edison has performed a Level of Service traffic study (Reference 4.4-22). The traffic study involved collecting traffic count data during and after a Fermi 2 refueling outage in order to factor in the fluctuation of vehicles accessing the site during these times. Existing information on area traffic flows was also utilized including average daily traffic counts presented in Figure 2.5-25. Consultations with the Michigan Department of Transportation and the Monroe County Road Commision were made during the course of the analyses.

In the EPRI study of twelve power plant projects, "traffic problems and congestion were mentioned as a negative factor in all 12 case studies." (Reference 4.4-12) The Fermi study analyzes the effects that both the projected operations and construction workforces will have on traffic flows in the vicinity of the Fermi site when combined with existing Fermi 2 traffic. The greatest negative impacts are projected to occur in 2017 when the construction workforce is at its peak of 2900 workers. It has been determined that by implementing potential improvements including signal installations and signal modifications, staggering worker shifts, bussing employees from off-site, minor lane additions and/or a second entrance to the site that a great deal of the increased traffic impacts can be minimized resulting in a SMALL impact.

The transportation impact of the construction workforce will be a function of several factors such as the number of workers and the workforce commuting patterns, including average distance traveled to the Fermi 3 construction site. The average distance traveled is estimated in Table 4.4-4-(A) and utilizes information in Table 4.4-4-(B).

Subsection 4.4.2 of the assumes that 15 percent of the peak construction workforce would consist of workers who have relocated from outside the region and that the remaining 85 percent would permanently reside within the Fermi region. Subsection 4.4.2 also assumes that the 15 percent of workers who relocate during construction will reside primarily in Monroe County (45 percent), Wayne County (25 percent), and Lucas County (20 percent), with the remaining 10 percent distributed among other region counties presented in Column A.

To project the distribution of the 85 percent of employees with permanent regional residency, American Community Survey Data 2005-2007 was referenced regarding the distribution of the total regional construction workforce as shown in Column B. The Column B data, however, may not be a good indicator of the residential distribution of the Fermi 3 workforce because of: 1) geographical considerations (distance from the Fermi site of populated counties, primarily Oakland County), and 2) the location of Union Locals having Monroe jurisdiction or otherwise located nearby, as provided in Table 4.4-4-(B). As a result of these considerations, the regional distribution values in Column B were adjusted using subject matter expert judgment to arrive at the assumed Fermi 3 workforce place of residence distribution in Column C. Comparing Columns B and C, the adjustments were to reduce the percentage of Fermi 3 construction workers assumed to reside in Oakland County (a 15 percentage point reduction) and Wayne County (a 4 percentage point reduction), and to increase the percentage assumed to reside in Lucas County (a 10 percentage point increase), Monroe County (a 5 percentage point increase), and in the “Other County” classification (a 4 percentage point increase).

Next, given the assumed distribution of relocating (Column A) and resident (Column C) Fermi 3 construction workers, the overall distribution of workers was calculated, as seen in Column D. The process used in the “operations employees” calculation was then repeated by determining the weighted distance to the Fermi site (calculated by estimating the distance from the center of each county’s largest city to the Fermi site) and then multiplying the result by the fraction of workers commuting from each respective county (Column G is equal to Column D multiplied by Column F). Lastly, the weighted values in Column G were added together to arrive at the average distance of 36.6 miles.

4.4.2.4.3 **Public Safety and Social Services**

The possibility exists that construction activities could result in a slight increase in demand for safety and social services due to relocated workers to the primary impact area counties. These services could include demands for police, fire, ambulance, and hospital services. However, given the estimated small percentage of additional households in all counties arising from Fermi 3 construction, and given that these additions are well within the long-term historical growth rate of housing and the 0.94 population growth for the area, it is expected that the additional households will represent a SMALL increase in the demand for police, ambulance, or hospital services in the primary impact area.

Fermi 3 construction activities also have the potential to negatively impact local community public safety facilities and services due to services needed by the site (e.g., construction workplace injury/accidents). However, construction practices, as described below, will be designed with the specific intent to minimize or eliminate these negative impacts. Accordingly, the expected impact on the following services is SMALL, and no mitigative measures are needed.

A construction safety plan, which conforms to industry requirements and OSHA regulations, will facilitate a safe working environment for the construction workforce. The workers undergo training to familiarize themselves with the safety plan, and members of the construction workforce are required to adhere to the established standards. Examples of proven safety measures include the required use of hard hats in construction areas, the availability of first aid supplies, and required use of tie lines for those working at elevated heights.

In addition, there will be limited access to the construction area. A security guard will be posted onsite and a badge system will be used to control personnel access. The site will include security lighting and fire suppression equipment. First aid stations will be established and maintained throughout the Fermi 3 construction area. First aid training will also be provided to selected individuals in the construction workforce. Standard procedures will be adopted for spill prevention and containment, injury response, and requests for assistance for local police, fire, and ambulance services.

Emergency, medical, fire, law enforcement, and other offsite response support to the Fermi site is performed in accordance with agreements established in the Fermi Emergency Plan contained in COLA Part 5.

4.4.2.4.4 **Public Utilities**

Construction of Fermi 3 will require onsite electricity, water, and wastewater services. These impacts, however, will represent no more than a SMALL increase in demand for local utility services. Relocating workers will also utilize these services but their dispersal throughout the region will minimize the impact on any single utility provider.

4.4.2.4.5 **Recreation, Tourism, Aesthetics, and Land Use**

One of the primary advantages of Fermi 3 is that it will be built on an existing site. As mentioned in Subsection 2.5.2.7, while there are recreation facilities near Fermi 3, the only foreseen impact on these facilities is a longer commute time if travel coincides with peak construction worker commutes. Consequently, the impacts on recreation and tourism due to construction are expected to be SMALL, and no mitigative measures are needed.

From an aesthetics perspective, the construction of Fermi 3 will occur in the heart of the Fermi site, and most of the activity will not be visible from beyond the site. The primary exceptions are the temporary increase in traffic volume that will noticeable, particularly during the peak construction months, plus the NDCT that will be approximately 600 feet tall and will become visible from beyond the site as construction proceeds; therefore, impacting the visual aesthetics of the area. Once construction is complete, the aesthetic and visual impacts associated with construction will recede, with only the NDCT impact remaining visible from offsite.

It is also very significant to note that the construction of Fermi 3 will produce economic benefits while conforming to the objectives established by the local planning authorities. Within the area there are three main agencies that influence local planning, these include: The Monroe Planning Department and Commission (Planning Commission), the Southeast Michigan Council of Government (SEMCOG), and the Frenchtown Township.

Figure 2.5-17 indicates that the Fermi site in the extreme eastern part of the township and bordering on Lake Erie is zoned for utility use, as is a corridor extending from the Fermi site to I-75 and following the highway for much of its route through the township.

Figure 2.5-18 indicates the future land use plans for Frenchtown Township as presented in the most recent (2002) Master Plan. As seen in the figure, the Fermi site is expected to remain zoned for utility use. Related to utility land use, the Master Plan states "The Future Land Use Map acknowledges the continued presence of the Enrico Fermi Energy Center by designating the entire complex as "utilities"." Thus, the addition of Fermi 3 is consistent with current and future land use plans in Monroe County. Therefore, land use impacts will be SMALL, and no mitigative measures are needed.

4.4.2.4.6 **Local Employment and Income**

As discussed above, it is reasonable to assume that approximately 85 percent, or 2,465 of the peak construction workers will be from the existing workforce in the primary impact area, and this will be a significant benefit. In addition to the direct employment benefits, there will be employment and income multiplier impacts arising from the construction jobs at Fermi 3, the local expenditures made by the construction workforce and the purchase of materials, supplies, and services during construction. This section estimates the multiplier impacts in the primary impact area associated with the construction of Fermi 3.

One way to estimate the multiplier impact of a new investment in a region is through the use of a regional input-output model, which can estimate an expected industry multiplier to be applied to the direct impact estimates. Input-output models typically use an accounting matrix that shows the change in output, earnings, or employment in all industries due to a change in investment in one industry. For estimating the impact of Fermi 3, the Regional Input-Output Modeling System (RIMS II model) developed and maintained by the U.S. Bureau of Economic Analysis was used. The RIMS II model can produce multipliers for roughly 500 industry classifications and, as a static equilibrium model, can predict the total impact associated with an initial investment, though it does not predict the timing of impacts. (Reference 4.4-20)

The RIMS II model requires the user to select a geographical area of study for which multipliers will be estimated. Typically, this will consist of contiguous counties near the investment location. For the Fermi 3 analysis, the primary impact area counties of Monroe, Wayne, and Lucas were selected.

Based on the "DOE NP2010 Nuclear Power Plant Construction Infrastructure Assessment" publication that lists craft requirements at peak, a weighted average direct wage (no fringes, overheads, or indirect are included) of the Fermi 3 construction workforce was then calculated to be $31.37 per hour (Table 4.4-5). Not including overtime, this hourly wage would result in an annual salary for craft workers of approximately $65,250 (2008 dollars). For the non-craft portion of the labor force, an average of $48.00 per hour was assumed; this equates to an annual salary of $99,840 (2008 dollars). Assuming craft labor comprises two-thirds of the total labor force and the non-craft comprises one-third of the labor force the weighted average annual direct wage during construction is $76,780 (2008 dollars). Taking $76,780 (2008 dollars) multiplied by 8,173 total man-years of employment equates to a revised estimate of wages paid during Fermi 3 construction of $627.5 million (2008 dollars).

From Subsection 4.4.2, the project is expected to create 8,173 man-years of employment and $627.5 million in direct wages, though not all man-years and wages are subject to the regional multiplier. Income and employment multipliers can be applied to income and employment for those workers moving into the primary impact area from outside the region, and to those workers living in the region, who will be hired from the ranks of the unemployed.

In terms of projecting the number of construction workers who will be hired from the ranks of the unemployed, current discussions with the craft trades in the Detroit and Toledo area indicated that current unemployment rates are 25 to 40 percent for most crafts. For purposes of this analysis, it is conservatively assumed that 25 percent of the Fermi 3 construction workforce hired from the region will be hired from the ranks of the unemployed and can be included in the multiplier impact analysis. The remaining 75 percent of the positions filled from the region are assumed to be filled by employed workers and are not subject to the multiplier impact analysis; hence, their multiplier is effectively one.

Table 4.4-6 shows the calculation process that produces the total construction employment and earnings impact estimate for the region and for the primary impact area counties of Monroe, Wayne, and Lucas. The top portion of the table indicates that of the 15 percent of the construction workforce assumed to move to the region, 90 percent (392 workers) are assumed to relocate to the primary impact area counties. In addition, of the 85 percent of the workforce assumed to be located in the region, approximately 70 percent are assumed to be located in the primary impact area. These percentage assumptions were initially made with regard to the peak workforce, but are here also applied to the overall man-years and earnings distribution.

In terms of calculating an employment multiplier impact for the primary impact area counties, a multiplier is applied to the man-years associated with workers relocating to the primary impact area (90 percent of the 15 percent relocating to the region), and to the man-years associated with the 25 percent of the regional workforce living in the primary impact area that are assumed to be unemployed. Combining these group results is an estimate of 2,334 man-years of employment, as seen in row C in the middle section of Table 4.4-6.

Applying the RIMS II direct effect employment multiplier for the primary impact area of 1.7113 times the 2,334 man-years of employment eligible for application of a multiplier yields a primary impact area employment impact of 3,994 man-years (row E). When combined with the 3,691 man-years of employment in the primary impact area not subject to the multiplier (these are those who are employed when hired for Fermi 3 construction, including the under employed), the total impact on the primary impact area is projected to be 7,685 man-years of employment (row G) in Table 1. For the Fermi 3 region as a whole (including those counties not in the primary impact area), the total man-years of employment including the multiplier impacts on the primary impact area will be 9,833 man-years as seen in row I of Table 4.4-6.

Turning to earnings (all in 2008 dollars) and following a similar methodology, Table 4.4-6 indicates that a multiplier is applied to the earnings of workers relocating to the primary impact area (90 percent of the 15 percent relocating to the region), and to the earnings of 25 percent of the regional workers living in the primary impact area assumed to be unemployed. Combining these groups in row L, it is seen that $179 million in primary impact area earnings is subject to the multiplier impact.

Applying the RIMS II direct effect earnings multiplier for the primary impact area of 1.5998 times the $179 million in earnings yields a primary impact area earnings impact of $287 million in row N of Table 4.4-6. When combined with the earnings in the primary impact area not subject to the multiplier ($283 million associated with those employed when hired for the project, including the under employed), the total impact on the primary impact area will be $570 million in earnings as indicated in row P. For the Fermi 3 region as a whole (including those counties not in the primary impact area), the total earnings generated, including the multiplier impacts on the primary impact area, is estimated to be $735 million.

4.4.3 **Environmental Justice Impacts**

The purpose of the environmental justice review is to determine if low income and minority populations would bear a disproportionate amount of any detrimental environmental impacts from the construction of Fermi 3. Potential areas of impact that deserve special attention include cultural, economic, and human health impacts.

Based on the analysis presented in Subsection 2.5.4, no counties within the 50-mile region qualified as a low income. However, as shown in Figure 2.5-30, 572 Census Block Groups (CBGs) within the region were minority areas, primarily these were associated with the cities of Detroit and Toledo. Specifically, of the 488 low-income CBGs located within the Michigan portion of the 50-mile region, 428 were in Wayne County. Similarly, of the 84 low-income CBGs located within the Ohio portion of the 50-mile radius, 71 were located in Lucas County. In Monroe County, only one CBG qualified as low-income, and this was located in the city of Monroe, southwest of the Fermi site.

Of the counties within a 50-mile radius of Fermi, only Wayne County qualified as a minority, based on a 52.89 percent minority population (see Figure 2.5-28). Although Wayne County is the only minority county within the 50-mile region, there was 1438 minority CBGs within the region. Most of the minority CBGs are associated with the cities of Detroit and Toledo. For example, of the 1316 minority CBGs within the Michigan portion of the 50-mile region, 1124 were located in Wayne County. Of the 122 minority CBGs located within the Ohio portion of the 50-mile region, 113 were located in Lucas County. In Monroe County, only one CBG qualified as minority and this was located in the city of Monroe. The minority CBGs are show in Figure 2.5-29.

4.4.3.1 **Impacts on Low Income Areas**

For there to be a significant concern that the culture, economy, or human health of low income populations may be harmed due to the construction of Fermi 3, or receive a disproportionate share of negative impacts: 1) a low income county, or CBGs in close proximity to the site would need to be present, 2) negative cultural, economic, or health impacts on such populations would need to be expected, and 3) the low income areas would be expected to encounter a disproportionate share of negative impacts from the construction of Fermi 3.

