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NIAGARA MOHAWK

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

January 25, 1983

Mr. Harold R. Denton
Director, Office of Nuclear
Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

In the Matter of
Niagara Mohawk Power Corporation
Nine Mile Point Nuclear Station Unit 2
Docket No. 50-410

Dear Mr. Denton:

Niagara Mohawk Power Corporation hereby tenders its application for an operating license for Nine Mile Point Nuclear Station Unit 2 in accordance with 10CFR2.101(a)(2), 10CFR50.30(c)(2), 10CFR73.55 and 10CFR2.790. This submittal consists of the following:

1. License Application (General Information and Affidavit) - 10 copies (3 originals)
2. Final Safety Analysis Report - 15 sets
3. Environmental Report - 20 sets
4. Physical Security Plan - 6 copies
5. Certain figures from FSAR Section 6A - 6 sets

Items 4 and 5 are materials for which proprietary status is being requested. These are being transmitted separately. The Physical Security Plan includes the Safeguards Contingency Plan. The Guard Training and Qualification Plan is the same as Nine Mile Point Unit 1 and has been approved by the NRC, but not submitted with this tendering.

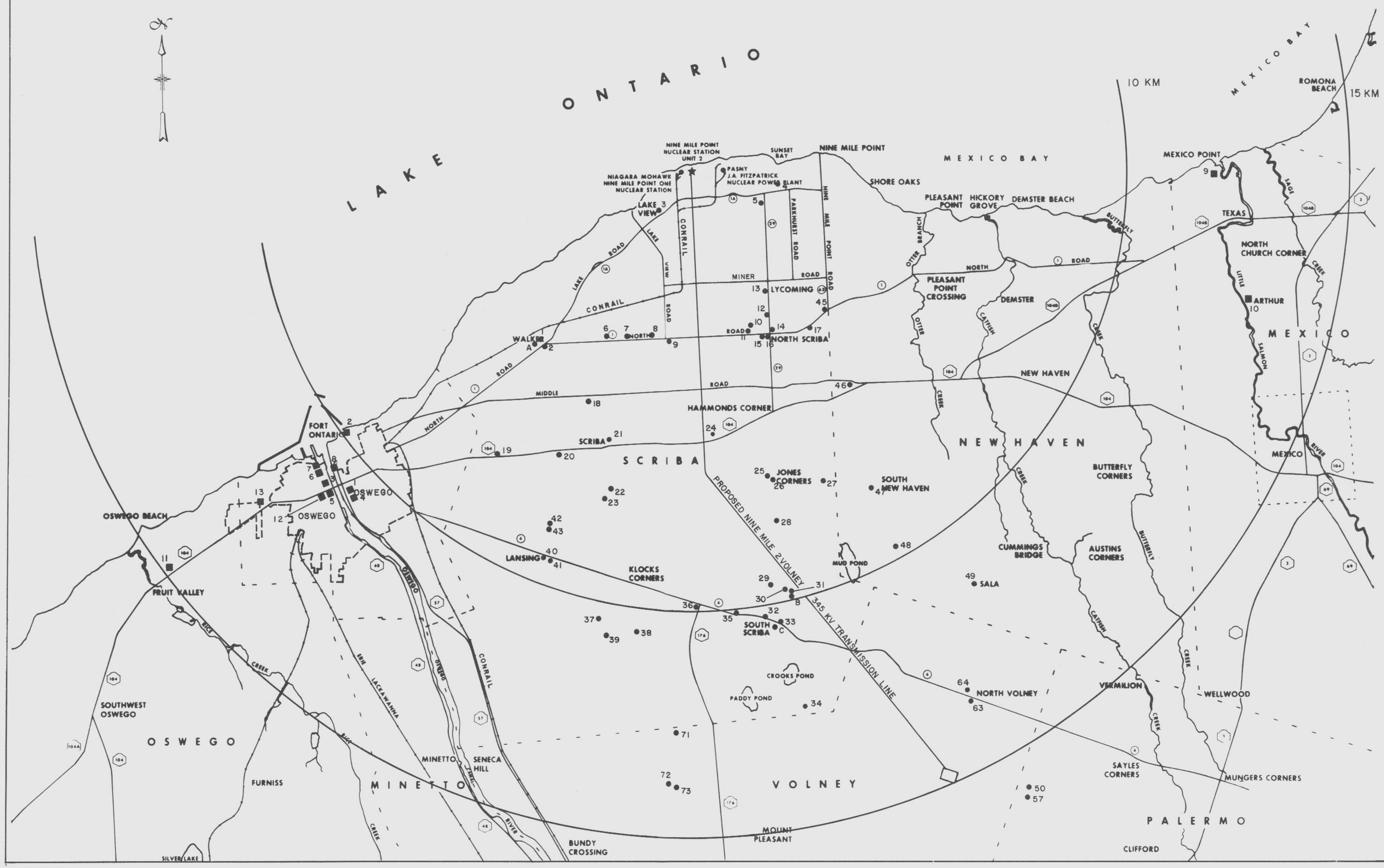
Very truly yours,

CVMangan

C. V. Mangan
Vice President
Nuclear Licensing & Engineering

Enclosures

8 Rids See Attached Dist Codes



SCALE – MILES (0, 1, 2, 3, 4)

SCALE – KILOMETERS (0, 1, 2, 3, 4, 5)

LEGEND:

Historical Sites

1 - Oswego City Library
2 - Fort Ontario
3 - Oswego Market House
4 - Richardson-Bates House
5 - U.S. Custom House
6 - Walton & Willett Stone House
7 - Fort Oswego
8 - Oswego Harbor
9 - Spy Island
10 - Arthur Tavern
11 - Fruit Valley C mmunity
12 - Oswego City Hall
13 - Sheldon Hall

Cultural Resources

1 - Saw Mill
2 - School House 12
3 - School House 15
4 - School House 16
5 - Stave Factory
6 - Store
7 - Cemetery
8 - School House 13
9 - Blacksmith Shop
10 - Cemetery
11 - Baptist Church
12 - School House 14
13 - Cheese Factory
14 - Blacksmith Shop
15 - Grocery & Post Office
16 - Harness Shop & Grocery
17 - Blacksmith Shop
18 - I. Hubble & Co.
19 - School House 4
20 - Cooper Shop
21 - School House 10, Cooper Shops, Store, Sash Factory Methodist-Espicopal Church, Hotel, Shoe Shop, Store & Post Office, Blacksmith Shops, Wagon Shop
22 - Cemetery
23 - Saw Mill
24 - School House 3
25 - School House 7
26 - Store
27 - Cider Mill
28 - Cooper Shop
29 - Wagon & Blacksmith Shop
30 - Steam Saw Mill
31 - Saw Mill
32 - School House 6
33 - Blacksmith Shop
34 - School House 21
35 - Cemetery
36 - H. Brown Hotel & Store
37 - School House 5
38 - Cheese Factory
39 - Saw Mill
40 - School House 3
41 - Harness Shop
42 - Cooper Shop
43 - Cooper Shop
44 - School House 17
45 - School House 18
46 - School House 8
47 - Stave Manufactory
48 - Stave Manufactory
49 - School House 9
63 - School House 10
64 - Methodist-Episcopal Church
71 - Saw Mill
72 - School House 11
73 - Cooper Shop
A - Flouring Mill
B - Flouring Mill
C - Flouring Mill

(For detailed information refer to Table 2.5-34 and Table 2.5-35)

■ HISTORICAL SITES
● CULTURAL RESOURCES
– – – – TOWN BOUNDARIES

FIGURE 2.5-19

HISTORICAL SITES AND CULTURAL RESOURCES WITHIN 15-KM OF UNIT 2

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

8302020036 - 01

FIGURE 2.4-4

VEGETATION TYPE MAP
345-KV TRANSMISSION CORRIDOR

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

8302020036-02

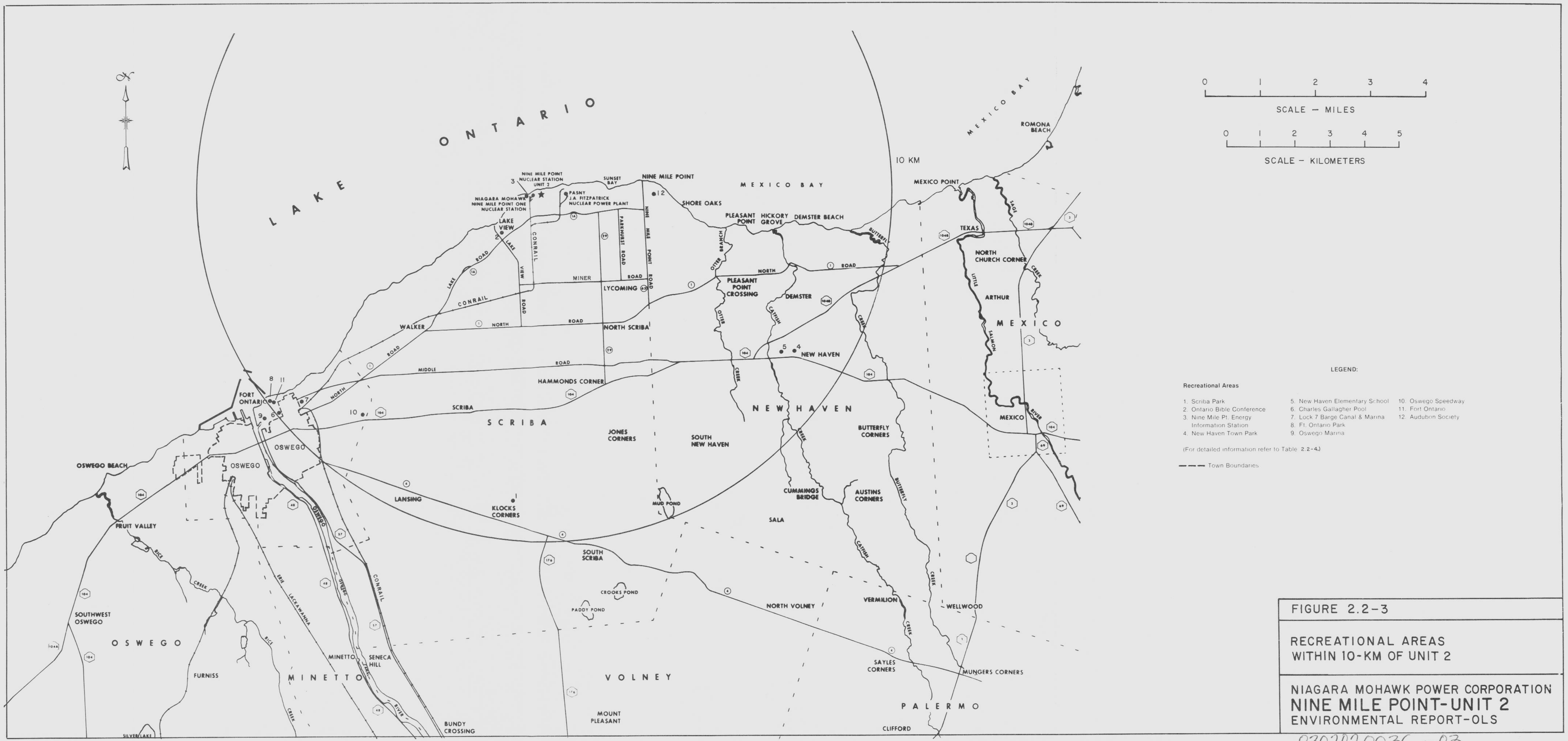
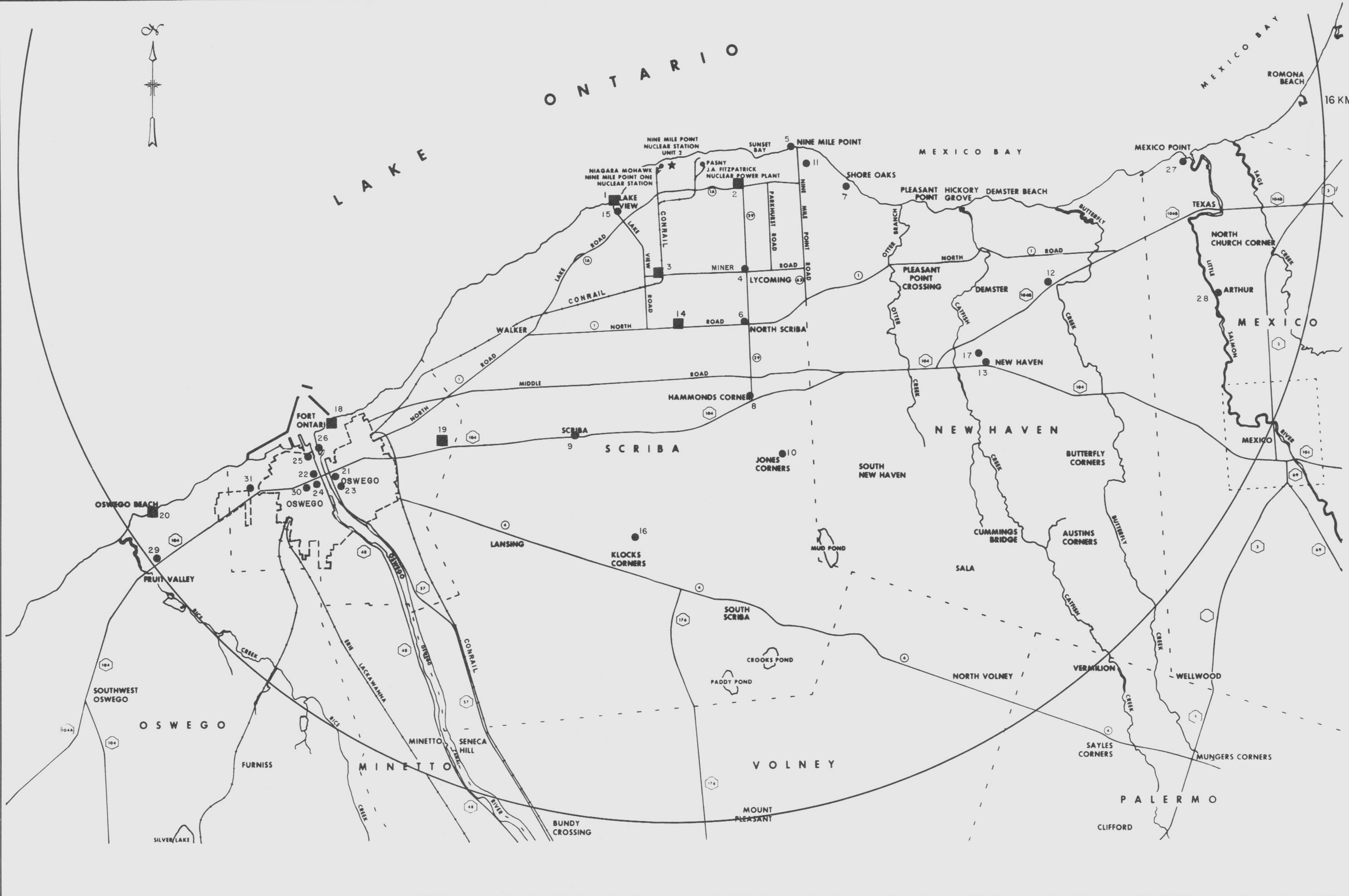


FIGURE 2.2-3

RECREATIONAL AREAS WITHIN 10-KM OF UNIT 2

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

8302020036-03



0 1 2 3 4

SCALE IN MILES

0 1 2 3 4 5

SCALE IN KILOMETERS

LEGEND

1. Lakeview Development
2. Intersection of NYS 29 & Lake Road
3. Intersection of Miner Road and railroad
4. Lycoming
5. Nine Mile Point Development
6. North Scriba
7. Shore Oaks Development
8. Hammonds Corner
9. Scriba
10. Jones Corner
11. Audubon Sanctuary
12. Demster Grove Campground
13. New Haven
14. North Road
15. Ontario Bible Conference Camp
16. Scriba Town Place
17. New Haven Town Park
18. Fort Ontario
19. Oswego Speedway
20. Oswego Beach
11. Oswego City Library
11. Oswego Market House
23. Richard Bates House
24. U.S. Custom House
25. Walter & Willett Stone House (Cahill's Fish Market)
26. Oswego Harbor
27. Spy Island
28. Arthur Tavern
29. Fruit Valley Community
30. Oswego City Hall
31. Sheldon Hall

■ STATION FACILITIES VISIBLE

● STATION FACILITIES NOT VISIBLE OR ONLY PARTIALLY VISIBLE

FIGURE 3.1-9

VISUALLY SENSITIVE & INTENSIVE LAND USE AREAS IN THE VICINITY OF NINE MILE POINT-UNIT 2

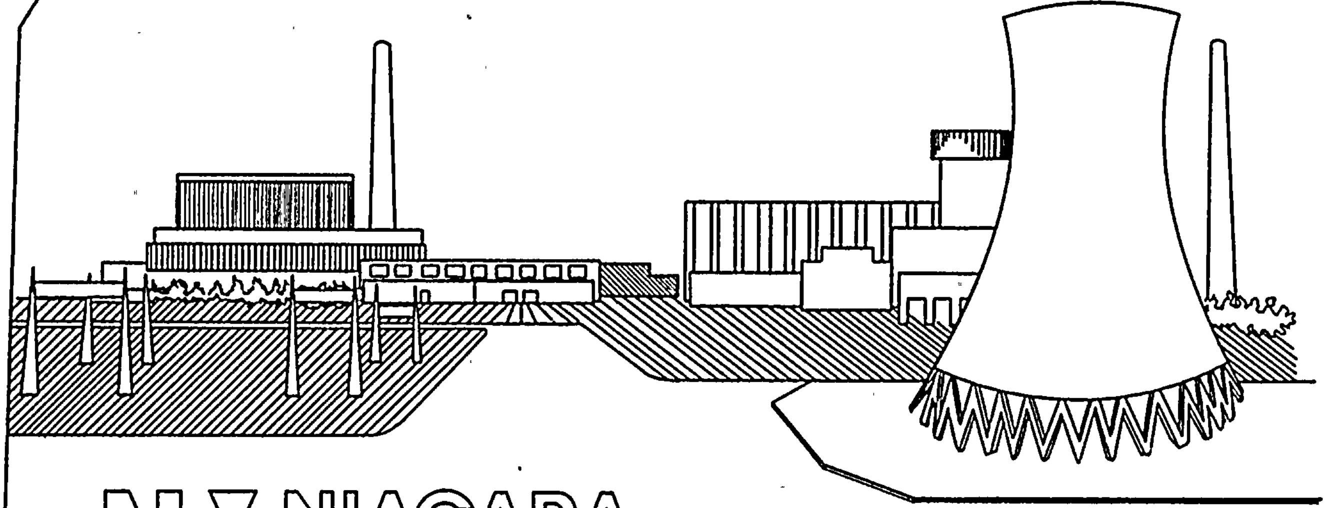
NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

8302020036 - 04

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

NINE MILE POINT NUCLEAR STATION — UNIT 2



NIAGARA MOHAWK

VOL. 1

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INTRODUCTION

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CHAPTER 1

INTRODUCTION

This Environmental Report - Operating License Stage (ER-OLS) is submitted by Niagara Mohawk Power Corporation (the Applicant) in fulfillment of the requirements of 10CFR51 and in support of an application for a license to operate the Nine Mile Point Nuclear Station Unit 2 (Unit 2). The content of this ER-OLS conforms with the guidance provided in Nuclear Regulatory Commission (NRC) Regulatory Guide 4.2, Revision 2 (NUREG-0099, July 1976), and with the NRC's Supplemental Guidance for the Preparation of Environmental Reports in Support of an Operating License Application (draft NUREG)[1,2]. However, to facilitate the NRC's review, the table of contents and section numbers conform with the guidance provided in the NRC's Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants (NUREG-0555)[3].

The Unit 2 Environmental Report - Construction Permit Stage was originally submitted by the Applicant to the Atomic Energy Commission on June 15, 1972 (Docket No. 50-410)[4]. The Unit 2 Final Environmental Statement was issued by the Atomic Energy Commission in June 1973, and a Construction Permit (CPPR-112) was issued to the Applicant on June 24, 1974[5,6].

On September 22, 1975, Niagara Mohawk Power Corporation entered into an agreement with four electric utilities, whereby each of the utilities would own, as tenants in common, proportional interests in Unit 2. The names of these utilities and their proportionate interests in Unit 2 are as follows:

Niagara Mohawk Power Corporation	41%
Central Hudson Gas & Electric Corporation	9%
Long Island Lighting Company	18%
New York State Electric & Gas Corporation	18%
Rochester Gas and Electric Corporation	14%

Under the terms of the agreement, the participants will share the electrical output and pay construction and operating costs according to their respective shares in Unit 2. The NRC approved the utilities' co-ownership in an amendment to the Unit 2 Construction Permit in October 1978[7]. Niagara Mohawk Power Corporation has the responsibility for licensing, design, procurement,

construction, operation, and all related functions with respect to Unit 2.

In fulfillment of the requirements of 10CFR51, Niagara Mohawk Power Corporation, on behalf of the co-tenants, submits this ER-OLS in support of an application for an Operating License for Unit 2.

1.1 PROPOSED PROJECT

Unit 2 is located on a 364-ha (900-acre) site owned by the Applicant and is situated on the southeast shore of Lake Ontario, Oswego County, NY, 10 km (6.2 mi) northeast of the city of Oswego and 53 km (32.8 mi) northwest of the city of Syracuse. Unit 2, occupying about 18.2 ha (45 acres), shares the site with the Applicant's Nine Mile Point Nuclear Station Unit 1 (Docket No. 50-220), which has been in commercial operation since 1969. Unit 2 is located approximately 274 m (900 ft) east of Unit 1. Located approximately 716 m (2,350 ft) east of Unit 2 is the James A. FitzPatrick Nuclear Power Plant, owned and operated by the Power Authority of the State of New York.

Unit 2 employs a nuclear steam supply system (NSSS) consisting of a single-cycle, forced circulating boiling water reactor (BWR). The plant rated core thermal power level is 3,323 MWt, corresponding to an electrical output of approximately 1,100 MWe.