The socioeconomic analysis found that no low-income county exists in the 50-mile radius of Fermi 3, and that there is only one nearby CBG in Monroe County that qualifies as low income. Thus, based on the definition of low income populations, the first criterion only marginally applies.

The remaining discussion addresses the second and third criteria and uses information from previous sections to support the conclusion that 1) very minimal cultural and health impacts would be expected while the economic benefits associated with Fermi 3 would be significantly positive, and 2) the low income CBG would not encounter a disproportionate share of any negative impacts.

Previous sections have indicated that the potential health impacts on local populations from construction of Fermi 3 are expected to be limited to minor noise impacts and possibly impacts related to the increased emissions and delays associated with worker vehicles and transportation of materials and supplies to the site. These impacts will be temporary and largely limited to the Fermi site and areas near the entrance to the Fermi site. Due to the limited geographic nature of such impacts, the nearest low income CBG in Monroe County would not be disproportionately impacted.

Concerning cultural impacts, a culture can be defined as “the ideas, customs, skills, arts, etc. of a given people in a given period.” Previous discussions have indicated that due to the dispersion the relocating workforce in the primary impact area it is estimated that 196 workers at the peak of construction will relocate to Monroe County. In 2000, the CBG in Monroe County that qualified as low-income had a population of 766 people; this represents approximately 0.5 percent of the 2000 Monroe County population. If a 0.5 percent of the relocating workers choose to reside in this CBG, it would mean that one worker would be added to this CBG. Therefore, there would be minimal potential for a significant change in culture that could theoretically be brought about by a change in population mix by the addition of one worker.

Related to economic impacts, the previous socioeconomic impact sections have concluded that the impacts of Fermi 3 construction are almost wholly positive and beneficial to the region. Primary benefits include employment and income benefits, and increased tax revenues. Though the most significant economic benefit will occur in Monroe County due to increased property tax revenues, all areas in the primary impact area will benefit economically from the project. Generally, low income populations can be assumed to benefit from these impacts to a comparable degree as other regional populations from these impacts. In summary, the impacts on low income populations are projected to be SMALL, and no mitigative measures are needed.

4.4.3.2 **Impacts on Minority Populations**

The same process followed in the previous section for low income populations can be followed to determine whether minority populations will be negatively and disproportionately impacted by the construction of Fermi 3. That is, for there to be a significant concern that the culture, economy, or human health of minority population areas may be harmed due to the construction of Fermi 3 or receive a disproportionate share of negative impacts, 1) a minority County or minority Census Block Groups in close proximity to the site would need to be present, 2) negative cultural, economic, or health impacts on such populations would need to be expected, and 3) the minority areas would be expected to encounter a disproportionate share of negative impacts from the construction of Fermi 3.

Wayne County is the only county within the 50-mile region classified as a minority area. In that Wayne County is not in the immediate vicinity of Fermi 3, while most of the impacts are limited to the plant site and the immediate surrounding area, Wayne County should not experience any negative impacts, and certainly the population would not be disproportionately impacted more than Monroe County.

In Monroe County, the only minority CBG was located in the city of Monroe and had a 2000 population of 738. This population number was approximately 0.5 percent of the 2000 Monroe County population. Given the expectation that negative impacts should be a temporary occurrence related to noise and traffic near the site, the CBG should not be directly affected by Fermi 3 construction. Further, should the 109 workers assumed to relocate to Monroe County do so in a distribution pattern similar to the current population, only one worker would establish a residence in the minority CBG. Given that this would be a minimal change in population, the impacts on health and culture should be very minor or nonexistent.

In summary, any negative impacts on minority populations are expected to be SMALL, and not disproportional to the overall population impacts. Therefore, no mitigation measures are required.

4.4.3.3 **Isolated Population Impacts**

The foregoing conclusions that there would be no environmental justice impacts were supported by Monroe County officials and other citizens. This is an important confirmation, because it is possible that small groups of low income or minority populations could be present and not detected at the CBG level. These potential populations could be involved in subsistence activities near or on the site and could be impacted by Fermi 3 construction.

Consultations with a local landowner, nearby clergy, and local county officials indicated that there were no known environmental justice issues or subsistence populations on or near the Fermi site that could be affected by Fermi 3 construction. Most discussions indicated that the project would be welcomed due to its economics benefits, with the only expected negative impact being increased traffic during the construction period.

In summary, no isolated populations engaged in subsistence activities are known to exist on or near the Fermi site. It is therefore concluded that disproportionate construction impacts to such populations would be SMALL, and no mitigative measures are needed.

4.4.4 **Summary**

The potential for negative environmental impacts during construction will largely be minimized through the application of routine construction procedures and the location of Fermi 3 at an existing and relatively remote site. Routine onsite procedures include those in the areas of site security, employment screening, fire protection, medical preparedness, spill containment measures, dust suppression, and other measures.

As discussed above, the primary concern regarding the potential for negative impacts is associated with the volume of traffic that will be accessing the site during the peak months of construction. To guard against preventable safety impacts and delays, it is appropriate to further investigate the potential for impacts through a full Level of Service analysis at the appropriate time, and to implement appropriate mitigation measures. Aside from the small negative impacts that could temporarily arise during the construction of Fermi 3, the socioeconomic benefits of the project will be significant and positive in the areas of employment, income generation, and tax benefits.

4.4.5 **References**

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Table 4.4-1 Estimated Construction Equipment Noise Emissions

Equipment	L_{eq} [1,2,3] @ 50 ft (dBA)	L_{eq} @ 1000 ft (dBA)
Backhoe	80	54
Grader	82	56
Dozer	83	57
Front End Loader	83	57
Compactor	80	54
Trencher	74	48
Pile Driver	89	63
Truck, Large	77	51
Concrete Vibrator	67	41
Concrete Saw	68	42
Mobile Crane	70	44
Stationary Crane	68	42
Diesel Generator	79	53
Air Compressor	76	50
Welder	68	42
Grinder	75	49
Forklift	76	50
Manlift	76	50
Overall Average[4]	N/A	<64
Maximum[5]	N/A	67

Notes:
1. Average sound pressure level at 50 feet horizontal distance from the equipment.
2. Based on information provided in Reference 4.4-7 and information available from previous similar projects.
3. Energy average sound pressure level at 50 feet horizontal distance from the equipment for work shift of 7 – 10 hours.
4. Exluding Pile Driving Noise
5. Including Pile Driving Noise

Table 4.4-2 Construction Workforce within 70-mi and 50-mi Radii of the Fermi Site

Category	70-mi Radius	50-mi Radius
Total Area Construction Workers, 2000	166,473	120,470
Projected Area Construction Workers, 2017	189,021	136,787
Fermi 3 Peak Employment Projection, 2017	2900	2900
Fermi 3 Peak Employment as a percent of 2017 Area Construction Employment	1.5	2.1
Fermi 3 Peak Employment from the Region if 85 percent are Hired Locally	2465	2465
Fermi 3 Employment from the Region as a percent of 2017 Region Construction Employment	1.2	1.8

Table 4.4-3 Regional Labor Force in 2000 for the Primary Impact Area and the Assumed Allocation of Fermi 3 Relocating Workers at Peak

Primary Impact Area County	Housing Units, 2000	Vacant Housing Units, 2000	Assumed Relocating Households	Relocating Households as Percent of Total Housing Unites	Relocating Households as Percent of Vacant Housing Units
Monroe	56,471	2699	196	0.35	7.26
Wayne	826,145	57,705	109	0.01	0.19
Lucas	196,259	13,412	87	0.04	0.65
Total	1,078,875	73,816	392	0.04	0.53

Table 4.4-3-(A) Selected Bulk Material Purchases and Approximate Costs

B&V Estimate	Quantity	Dollar/Unit Costs	Material Cost $2008
Concrete (cubic yards)	460,000	150.00	$69,000,000
Reinforced steel and embedded parts (ton)	46,000	1,120.00	51,520,000
STRUCTURAL Steel, Decking (ton)	25,000	1,350.00	33,750,000
Cable tray (feet)	220,000	22.75	5,005,000
Conduit (feet)	1,200,000	7.30	8,760,000
Power Cable (feet)	1,400,000	5.00	7,000,000
Control Wire (feet)	5,400,000	1.10	5,940,000
Large bore pipe >2.5 (feet)	260,000	96.74	25,152,400
Small bore pipe (feet)	430,000	32.00	13,760,000
Process and Instrument tubing 9 (feet)	740,000	16.00	11,840,000
	Total Selected Material cost($)		231,727,400

Table 4.4-4 Assumed Primary Impact Area Relocating Worker Households and Students

Primary Impact Area County	Assumed Relocating Households	Average Students Per Household in the Primary Impact Area	Projected Additional Students from Relocating Construction Workers
Monroe County	196	0.44	86
Wayne County	109	0.50	55
Lucas County	87	0.40	26
Total	392	0.43	167

Notes:

Average number of students per household calculated from Table 2.5-43 through Table 2.5-45.

Table 4.4-4-(A)Projected Fermi 3 Construction Workforce County of Residence and Average Commute Estimation

County	15 Percent Relocating to Fermi Region Assumed County of Residence for Relocating Construction Workers by County (A)	85 Percent In Fermi Region Regional Construction Workforce Distribution by County* (B)	Fermi 3 Adjustments based on Distance and Union Hall Locations (C)	Estimation of the Average Commuting Distance of the Fermi 3 Construction Workforce Percent of Total Fermi 3 Construction Workforce Residing in Each County (D)[1]	Major City in County (E)	Distance to Fermi (miles) (F)	Weighted Average Distance Calculation (miles) (G)[2]
Monroe County (MI)	45.0%	6.0%	11.0%	16.1%	Monroe City	10.0	1.6
Wayne County (MI)	25.0%	42.5%	38.5%	36.4%	Detroit	35.7	13.0
Lucas County (OH)	20.0%	11.4%	21.4%	21.2%	Toledo	30.3	6.4
Washtenaw County (MI)	3.0%	6.8%	6.8%	6.2%	Ann Arbor	43.1	2.7
Oakland County (MI)	3.0%	25.9%	10.9%	9.7%	Pontiac	64.1	6.2
Wood County (OH)	2.0%	3.9%	3.9%	3.6%	Bowling Green	53.5	1.9
Lenawee County (MI)	1.0%	3.6%	3.6%	3.2%	Adrian	63.8	2.1
Other County	1.0%	N/A	4.0%	3.6%	Other	75.0	2.7
				Average Commuting Distance (Miles)			36.6

*Based on American Community Survey Data 2005-2007

Note 1: (0.15*A)+(0.85*C)=D

Note 2: D*F=G

Table 4.4-4-(B)Regional Union Construction Labor Force and Wage by Major Craft Occupation, 2009

Primary Coverage Unions	Location	Number of Journeymen	Number of Apprentice	Base Journeyman Wages ($2009)
Iron Worker #55	Toledo	661	72	28.00
Boiler Makers #85	Toledo	256	144	33.43
Electrician #8	Toledo	1,520	194	34.00
Operating Eng. #324	Michigan (State wide)	4,500	77	32.75
Brick Layer-Allied	SEM*	1,550	138	29.00
Pipefitter/Plumber #671	Monroe	335	21	32.32
Cement Mason #886	SEM*	400	24	28.00
Sheet Metal Worker #33	SEM*	400	50	29.00
Carpenters	SEM*	4,391	338	30.16
Laborers #959	SEM*	1,091	63	26.28
Insulators #45	Toledo	110	57	29.37
Other Union Hall Locations				
Iron Workers #25	Detroit	2,500	200	29.00
Boiler Makers #169	Detroit	444	146	32.89
Electrician #58	Detroit	4,024	275	35.85
Pipefitter/Plumbers #636	**Detroit**	**1,650**	**140**	**36.25**
Insulators #25	**Detroit**	**195**	**35**	**30.77**

*SEM-Southeast Michigan

Table 4.4-5 Average Wage Data for Key Craft Occupations in the Fermi Region[1]

Occupation	Weights	Average Wage (2008 dollars)
Iron Workers	19.7%	$28.50
Boiler Makers	4.1%	$33.16
Electricians	19.7%	$34.93
Operating Engineers	8.8%	$32.75
Pipefitters-Plumbers	18.4%	$34.29
Cement Mason	2.0%	$28.00
Sheet Metal Worker	3.4%	$29.00
Carpenters	10.9%	$30.16
Laborers	10.9%	$26.28
Insulators	2.0%	$30.07
Weighted Average		$31.37

[1]Information derived from ER Table 2.5-28(A)

Table 4.4-6 Fermi 3 Construction Workforce Employment and Earnings Impacts

Counties in Primary Impact Area	15% Relocating		85% Locals	
	Relocating Distribution	Workers @ Peak	Fermi 3 Adjusted	Workers @ Peak
Monroe County (MI)	45.0%	196	11.0%	272
Wayne County (MI)	25.0%	109	38.5%	948
Lucas County (OH)	20.0%	87	21.4%	527
Primary Impact Area (PIA) Subtotal	*90.0%*	*392*	*70.9%*	*1,746*
Washtenaw County (MI)	3.0%	13	6.8%	168
Oakland County (MI)	3.0%	13	10.9%	267
Wood County (OH)	2.0%	9	3.9%	95
Lenawee County (MI)	1.0%	4	3.6%	89
Other County/Misc	1.0%	4	4.0%	99
Region Total	100.0%	435	100%	2,465
Estimated Employment Benefits with Multiplier Impacts				
Total Man Years of Employment (based on 17 million hours)	8,173			
A) In-migrant const. man-years (8173*0.15*.9)	1,103			
B) Resident Unemployed Man-years (8173*0.85*0.709*0.25)	1,230			
C) Man Years Multiplier Applicable (A+B)	2,334			
D) RIMSII Employment Multiplier, Construction Sector	1.7113			
E) PIA Man Years, Multiplier Applicable (C*D)	3,994			
F) PIA Man-years not Multiplier Applicable (8173*0.85*0.709*0.75)	3,691			
G) Total Man-years of Employment in PIA (E+F)	**7,685**			
H) Regional Man-years not in PIA ((8173*0.15*0.1) + (8173*0.85*0.291))	2,148			
I) Total Regional Impact, with PIA multiplier impact (H + G)	**9,833**			
Estimated Earnings Benefits with Multiplier Impacts				
Total Earnings Estimate	$627,526,667			
J) In-migrant const. earnings ($627.5 M *0.15*0.9)	$84,716,100			
K) Resident Unemployed Earnings ($627.5 M *0.85*0.709*0.25)	$94,478,062			
L) Earnings Multiplier Applicable (J+K)	$179,194,162			
M) RIMS II Earnings Multiplier, Construction Sector	1.5998			
N) PIA Earnings, Multiplier Applicable (L*M)	$286,674,820			
O) PIA Earnings Not Multiplier Applicable ($627.5 M *0.85*0.709*0.75)	$283,434,185			
P) Total Earnings in PIA (N+O)	$570,109,005			
Q) Regional Earnings not in PIA (($627.5 M *0.15*0.1) + ($627.5 M *0.85*0.291))	$164,898,320			
R) Total Regional Impact, with PIA multiplier impact (P+Q)	**$735,007,325**			

Note: The formulas shown in parentheses may differ to the corresponding result due to rounding.

Figure 4.4-1 Fermi 3 Total Number of On-Site Workers During the 10 Year (120 Month) Construction Period

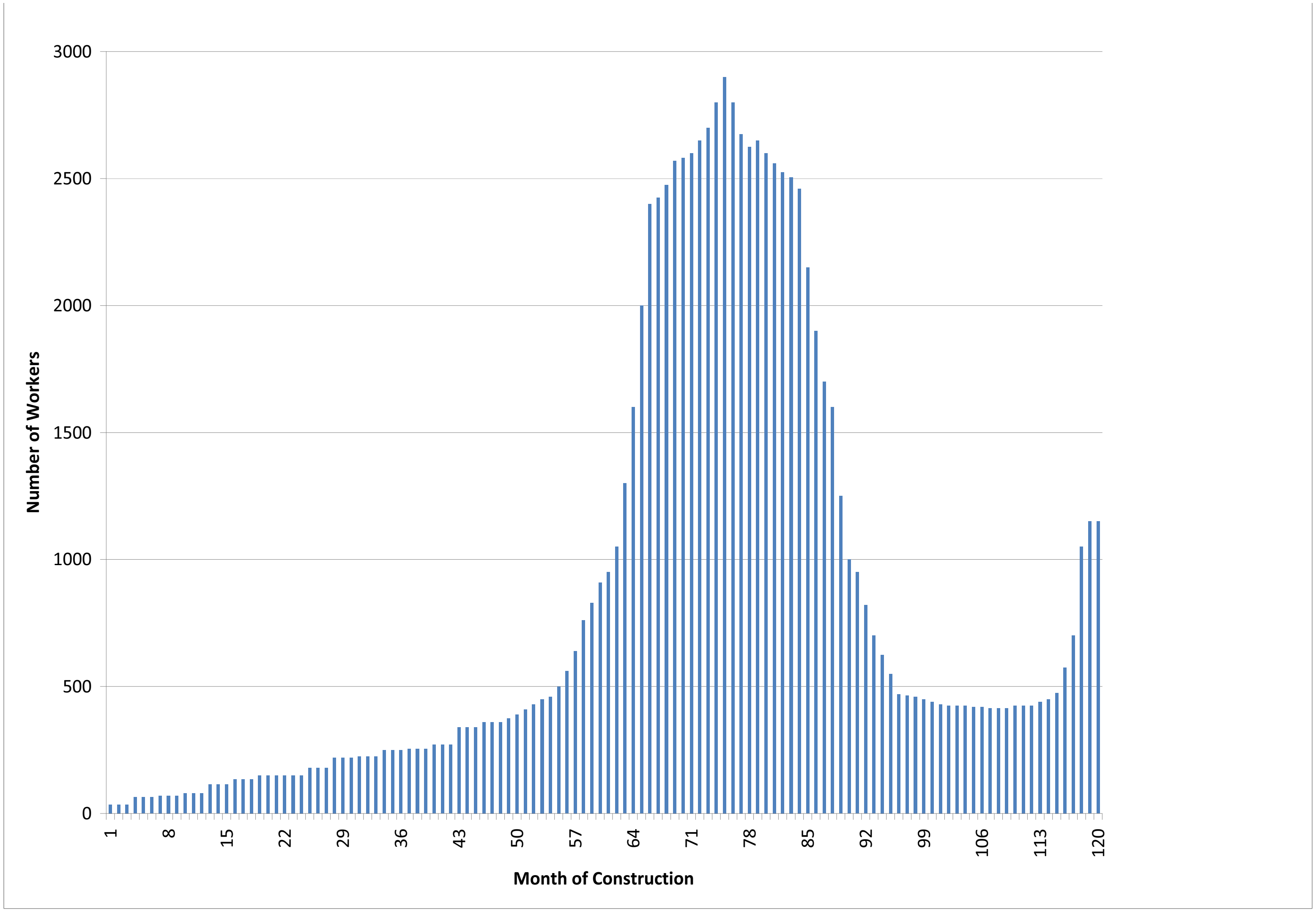


Figure 4.4-2 Fermi 3 Operating Staff On-Site During Construction

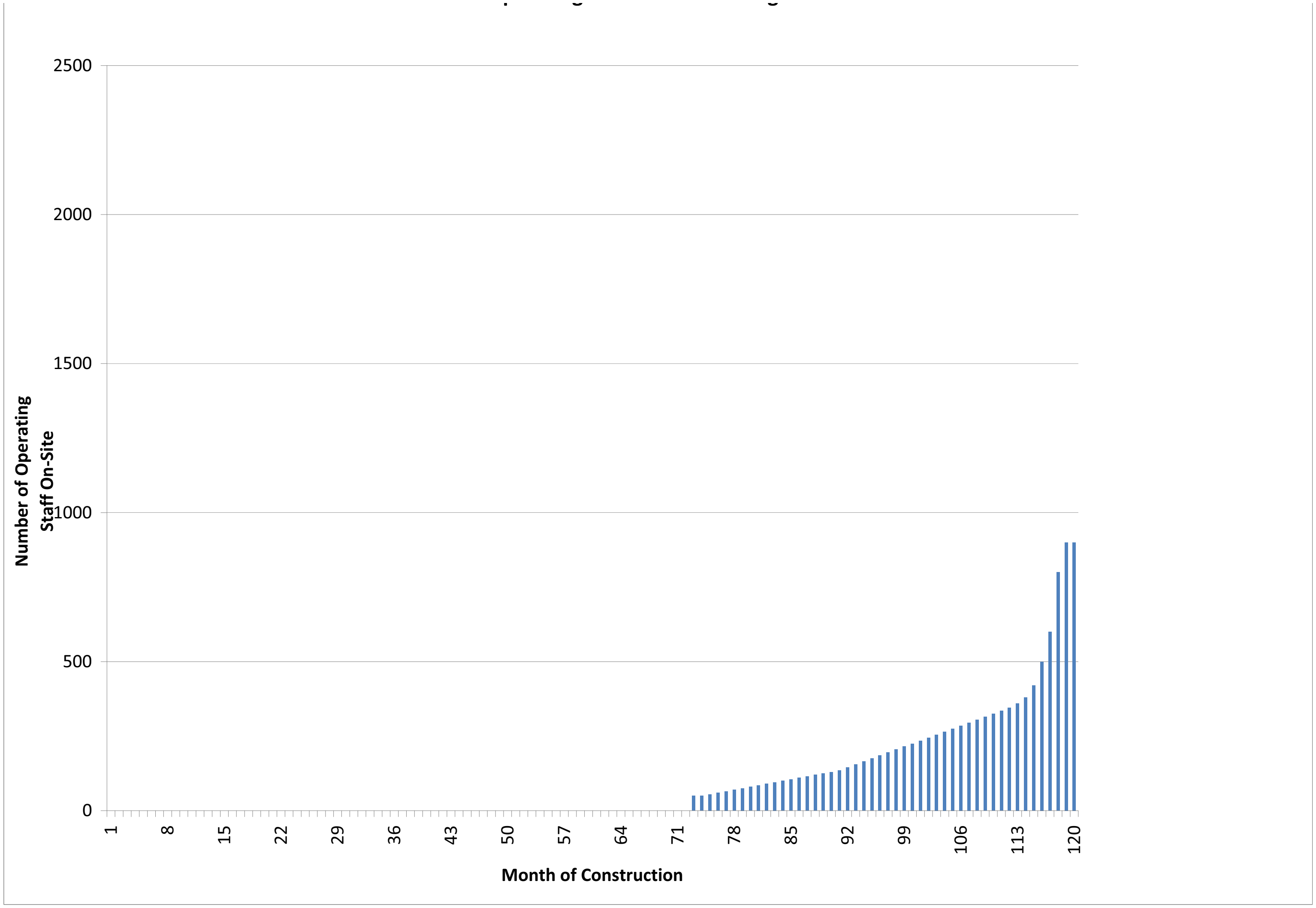
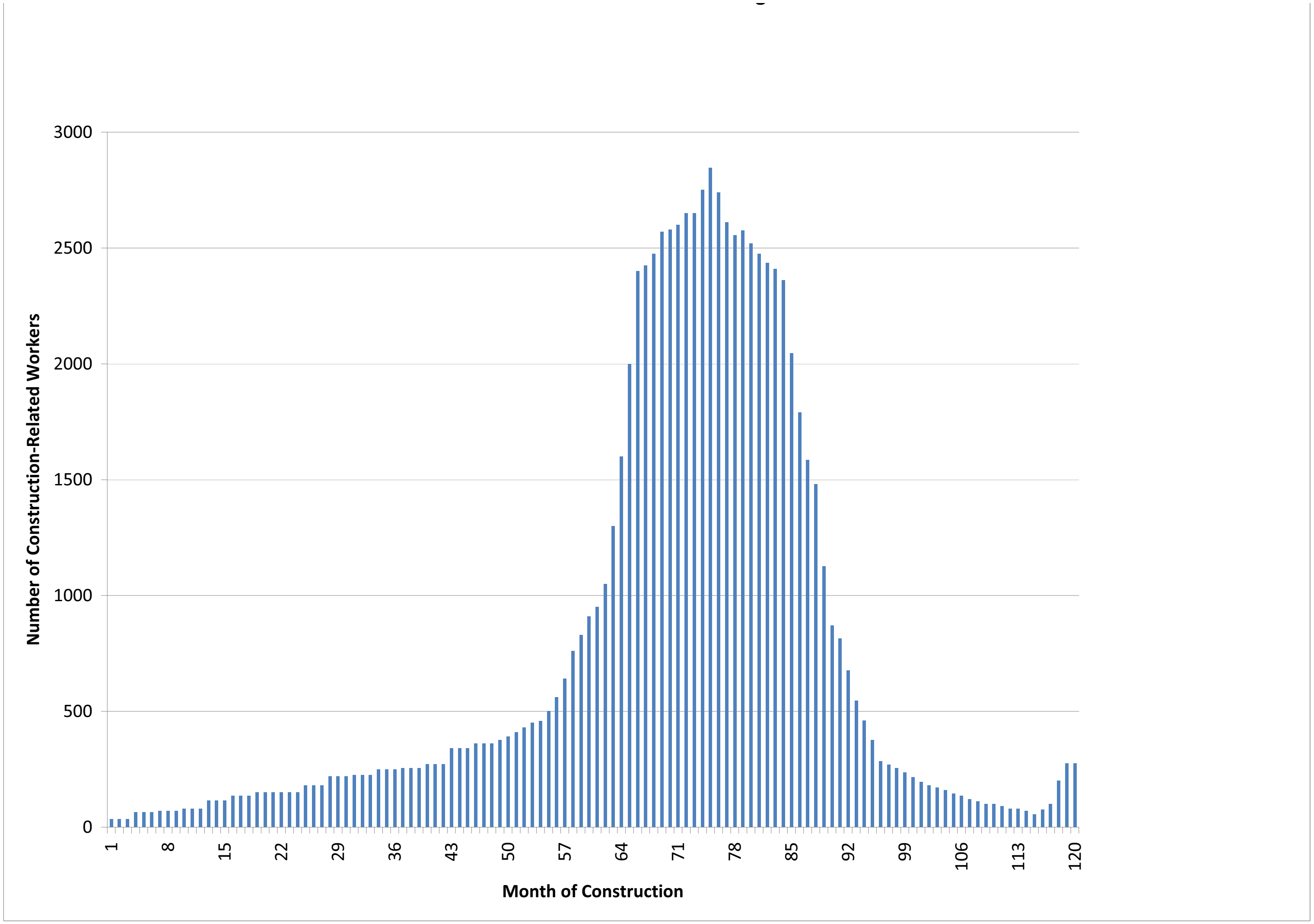


Figure 4.4-3 Fermi 3 Construction Related Staff On-Site During the Construction Period



4.5 Radiation Exposure to Construction Workers

This section evaluates the potential radiological dose impacts to construction workers at Fermi 3 resulting from the operation of Fermi 2.

4.5.1 **Site Layout**

Fermi 3 is located to the southwest of Fermi 2. Fermi 2 is expected to be operating normally during the construction period for Fermi 3. Construction support areas such as offices, parking, warehouses, and laydown areas are also located to the south and west of the new facility location.

Figure 4.5-1 shows the construction areas relative to the Fermi 2 power block and associated facilities.

4.5.2 **Radiation Sources**

Construction workers at a new facility on the site could be exposed to radiation from a range of sources associated with the normal operation of Fermi 2. These include direct radiation, radiation from gaseous effluents, and radiation from liquid effluents.

Figure 4.5-1 shows the location of the primary sources of radiation from Fermi 2 relative to the construction areas, as discussed below.

4.5.2.1 **Direct Radiation Sources**

A large portion of the radiation dose to construction workers is expected to be due to the “skyshine” (gamma radiation that scatters in the atmosphere and is reflected back to the ground) from the nitrogen-16 (N-16) source present in the operating Fermi 2 main turbine steam cycle. Hydrogen Water Chemistry (HWC) is employed at Fermi 2 in order to control the production of corrosion products and thereby mitigate intergranular stress corrosion cracking of susceptible components. The Fermi 2 Updated Final Safety Analysis Report (UFSAR), Table 11.1-5, indicates an N-16 specific activity of 100 μCi/g in the steam for normal water chemistry, and 600 μCi/g for HWC (Reference 4.5-1). The N-16 activity present in the main steam lines, turbines, and moisture separators provides an air-scattered radiation dose contribution to locations outside Fermi 2 structures as a result of the high energy gamma rays which N-16 emits as it decays.

Other sources at the Fermi 2 with the potential for a direct radiation dose contribution to construction workers are the condensate storage tanks and the onsite low level waste storage facility. The minimal activity within the tanks and the concrete shielding used in the design of the onsite storage facility results in a negligible dose rate at the site boundary (Reference 4.5-1, Section 12.1.1.2). Therefore, these sources of direct radiation are deemed negligible in comparison with the skyshine doses when considering the dose to construction workers.

Depending on the construction schedule undertaken for Fermi 3, a potential source of direct radiation could be an independent spent fuel storage installation (ISFSI) constructed for Fermi 2. The ISFSI dose contribution to a Fermi 3 construction worker is calculated at a distance of 820 feet from the ISFSI pad for an exposure period of 2080 hours. The distance of 820 feet is based on the closest Fermi 3 structures. The estimated dose for a 2080 hour exposure period at a distance of 820 feet from the ISFSI pad is approximately 13.8 mrem/yr.