The NSSS supplier is General Electric Company-Nuclear Energy Group. Stone & Webster Engineering Corporation, the architect-engineer, is responsible for the design and construction management of the plant.

The containment design for Unit 2 employs the BWR Mark II concept of over-under pressure suppression with multiple downcomers connecting the reactor drywell to the water-filled pressure suppression chamber. The primary containment is a steel-lined, reinforced-concrete enclosure housing the reactor and suppression pool. The reactor building completely encloses the primary containment. This structure provides secondary containment when the primary containment is closed and primary containment when the primary containment is open, as during refueling.

The source and discharge of all cooling water required for Unit 2 is Lake Ontario. The closed-loop circulating water system employs a single-cell, wet-evaporative, natural-draft cooling tower utilizing a counterflow design. The lake intake system conveys required cooling water from Lake

Ontario through two submerged intake structures, which are independently connected to the screenwell by intake pipes located within separate tunnels below the lake bottom. One tunnel also contains a discharge pipe that conveys service water system effluent, cooling tower blowdown, and liquid waste effluent to the submerged offshore discharge diffuser.

Power generated at Unit 2 will be transmitted directly to the new 345-kV Scriba Substation, located approximately 0.81 km (0.5 mi) south of the plant. Under normal operating conditions, power will be fed into the New York Power Pool interconnected electric system via a new 14.35 km (8.9 mi) long, 345-kV transmission line extending south from the Scriba Substation to the Applicant's existing 345-kV Volney Substation. The new Nine Mile 2-Volney 345-kV transmission line extends along an existing right-of-way its entire length[8].

The approximate schedule for Unit 2 fuel loading and commercial operation is March 1986 and October 1986, respectively.

1.1.1 References

1. Nuclear Regulatory Commission. NUREG-0099. Regulatory Guide 4.2, Revision 2. Preparation of Environmental Reports for Nuclear Power Stations. July 1976.

2. Nuclear Regulatory Commission. Draft NUREG. Supplemental Guidance for the Preparation of Environmental Reports in Support of an Operating License Application.

3. Nuclear Regulatory Commission. NUREG-0555. Environmental Standard Review Plans for the Environmental Review of Construction Permit Applications for Nuclear Power Plants, May 1979.

4. Nine Mile Point Nuclear Station Unit 2, Applicant's Environmental Report - Construction Permit Stage. NRC Docket No. 50-410, Niagara Mohawk Power Corporation, June 1972.

5. United States Atomic Energy Commission. Final Environmental Statement Related to Construction of Nine Mile Point Nuclear Station Unit 2. NRC Docket No. 50-410. Niagara Mohawk Power Corporation. June 1973.

6. United States Atomic Energy Commission. Construction Permit No. CPPR-112. NRC Docket No. 50-410. Nine Mile Point Nuclear Station Unit 2. Niagara Mohawk Power Corporation. June 24, 1974.

7. Nuclear Regulatory Commission. Construction Permit No. CPPR-112, Amendment No. 1. NRC Docket No. 50-410. Nine Mile Point Nuclear Station Unit 2. Niagara Mohawk Power Corporation. October 27, 1978.

8. Amended Article VII Application for Nine Mile 2 - Volney 345 KV Transmission Facility. Exhibits and Direct Testimony. Niagara Mohawk Power Corporation, April 1982.

1.2 STATUS OF REVIEWS AND APPROVALS

Licenses, permits, and other approvals required for the operation and maintenance of Unit 2 are listed in Table 1.2-1, which also identifies:

1. Activity/plant component for which approval was required.
2. Name of the agency responsible for issuing the approval.
3. Date that the approval was requested.
4. Status of each approval.

The status of approvals that entailed major environmental review (except for the NRC licenses) is discussed in the following paragraphs.

National/State Pollutant Discharge Elimination System (NPDES/SPDES) Permits

Section 402 of the federal Water Pollution Control Act amendments (1972) established a permit program to regulate the discharge of pollutants into navigable waters. Accordingly, the U.S. Environmental Protection Agency (EPA) is authorized to issue permits and establish effluent limitations, monitoring, reporting, and other requirements consistent with national water quality goals. Section 402 also provides that states may administer their own permit programs upon approval by the EPA.

On October 14, 1975, the EPA issued a combined NPDES permit for Niagara Mohawk Power Corporation's (NMPC) Nine Mile Point Nuclear Station, Units 1 and 2; whereby, specific effluent limitations, monitoring and reporting requirements, and compliance schedules for various waste streams at Unit 1 and at Unit 2 when it becomes operational are set forth.

In 1978, the New York State Department of Environmental Conservation (NYSDEC) was given the authority and responsibility for administering the Section 402 permit program. NYSDEC issued a combined draft SPDES permit (Appendix 1A) for Units 1 and 2, which sets forth specific effluent limitations, monitoring and reporting requirements, and compliance schedules for various nonradiological waste streams at Unit 1 and at Unit 2 when it becomes operational. Sections 3.3, 3.4, and 3.6 describe the various wastewater discharges that are regulated by the Unit 2 SPDES permit. The

anticipated impact of these discharges on water quality and aquatic ecology is discussed in Sections 5.2.2, 5.3.2, and 5.5.

Water Quality Certification

Section 401 of the federal Water Pollution Control Act amendments (1972) requires applicants for a federal license to construct or operate facilities that may result in a discharge into navigable waters to obtain a certification from the state that the discharge will comply with applicable water quality standards. NMPC applied to NYSDEC and received on February 23, 1977, a water quality certification for Unit 2 (Appendix 1B).

This certification identifies the water quality standards that must be met at the facility and establishes requirements for monitoring, assessing, and reporting compliance with these standards. Sections 3.6, 5.3, and 5.5 address Unit 2 compliance with water quality standards.

Transmission Line Certification

In the state of New York, before constructing a major transmission facility, an applicant must obtain a Certificate of Environmental Compatibility and Public Need from the New York State Public Service Commission, in accordance with Article VII of the New York State Public Service Law. During Article VII proceedings, a detailed examination of the proposed facility design, construction, cost, need, and environmental impact is undertaken. Alternative routes, lines, facility designs, and construction procedures are evaluated. The environmental impact assessment must consider such factors as topography, soils, hydrology, natural constraints, biota, land use, cultural resources, and visual impact. Before reaching a decision on a transmission line proposal, the Public Service Commission conducts a hearing to obtain input from all concerned parties.

On March 15, 1978, NMPC submitted an Article VII application to the Public Service Commission for a proposed double-circuit, 765-kV line extending from Unit 2 to a new substation (East Volney Substation), to be located adjacent to NMPC's existing 345-kV Volney Substation(1). Public hearings on the proposed line were held between November 1978 and January 1979. However, NMPC subsequently reevaluated the need for a 765-kV line linking Unit 2 and the proposed 765-kV East Volney Substation. In 1981, NMPC revised its transmission line proposal to consist of a 345-kV line extending from Unit 2 to a new substation

(Scriba Substation) to be located 0.81 km (0.5 mi) south of the plant. From the new Scriba Substation, a new single-circuit 345-kV line will be constructed within an existing right-of-way, 14.35 km (8.9 mi) south to NMPC's existing Volney Substation.

An application for an amendment reflecting the revised proposal was filed with the Public Service Commission in April 1982[2]. Commission approval of NMPC's request for a Certificate of Environmental Compatibility and Public Need is anticipated by April 1983.

Section 3.7 provides a detailed description of the transmission facilities that will serve Unit 2. Sections 5.1.2 and 5.6 describe the anticipated environmental impacts related to the operation of the line.

1.2.1 References

1. Article VII Application for Proposed Nine Mile 2 - Volney 765 KV Transmission Facility. Niagara Mohawk Power Corporation, March 1978.

2. Amended Article VII Application for Proposed Nine Mile 2 - Volney 345 KV Transmission Facility. Niagara Mohawk Power Corporation, April 1982.

TABLE 1.2-1

PERMITS AND APPROVALS

Agency	Type of Approval	Authorized Activity/ Plant Component	Application Date	Status
Nuclear Regulatory Commission	Special nuclear material license	Storage of neutron detectors	3/23/82	Granted 4/19/82
	Special nuclear material license	Fuel receipts	3/1/85	Approval anticipated by 7/1/85
	By-product material license	Radiation monitors/ calibration sources	1/1/84	Approval anticipated by 6/1/84
	Reactor operating license	Fuel loading	1/31/83	Approval anticipated by 1/1/86
Federal Aviation Administration	Navigational interference approval	Cooling tower	4/25/77	Granted 8/8/77 Extended 5/29/79 and 10/8/80
	Navigational interference approval	Stack	4/1/83	Approval anticipated by 4/1/84
American Society of Mechanical Engineers	Owner certificate of authorization	Nuclear power plant components	4/17/76	Granted 8/23/76 Extended 7/5/79 Extension requested 6/5/82
New York State Department of Environmental Conservation	Emission source environmental rating	Operation of cooling tower	1/1/84	Approval anticipated by 8/1/84
	Section 401 water quality certification	Discharge of wastewater effluents	2/24/76	Granted 2/23/77
	SPDES permit	Discharge of wastewater effluents	9/28/79	Approval pending
New York State Public Service Commission	Certificate of environmental compatibility and public need	Transmission line	3/15/78 Amended application filed 4/82	Approval anticipated by 4/83

TABLE 1.2-1 (Cont)

Agency	Type of Approval	Authorized Activity/ Plant Component	Application Date	Status
New York State Department of Health	Radioactive material registration	Radioactive sources not covered by NRC license	1/1/84	Approval anticipated by 6/1/84

1.3 CROSS REFERENCE TO REGULATORY GUIDE 4.2, REVISION 2

The following list of Regulatory Guide 4.2, Revision 2, section numbers and titles (left column) is cross-referenced to ER-OLS preparation section numbers and titles (right column). Also noted in the cross reference are corresponding sections of the draft NUREG, entitled Supplemental Guidance for the Preparation of Environmental Reports in Support of an Operating License Application, which was recently issued specifically as a guide for ER-OLS preparation and intended to supplement Regulatory Guide 4.2, which addresses primarily the ER-CPS. The NRC requested NMPC to adhere to the draft NUREG for the Nine Mile Point Unit 2 ER-OLS where the NUREG modifies Regulatory Guide 4.2. Previously, the NRC had requested NMPC to conform to the format and guidelines of the Environmental Standard Review Plans (ESRP) developed as draft NUREG-0158, which subsequently was issued as NUREG-0555. While the Nine Mile Point Unit 2 ER-OLS has been modified according to the draft NUREG, its format generally follows the ESRP. Therefore, to facilitate review, the following cross reference is provided.

As an additional aid in using the cross reference, where a Unit 2 ER-OLS section or subsection title requires further cross reference to a chapter or higher-level section, a reference is given in parentheses.