Fermi 1 will be decommissioned before the construction of Fermi 3. In accordance with the limits established in 10 CFR 20.1402, the dose from Fermi 1 can not exceed 25 mrem/yr. It is expected that the dose from Fermi 1 will be significantly less than 25 mrem/yr.

4.5.2.2 **Radiation from Gaseous Effluents**

Fermi 2 is designed with the provision for releasing airborne effluents via three gaseous effluent release points to the environment. These are the radwaste building vent, the reactor building vent, and the turbine building vent (Reference 4.5-1, Section 11.3.7). The reactor building vent is the primary release point and includes exhaust from the offgas system, turbine gland seal system, and the reactor building ventilation. The turbine building vent contains low activity exhaust resulting from small leaks from the turbine, condenser and other components in the turbine building. The radwaste building vent contains low activity exhaust resulting from small leaks from laboratory fume hoods, tank vents, and contaminated cubicles. The expected radiation sources (nuclides and activities) for the primary gaseous effluents are listed in the Fermi 2 UFSAR, Table 11.3-1 (Reference 4.5-1).

4.5.2.3 **Radiation from Liquid Effluents**

Fermi 2 releases radioactive liquid effluents via the circulating water reservoir blowdown line. The minimum dilution flow is approximately 10,000 gpm (Reference 4.5-1, Section 11.2.8). The annual expected maximum dose to an individual resulting from Fermi 2 liquid effluents is presented in the Fermi 2 UFSAR (Reference 4.5-1, Appendix 11A). When effluents are released, they discharge directly to Lake Erie via the circulating water reservoir blowdown line. Lake Erie provides further dilution through natural mixing characteristics in the vicinity of the discharge. From Figure 4.5-1, it is clear that construction activities for a new facility would be well removed from the release point for liquid effluents.

4.5.3 **Measured and Calculated Radiation Dose Rates**

Measured and reported data from Fermi 2 is available for gaseous and liquid effluents, as well as direct radiation sources. This information is reported annually to the NRC as part of the Radioactive Effluent Release and Radiological Environmental Operating Report. Reports from the years 1999 through 2008 were utilized in the preparation of this section (Reference 4.5-2 through Reference 4.5-9 and Reference 4.5-11 through Reference 4.5-13).

4.5.3.1 **Dose Rate from Direct Radiation Sources**

Fermi 2 measures radiation doses at various locations on the site using thermoluminescent dosimeters (TLDs). As shown on Figure 4.5-2, TLDs T47, T48, T54, and T64 are the TLDs closest to the expected construction areas for the Fermi 3 site. The location of TLD 47 represents the maximum radiation exposure a construction worker is expected to encounter, TLD T48 is representative of the near edge of the Fermi 3 construction site (southwest of the Fermi 2 plant buildings), TLD T54 is representative of the far edge of the Fermi 3 construction site, and TLD T64 is representative of the location of the ISFSI site due west of Fermi 2. Measurements from these TLDs are used to determine the expected direct radiation dose to construction workers.

Table 4.5-1 collects ten years of radiation dose rate data for the four TLDs of interest. As explained in the footnotes of the table, the dose rates from the Radioactive Effluent Release and Radiological Environmental Operating Reports are expressed in units of radiation exposure (Roentgen) and represent one year (365 days x 24 hours/day = 8760 hours) of exposure time. In order to compare the expected dose rates to the dose limits prescribed in 10 CFR 20, conversion of these dose rates into mrem/yr is necessary.

The most limiting annual dose rates at the four TLDs of interest were 410.31 milliroentgen/yr, recorded at TLD T47 in 2008 and 194.96 milliroentgen/yr, recorded at TLD T48 in 2008 (Reference 4.5-12). TLD T47 and TLD T48 are approximately 525 ft and 1000 ft from the centerline of the Fermi 2 Turbine Building, respectively (Reference 4.5-9). Conversion of these radiation exposures into a dose equivalent in tissue is accomplished by multiplying by 0.95 (Reference 4.5-10). Conversion results in an annual dose rate of 389.79 mrem/yr at T47 and 185.21 mrem/yr at T48. The annual dose measured at these TLDs was accumulated over an exposure time of 8760 hours. It is assumed that construction workers will work standard 8-hour shifts. Applying this work rate to 5 days per week, 52 weeks per year, yields 2080 hours per year. Therefore, the annual dose to a construction worker due to direct radiation at the Fermi 3 construction site is approximately 92.6 mrem/yr at TLD T47 and 44.0 mrem/yr at TLD T48. While the dose rate measured at TLD T47 is the most bounding of the four TLD locations, this location overestimates the average dose rate a construction worker would incur on the Fermi 3 construction site. From Figure 4.5-1 and Figure 4.5-2, TLD T47 is located on the Protected Area fence south of the Fermi 2 Turbine Building, well removed from the eventual location of the Fermi 3 building structures. As such, the location of TLD T48 is more representative of the areas where the bulk of the construction activities will occur. However, for conservatism, the construction worker dose is calculated using an average of TLD 47 and TLD 48.

As a comparison, the most limiting annual dose at TLD T54 was 77.34 milliroentgen/yr in 2008 (Reference 4.5-12). TLD T54 is approximately 1530 ft from the centerline of the Fermi 2 Turbine Building (Reference 4.5-1). The estimated annual dose to a construction worker at TLD T54 is approximately 17.4 mrem/yr.

The most limiting annual dose at TLD T64 was 101.05 milliroentgen/yr in 2008 (Reference 4.5-12). TLD T64 is approximately 1340 ft from the centerline of the Fermi 2 Turbine Building (Reference 4.5-1). The estimated annual dose to a construction worker at TLD T64 is approximately 22.8 mrem/yr.

The dose measured by these TLDs includes background radiation. Based on remote TLDs background radiation is approximately 50 mrem per year. This corresponds to an annual radiation dose to a construction worker of approximately 12 mrem per year based on a 2080 working hours in a year. Subtracting the background radiation yields a direct dose from Fermi 2 as measured by the average of TLD 47 and TLD 48 of 56.3 mrem per year.

The ISFSI dose is conservatively based on all planned casks being located at a single point on the ISFSI pad, and assumes all fuel is 15 years old and uniformly loaded. By assuming a single point, which is physically impossible, additional separation distance shielding is neglected as is the cask to cask shielding. The fuel will also be loaded using industry accepted programs placing the oldest fuel on the outside and newer fuel in the middle. This arrangement provides additional shielding of the more radioactive fuel which is also not accounted for. The ISFSI dose is calculated at a distance of 820 feet from the ISFSI pad for an exposure period of 2080 hours. The distance of 820 feet is based on the closest Fermi 3 structures. The estimated dose for a 2080 hour exposure period at a distance of 820 feet from the ISFSI pad is approximately 13.8 mrem/yr.

Fermi 1 will be decommissioned before the construction of Fermi 3. In accordance with the limits established in 10 CFR 20.1402, the dose from Fermi 1 to an individual Fermi 3 construction worker can not exceed 25 mrem/yr, regardless of the number of hours the worker spends on site. Therefore, the maximum dose due to the decommissioned Fermi 1 site is 25 mrem/yr.

4.5.3.2 **Dose Rate from Gaseous Effluents**

Environmental radiological monitoring data obtained from the Fermi 2 Annual Radioactive Effluent Release and Radiological Environmental Operating Report were used to assess any potential radiological impact on construction workers due to the operation of Fermi 2. The data from these reports is considered representative for the Fermi 3 site dose evaluations.

The Annual Radioactive Effluent Release and Radiological Environmental Operating Reports for 1999 through 2008 (Reference 4.5-2 through Reference 4.5-9, Reference 4.5-11, and Reference 4.5-13) give both the airborne effluent doses for the most highly exposed individual living near the plant, as well as the maximum potential dose to a visitor to Fermi 2 due to all radioactive effluents, including noble gases. The annual doses to the most highly exposed individual living near the site are negligible.

TLD T54 is positioned very close to the Fermi 2 Visitor's Center. Due to the proximity of this location to the expected Fermi 3 construction site, the dose rates due to gaseous effluents calculated at the Visitor's Center are representative of the dose rates to which the construction workers would be exposed.

The radiological data was collected for the years 1999 through 2008 and is presented in Table 4.5-2 (Reference 4.5-2 through Reference 4.5-9, Reference 4.5-11, and Reference 4.5-13). The annual doses at the Visitor's Center were calculated based on an exposure time of 4 hours/year. Dividing these annual doses by four results in an hourly dose rate which is representative of what a construction worker could expect to receive, and can then be used to extrapolate the dose rate to construction workers on an annual basis (2080 hours) due to gaseous effluent from Fermi 2. This extrapolation is shown in Table 4.5-6 and resulted in a maximally exposed organ (thyroid) dose of 10.4 mrem/yr and a maximum whole body dose of 1.6 mrem/yr for the maximum annual dose from Fermi 2 gaseous releases.

4.5.3.3 Dose Rate from Liquid Effluents

The Annual Radioactive Effluent Release and Radiological Environmental Operating Reports for 1999 through 2008 (Reference 4.5-2 through Reference 4.5-9, Reference 4.5-11, and Reference 4.5-13) explicitly state that “there were no releases of liquid radioactive effluents,” and furthermore that “there has not been a liquid radioactive discharge from Fermi 2 since 1994.”

As such, the dose rate from liquid effluents is not expected to be a factor in the cumulative dose to construction workers.

4.5.4 Construction Worker Dose Estimates

The overall estimate of dose to construction workers considers an occupational exposure period of 2080 hours per year, and a construction work force of approximately 2,900. All annualized dose estimates developed in this section are based on a 2080-hour year. Contributions from each type of source are developed below and a total estimated dose is provided in the conclusions.

4.5.4.1 Dose Estimate from Direct Radiation Sources

As described in Subsection 4.5.3.1, a dose rate of 56.3 mrem/yr for the Fermi 3 construction area is used to estimate the annual dose to construction workers from N-16 skyshine radiation. Fermi 2 utilizes hydrogen water chemistry, which results in elevated skyshine doses.

A dose rate of 13.8 mrem/yr for the Fermi 3 construction area is used to estimate the annual dose to construction workers from Fermi 2 ISFSI radiation. A dose rate of 25 mrem/yr for the Fermi 3 construction area is used to estimate the annual dose to construction workers from the decommissioned Fermi 1 site radiation.

As described in Subsection 4.5.2.1, the contribution to the total dose estimate for construction workers from the condensate storage tanks and the onsite storage facility are negligible.

4.5.4.2 Dose Estimate from Gaseous Effluents

Table 4.5-6 provides the estimated bounding dose of 10.4 mrem/yr to a maximally exposed organ (thyroid) and whole body dose of 1.6 mrem/yr from gaseous effluents.

4.5.4.3 Dose Estimate from Liquid Effluents

Liquid radioactive effluents from Fermi 2 can be released to Lake Erie via the circulating water reservoir blowdown line. However, there have been no liquid radioactive effluent releases from Fermi 2 since 1994. As such, the dose estimate from liquid effluents is negligible.

4.5.5 Summary and Conclusions

The annual dose to an individual construction worker from all three pathways is summarized in Table 4.5-4 and compared to the public dose criteria in 10 CFR 20.1301 and 40 CFR 190 in Table 4.5-5 and Table 4.5-6, respectively. Because the calculated doses meet the public dose criteria of 10 CFR 20.1301 and 40 CFR 190, the workers would not need to be classified as radiation workers and no shielding or other protective measures are required. Table 4.5-7 shows that the doses also meet the design objectives of 10 CFR 50, Appendix I, for gaseous and liquid effluents.

The maximum annual collective dose to the construction work force (2900 workers) is estimated to be 280 person-rem.

It is concluded that annual construction worker doses attributable to the operation of Fermi 2 for the Fermi 3 construction areas would be SMALL because it would be a fraction of 10 CFR 20 and 10 CFR 50 Appendix I limits. Thus, monitoring of individual construction workers will not be required. Construction workers will be treated as if they were members of the general public in unrestricted areas.

4.5.6 References

4.5-1 Detroit Edison, “Fermi 2 Updated Final Safety Analysis Report, UFSAR.”

4.5-2 Detroit Edison, “Fermi 2 – 1999 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 1999 through December 31, 1999.”

4.5-3 Detroit Edison, "Fermi 2 – 2000 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2000 through December 31, 2000.”

4.5-4 Detroit Edison, “Fermi 2 – 2001 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2001 through December 31, 2001.”

4.5-5 Detroit Edison, “Fermi 2 – 2002 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2002 through December 31, 2002.”

4.5-6 Detroit Edison, “Fermi 2 – 2003 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2003 through December 31, 2003.”

4.5-7 Detroit Edison, “Fermi 2 – 2004 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2004 through December 31, 2004.”

4.5-8 Detroit Edison, “Fermi 2 – 2005 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2005 through December 31, 2005.”

4.5-9 Detroit Edison, “Fermi 2 – 2006 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2006 through December 31, 2006.”

4.5-10 Turner, J.E., “Atoms, Radiation, and Radiation Protection,” Pergamon Press, 1986.

4.5-11 Detroit Edison, “Fermi 2 - 2007 Annual Radioactive Effluent Release and Radiological Environmental Operating Report for the period of January 1, 2007 through December 31, 2007.”

4.5-12 Detroit Edison, “Fermi 2 - 2008 Annual Radiological Environmental Operating Report for the period of January 1, 2008 through December 31, 2008.”

4.5-13 Detroit Edison, “Fermi 2 - 2008 Annual Radioactive Effluent Release Report for the period of January 1, 2008 through December 31, 2008.”

Table 4.5-1 TLD Annual Dose(milliroentgen/yr)[1,2]

	TLD Locations[3]			
Year	TLD T47 – South of Turbine Building rollup door on PAF, 0.1 miles from Fermi 2 Reactor	TLD T48 – 30 ft. from corner of AAP on PAF, 0.2 miles from Fermi 2 Reactor	TLD T54 – Pole next to Fermi 2 Visitor's Center, 0.3 miles from Fermi 2 Reactor	TLD 64 – West of switchgear yard on PAF, 0.2 miles from Fermi 2 Reactor
1999	142.68	92.19	52.89	64.31
2000	202.53	124.8	72.30	86.85
2001	288.85	142.76	64.77	81.14
2002	292.63	153.6	63.32	83.13
2003	296.77	161.6	68.57	84.51
2004	316.53	162.28	66.10	86.48
2005	293.99	143.68	62.73	80.71
2006	293.30	161.38	68.98	82.60
2007	329.12	179.17	69.53	92.92
2008	410.31	194.96	77.34	101.05

Notes:

1. TLD annual doses are based on continuous exposure (8760 hours).
2. The TLD dose rates are given in terms of exposure (Roentgen) rather than dose equivalent (rem). Conversion of Roentgen to rem for gamma radiation in tissue is 1 Roentgen = 0.95 rem (Reference 4.5-10).
3. The locations of the TLDs are indicated in Figure 4.5-2.

Source: Reference 4.5-2 through Reference 4.5-9, Reference 4.5-11, and Reference 4.5-12

Table 4.5-2 Annual Doses to Members of the Public at the Visitor's Center from Gaseous Releases from Fermi 2[1]

Year	Maximally Exposed Organ (Thyroid) (mrem/yr)	Total Body Dose (mrem/yr)
1999	0.02	0.0003
2000	0.01	0.002
2001	0.02	0.003
2002	0.01	0.003
2003	0.003	0.0004
2004	0.004	0.002
2005	0.0023	0.0017
2006	0.0027	0.0018
2007	0.0029	0.0020
2008	0.0048	0.0021

Notes:

1. Doses are based on an exposure time of 4 hours per year.

Source: Reference 4.5-2 through Reference 4.5-9, Reference 4.5-11, and Reference 4.5-13

Table 4.5-3 Estimated Doses to Construction Workers from Gaseous Releases from Fermi 2

	Maximally Exposed Organ (Thyroid)(mrem/hr)	Total Body Dose (mrem/hr)
2001	5.0E-03	7.5E-04
For 2080 per year	10.4 mrem/yr	1.6 mrem/yr

Table 4.5-4 Annual Dose to a Construction Worker by Source (mrem)

	Fermi 2	Direct ISFSI[1]	Fermi 1	Gaseous	Liquid	Total[2]
Critical Organ	-	-	-	10.4	N/A	10.4
Whole Body	56.3[3]	13.8	25	1.6	N/A	96.6

Notes:

1. The ISFSI and decommissioned Fermi 1 site only contribute to the direct dose.
2. The Total dose calculation for Whole Body exposure may not match the sum of the individual dose values due to rounding.
3. The Fermi 2 dose is an average of TLD 47 and TLD 48 to represent the maximum dose to any single construction worker.

Table 4.5-5 Comparison of Construction Worker Dose to Public Dose Limits Specified in 10 CFR 20.1301

Type of Dose	Annual Dose Limits	Estimated Dose
Total effective dose equivalent per year	100 mrem	96.6 mrem
Maximum dose in any hour	2 mrem	<< 1 mrem

Table 4.5-6 Comparison of Construction Worker Dose from Gaseous Effluent Discharges to Public Dose Limits Specified in 40 CFR 190[1]

Type of Dose	Annual Dose Limits	Estimated Dose
Whole body dose	25 mrem	1.6 mrem
Thyroid doses	75 mrem	10.4 mrem
Other organ doses	25 mrem	< 1 mrem

Notes:

1. 10 CFR 20 requires that the dose to an individual from radioactive effluents also meet 40 CFR 190 limits.

Table 4.5-7 Comparison with 10 CFR 50 Appendix I Criteria for Effluent Doses

	Annual Dose (mrem)	
	Annual Limit	Estimated Dose
Whole body dose from liquid effluents	3	Negligible[1]
Organ dose from liquid effluents	10	Negligible[1]
Whole body dose from gaseous effluents	5	1.6
Organ dose from all effluents	15	10.4

Notes:
1. Per Reference 4.5-13, there have been no liquid effluent releases at Fermi 2 since 1994.

Figure 4.5-1 Radiation Sources from Fermi 2

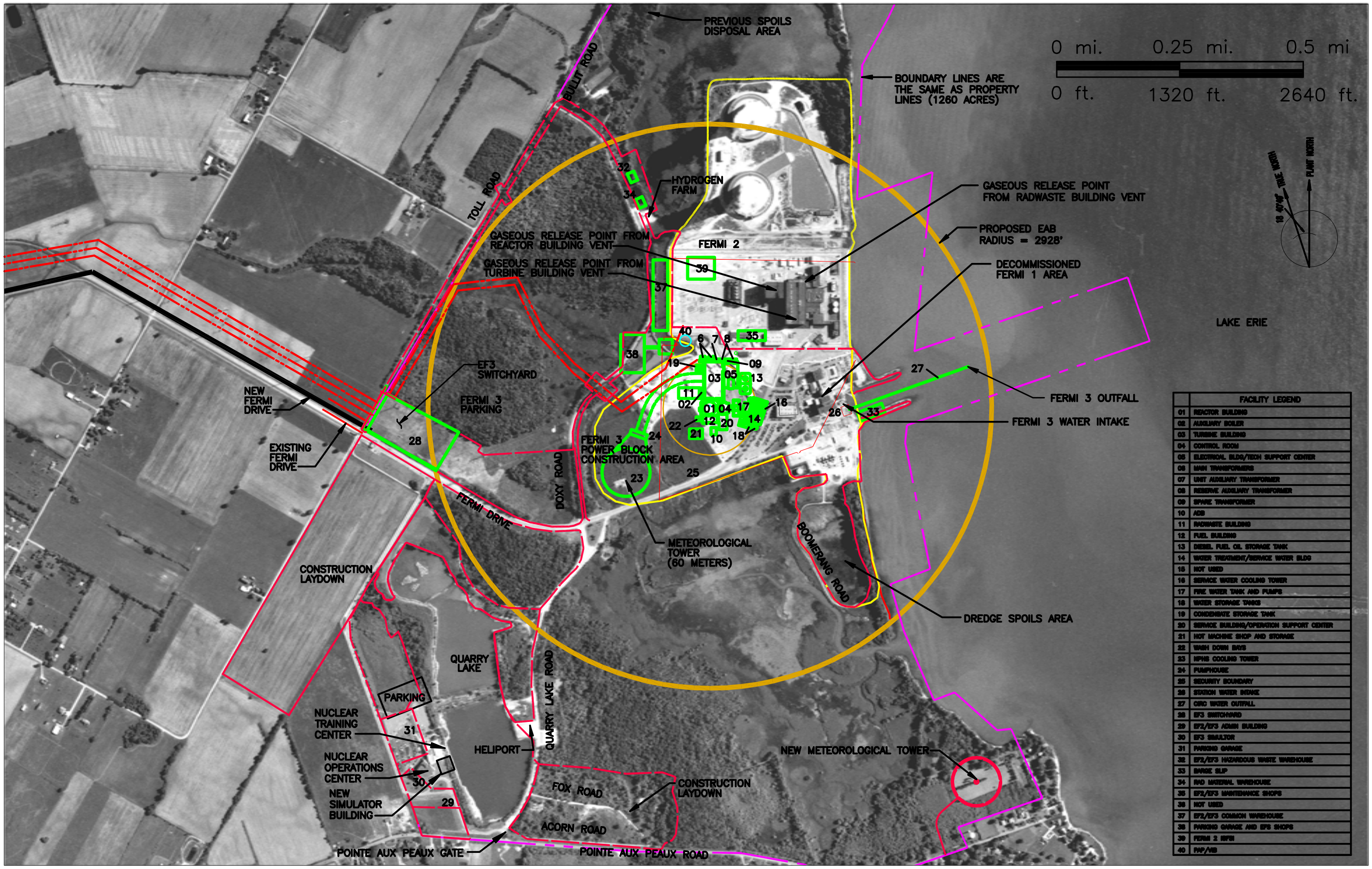
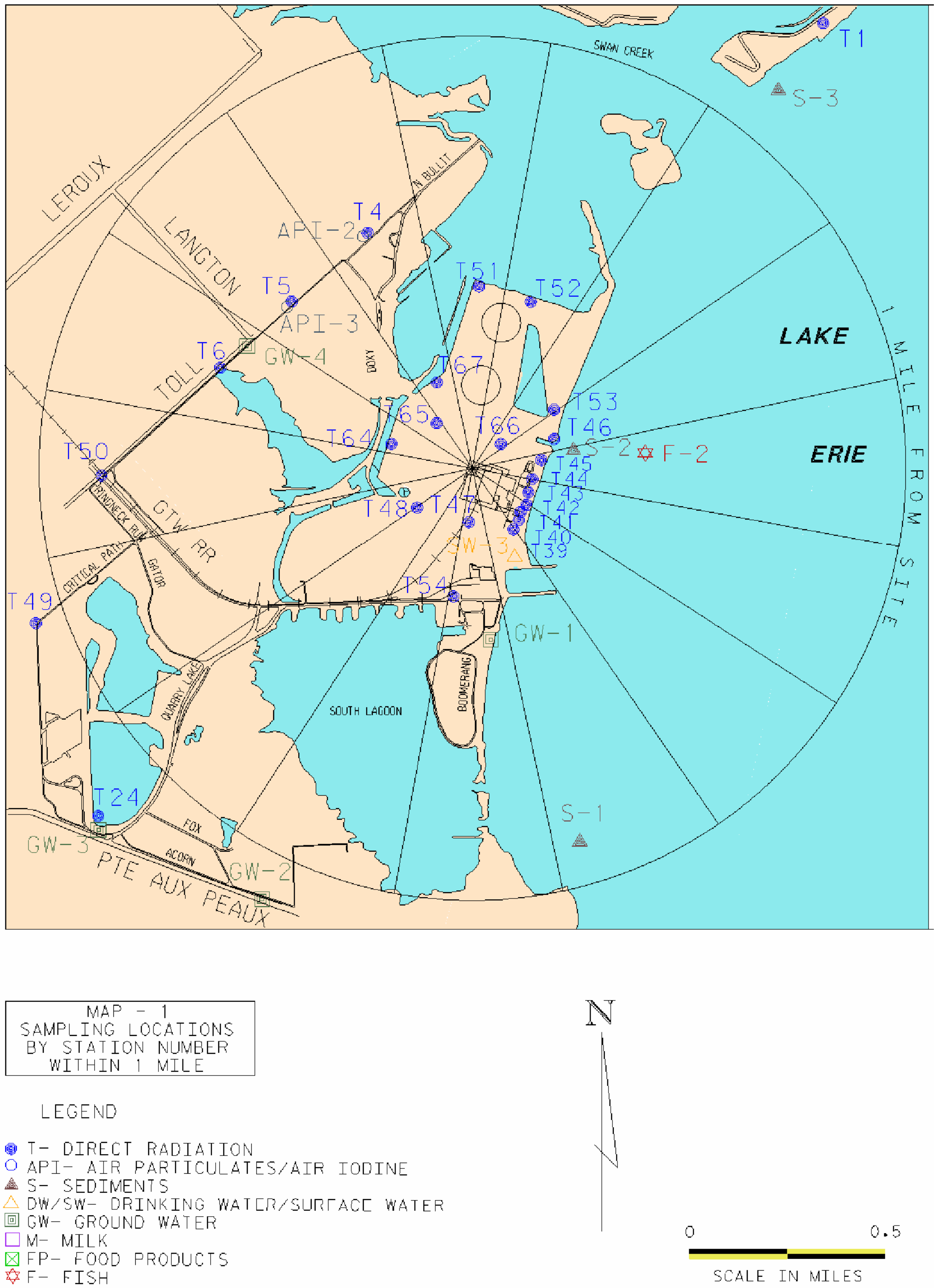


Figure 4.5-2 TLD Locations for Fermi 2



4.6 Measures and Controls to Limit Adverse Impacts During Construction

This section summarizes adverse environmental impacts of construction, as well as controls to limit these impacts. Table 4.6-1 shows the cause-and-effect relationships between construction environmental impacts and actions and affected environmental resources. Significance levels SMALL (S), MODERATE (M), and LARGE (L) are determined assuming that measures and controls are implemented for each impact. If a range of effect is expected, then two significance levels are assigned, such as M-L, meaning a MODERATE to LARGE impact. The levels of impact significance (S, M, and L) are defined below:

SMALL Environmental effects are not detectable or are so minor that they neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.

MODERATE Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

Table 4.6-1 also summarizes specific measures and controls (both preventative and mitigative) to alleviate construction impacts. Each "Impact Description or Action" attribute is assigned a number, and each "Specific Measures and Controls" attribute is assigned a number that corresponds to the respective "Impact Description or Action." The assignment of significance levels (S, M, and L) in Table 4.6-1 is based on the assumption that the corresponding measures and controls have been taken for each impact. The measures and controls described in Table 4.6-1 are considered reasonable from practical, engineering, and economic standpoints. The measures and controls are generally accepted practices within the utility industry, and stem from guiding statutes and regulatory requirements. These measures and controls, therefore, are appropriate and not expected to create a hardship for the applicant.

4.6.1 References

None.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 1 of 9)

	Impact Category and Level of Impact															
Environmental Resource Categories	**Noise**	**Erosion/Sediment**	**Air Quality/Dust**	**Traffic**	**Effluents and wastes**	**Surface water Impacts**	**Groundwater Impacts**	**Land Use protection/restoration**	**Water-use protection/restoration**	**Terrestrial Ecosystem Impacts**	**Aquatic Ecosystem Impacts**	**Socioeconomic Impacts**	**Radiation Exposure to**	**Other Site-Specific Impacts**	**Impact Description or Action**	**Specific Measures and Controls**
4.1 Land-Use Impacts																
4.1.1 Site and Vicinity		S			S			S						S	1) Construction of new buildings and impervious surfaces. 2) Ground-disturbing activities, including grading and re-contouring. 3) Removal of existing vegetation. 4) Potential hazardous material spills. 5) Stockpiling of soils onsite. 6) Disposition of dredge materials and use of borrow material.	1 and 2) Conduct ground-disturbing activities in accordance with permit requirements. Implement erosion control measures described in the SESC Plan. 3) Limit vegetation removal to those areas designated for construction activities. Restore temporarily disturbed areas. 4) Remove hazardous wastes/spills with rigorous compliance with applicable regulations. Plant staff will implement PIPP measures. 5) Restrict soil stockpiling and reuse to designated areas within the construction footprint on the Fermi site. 6) Use BMPs listed in the SESC plan and minimize footprint of the designated construction area. Place dredge materials in the dredge spoils area (surrounded by Boomerang Road).