Regulatory Guide 4.2, Rev. 2		Unit 2 ER-OLS	
Section	Title	Section	Title
1.1	System Demand and Reliability	1.1	Proposed Project
1.2	Other Objectives		Not applicable
1.3	Consequences of Delay		Not applicable
2.1	Geography and Demography:		
2.1.1	Site Location and Description	2.1	Description of Station Location
2.1.2	Population Distribution	2.5.1	Demography
2.1.3	Uses of Adjacent Lands and Waters	2.2.1	The Site and Vicinity (Land Use)
		2.2.2	Land: Transmission Corridors and Offsite Areas
		2.2.3	Land: The Region
		2.3.2	Water Use

Regulatory Guide 4.2, Rev. 2 Section	Title	Unit 2 ER-OLS Section	Title
		2.5.2	Community Characteristics of Region
2.2	Ecology	2.4	Ecology
2.3	Meteorology	2.7 2.9	Meteorology Ambient Air Quality
2.4	Hydrology	2.3.1 2.3.3	Hydrology Water Quality
2.5	Geology	2.6	Geology
2.6	Regional Historic, Archeological, Architectural, Scenic, Cultural, and Natural Features	2.5.3	Historic and Archeological Sites and Natural Landmarks
2.7	Noise	2.10	Noise
3.1	External Appearance	3.1	External Appearance and Plant Layout
3.2	Reactor and Steam-Electric System	3.2	Reactor Steam-Electric System
3.3	Station Water Use	3.3	Plant Water Use
3.4	Heat Dissipation System	3.4	Cooling System
3.5	Radwaste Systems and Source Term	3.5	Radioactive Waste Management Systems
3.6	Chemical and Biocide Wastes	3.6.1	Wastes Containing Chemicals or Biocides
3.7	Sanitary and Other Waste Systems	3.6.2 3.6.3	Sanitary System Wastes Other Wastes
3.8	Reporting of Radioactive Material Movement	3.8	Radioactive Material Movement
3.9	Transmission Facilities	3.7	Power-Transmission Systems

Regulatory Guide 4.2, Rev. 2 Section	Title	Unit 2 ER-OLS Section	Title
4.0	Environmental Effects of Site Preparation, Station Construction, and Transmission Facilities Construction	4.0	Environmental Impacts of Construction
5.1	Effects of Operation of Heat Dissipation System	5.3	Cooling System Impacts
5.1.1	Effluent Limitations and Water Quality Standards	5.5.2	Compliance with Effluent Standards
5.1.2	Physical Effects	5.3.1.1	Hydrodynamic Descriptions and Physical Impacts (Intake System)
		5.3.2.1	Thermal Description and Physical Impacts (Discharge System)
5.1.3	Biological Effects	5.3.1.2	Aquatic Impacts (Intake System)
		5.3.2.2	Aquatic Impacts of the Discharge
5.1.4	Effects of Heat Dissipation Facilities	5.3.3	Heat Dissipation System
5.2	Radiological Impact From Routine Operation	5.4	Radiological Impacts of Normal Operation
5.3	Effects of Chemical and Biocide Discharges	5.5	Nonradioactive Waste System Impacts
5.4	Effects of Sanitary Waste Discharges	5.5	Nonradioactive Waste System Impacts
5.5	Effects of Operation and Maintenance of the Transmission Systems	5.6	Transmission System Impacts
5.6	Other Effects	5.1	Land Use Impacts
		5.2	Hydrological Alterations, Plant Water Supply, and Water Use Impacts

Regulatory Guide 4.2, Rev. 2 Section	Title	Unit 2 ER-OLS Section	Title
		5.8.1	Physical Impacts (Socioeconomic Impacts)
5.7	Resources Committed	5.1.1	The Site and Vicinity
		5.1.2	Transmission Corridors and Offsite Areas
		5.1.3	Historic and Archeological Sites
		5.2.2.5	Irreversible and Irretrievable Commitment of Resources (Water Use Impacts)
		5.3.3.2.3	Effects of Heat Dissipation System Operation on Wildlife
		5.5.5	Irreversible and Irretrievable Commitment of Resources (Nonradiological Waste System Impacts)
		5.6.2.6	Aquatic (Transmission System Impacts - Operation)
		5.6.3.1	Land Use Impacts (Transmission System Impacts to Man)
		10.2	Irreversible and Irretrievable Commitments of Resources (Evaluation of the Proposed Action)
5.8	Decommissioning and Dismantling	5.9	Decommissioning
5.9	The Uranium Fuel Cycle	5.7	Uranium Fuel Cycle Impacts
6.0	Effluent and Environmental Measurements and Monitoring Programs		See below:
6.1	Applicant's Preoperational Environmental Programs		

Regulatory Guide 4.2, Rev. 2 Section	Title	Unit 2 ER-OLS Section	Title
6.1.1	Surface Waters	6.1.1	Preoperational Monitoring (Thermal)
		6.5.2	Aquatic Ecology
		6.6.2	Surface Water
		6.3	Hydrological
6.1.2	Ground Water	6.6.1	Ground Water
		6.3	Hydrological
6.1.3	Air	6.4	Meteorological
		6.7.3	Air Quality Monitoring System
6.1.4	Land	6.5.1	Terrestrial Ecology and Land Use
		6.7.4	Geotechnical Monitoring
		6.7.1	Ambient Noise Survey
		6.7.2	Seismic Monitoring
6.1.5	Radiological Monitoring	6.2	Radiological
6.2	Applicant's Proposed Operational Monitoring Programs	6.1.2	Operational Monitoring (Thermal)
		6.2.2	Operational Monitoring (Radiological)
		6.3.3	Operational Monitoring Program (Hydrological)
		6.4.2	Operational Monitoring (Meteorological)
		6.5.1.2	Preoperational and Operational Monitoring (Biological)
		6.5.2.2	Operational Monitoring (Aquatic Ecology)
		6.6.1.2	Operational Monitoring (Groundwater)
		6.6.2.2	Operational Monitoring (Surface Water)
		6.8.3	Operational Monitoring: A Summarization
6.3	Related Environmental Measurement and Monitoring Programs		Not Addressed in ER-OLS.

Regulatory Guide 4.2, Rev. 2 Section	Title	Unit 2 ER-OLS Section	Title
6.4	Preoperational Environmental Radiological Monitoring Data	6.2.1	Preoperational Monitoring (Radiological)
7.1	Station Accidents Involving Radioactivity	7.1	Plant Accidents
7.2	Transportation Accidents Involving Radioactivity	7.2	Transportation Accidents
7.3	Other Accidents		Not addressed in ER-OLS.
8.0	Economic and Social Effects of Station Construction and Operation	8.0 5.8.2 10.4	The Need for the Plant Social and Economic Benefit-Cost Balance
9.0	Alternative Energy Sources and Sites	9.0	Alternatives to the Project
10.0	Station Design Alternatives	9.0	Alternatives to the Project
11.0	Summary Cost-Benefit Analysis	10.4	Benefit-Cost Balance
12.0	Environmental Approvals and Consultation	1.2	Status of Reviews and Approvals
13.0	Summary of Actions Taken	11	Summary of Actions Taken

NOTE: This section is not in Regulatory Guide 4.2, Rev. 2, but is included in the draft NUREG, entitled Supplemental Guidance for the Preparation of Environmental Reports in Support of an Operating License Application.

Regulatory Guide 4.2, Rev. 2		Unit 2 ER-OLS	
Section	Title	Section	Title
13.0	References		Not applicable.
NOTE:	Section 14 of draft NUREG		References in ER-OLS are placed at the end of each two-digit section.

APPENDIX 1A

DRAFT SPDES PERMIT
NINE MILE POINT NUCLEAR STATION UNITS 1 AND 2
NIAGARA MOHAWK POWER CORPORATION

EXTRA HIGH PRIORITY

BUREAU OF WASTEWATER FACILITIES DESIGN

DRAFT SPDES PERMIT TRANSMITTAL FORM AND FACT SHEET DATA

To: Mr. Garvey Chief, Permit Administration Section, BPS
From: Mr. Loveridge Chief, Industrial Inorganics Section, BWFD

Date: March 12, 1982

Permit No: NY 000 1015

SIC CODE: 4911

Name: Nine Mile Point Units 1 and 2
Niagara Mohawk

Receiving Water: Lake Ontario

Location:
Scriba (T), Oswego

Class: A Special

Average Total FLow:
395 MGD Unit #1
41 MGD Unit #2

Type of Operation and Major Products:
Nuclear Electric Generation 610 MW Unit #1
1100 MW Unit #2

Production Levels if Effluent Guidelines Exist:

NA

Rationale For Permit Conditions:

1. EPA Part 423 - Existing and proposed effluent guidelines and standards for steam electric generating category.

2. NYS Water Quality Criteria & Standards (Part 701-704).

3. Review of documents submitted by the permittee which evaluated the environmental effects of the facility's circulating cooling water system.

Comments on Pertinent Data:

1. NYSDEC has utilized existing and proposed EPA effluent guidelines to determine appropriate effluent limitations achievable by BAT. Limits on cyanide have been included since the permittee's priority pollutant monitoring indicated that the facility was discharging cyanide. Discharges of significant concentrations of other priority pollutants were not noted.

2. The SPDES permit issued for this facility expired on June 31, 1981. The expired permit has continued in effect under Section 401 of the State Uniform Procedures Act.

3. Monitoring of internal waste streams has been included since it is impractical to monitor these waste streams following dilution with other waste streams.

4. New outfalls 001-008 and 040-041 become effective upon initiation of operation of Unit #2 (expected in 1986). Discharges occurring during the construction of Unit #2 are covered by SPDES permit NY 009 4463.

5. EPA staff have reviewed the permittee's 316(a) demonstration for Unit #1 and recommend that a 316(a) waiver be granted for this unit.

Staff of EPA's Water Resources Section have concluded that violation of the 3°F maximum surface temperature rise criterion (of the New York State Thermal Water Quality Criteria for Lakes) by the operation of MNPC's Nine Mile Point Unit 1 facility does not appear to have precluded the presence of a balanced, indigenous community in the vicinity of the facility. Although the facility has had some impact on the localized area, the continued operation of Nine Mile Point Unit 1 alone will not have an adverse impact on the aquatic community. This is demonstrated by the similarity between population fluctuations in the vicinity of Nine Mile Point and in the southeast area of Lake Ontario as a whole.

DEC staff concur with this conclusion. In fact, DEC approved a 3°F increase in discharge temperature and intake-discharge temperature difference for outfall 010 that was included in the SPDES permit issued for Unit #1 on June 23, 1981.

A mixing zone of 425 acres has been delineated in the permit in which the discharge from Unit #1 may exceed the 3°F surface isotherm.

6. The circulating cooling water system for Unit #2 includes a cooling tower which is reflective of best available technology economically available for reduction in heat. The discharge from the cooling tower is discharged to Lake Ontario via an offshore, twoport diffuser. It is expected that the surface plume will comply with the thermal criteria limiting the increase in surface temperature to 3oF. Interaction with the discharge plumes from the Nine Mile Point Unit #1 and adjacent PASNY Fitzpatrick facility is not anticipated to be extensive. The permittee will be required to conduct a two year monitoring program to verify the extent of the discharge plume from Unit #2 and any interaction with Unit #1 or Fitzpatrick.

   NYSDEC will review the results of this program to determine whether the permittee is in compliance with thermal water quality criteria.

7. The draft permit includes a contingent approval of the 316(b) demonstration for Unit #1. A (b) demonstration was not required for Unit #2 since the circulating cooling water system includes a cooling tower and a fish by-pass, collection and return system.