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 2 of 9)

Environmental Resource Categories	Impact Category and Level of Impact														Impact Description or Action	Specific Measures and Controls
	Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts		
4.1.2 Transmission Corridors and Offsite Areas.		S						S							1) Potential adverse impact due to soil compaction and erosion. 2) Potential impacts to agricultural land and vegetation. About 1069 acres of land could potentially be affected along the entire 29.4-mile offsite route; about 393 acres along the new 10.8-mile portion of the corridor would be most affected because ROW expansion to an assumed 300-foot width and construction of transmission towers and steel poles along this portion would be required.	The 345 kV transmission system and associated corridors are exclusively owned and operated by the ITC*Transmission*. The applicant has no control over the construction or operation of the transmission system. The construction impacts are based on publicly available information and reasonable expectations on the configurations and practices that ITC*Transmission* is likely to use based on standard industry practice. Such efforts would likely include transmission design considerations and Best Management Practices that would minimize the effects on land use

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 3 of 9)

	Impact Category and Level of Impact															
Environmental Resource Categories	**Noise**	**Erosion/Sediment**	**Air Quality/Dust**	**Traffic**	**Effluents and wastes**	**Surface water Impacts**	**Groundwater Impacts**	**Land Use protection/restoration**	**Water-use protection/restoration**	**Terrestrial Ecosystem Impacts**	**Aquatic Ecosystem Impacts**	**Socioeconomic Impacts**	**Radiation Exposure to**	**Other Site-Specific Impacts**	**Impact Description or Action**	**Specific Measures and Controls**
4.1.3 Historic Properties		S										S		S	1) Damage to uninspected archaeological sites due to ground disturbing activities (transmission corridors) 2) Permanent visual impacts to site-vicinity above-ground resources from cooling tower.	1) ITC*Transmission* would be expected to conform to regulatory requirements pertaining to uninspected archaeological sites that could be impacted by transmission line development. 2) The closest above-ground historic resource is located 0.5 mile from the construction site, and all others are located 2 to 3 miles distant. Visual impacts are not substantial and no measures or controls are necessary.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 4 of 9)

Environmental Resource Categories	Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts	Impact Description or Action	Specific Measures and Controls
	Impact Category and Level of Impact															
4.2 Water Related Impacts																
4.2.1 Hydrologic Alterations		S				S	S								1) Construction activities increase runoff and silt loads to surface waters. 2) Use of the spoil fill and aggregate stockpile areas may result in increased runoff and silt to surface waters. The above impacts are temporary, lasting during the construction phase.	1and 2) Develop and implement the SESC Plan. This plan may require use of silt fences, straw bales, slope breakers, and other erosion prevention measures.
4.2.2 Water Use Impacts						S	S		S						1) Potential increased turbidity of Lake Erie. 2) Minor drawdown of nearby wells due to dewatering activity. Wetlands are not adversely impacted by dewatering.	1) Use of the construction SESC Plan will limit sedimentation of drainage to Lake Erie. 2) Dewatering plan will minimize the amount of water discharged.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 5 of 9)

Environmental Resource Categories	Impact Category and Level of Impact														Impact Description or Action	Specific Measures and Controls
	Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts		
4.3 Ecological Impacts																
4.3.1 Terrestrial Ecosystems	S		S		S			S		S					1) Noise from construction could startle wildlife. 2) Fugitive dust and equipment emissions. 3) Vegetation clearing and grading would disturb/destroy habitat and displace/kill wildlife (temporary and permanent impacts). 4) Potential for birds to collide with construction equipment (cranes, buildings). 5) Wetland impacts 6) Construction near or on Threatened and Endangered (T&E) species habitat.	1) MDNR construction limitation recommendations for bald eagle nests will be followed. 2) Fugitive dust is controlled through construction watering, and vehicle emissions by regularly scheduled maintenance. 3) Use developed and previously disturbed grounds where possible. Limit clearing to the smallest quantity of land practical to construct Fermi 3. Revegetation will follow construction. 4) Impact is considered SMALL. 5) Wetland mitigation to be developed in consultation with MDEQ and USACE 6) American lotus mitigation to be developed in consultation with MDNR.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 6 of 9)

Environmental Resource Categories	Impact Category and Level of Impact														Impact Description or Action	Specific Measures and Controls
	Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts		
4.3.2 Aquatic Ecosystems		S				S					S				1) Shoreline/bed/benthic erosion from construction/dredging (temporary impacts). 2) Possible spills from construction and/or construction equipment (temporary impacts). 3) Potential adverse impacts caused by dredging.	1) Implement measures in the SESC Permit & NPDES Permit. 2) Implement measures in the PIPP. 3) Implement measures outlined in the USACE Permit.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 7 of 9)

Environmental Resource Categories	Impact Category and Level of Impact														Impact Description or Action	Specific Measures and Controls
	Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts		
4.4 Socioeconomic Impacts																
4.4.1 Physical Impacts	S		S									S			1) Increase in noise levels at nearby receptors during construction. 2) Increased air emissions and fugitive dust. 3) Potential offsite building impacts from blasting.	1) Implement standard noise control measures for construction equipment (silencers). 1) Limit the types of construction activities during nighttime and weekend hours. 1) Notify all affected neighbors of planned activities. 1) Establish a construction noise monitoring program. 2) Fugitive dust is controlled through construction watering, vehicle emissions by regularly scheduled maintenance. 3) Distances to offsite buildings render mitigation unnecessary.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 8 of 9)

Environmental Resource Categories	Impact Category and Level of Impact: Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts	Impact Description or Action	Specific Measures and Controls
4.4.2 Social and Economic				M-L				S				S		S	1) The increase in project-related population creates an increased demand for short-term housing. 2) Increased construction-related populations may temporarily affect adequacy of public services, tourism/recreation, and public utilities. 3) Potential for increased traffic and accidents with increased construction traffic on North Dixie Highway near Fermi Drive. 4) Potential conflict with zoning restrictions.	1) Influx of construction personnel is within the anticipated growth rate. Anticipate that existing housing is sufficient. 1) Housing construction will comply with land use ordinances to prevent overcrowding and promote “smart growth.” 2) Impacts are within the overall growth rate for the region. User fees and taxes will fund demands. 3) The applicant will pursue level of service analysis at the appropriate time and in conjunction with the Michigan Department of Transportation (MDOT), the Monroe County Road Commission, and other appropriate agencies to determine possible mitigation measures. 4) Fermi site is zoned for Public Service. Therefore, no zoning conflicts will be introduced.

Table 4.6-1 Summary of Measures and Controls to Limit Adverse Impacts During Construction (Sheet 9 of 9)

Environmental Resource Categories	Impact Category and Level of Impact														Impact Description or Action	Specific Measures and Controls
	Noise	Erosion/Sediment	Air Quality/Dust	Traffic	Effluents and wastes	Surface water Impacts	Groundwater Impacts	Land Use protection/restoration	Water-use protection/restoration	Terrestrial Ecosystem Impacts	Aquatic Ecosystem Impacts	Socioeconomic Impacts	Radiation Exposure to	Other Site-Specific Impacts		
4.4.3 Environmental Justice				S				S				S			1) No disproportionately high, adverse impacts have been identified in the primary impact area.	1) No mitigation measures are deemed necessary.
4.5 Radiation Exposure to Construction Workers																
4.5.1 Worker Impacts													S		1) Construction workers could be exposed to radiation from a range of sources including direct radiation, radiation from gaseous and liquid effluents, radiation associated with onsite low level waste and spent fuel storage.	1) The annual construction worker doses attributable to the operation of Fermi 2 for the construction areas for a new facility would be within 10 CFR 20 limits for members of the public. Monitoring of individual construction workers is not required. Facility staff will be treated as members of the general public in unrestricted areas.

4.7 Cumulative Impacts of Construction

This section discusses cumulative impacts to the environment that could result from the construction of Fermi 3. A cumulative impact is defined in the Council of Environmental Quality (CEQ) regulations (40 CFR 1508.7) as an "impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions."

The construction impacts of Fermi 3, as described in Chapter 4, are combined with other past, present, and reasonably foreseeable future actions that would affect the same resources in the vicinity. Cumulative impacts anticipated during construction phases are discussed in this section.

To determine whether cumulative impacts to the existing environment near the Fermi site are likely to occur, the baseline environmental information and proposed, ongoing and future development projects in the Fermi area of similar magnitude (Chapter 2) are considered herein along with the environmental impacts (Chapter 4) of constructing a new unit on the Fermi site. For purposes of this review, the geographical area considered for cumulative impacts from construction is Monroe County, and the focus includes and Fermi 3 along with other comparable projects. Apart from Fermi 3, the only known major construction project planned in Monroe County is the installation of scrubbers at the Monroe Power Plant. The respective environmental impacts from Fermi 3 and Monroe Power Plant construction are anticipated to be contained within the respective sites by various regulatory and permit requirements. Furthermore, potential cumulative impacts related to the scrubber installation (e.g., air quality effects from construction equipment, increased temporary work force size, and commuter traffic) are anticipated to decrease before Fermi 3 construction is started. Therefore, Fermi 3 is considered the primary action influencing cumulative impacts for the Fermi 3 project.

As discussed in the Chapter 4 introduction, activities involving Fermi 1 and 2 will be taking place during the Fermi 3 construction period (e.g. deconstruction of Fermi 1, relocation of Fermi 2 outbuildings, access separation between Fermi 2 and 3, etc.). Although they are separate activities from Fermi 3 construction, there is still a close interdependent environmental relationship. Accordingly, the Chapter 4 impacts previously took these activities into consideration in characterizing the Fermi 3 construction impacts, and no specific itemization is provided in this section for Fermi 1 and 2 cumulative impacts.

4.7.1 Land Use

For purposes of this analysis, the geographical area considered for cumulative impacts to land use resulting from construction is a circular area within 7.5 miles of the existing facility, centered on the proposed Fermi 3 location. Approximately 302 acres of the existing 1260-acre Fermi site will be used for construction of Fermi 3. Of the 302 acres required, approximately 112 acres already are developed and contain structures, pavement or other maintained areas; the remainder is composed of various terrestrial habitats as discussed in Subsection 4.3.1 and shown on Figure 4.3-2. The construction and operation of Fermi 2 did not stimulate substantial industrial growth in Monroe County, and impacts from construction of Fermi 3 are expected to be similar. Land use in the undeveloped portions of the Fermi site is devoted almost exclusively to the DRIWR. Actions to reduce land use impacts would include re-vegetation using native species to improve forage and shelter quality for wildlife use. Rural and agricultural land uses are dominant near the Fermi site. These land uses will not be affected by Fermi 3 construction, except for the offsite transmission corridor, which is in existing right-of-way (ROW). No other Federal or major construction projects are known in Monroe County during the same time as Fermi 3 construction.

Cumulative impacts for land use consist of development and land conversions to accommodate Fermi 3 facilities. Analysis of land use effects at the Fermi site includes an increase in impervious surface, resulting in increased stormwater runoff. Much of the area to be disturbed by construction of Fermi 3 was previously disturbed during Fermi 1 or Fermi 2 construction, although some locations have remained undisturbed for longer periods allowing volunteer vegetation to become established (Subsection 4.1.1.2). To construct Fermi 3 some of these disturbed areas would be cleared, but portions not needed for safety or operational reasons would be revegetated using native species.

Additional transmission towers and steel poles will be constructed in an existing transmission corridor, extending approximately 29.4 miles within an assumed 300-foot wide ROW. Monroe County, which immediately surrounds the Fermi site and the offsite transmission corridor, is predominantly rural and agricultural land uses or forested. These land uses affected by construction of Fermi 3 will be temporary; and because the new transmission lines will use existing ROWs and towers to the maximum extent practicable, land use impacts are minimized.

Construction of Fermi 3 will contribute to changing land use within the Fermi site, but is not likely to encourage offsite industrial development on a scale similar to the facility, in part because of county and township zoning, which favors preservation of agricultural and rural land use. No large-scale industrial or commercial projects are planned near the Fermi site or the offsite transmission line. The Fermi site is zoned for public service/ utilities and this land use is not expected to change. Because Fermi 3 construction will comply with all applicable county or township land use and zoning regulations, the cumulative impacts are anticipated to be SMALL, and no mitigative measures are needed.

4.7.2 **Air Quality**

For purposes of this analysis, the geographical area considered for cumulative impacts to air quality resulting from construction is Monroe County, and the focus includes Fermi 3 along with other sources of similar emissions. As indicated in Subsection 4.4.1.2, Monroe County is designated by USEPA as a non-attainment area for the annual $PM_{2.5}$ standard and a maintenance area for the 8-hour ozone standard. A temporary increase in air pollution will arise during construction activities; however, the net impact on the local and regional air qualilty is expected to be minimal. Apart from Fermi 3, the only known major construction project planned in Monroe County is the installation of scrubbers at the Monroe Power Plant. The effects of Fermi 3 and Monroe Power Plant construction are anticipated to be contained within the respective sites by various regulatory and permit requirements. Additionally, the bulk of the Monroe Power Plant scrubber work is projected to be completed prior to the commencement of Fermi 3 construction. Accordingly, the temporary impact of construction activities should not produce noticeable air quality impacts or elevate air pollutant levels. The vehicles and machinery used onsite will comply with applicable government standards during construction activities and dust control procedures will be employed. The rural nature of the construction area will help prevent a marked impact on air quality beyond the site. However, the cumulative impact on air quality in Monroe County during construction is projected to be temporary and SMALL, and no mitigative measures are needed.

4.7.3 **Hydrology, Water Use, and Water Quality**

No direct or indirect impact will occur to surface waters from Fermi 3 construction, with the exceptions of a small wetland area in the DRIWR, certain onsite water bodies, the vicinity of the existing station water intake, and the barge slip in Lake Erie. Thus, cumulative impacts for surface water in this analysis are limited to Fermi 2 and Fermi 3. The impact area for groundwater is Monroe County because of possible impacts to subsurface aquifers from dewatering during Fermi 3 construction.

Past and present impacts are from existing activities and no known major projects are being proposed within the timeframe of the Fermi 3 project. Future impacts are determined from knowledge of potential development in the resource areas.

The Fermi vicinity has abundant water supplies and temporary water needed for construction will not affect the availability of water for other water users, including groundwater. Groundwater will not be used for construction activities and is limited to withdrawals for dewatering. Dewatering of the construction site during excavation will be temporary, effects will be limited to the immediate area during construction and other groundwater users in Monroe County, primarily rock quarries, will not be adversely affected. It is anticipated that groundwater effluent will be discharged to a local surface water effluent location in accordance with appropriate local and environmental permit requirements. This discharge is not anticipated to require wastewater treatment plant expansion. All surface waters within or near the Fermi site will be avoided to the extent feasible. In addition, construction activities, construction materials and construction site good housekeeping rules implemented under the SESC Plan and the PIPP will minimize any impacts from construction-related runoff to surface water quality. The usability of the water by others will not be significantly impacted by Fermi 3 construction.

There will be a permanent change in water seepage patterns into groundwater from expansion of impervious area within the Fermi site. Implementation of the PIPP will control loss or potential seepage of construction-related pollutants into groundwater.

4.7.3.1 **Surface Water Use**

Fermi 3 will obtain its potable water from Frenchtown Township, which obtains its water from Lake Erie. The potable water use rate for Fermi 3 construction is planned at a maximum of 8,700 gallons per day (Subsection 4.2.1.8). Fermi 3 construction activities are estimated to need between 350,000 to 600,000 gallons per day from Lake Erie for concrete batch plant operation, dust suppression and sanitary needs.