   Approval of the 316(a) and (b) demonstrations for Unit #1 allows the permittee to continue operation of the facility as presently designed. Department biologists have determined that the facility has a minimum impact on the aquatic biota of Lake Ontario. These approvals are applicable only to the 5 year life of the permit. The permit includes a biological monitoring program to assess continuing aquatic impacts of facility operation and compare these impacts with those previously monitored.

PROJECT ENGINEER: ALLAN GEISENDORFER

cc: C. Blum, NIMO , w/permit
E. Radle, BEP, w/permit
K. Gumaer, Region 7, w/permit

Copies:

Facility ID No. : NY-000 1015

Effective Date (EDP) : EDP

Expiration Date (ExDP) : EDP + 5 Years

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES)
DISCHARGE PERMIT

Special Conditions
(Part I)

DRAFT

This SPDES permit is issued in compliance with Title 8 of Article 17 of the Environmental Conservation Law of New York State and in compliance with the Clean Water Act, as amended, (33 U.S.C. §1251 et. seq.) (hereinafter referred to as "the Act").

Permittee Name: Niagara Mohawk Power Corp. Attn: Mr. J. M. Toennies, Env. Affairs Director

Permittee Street: 300 Erie Boulevard West

Permittee City: Syracuse State: NY Zip Code: 13202

is authorized to discharge from the facility described below:

Facility Name: Nine Mile Pt. Nuclear Generating Station Units #1 and 2

Facility Location (C,T,V): Scriba (T) County: Oswego

Facility Mailing Address (Street): Lake Road

Facility Mailing Address (City): Lycoming (T) State: NY Zip Code: 13093

into receiving waters known as:

Lake Ontario Class A Special

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

This permit and the authorization to discharge shall expire on midnight of the expiration date shown above and the permittee shall not discharge after the expiration date unless this permit has been renewed, or extended pursuant to law. To be authorized to discharge beyond the expiration date, the permittee shall apply for permit renewal as prescribed by Sections 17-0803 and 17-0804 of the Environmental Conservation Law and Parts 621, 752, and 755 of the Departments' rules and regulations.

By Authority of William L. Garvey, P.E., Chief, Permit Administration Section
Designated Representative of Commissioner of the
Department of Environmental Conservation

________________ Date

________________ Signature

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDP
and lasting until EDP + 5 Years
the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

Outfall Number & Effluent Parameter	Discharge Limitations Daily Avg.	Discharge Limitations Daily Max.	Units	Monitoring Reqmts. Measurement Frequency	Monitoring Reqmts. Sample Type
010 Condenser Cooling Water Unit #1					
Flow*				Continuous	Calculated
Discharge Temperature Intake - Discharge		115	°F	Continuous	Metered
Temperature Difference[a]		35	°F	"	"
Net Rate of addition of heat[a]		1.11	10^9kcal/hr.	Hourly	Calculated
Cyanide[d]		0.1	mg/l	Monthly	12.-hr.Composite
011 Unit #1 Wastewater					
Flow*				Batch Once before Discharge	Calculated
Oil and Grease		15	mg/l	"	Grab
Suspended Solids	30	50	mg/l	"	"
pH	6.0 - 9.0 (Range)		SU	"	"
Cyanide[d]	0.4		mg/l	"	"
020 Storm Drainage (No Monitoring Required) Unit #1					
021 Filter Backwash & Makeup Demineralizer Water Supply					
Flow*				Batch Once before discharge	Calculated
Oil and Grease		15	mg/l	"	Grab
Suspended Solids	30	50	mg/l	"	"
pH	6.0 - 9.0 (Range)		SU	"	"
022 Security Building Air Conditioning[b]					
Oil and Grease		15	mg/l	Bimonthly	Grab
Suspended Solids	30	50	"	"	"
pH	6.0 - 9.0 (Range)		SU	"	"

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning with initiation of reactor low power testing (Unit #2) and lasting until EDP + 5 Years
the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

Outfall Number & Effluent Parameter	Discharge Limitations Daily Avg.	Discharge Limitations Daily Max.	Units	Monitoring Reqmts. Measurement Frequency	Monitoring Reqmts. Sample Type
001-006 Storm Drainage (No monitoring required)					
007 Floor and Equipment Drains					
Oil and Grease		15	mg/l	2/Month	Grab
Suspended Solids	30	50	"	"	"
pH 6.0 - 9.0 (Range)			SU	"	"
008 Screen Well Fish Diversion System (No Monitoring Required)					
040 - Cooling Tower Blowdown (Unit #2)[c]					
FLow*				Continuous	Recorder
Discharge Temperature		110(43.3)	°F(°C)	"	"
Intake - Discharge Temperature Difference		30(16.7)	"	"	"
Net Addition of Heat		0.12×10^9	kcal/hr.	Daily	Calculated
Total Residual Chlorine	0.2	0.5	mg/l	Continuous	Recorder
pH 6.0 - 9.0 (Range)			SU	2/Week	Grab
041 Unit #2 Wastewater (Including Demineralizer Regeneration Wastes, Filter Backwash, Floor Drains, & Treated Radioactive Wastes).					
FLow*				Batch	Calculated
Oil and Grease		15	mg/l	"	Grab (once before discharge)
Suspended Solids	30	50	"	"	"
pH 6.0- 9.0 (Range)			SU	"	"

FOOTNOTES

*Monitoring Requirement Only

[a]The intake temperature shall be considered that temperature existing after intake water tempering.

[b]These limits and monitoring requirements shall not apply if this wastewater is discharged upstream of the sewage treatment facility.

[c]There shall be no discharge of heat from the main condensers except heat may be discharged in blowdown from recirculcated cooling water systems provided the temperature at which the blowdown is discharged does not exceed at any time the lowest temperature of recirculated cooling water prior to the addition of the makeup water.

[d] Monitoring and limits may be deleted following DEC evaluation of one year of monitoring data.

EFFLUENT LIMITATIONS

During the period beginning EDP and lasting until EDP + 5 Years discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

TABLE I

Outfall Number	Effluent Limitations (Maximum Limits except where otherwise indicated)			
030	(X) Flow	30 day arithmetic mean	65,000	( )MGD (X)GPD
	(X) BOD_5	30 day arithmetic mean	25 mg/l and	___ lbs/day (1)
	( ) BOD_5	7 day arithmetic mean	___ mg/l and	___ lbs/day
	(X) BOD_5	Daily	45 mg/l and	___ lbs/day
	( ) UOD (2)	Daily	___ mg/l and	___ lbs/day
	(X) Suspended Solids	30 day arithmetic mean	25 mg/l and	___ lbs/day (1)
	( ) Suspended Solids	7 day arithmetic mean	___ mg/l and	___ lbs/day
	(X) Suspended Solids	Daily	45 mg/l and	___ lbs/day

(X) Effluent disinfection required: (X) all year
( ) Seasonal from ______ to ______
Fecal Coliform 30 day geometric mean shall not exceed 200/100 ml
Fecal Coliform 7 day geometric mean shall not exceed 400/100 ml
Fecal Coliform 6 hour geometric mean shall not exceed 800/100 ml (3)
Fecal Coliform No individual sample may exceed 2400/100 ml (3)
If chlorine is used for disinfection, a chlorine residual of 0.5-2.0 mg/l shall be maintained in the chlorine contact chamber whenever disinfection is required. If specified here, the chlorine residual in the final discharge shall not exceed 0.5 mg/l.

( )	Total Coliform	Daily	___ /100 ml
( )	Total Kjeldahl Nitrogen	Daily	___ /mg/l as N
( )	Ammonia	Daily	___ /mg/l as NH_3
( )	Dissolved Oxygen	Minimum	greater than ___ mg/l
(X)	pH	Range	6.0 to 9.0
(X)	Settleable Solids	Daily	0.1 ml/l
( )	Phosphorus	Daily	___ mg/l as P
( )	Total Nitrogen	Daily	___ mg/l as N
( )	___		

TABLE 2

Monitoring Requirements

Parameter	Frequency	Sample Type	Sample Location Influent	Sample Location Effluent
(X) Total Flow, MGD	2/Month	Grab		
(X) BOD_5, mg/l	"	"		
(X) Suspended Solids, mg/l	"	"		
(X) Fecal Coliform, No./100 ml	"	"		
( ) Total Coliform, No./100 ml				
( ) Total Kjeldahl Nitrogen, mg/l as N				
( ) Ammonia, mg/l as NH_3				
( ) Dissolved Oxygen, mg/l				
(X) pH	2/Month	Grab		
(X) Settleable Solids, ml/l	"	"		
(X) Residual Chlorine, mg/l	"	"		X (4)
( ) Phosphorus, mg/l as P				
( ) Temperature, °C				
( ) Total Nitrogen, mg/l as N				
( ) Visual Observation				
( ) ___				

(1) and effluent values shall not exceed ______ % of influent values.
(2) UOD (Ultimate Oxygen Demand) shall be computed and reported as follows:
$UOD = 1\frac{1}{2} \times BOD_5 + 4\frac{1}{2} \times TKN$ (Total Kjeldahl Nitrogen).
(3) applicable only in the Interstate Sanitation District.
(4) sample contact chamber effluent and final effluent if limits are specified for both.

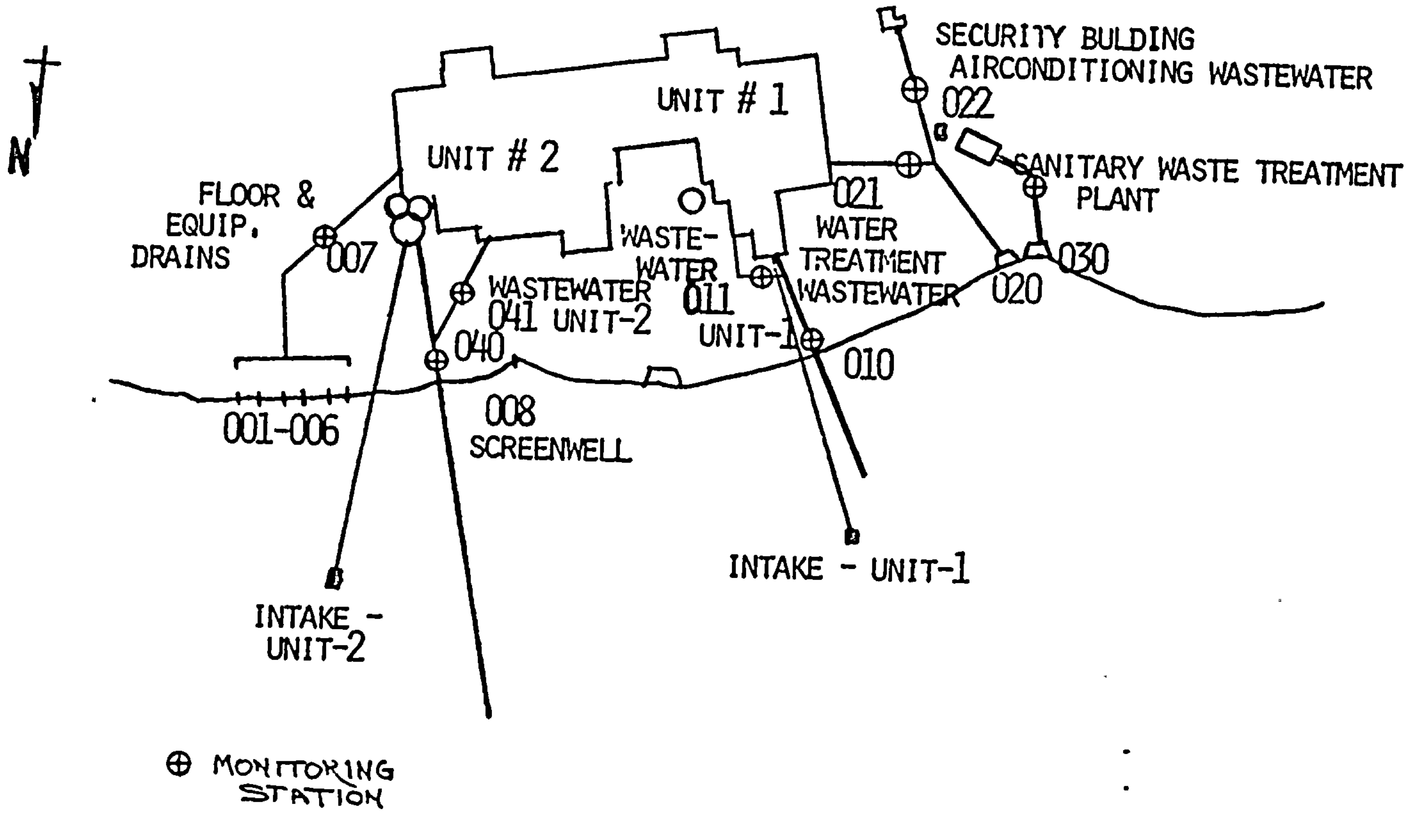
Definition of Daily Average and Daily Maximum

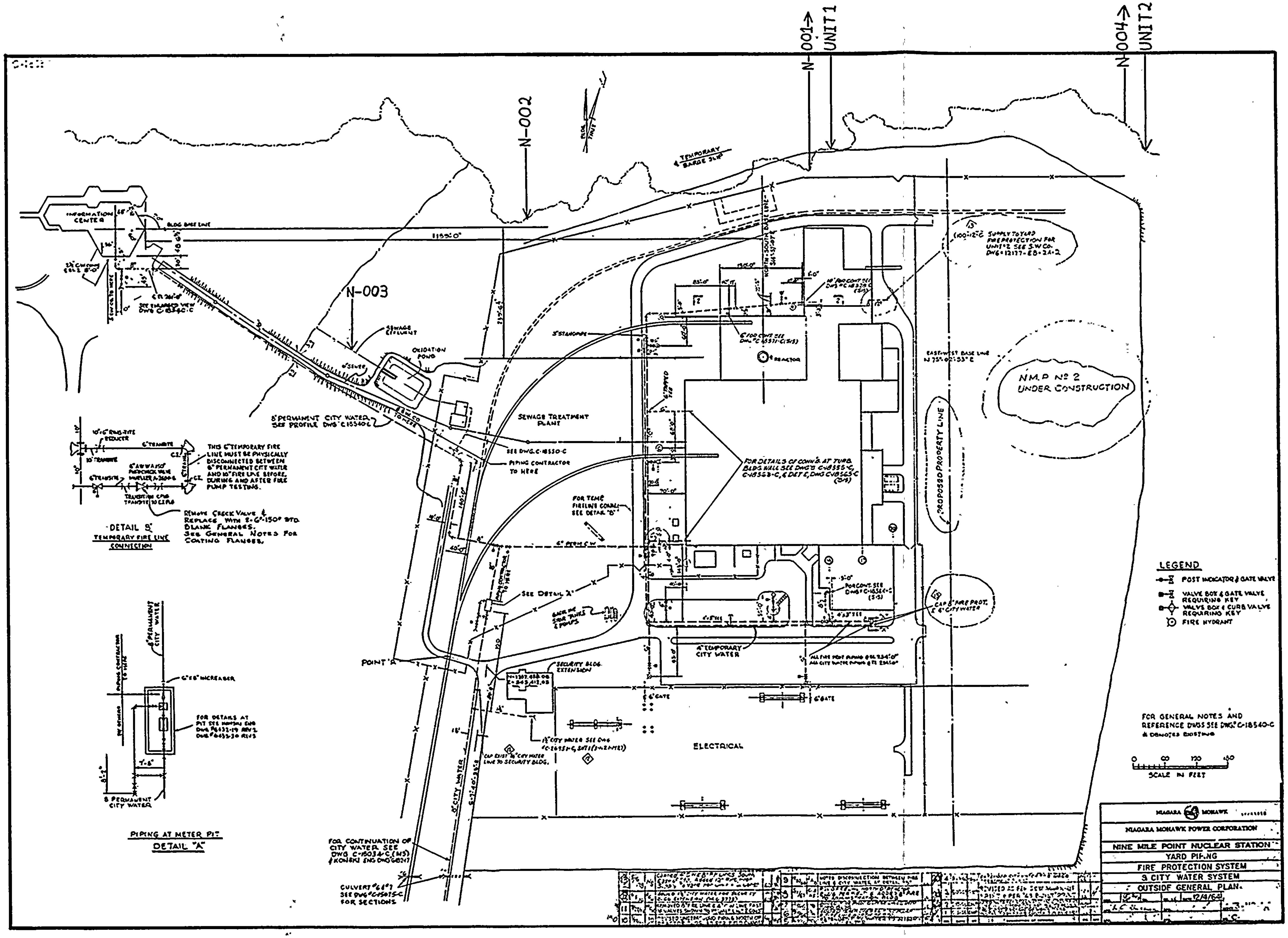
The daily average discharge is the total discharge by weight or in other appropriate units as specified herein, during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges in appropriate units as specified herein divided by the number of days during the calendar month when the measurements were made.

The daily maximum discharge means the total discharge by weight or in other appropriate units as specified herein, during any calendar day.

Monitoring Locations

Permittee shall take samples and measurements to meet the monitoring requirements at the location(s) indicated below: (Show locations of outfalls with sketch or flow diagram as appropriate).




N-001→
UNIT1
N-004→
UNIT2
N-002
N-003
INFORMATION CENTER
OXIDATION POND
SEWAGE TREATMENT PLANT
REACTOR
N.M.P. No 2
UNDER CONSTRUCTION
PROPOSED PROPERTY LINE
8" PERMANENT CITY WATER
POINT 'A'
8" CITY WATER
ELECTRICAL
DETAIL 'B'
TEMPORARY FIRE LINE CONNECTION
PIPING AT METER PIT
DETAIL 'A'
LEGEND
POST INDICATOR & GATE VALVE
VALVE BOX & GATE VALVE REQUIRING KEY
VALVE BOX & CURB VALVE REQUIRING KEY
FIRE HYDRANT
FOR GENERAL NOTES AND REFERENCE DWGS SEE DWG C-18540-C
SCALE IN FEET
NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT NUCLEAR STATION
YARD PIPING
FIRE PROTECTION SYSTEM
& CITY WATER SYSTEM
OUTSIDE GENERAL PLAN

ADDITIONAL REQUIREMENTS:

I. The following requirements are applicable to Units #1 and 2.

1. There shall be no discharge of PCBs from this facility.

2. In regard to general conditions 11.5, items #3, and #4 shall be reported semi-annually to NYSDEC offices in Cortland and Albany.

3. There shall be no discharge of boiler chemical cleaning compounds or boiler blowdown from this facility.

4. Radiocativity

   a. Gross Beta - shall not exceed 1,000 picocuries per liter in the absence of Sr^{90} and alpha emitters.

   b. Radium 226 - Shall not exceed 3 picocuries per liter.

   c. Strontium 90 - Shall not exceed 10 picocuries per liter.

5. The permittee shall submit on a trimesterly basis a report to the Department's offices in Cortland and Albany by the 28th of the month following the end of the period. Submission of reports for Unit #2 shall commence with the initiation of reactor low power testing.

   a. Daily minimum, average, and maximum station electrical output shall be determined and logged.

   b. Daily minimum, average, maximum water use shall be directly or indirectly measured or calculated and logged.

   c. Daily minimum, average, and maximum intake and discharge temperatures shall be logged.

   d. Measurements in a,b, and c shall be taken on an hourly basis.

6. The location, design, construction, and capacity of cooling water intake structures, in connection with point source thermal discharges, shall reflect the best technology available for minimizing adverse environmental impact.

7. All thermal discharges to the waters of the state shall assure the protection and propagation of a balanced indigenous population of shellfish, fish, and wildlife in and on the body of water.

8. Niagara Mohawk shall notify the Department within one week from the time of submission to the Nuclear Regulatory Commission of any requested changed in the environmental technical specifications reouirements which could in any way affect the requirements of this permit.

9. Niagara Mohawk shall also submit concurrently to the Department any report on the environment it submits to any federal, state, or local agency.

10. Niagara Mohawk shall provide access to the Nine Mile Point Site at any time to representatives of the Department subject to site security regulations to assess the environmental impact of the operation of the Nine Mile Point Nuclear Facility and to review any sampling program, methodology, and the gathering and reporting of any data.

11. No biocides, slimicides, or corrosion control chemicals are authorized for use, except for those listed by parameter in the permit. Prior Department approval is required for any additional use of these chemicals as well as for theuse of any new water treatment chemicals.

II. The following requirements are applicable to Unit #1.

1. By EDP + 1 month, the permittee shall submit final plans, signed and sealed by an engineer licensed to practice in New York State, describing the termination of discharges 011 and 021 as previously proposed by permittee in their 12/21/81 submision.

2. By EDP + 9 months, the permittee shall terminate discharges 011 and 021.

3. The Department has approved the applicant's request pursuant to Section 316(a) of the Clean Water Act (CWA) for alternative effluent limitations at this facility. The thermal effluent limitations on page 2 of this permit reflect this approval.

4. The water temperature at the surface of Lake Ontario shall not be raised more than three Fahrenheit degrees over the temperature that existed before the addition of heat of artificial origin except in a mixing zone consisting of an area of 425 acres from the point of discharge, this temperature may be exceeded.

5. The Department has contingently approved the applicant's consideration of intake impacts submitted pursuant to Section 316(b) of the CWA.Completion of the biological monitoring program described in Additional Requirement Section IV and demonstration of impacts similar to previous studies is required to obtain final approval of the 316(b) request.

III. The following requirements are applicable to Unit #2.

1. By initiation of reactor lower power testing, the company shall file for approval with the Department at its offices in Albany and Syracuse an updated report on all Unit #2 water treatment, corrosion inhibitor, anti-fouling, slimicide, biocide, and boiler cleaning chemicals or compounds. Such report shall identify each product by chemical formula and/or composition, annual consumption, frequency of use, maximum use per incident, effluent concentration, bioassay and toxicity limits, and procedures for use. Approval shall only be granted for those circumstances and uses which do not contravene New York State Water Quality Standards. No substitutions will be allowed without prior approval. Wastewaters containing chemicals and oil shall be collected and treated prior to dilution with non-contact cooling water in faciliites which shall be approved by the Department.

2. No discharge from this facility shall cause violation of the New York State Department of Health regulations contained in 10 NYCRR Part 170 at the source of intake of any water supply used for drinking, culinary or food processing purposes.