The cumulative impacts of surface water use for construction at Fermi 3 combined with existing use of Lake Erie water would be SMALL, and no mitigative measures are needed.

4.7.3.2 **Surface Water Quality**

Three primary accountabilities will limit the effects from construction activities to surface water quality:

1. The NPDES discharge permit for Fermi 2 includes limitations for stormwater runoff discharge from the Fermi site with associated monitoring and reporting requirements. These requirements will continue to be applicable during the construction phase for Fermi 3. A permit modification to include the new construction at Fermi 3 would be required by MDEQ.
2. Construction impacts for Fermi 3 will be reduced and effectively managed through permit compliance and through implementation of the NPDES Stormwater Construction Permit. The Stormwater Construction Permit will establish plans to minimize erosion, control sediment, manage construction materials/activities and reduce the impact of any surface runoff from the construction site to the waterways in the site vicinity.
3. A Soil Erosion and Sedimentation Control (SESC) Permit from Monroe County Drain Commission. As part of the SESC Permit, a detailed SESC Plan will be developed. Details regarding the SESC Permit and Plan are discussed in Subsection 4.2.1.

The continuing NPDES permit limitations on the discharges from Fermi 2 and the continuing regulation of water quality criteria in Lake Erie by the MDEQ and EPA provide a management system with measurable standards to control cumulative impacts on surface water quality.

Construction plans and permit limitations will be designed to minimize temporary impacts to surface water quality from construction of Fermi 3. The cumulative impacts to surface water quality resulting from construction of Fermi 3 would be SMALL, and no mitigative measures are needed.

4.7.3.3 **Groundwater Use**

Fermi 3 construction will have no impact to local sole source aquifers (SSA). The closest SSA is located approximately 35 miles southeast of the site, across Lake Erie.

The largest regional groundwater use is by quarries, with some additional use by various local governments. There is some concern among local residents about groundwater levels in the Fermi area, believing the quarries may be contributing to drawdown of local water levels. Fermi 3 construction dewatering is not anticipated to contribute further to this local concern, as described in Section 4.2.

No major project of similar magnitude is planned for development in Monroe County during the Fermi 3 construction period. Therefore, no cumulative interaction related to Fermi 3 construction would occur. The following discussion is focused on Fermi 3 impacts to existing local uses.

As noted above in Subsection 4.7.3, dewatering effluent (groundwater within the overburden and Bass Islands aquifer) will be discharged to a local surface water effluent location during the construction excavation phase. The construction dewatering impact is discussed in Section 4.2. Once details related to construction are determined following final project design, the drawdown impact on groundwater users in the affected area will be further investigated before dewatering is started.

Considering that no discharges to groundwater will occur and the low volume of dewatering required during excavation, with the implementation of mitigation measures discussed in Section 4.6, Fermi 3 construction impacts to groundwater are expected to be SMALL and are not anticipated to affect groundwater use away from the Fermi site.

4.7.3.4 **Groundwater Quality**

Because of changes in seepage patterns from temporary redirection of surface flows for construction and stormwater runoff control, groundwater recharge may be temporarily reduced during the construction phase of Fermi 3. As building construction and paving progresses, increased runoff and decreased seepage on the developed portion of the site may occur. However, there will be no groundwater discharges, so groundwater quality will not be affected by influents or seepage.

The impact of this reduction in groundwater recharge on groundwater quality is expected to be minimal because the larger area surrounding the construction site will not be affected. Execution of the SESC Plan and its housekeeping elements will limit potential groundwater contamination resulting from the potential seepage of construction materials/supplies into groundwater. Potential contamination of groundwater from Fermi 3 construction activities will be limited by such actions as preventing spills, leaks and material releases under the SESC Plan, the PIPP, appropriate use of chemical storage systems, and frequent inspections of material storage systems.

Combined with existing and proposed activities at the Fermi site and in Monroe County, the cumulative impacts to groundwater quality are expected to be SMALL, and no mitigative measures are needed.

4.7.4 **Ecology**

The Fermi 3 site layout and construction plan was designed to minimize site-specific and cumulative impacts to the terrestrial ecosystem to the greatest feasible extent while meeting the project purpose. Currently developed and previously disturbed land will be preferentially used wherever practicable. Approximately 9.34 acres of wetlands and 5.18 acres of open water habitats would be permanently impacted.

A 29.4-mile 345 kV transmission line corridor, with an assumed width of 300 feet, between the Fermi site and the Milan Substation is being proposed. Route selection will use already developed land to avoid impacts to terrestrial resources. The land in the transmission corridor is not owned or controlled by Detroit Edison. Accordingly, any impacts would be addressed by ITC*Transmission*. Should any such impacts be unavoidable, mitigation to alleviate the adverse effects would be expected to be provided in coordination with the appropriate land authority (e.g., MDNR) in compliance with applicable regulatory oversight.

There are no other past, present, or known planned actions in Monroe County that involve major effects on wildlife and wildlife habitat similar to those from construction of Fermi 3. Most impacts from construction would be temporary or limited in effect through site management and regulatory compliance mechanisms. American lotus in wetlands affected by construction activities will be subject to future consultation with MDNR to minimize impacts (Subsection 4.3.1.2.1). Construction activities near bald eagle nests, particularly noise, will be limited during the nesting season to reduce the effects of disturbance. Therefore, cumulative impacts to county rare species, plant communities or wildlife will be SMALL, and no mitigative measures are needed.

4.7.4.1 **Terrestrial Ecology**

The geographic area evaluated for cumulative effects to terrestrial resources (vegetation and wildlife) is the vegetation or species-specific habitat within one mile of the Fermi 3 site and along the offsite transmission corridor. Existing terrestrial resources are described in Subsection 2.4.1, and the potential impacts to these resources are discussed in Subsection 4.3.1. As noted in Subsection 4.3.1, aside from developed or temporarily impacted areas, Fermi 3 construction will impact 9.34 acres of wetlands. In the region (50-mile radius) there are 910,711 acres of this habitat where the total wetland acreage was derived by combining open water, emergent herbaceous and woody wetland acreage (Table 2.2-7). As a percentage of the regional acreage, approximately 0.001 percent of the total disturbance will be in wetland habitats. These impacts are the minimum needed to satisfy the project need and purpose and impacts will have been reduced by avoiding adverse effects to protected species, wildlife resources, wetlands, and other resources as discussed in Subsection 4.3.1. Construction work is subject to regulatory compliance requirements, which further promotes impact avoidance. Terrestrial resource use in the region will not be dramatically shifted from agricultural to industrial or urban uses because of the addition of another nuclear unit to the Fermi site. Thus, the cumulative impacts to terrestrial resources from construction of Fermi 3 are considered SMALL, and no additional mitigative measures are needed.

Coastal Emergent Wetlands and other wetlands yet to be identified will be avoided to the extent feasible. Approximately 9.34 acres of wetland, composed of forested wetland (3.57 acres), and emergent wetland (5.77 acres), associated with DRIWR, would be permanently impacted. An additional 5.18 acres of open waters also would be permanently impacted. Wetland acreage filled for Fermi 3 construction may require separate mitigation. Cumulative impacts to wetlands are expected to be MODERATE. The type and extent of wetland mitigation will be determined during the Clean Water Act Section 404 permitting process.

The cumulative impacts from offsite transmission line construction were assessed using desktop research and ground studies. Detroit Edison does not own the offsite ROW and does not control the construction or operation activities in the offsite transmission corridor. Resource agency consultation is expected by ITC*Transmission* during the final stages of offsite transmission route development. This will allow for measures to be taken to avoid or minimize impacts. However, line routing uses already developed lands as much possible, including avoiding protected species, wetlands and other important terrestrial resources wherever feasible. Because wildlife impacts from construction, including wildlife displacement, fugitive dust and noise from construction are localized, temporary and minimized in accordance with regulatory limitations, they are considered cumulatively SMALL, and no mitigative measures are needed.

No Federal-listed threatened, endangered, or other protected species would be affected. Two state-listed species (American lotus, and eastern fox snake) are found on the Fermi site. American lotus would be minimally affected by Fermi 3 construction affecting the south canal. Eastern fox snakes could be minimally affected by Fermi 3 construction. Potential impacts are minimized to the extent practicable by minimizing impacts to the habitat areas used by these species and in the case of the fox snake, the preparation of a mitigation plan. Clearing of wooded areas has been planned so that wildlife corridors and roosting or nesting areas would be avoided. Temporarily disturbed sites will be replanted with native vegetation following completion of the project. In some cases (e.g., erosion control), revegetation would occur sooner in locations vulnerable to degradation unless stabilized by vegetation.

The potential impact of construction on bird collisions associated with the cooling tower or construction cranes is a poorly understood topic. However, experience suggests that any impacts are relatively small. In a recent study by Detroit Edison, 19 individual birds in 13 species were found dead below the Fermi 2 cooling towers during a 73-day period from March to June 2008. This averages to 0.26 bird per day, a collision rate unlikely to affect the population size of these birds. Based on current knowledge with the Fermi 2 towers and experience during Fermi 2 construction, it is reasonable to assume that the use of construction cranes during Fermi 3 cooling tower construction would have little cumulative effect on regional bird populations.

In sum, the anticipated cumulative impacts of onsite and offsite activities are expected to remain SMALL relative to terrestrial ecology.

4.7.4.2 **Aquatic Ecology**

For this analysis, the geographic region encompassing past, present and foreseeable construction actions (including Fermi 3) is the area immediately surrounding the Fermi site, including adjoining sections of Lake Erie, offsite ponds or lakes (e.g., the Quarry Lakes), and offsite transmission line rights-of-way that cross surface water resources. There are no known projects of similar scale to Fermi 3 started or planned within the construction timeframe of Fermi 3. Cumulative impacts to wetlands are described in Subsection 4.7.4.1. Direct impacts to onsite aquatic resources at the Fermi site from Fermi 3 construction activities are expected to be minimal.

Dredging of a barge slip within the existing Lake Erie intake embayment may be conducted to allow delivery of heavy construction equipment and building materials during Fermi 3 construction and for removal of construction debris. If done, this activity may result in a localized temporary loss of benthic biota. Dredging also may take place at the intake embayment to allow for the addition of a new water intake for Fermi 3. These dredging activities are expected to be similar to ongoing operations and maintenance (O&M) dredging activities used to maintain the barge slip and the intake embayment in operable condition under an existing USACE permit. Because dredging must comply with the existing permit, the added barge traffic would not substantively increase existing barge traffic in Lake Erie and no new roads or other transportation means would be required, no adverse impacts are anticipated from this activity. Dredge spoils are expected to be contained in the Spoils Disposal Pond at Outfall 013, as designated in the Fermi 2 NPDES permit.

Additional impacts to offsite aquatic resources from transmission line construction, as discussed in Subsection 4.1.2, also are expected to be minimal. Wetlands and other aquatic resources will be avoided to the extent feasible. Where impacts will occur, measures to minimize impacts are expected to be used by ITC*Transmission* to lessen the impact. Design of the new transmission lines and corridors would be expected to span aquatic ecosystems encountered as much as possible. Existing transmission towers are likely to be used as much as possible. If new transmission towers are needed, construction would be expected to be limited to terrestrial locations to the maximum extent possible. ROW clearing may occur adjacent to aquatic resources; however, indirect impacts to aquatic resources are expected to be minimized through preventative measures developed and implemented using the appropriate SESC Plan.

Indirect impacts to aquatic systems, such as increased sedimentation and local increased water flow are expected, primarily in dredged locations. These effects could cause temporary losses to benthic habitat and biota from siltation, as well as short-term declines in phytoplankton productivity and zooplankton densities in the immediate area affected by construction. However, the increased availability of nutrients should result in a temporary increase in planktonic organisms following the cessation of construction activities. While food resources for forage fish species would be temporarily reduced, these effects will be limited in duration, localized in effect and temporary, so adverse effects would cease on completion of dredging. Affected aquatic systems are expected to revert to pre-construction conditions following construction, and impacts are anticipated to be SMALL, and no mitigative measures are needed.

Other less likely but potential impacts may include interruption of fish migration and spawning and fish mortality related to accidental toxic spills. While it is not expected that migratory pathways would be physically barricaded during construction, increased turbidity can inhibit migratory cues in some fish species. Contaminants in construction effluents can also act as chemical barriers inhibiting fish migratory behavior. To reduce sediment loading and effluent runoff into water bodies, potentially affected by construction activities, the SESC Plan and the PIPP will be implemented before the start of construction.

Planktonic and benthic community composition has changed in western Lake Erie from increasing pollution in the 1970s that was reduced through the 1980s, resulting in species composition changes, mainly among invertebrate species, such as aquatic insects. However, fish communities identified in both historic and recent surveys are similar, indicating that the fish community of Lake Erie near the Fermi site has not changed appreciably because historic studies (late 1970s) were performed prior to Fermi 2 power plant operations. Construction and operation of Fermi 2 did not appreciably change Lake Erie aquatic habitats near the Fermi site, and a similar result is anticipated for Fermi 3 construction.

In summary, cumulative impacts on aquatic resources by Fermi 3 construction would be SMALL.

4.7.5 Socioeconomic, Environmental Justice, Historic and Cultural Resources

The socioeconomic impacts of power plant construction are mainly a function of construction workforce size, wages and the number of relocated workers relative to the available community facilities and services. The more workers that must re-locate to the construction site, the more likely it is that negative impacts could accrue, unless adequate housing and services are available. While a precise count is not available, reasonable assumptions appropriate for evaluating the socioeconomic impacts on the region were made to evaluate potential impacts; these are further described in Section 4.4. Aside from Fermi 3, the only other major project identified is the installation of scrubbers at the Monroe Power Plant. However, the bulk of this effort is projected to be completed prior to the commencement of Fermi 3 construction. Accordingly, no cumulative impact is anticipated in the socioeconomics of the site vicinity.

The geographical area of the cumulative analysis varies depending on the particular impacts considered, and may depend on specific boundaries, such as tax jurisdictions, or may be distance-related, as for environmental justice. For evaluation of cumulative effects from a socioeconomic perspective, Monroe County is considered likely to have the highest concentration of adverse socioeconomic impacts (Subsection 4.4.2) because of a history of slow rural growth, with other impacts diffused through the larger metro regions of Detroit and Toledo. The area of potential effect (APE) to archaeological resources is the Fermi site. The cultural resources APE consists of the Fermi 3 project area and cultural resources located outside the site boundary.