3. Pursuant to Part 704 Criteria Governing Thermal Discharges, Section 704.3-Mixing Zone Criteria, upon the presentation of a final design for the discharge, the Department shall specify, as appropriate, definable numerical limits for the mixing zone, including linear distances from the point of discharge, surface area involvement, and volume of receiving water entrained in the thermal plume.

4. Not less than 180 days prior to the initiation of discharge from the Nine Mile Point Nuclear Generating Station Unit #2, Niagara Mohawk shall submit for approval to the Department of Environmental Conservation a plan of study for evaluating the environmental effects of such discharges on Lake Ontario which shall include but not be limited to the following:

   a. Assessment of the effects of the intake on organisms entrained in the intake water flow.

   b. Assessment of the effects of the intake on fishes impinged on any intake structure screens.

   c. Verification of the extent of the thermal plume in the receiving waters by conducting thermal surveys in alternate months except for December through March during the first two years of operation.

   d. Prior to operation of Nine Mile Point Unit #2, existing biological studies in Lake Ontario as required by regulatory agencies shall continue; subsequent to Unit #2 operation, such study programs shall be adjusted as required by regulatory agencies to assess the operating impact of Unit #2. Requirements to submit reports, frequency of submission, and content shall be established at the time of approval of the study programs.

5. Not less than 180 days prior to the initiation of discharges from the Nine Mile Point Nuclear Generating Station Unit #2, Niagara Mohawk shall submit to NYSDEC offices in Albany three copies of the following plans and specifications. Plans shall be stamped by an engineer licensed in New York State.

   a. Plans of proposed structures, including intake structure, diffuser, tunnel cross-section, cooling tower, screenwell building, and equipment.

   b. Plans of all onsite treatment facilities including oil/water separators.

   c. Piping and/or flow diagrams for all facility waste streams, including any piping to or from Nine Mile Point Unit #1 and contaminated plant and site drainage.

   d. Flow diagram of circulating cooling water system from the intake to the diffuser.

   e. Specifications on piping and pumps.

IV. Biological Monitoring and Related Matters

a. Previous Biological Monitoring Data - By July 1, 1982, the permittee shall file with the Chief, Bureau of Environmental Protection in Albany; Fishery Section head in Cape Vincent; and with the Regional Supervisor of Fish and Wildlife in Syracuse a report containing and/or identifying all previous reports regarding this facility which contain biological data relating to the ecological effects of plant operation from March 31, 1975 to the present. Previously submitted reports need not be duplicated, but title, date, and data location must be completely identified. A copy of all unsubmitted reports and data shall be sent to the above offices by July 1, 1982. Data to be report should include , but is not necessarily limited to cooling water flows, dates, times, available operating and meteorological conditions, and species, numbers, and other available biological information.

b. Impingement Monitoring - The permittee shall conduct a program to determine the numbers and total weights by species of fish impinged on all intake traveling screens.

1. Collections shall be made seventy-eight (78) days each year, provided that the circulating water pumps are in operation. When collection days coincide with shut down of the main circulating water pumps, collections need not be taken. Collections shall be obtained at the following intensity on days randomly selected within each month. Should the randomly selected dates result in a period in excess of 10 days during any month in which sampling does not occur, additional sampling is required so that periods in excess of 10 days without a sample do not occur.

Month	Number of Sample Days
January	4
February	4
March	4
April	16
May	20
June	4
July	4
August	6
September	4
October	4
November	4
December	4

2. Collections shall be conducted for a minimum period of 24 hours. The beginning of the 24-hour period shall be selected and held constant by the permittee for all collections.A collection period shall be no longer than 26 hours. Impingement collection shall be calculated and reported on a 24-hour basis.

3. Travelling screens shall be washed untill they are clean prior to the start of the 24-hour collection period.

4. Individual length (cm) and weight (g) measurements shall be made on white perch, smallmouth bass, yellow perch, alewife, rainbow smelt, and each species of salmonid in order to characterize the size distribution for each 24-hour collection. No less than 25 organisms of each species shall be measured unless less than 25 individuals occur in the collection.

If more than 25 individuals of a single species are collected, except for smallmouth bass, yellow perch and each species of salmonid which are to be processed separately, a representative subsample of 25 fish shall be removed and lengths and weights recorded for the subsample. In the event of high impingment numbers, an estimate of the numbers and total weights by species fish shall be calculated as follows:

$$\text{Estimated No. of Fish} = \frac{(\text{Volume of Total Sample}) \times (\text{No. of Fish in Subsample})}{\text{Volume of Subsample}}$$

The total sample volume shall be determined by repeatedly filling a volumetrically graduated 20-gallon plastic container and then recording and summing the values. The total volume is then thoroughly mixed by hand or with a shovel and spread out evenly over a flat surface. An aliquot of the total sample is randomly selected and this sample portion is removed from the flat surface and measured in the graduated container to determine its approximate volume. The total number of fish in the subsample is then determined.

In the event of extremely large impingement loads, the permittee may request regional staff to make adjustments to or suspend the above subsampling procedures.

5. Electrical output and operation of the condenser cooling water system including intake and discharge temperature and total flow shall be recorded on a daily basis and tabulated as required in the following section on reporting.

6. By July 1, 1982, the permittee shall file for approval at the office in Section IVa. above a planwhich will determine the collection efficiency of the following impinged organisms: white perch, smallmouth bass, yellow perch, alewife, and rainbow smelt. Prior collection efficiency data specific to this plant may be substituted for the above plan provided that it is submitted by July 1, 1982, to NYSDEC and approved by NYSDEC.

c. Reporting

1. All data required by Section IV or incorporated by reference in Section IV shall be included in an annual biological monitoring report.

2. The annual report shall be submitted by six months from the last month of data collection.

3. The following shall be included in the annual report in addition to (1) above:

a. Monthly and annual totals of impingement by species and grand total over all species. The calculations to be done are as follows:

-1- Monthly "mean" is equal to the total number of fish impinged by species on the sampling days in the month divided by the total number of sampling days.

-2- Annual "mean" is equal to the total number of fish impinged by species on the sampling days in the year divided by the total number of sampling days.

Similar calculations shall be made for a grand total over species. The total number of fish and sampling days shall be clearly indicated in any table reporting the "totals."

b. An estimate of the collection efficiencies to be determined pursuant to Section IV b.(6) above. If sufficient time is not available to include these estimates in the first annual report, the permittee may, upon written request and substantiation and with NYSDEC approval, extend this reporting requirement into an annual report other than the initial.

c. Estimates shall be developed of the average monthly impingement rate based on the number of sampling days and total volume of water pumped during these days, and also of the total monthly impingement based on the average monthly rate and the volume of water pumped during the month, for each species impinged.

4. All measurement shall use the metric system, e.g. flows should be in cubic meters/sec. (m^3/s).

5. Copies of all reports regarding water and biological parameters related to intake and discharge considerations, whether generated for this permit or otherwise, shall be sent to the offices in Section IV a. above.

6. Report(s) submitted in fulfillment of permit conditions shall clearly identify on the title page the permit number and the specific section(s) by character and number that the report(s) fulfill. Each section of the text of such report(s) shall identify the section(s) of the permit that it fulfills.

7. NYSDEC reserves the right to have more frequent submittal of the data required to be reported, provided that the permittee is given at least one (1) month prior notice of such more frequent reporting requirements.

8. The measures the permittee instituted, if any, in the reporting year to accomplish minimization of facility impacts on aquatic biota.

9. The formats for reporting the following data are included in Appendix A. Data sheets for reporting in the Annual Report:

   a. Flow
   b. Temperature
   c. Circulator operation
   d. Electrical output

d. Biological specimens may be required to be submitted to NYSDEC upon request.

e. The facility shall be operated in such a manner as to minimize facility impacts on aquatic biota.

f. As a result of NYSDEC's review of the biological monitoring program, the permittee may be required to implement appropriate methods and procedures to reduce to the fullest extent possible the effects of facility operation on aquatic organisms.

SCHEDULE OF COMPLIANCE FOR EFFLUENT LIMITATIONS
(Continued)

c) The permittee shall submit copies of the written notice of compliance or noncompliance required herein to the following offices:

Chief, Compliance Section
New York State Department of Environmental Conservation
50 Wolf Road
Albany, New York 12233

Regional Engineer #7
New York State Department of Environmental Conservation
7481 Henry Clay Boulevard
Liverpool, NY 13088

Dr. Richard Baker, Chief
Permits Administration Branch
Planning & Management Division
USEPA Region II, 26 Federal Plaza
New York, New York 10278

The permittee shall submit copies of any engineering reports, plans of study, final plans, as-built plans, infiltration-inflow studies, etc. required herein to the New York State Department of Environmental Conservation Regional Office specified above unless otherwise specified in this permit or in writing by the Department or its designated field office.

91-18-2 (9/76)

MONITORING, RECORDING AND REPORTING

a) The permittee shall also refer to the General Conditions (Part II) of this permit for additional information concerning monitoring and reporting requirements and conditions.

b) The monitoring information required by this permit shall be summarized and reported by submitting a completed and signed Discharge Monitoring Report form once every 1 months to the Department of Environmental Conservation and other appropriate regulatory agencies at the offices specified below. The first report will be due no later than
Thereafter, reports shall be submitted no later than the 28th of the following month(s):

Water Division
New York State Department of Environmental Conservation
50 Wolf Road - Albany, New York 12233

New York State Department of Environmental Conservation
Regional Engineer - Region #7
7481 Henry Clay Boulevard
Liverpool, N.Y. 13088

Oswego County Dept. of Health
P.O. Box 1325
421 Montgomery Street
Syracuse, New York 13202
Attn: Bob Burdick

[X] (Applicable only if checked):
Dr. Richard Baker, Chief - Permits Administration Branch
Planning & Management Division
USEPA Region II
26 Federal Plaza
New York, New York 10278

c) If so directed by this permit or by previous request, Monthly Wastewater Treatment Plant Operator's Reports shall be submitted to the DEC Regional Office and county health department or county environmental control agency specified above.

d) Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

e) If the permittee monitors any pollutant more frequently than required by the permit, using test procedures approved under 40 CFR 136 or as specified in the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Discharge Monitoring Reports.

f) Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean unless otherwise specified in the permit.

g) Unless otherwise specified, all information submitted on the Discharge Monitoring Form shall be based upon measurements and sampling carried out during the most recently completed reporting period.

h) Blank Discharge Monitoring Report Forms are available at the above addresses.

APPENDIX 1B

SECTION 401 WATER QUALITY CERTIFICATION
NINE MILE POINT NUCLEAR STATION UNIT 2
NIAGARA MOHAWK POWER CORPORATION

New York State Department of Environmental Conservation

Division of Pure Waters

Peter A. A. Berle,
Commissioner

February 23, 1977

Mr. J. M. Toennies, Director
Environmental Affairs
Niagara Mohawk Power Corporation
300 Erie Boulevard West
Syracuse, New York 13202

Re: 401 Water Quality Certification
Nine Mile Point Nuclear Station
Unit #2

Dear Mr. Toennies:

In response to your request of February 24, 1976 for recertification pursuant to Section 401 of the Federal Water Pollution Control Act Amendments of 1972 to the original certification issued for this facility dated October 12, 1973, the New York State Department of Environmental Conservation hereby supercedes the existing certification as follows:

Public notice was duly given pursuant to Part 608.16 of the Official Compilation of Codes, Rules and Regulations of the State of New York. The Department of Environmental Conservation hereby issues the certification in accordance with Section 401 of the Act and in accordance with applicable effluent limitations or other limitations in Sections 301, 302, 306 and 307 of the Act for construction of the Nine Mile Point Unit #2 Nuclear Generating facility on Lake Ontario in the Town of Scriba, Oswego County, New York.