During construction of Fermi 3, the project will generate considerable direct and indirect socioeconomic benefits (e.g., stabilized housing market, worker wages and increased tax and user fee revenues) while maintaining consistency with the county development plan. Substantial positive benefits would accrue in Monroe County, including low income and minority areas, while having a SMALL impact on area culture and human health. The potential for negative impacts will be controlled through appropriate construction and safety practices, traffic flow management and other measures as discussed in Subsection 4.1.1.3. Low income or minority groups within the region would not suffer adverse or disproportionate impacts from Fermi construction activities. Therefore, the cumulative impacts on environmental justice would be SMALL, and no mitigative measures are needed.

As discussed in Subsection 4.1.3.1, construction impacts to historic properties or cultural resources identified within the footprint of the Fermi 3 construction are considered SMALL, and no mitigative measures are needed. Approved procedures will be implemented to ensure that either known or newly discovered historic and cultural sites will not be inadvertently affected during onsite construction activities. Construction of the new facility would not affect land outside the current Fermi property boundaries. Therefore, the cumulative impacts to socioeconomic, cultural or historical and environmental justice would be SMALL, and no mitigative measures are needed.

4.7.6 Non-Radiological Health

No projects of similar scale to Fermi 3 are planned near the site. Because construction impacts are limited to the Fermi site and the offsite transmission line corridor, non-radiological health impacts will be localized such that projects outside the Fermi site need not be considered in this cumulative analysis.

The non-radiological health risk to workers is expected to be dominated by occupational injuries at rates below average U.S. industrial rates. Health impacts on the public from noise was evaluated and found to be minor (Subsection 4.4.1.1). Noise impacts to workers are controlled through adherence to OSHA regulations. In summary, the cumulative impacts on non-radiological health would be SMALL, and no mitigative measures are needed.

4.7.7 **Radiological Impacts**

This impact analysis is limited to the Fermi site during construction of Fermi 3 and is based on continuing operation of Fermi 2 (including ISFSI) and decommissioned Fermi 1. No other significant radiological sources are present in the region nor are new radiation sources (other than Fermi 3) known as possibly occurring in the region. During construction of Fermi 3, construction workers onsite will be exposed to low-level radiation doses from the continued operation of Fermi 2 (including ISFSI) and decommissioned Fermi 1 (Subsection 4.5.5). Doses were calculated based on exposure to direct radiation, gaseous effluents and liquid effluents likely to occur during ordinary plant operations. The total individual dose received during the construction period from all onsite sources is summarized in Table 4.5-5 relative to public dose criteria. This data indicates that construction workers would not be classified as radiation workers.

Based on available data reviewed, dosage levels would be low, averaging 72 percent of the maximum allowable dose (Table 4.5-5). Exposure to construction workers experiencing annual doses attributable to operation of Fermi 2 would be SMALL because exposure would be within 10 CFR 20 and 10 CFR 50 Appendix I limits. Thus, monitoring of individual construction workers will not be required. Construction workers will be treated as if they were members of the public in unrestricted areas. Access to restricted areas generally will not be provided to construction workers. Radiological impacts to workers and the public will be SMALL, and no mitigative measures are needed.

4.7.8 **Conclusion**

This section summarizes potential cumulative impacts resulting from Fermi 3 construction at the Fermi site. This impact evaluation describes existing and known foreseeable impacts of similar magnitude in Monroe County and Fermi 3 construction plans during the construction period.

For the potential impacts addressed, cumulative impacts resulting from construction or from planned mitigations/avoidance are SMALL, and no mitigative measures are needed. Project status during construction will be monitored and procedures may be modified as necessary to maintain public and worker safety and environmental health.

4.8 Summary of Construction and Pre-Construction Activities

Table 4.8-1 summarizes the construction and pre-construction related impacts associated with the building of Fermi 3 in accordance with the Limited Work Authorization Rulemaking that became effective November 8, 2007, and associated guidance.

The table provides a reference to each section within Chapter 4 that provides potential impacts and significance determination. The potential impacts and significance determination utilized the three significance levels of SMALL (S), MODERATE (M), and LARGE (L) as defined in Footnote 3 of Table B-1 of 10 CFR 51. As indicated in the Introduction to Chapter 4, the chapter sections do not individually distinguish between pre-construction and construction impacts; therefore, the identified potential impacts and significance determination was determined evaluating the combined impact of pre-construction and construction activities. The Estimated Impacts Percentage provides a relative estimate of impacts to the environment attributable to either pre-construction or construction activities. The Basis for Estimate provides the supporting justification for the estimated impacts percentage.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 1 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Section 4.1 Land Use Impacts				
Subsection 4.1.1.1 The Site and Vicinity, Site and Vicinity Land Use Impacts	S – Land Use	10%	90%	Estimates are based on the area of land use that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1). It is assumed that the construction of SSC's will occur on no more than approximately 25 acres of the project area being developed (i.e., 302 acres, excluding offsite electric transmission lines)
Subsection 4.1.1.2.1 Local Monroe County and Frenchtown Township Land Use	S – Land Use	10%	90%	Estimates are based on the area of land use that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1). It is assumed that the construction of SSC's will occur on no more than approximately 25 acres of the project area being developed (i.e., 302 acres, excluding offsite electric transmission lines)
Subsection 4.1.1.2.2 Agricultural and Soil Issues	S – Land Use	10%	90%	Estimates are based on the area of land use that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1). It is assumed that the construction of SSC's will occur on no more than approximately 25 acres of the project area being developed (i.e., 302 acres, excluding offsite electric transmission lines)

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 2 of 10)

Section Reference	Potential Impacts and Significance[a]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.1.1.2.3 Federal, Regional, and State Land Use Plans	S – Land Use	10%	90%	Estimates are based on the area of land use that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1). It is assumed that the construction of SSC's will occur on no more than approximately 25 acres of the project area being developed (i.e., 302 acres, excluding offsite electric transmission lines)
Subsection 4.1.1.3 The Site and Vicinity, Transportation and Rights-of-Way	S – Land Use	70%	30%	Estimates are based on the area of land use that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1). Estimates also based on percent of man hours expected to be dedicated to the construction of activities within the definition of construction of SSC as this provides a measure of impacts to vicinity and transportation relative to land use.
Subsection 4.1.2 Transmission Corridors and Offsite Areas, Planning and Zoning	S – Land Use	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.
Subsection 4.1.2.1 Planning and Zoning	S – Land Use	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.
Subsection 4.1.2.2 Transmission Corridors and Offsite Areas, Transportation and Rights-of-Way	S – Land Use	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 3 of 10)

Section Reference	Potential Impacts and Significance[a]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.1.2.4 Transmission Corridors and Offsite Areas, Corridor Restoration and Management Actions	S – Land Use	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.
Subsection 4.1.3.1.1 Archaeological Sites	S – Land Use	5%	95%	The impacts to archaeological sites, i.e., below-ground resources, will apply almost exclusively to preconstruction activities. The archaeological sites were previously identified and ground-disturbing activities such as excavation areas, access roads, and laydown areas will provide the greatest impacts.
Subsection 4.1.3.1.2 Above-Ground Resources Sites	S – Land Use	5%	95%	The impacts to above-ground resources sites, will apply almost exclusively to preconstruction activities. The construction activities associated with Fermi 3 that would impact these sites are limited to the introduction of a permanent visual element, the cooling tower, into the viewshed.
Subsection 4.1.3.2 Historic Properties, Transmission Corridors and Offsite Areas	Not Determined[b]	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's. Detroit Edison has no control or ownership over the transmission.
Section 4.2 Water-Related Impacts				
Subsection 4.2.1.3 Construction Water Sources	S – Water	50%	50%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for construction batch plant operations, dust suppression, and sanitary water needs.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 4 of 10)

Section Reference	Potential Impacts and Significance[a]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.2.1.4 Water Bodies Receiving Construction Effluents	S – Water	25%	75%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for dredge spoil disposal, the filling of onsite water bodies, and expected storm water flow.
Subsection 4.2.1.5 Effects of Dewatering	S – Water	95%	5%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for dewatering.
Subsection 4.2.1.6 Transmission Facilities	S – Water	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.
Subsection 4.2.1.7 Floodplains and Wetlands	S – Water	5%	95%	Estimates are based on the expected acreage of land delineated as wetlands that that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1).
Subsection 4.2.1.8 Groundwater and Surface Water Users	S – Water	50%	50%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for dewatering activities and potable water consumption
Subsection 4.2.2.2 Water-Use Impacts, Water Quality of Bodies Receiving Construction Effluents	S – Water	25%	75%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for dredging, site development, stormwater controls, and other activities as needed.
Subsection 4.2.2.3 Water-Use Impacts, Water Quality Used and Quantity Available to Other Users	S – Water	25%	75%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for concrete batch plant operations, dust suppression, and establishment of new cover vegetation.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 5 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.2.2.4 Water-Use Impacts, Water Quality Changes Due to Substratum Exposure	S – Water	25%	75%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in the discharge of water from the Spoil Disposal Pond and impacts to the intake and discharge areas.
Subsection 4.2.2.5 Water-Use Impacts, Effects of Alterations on Other Water Users	S – Water	95%	5%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's to the need for dewatering.
Section 4.3 Ecological Impacts of Construction				
Subsection 4.3.1.1.1 Vegetation on the Site and in the Vicinity	S – Terrestrial Ecosystems	10%	90%	Estimates are based on the acreage that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1).It is assumed that the construction of SSC's will occur on no more than approximately 25 acres of the project area being developed (i.e., 302 acres, excluding offsite electric transmission lines)
Subsection 4.3.1.1.2 Wildlife on the Site and in the Vicinity	S – Terrestrial Ecosystems	10%	90%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in takes or displacement of wildlife, fugitive dust emissions, bird collisions with elevated construction equipment, pollutant spills, and noise.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 6 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.3.1.2.1 Important Species	S – Terrestrial Species	10%	90%	Estimates are based on the area of land use and potential presence of important species within those areas dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1). It is assumed that the construction of SSC's will occur on no more than approximately 25 acres of the project area being developed (i.e., 302 acres, excluding offsite electric transmission lines)
Subsection 4.3.1.2.2 Important Habitats	M – Terrestrial Habitats	5%	95%	Estimates are based on the expected acreage of land delineated as wetlands that that will be dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1).
Subsection 4.3.1.5 Terrestrial Ecosystems, Transmission Corridors and Other Offsite Areas	S – Terrestrial Ecosystems	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.
Subsection 4.3.2.1 Aquatic Ecosystems, Impacts to Impoundments and Streams	S – Aquatic Ecosystems	25%	75%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in increased sedimentation and turbidity, increased sediment/silt loads into onsite impoundments, surface drainages, site clearing and grading, loss of vegetated buffer zones, and site dewatering.
Subsection 4.3.2.2 Aquatic Ecosystems, Impacts to Lake Erie	S – Aquatic Ecosystems	5%	95%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in dredging activities within Lake Erie and dewatering.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 7 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.3.2.3 Aquatic Ecosystems, Impacts to the Transmission Corridors and Offsite Areas	S – Aquatic Ecosystems	0%	100%	Activities within transmission corridors are not included within the definition of construction of SSC's.
Subsection 4.3.2.4.1 Threatened and Endangered Species	S – Aquatic Species	5%	95%	Estimates are based on the area of aquatic habitat and potential presence of threatened and endangered species within those areas dedicated to Structures, Systems and Components (SSC) with a reasonable nexus to radiological health and safety and common defense and security, and meet the criteria in 10 CFR 50.10(a)(1).
Subsection 4.3.2.4.2 Commercial and Recreational Aquatic Species	S – Aquatic Species	5%	95%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in increased turbidity presenting potential direct and indirect impacts to commercial and recreational aquatic species.
Subsection 4.3.2.4.3 Other Important Species	S – Aquatic Species	5%	95%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in increased turbidity and physical impacts to benthic habitat impacting other important species such as the mayfly.
Subsection 4.3.2.5 Summary	S – Aquatic Ecosystems and Species	5%	95%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in potential increases in erosion that could lead to deposition in aquatic water bodies.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 8 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Section 4.4 Socioeconomic Impacts				
Subsection 4.4.1.1.4 Potential Impacts	M – Short Term S – Long Term Socioeconomic	50%	50%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in noise impacts.
Subsection 4.4.1.1.6 Buildings	S – Socioeconomic	25%	75%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in shock and vibration.
Subsection 4.4.1.2 Physical Impacts, Air Quality	S – Socioeconomic	70%	30%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in an increase in air pollution attributable to engine exhaust from worker vehicles and machinery and percent of man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.1.3 Physical Impacts, Dust	S – Socioeconomic	50%	50%	Estimates based upon the expected contribution of activities within the definition of construction of SSC's resulting in the generation of dust onsite activities such as operation of the concrete batch plant, vehicle operation, site leveling and dirt work and percent of man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.2.2 Social and Economic Impacts, Local Housing	S – Socioeconomic	70%	30%	Estimates based on percent of man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.2.4.1 Education	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 9 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Subsection 4.4.2.4.2 Transportation	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.2.4.3 Public Safety and Social Services	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.2.4.4 Public Utilities	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.2.4.5 Recreation, Tourism, Aesthetics, and Land Use	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.3.1 Environmental Justice Impacts, Impacts on Low Income Areas	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.3.2 Environmental Justice Impacts, Impacts on Minority Populations	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.
Subsection 4.4.3.3 Environmental Justice Impacts, Isolated Population Impacts	S – Socioeconomic	70%	30%	Estimates based on percent to man hours expected to be dedicated to the construction of activities within the definition of construction of SSC.

Table 4.8-1 Summary of Construction and Pre-Construction Related Impacts (Sheet 10 of 10)

Section Reference	Potential Impacts and Significance[(a)]	Estimated Impacts Percentage		Basis for Estimate
		Construction	Pre-Construction	
Section 4.5 Radiation Exposure to Construction Workers				
Subsection 4.5.2 Radiation Sources	S – Radiation	80%	20%	Estimates based on percent to man hours on site and consideration of proximity of workers to radiation sources.
Subsection 4.5.3 Measured and Calculated Radiation Dose Rates	S – Radiation	80%	20%	Estimates based on percent to man hours on site and consideration of proximity of workers to radiation sources.
Subsection 4.5.4 Construction Worker Dose Estimates	S – Radiation	80%	20%	Estimates based on percent to man hours on site and consideration of proximity of workers to radiation sources.

Notes:

a. As discussed in the associated sections, the assigned potential impact significance levels of (S)MALL, (M)ODERATE, or (L)ARGE are based on the assumption that mitigation measures and controls would be implemented, where identified.

b. Detroit Edison has no control or ownership over the proposed offsite transmission corridors. ITC*Transmission* follows the applicable regulatory processes and approvals in order to implement changes to the transmission system. Accordingly, Detroit Edison cannot reasonably provide the transmission system detailed impacts encountered by ITC*Transmission.* It would be expected that ITC*Transmission* would conduct the necessary cultural resource surveys consistent with State and Federal regulatory requirements.