This certification is intended to apply to proceedings before the U. S. Nuclear Regulatory Commission and the U. S. Environmental

Protection Agency. This certification is issued due to fundamental changes in the circulating cooling water system from open cycle once through cooling to closed cycle cooling utilizing a natural draft evaporative cooling tower. Based upon the foregoing, the Department of Environmental Conservation hereby certifies that Niagara Mohawk will comply with all applicable provisions of 301, 302, 306 and 307 of the Act for its Nine Mile Point Nuclear Generating Station Unit #2 provided that:

I. There are no future changes in any of the following that would result in non-compliance with Sections 301, 302, 306 and 307 of the Act.

A. The proposed construction and operation of the facility;

B. The characteristics of the waters into which discharges are made;

C. The water quality criteria applicable to such waters;

or

D. Applicable effluent limitations or other requirements.

II. The applicable provisions of State laws and regulations are complied with; and

III. The following effluent limitations and monitoring requirements which shall be conditions of any U. S. Nuclear Regulatory Commission license or U. S. Environmental Protection Agency NPDES permit for Nine Mile Point Unit #2 pursuant to Section 401d of the Act are complied with.

1. Pursuant to Part 704 Criteria Governing Thermal Discharges Section 704.1(a),all thermal discharges to the waters of the State shall assure the protection and propagation of a balanced indigenous population of shellfish, fish and wildlife in and on the body of water

2. Pursuant to Part 704 Criteria Governing Thermal Discharges Section 704.5 the location, design, construction and capacity of cooling water intake structures in connection with point source thermal discharges shall reflect the best technology available for minimizing adverse environmental impact.

3. Pursuant to Part 701 Classifications and Standards of Quality and Purity Part 701.4 the following classes and standards for fresh surface waters shall be attained in Lake Ontario outside the zone of active mixing induced by the turbulence of the discharge.

Suspended, colloidal or settleable solids	None from sewage, industrial wastes or other wastes which will cause deposition or be deleterious for any best usage determined for the specific waters which are assigned to each class.
Oil and floating substances	No residue attributable to sewage, industrial wastes or other wastes nor visible oil film nor globules of grease.
Taste and odor-producing substances, toxic wastes and deleterious substances	None in amounts that will be injurious to fishlife or which in any manner shall adversely effect the flavor, color or odor thereof, or impair the waters for any best usage as determined for the specific waters which are assigned to each class.
Radioactivity	
a. Gross Beta	Shall not exceed 1,000 picocuries per liter in the absence of Sr^{90} and alpha emitters.
b. Radium 226	Shall not exceed 3 picocuries per liter.
c. Strontium 90	Shall not exceed 10 picocuries per liter.

4. Pursuant to Part 702 Special Classifications and Standards Section 702.1 Quality Standards for Class A Special Waters the following additional requirements shall be achieved in Lake Ontario outside the zone of active mixing induced by the turbulence of the discharge.

Total Dissolved Solids	Should not exceed 200 milligrams per liter
pH	Should not be outside the range of 6.7 to 8.5
Radioactivity	Should be kept at the lowest practicable levels and in any event should be controlled to the extent necessary to prevent harmful effects on health.

5. No discharge from this facility shall cause violation of the New York State Department of Health regulations contained in 10 NYCRR Part 170 at the source of intake of any water supply used for drinking culinary or food processing purposes.

6. Pursuant to Part 704 Criteria Governing Thermal Discharges Section 704.3 Mixing Zone Criteria, upon the presentation of a final design for the discharge the Department shall specify definable numerical limits for the mixing zone, including linear distances from the point of discharge, surface area involvement, of volume of receiving water entrained in the thermal plume, as appropriate.

7. Not less than 180 days prior to the initiation of discharge from the Nine Mile Point Nuclear Generating Unit #2 Niagara Mohawk shall submit to the Department of Environmental Conservation, for approval, a plan of study for evaluating the environmental effects of such discharges on Lake Ontario, which shall include, but not be limited to the following:

A. Assessment of the effects of the intake on organisms entrained in the intake water flow.

B. Assessment of the effects of the intake on fishes impinged on any intake structure screens

C. The extent of the thermal plume in the receiving waters, to be verified by thermal survey in alternate months except for December through March during the first two years of operation.

D. Prior to operation of Nine Mile Point Unit #2 existing biological studies in Lake Ontario as required by regulatory agencies shall continue; subsequent to Unit #2 operation such study programs shall be adjusted as required by regulatory agencies to assess the operating impact of Unit #2. Requirements to submit reports, frequency of submission, and content shall be established at the time of approval of the study programs

7. Starting one month subsequent to plant operation Niagara Mohawk shall submit to the Department a monthly report of daily operating data by the 30th of the month following for:

A. Daily minimum, maximum and average station electrical output in megawatts;

B. Daily minimum, maximum and average intake water volume;

C. Temperature in degress farenheit of the intake and discharge shall be monitored continuously and daily minimum, maximum and average intake and discharge temperatures shall be reported.

8. There shall be no discharge of heat from the main condensors except heat may be discharges in blowdown from recirculated cooling water systems provided the temperature at which the blowdown is discharges does not exceed at any time the lowest temperature of recirculated cooling water prior to the addition of make-up water.

9. Neither free available chlorine or total residual chlorine may be discharged from any unit for more than two hours in any one day.

10. The discharge of free available chlorine shall not exceed a maximum concentration of 0.5 mg/l nor an average concentration of 0.2 mg/l, with the furter restriction that the concentration of total residual chlorine in the receiving waters outside the zone of active mixing induced by the turbulence of the discharge shall not exceed 0.05 mg/l.

11. Niagara Mohawk shall notify the Department within one week from the time of submission to the Nuclear Regulatory Commission of any requested change in the environmental technical specifications requirements which could in any way affect the requirements of this certification.

12. Niagara Mohawk shall also submit concurrently to the Department any report on the environment it submits to any Federal, State or local agency.

13. Niagara Mohawk shall provide access to the Nine Mile Point Site at any time to representatives of the Department subject to site security regulations to assess the environmental impact of the operation of the Nine Mile Point Nuclear Unit #2, and to review any sampling program, methodology, and the gathering and reporting of any data, pursuant to the conditions of this certification.

This certification is issued solely for the purpose of Section 401 of the Act. If any condition of this certification is subsequently declared invalid, the Department shall reconsider the entire certification and make appropriate amendments and modifications as a result of such considerations.

A copy of this certification is being forwarded to the Director of Regulation, United States Nuclear Regulatory Commission and the Regional Administrator of the U. S. Environmental Protection Agency, Region II.

Very truly yours,

Eugene Seebald
for

William L. Garvey
Director
Bureau of Standards & Compliance

cc: U.S. NRC
cc: U.S. EPA

CHAPTER 2

ENVIRONMENTAL DESCRIPTIONS

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CHAPTER 2

ENVIRONMENTAL DESCRIPTIONS

2.1 DESCRIPTION OF THE STATION LOCATION

The Nine Mile Point site comprises approximately 364 ha (900 acres) on Great Lots 12 and 13, which are located on the south shore of Lake Ontario in the town of Scriba, Oswego County, New York. The land is owned by Niagara Mohawk Power Corporation (NMPC). Figure 2.1-1 shows the general location of the site in relation to the surrounding 80-km (50-mi) area and shows parts of New York State, Lake Ontario, and Canada. Figure 2.1-2 shows the surrounding 10-km (6.2-mi) area and the location of the site in relation to Oswego County, New York.

Unit 2 shares the site with Nine Mile Point Unit 1. Unit 2 occupies about 18.2 ha (45 acres) of the total site. The structures located onsite are principally owned by NMPC and include: the Energy Information Center (owned jointly by NMPC and the Power Authority of the State of New York), sewage treatment plants, security buildings, Nine Mile Point Units 1 and 2, and contractor buildings. The Unit 2 natural-draft cooling tower is approximately 454 m (1,490 ft) southeast of the Unit 2 reactor centerline. Other structures are associated with the transmission lines. The James A. FitzPatrick Nuclear Power Plant, owned by the Power Authority of the State of New York, is located on a 283.5-ha (700.5-acre) site immediately east and adjacent to the Nine Mile Point site. Centerline-to-centerline distance between Unit 2 and the FitzPatrick plant is about 716 m (2,350 ft). Details of Unit 2 structures are shown on Figure 3.1-1.

There are no private residences or public facilities onsite. The Energy Information Center, however, is open to the public Tuesday through Sunday, 10:00 am to 5:00 pm, throughout the year. A picnic area is provided west of the center.

Plant property lines, site boundary lines, and the exclusion area boundary are identical as indicated on Figure 2.1-3.

The reactor center coordinates for Unit 2 are listed as follows:

Geographic Coordinates	Zone Universal Transverse Mercator (UTM)	NYS Coordinate System - Central Grid Zone
43 deg - 31' 17" N. Latitude	N4819478 m	N1283187
76 deg - 24' 27" W. Longitude	E386254 m	E546658

The nearest city is Oswego, which is about 10 km (6.2 mi) southwest of the site. Other towns, villages, and shore points located within 10 km (6.2 mi) of the site are listed in Table 2.1-1[1]. Further information about population is provided in Section 2.5.1.

Syracuse, the nearest major population center, is located about 53 km (32.8 mi) southeast of the site. Other cities, towns, and villages are shown on Figures 2.1-1 and 2.1-2. Section 2.2 provides further information on land use.

Nearby water bodies include the Otter Branch and Catfish Creek, which both flow into Lake Ontario. The former is located about 5.5 km (3.4 mi) southeast of the site, and the latter is approximately 6.8 km (4.2 mi) to the southeast.

Unit 2 is located about 1.6 km (1 mi) from the nearest public road, County Route 29, which delineates the eastern boundary of the FitzPatrick plant site. State Highway 104 is located about 6.2 km (3.9 mi) southeast of Unit 2. A spur of the Consolidated Railroad Corporation provides rail service to the station. Figure 2.1-3 provides locations and routes of major highways and railroads.

The location of the station on the south shore of Lake Ontario places it outside regular ship traffic lanes. Ships enroute to and from the Port of Oswego, the nearest commercial port, pass about 11.3 km (7 mi) north of the site[2].

2.1.1 References

1. USGS Topographic Maps, 1:24,000 Series. Washington, DC, 1954.

2. Anderson, D. Personal Communication, EXPO, Coast Guard Unit, Oswego, NY, August 14, 1979.

TABLE 2.1-1

TOWNS, VILLAGES, AND SHORE POINTS
LOCATED WITHIN 10 KM OF THE SITE

Place	Approximate Distance and Direction from Station [km, direction,(mi)]
Lycoming (V)	3.2 SE (2.0)
North Scriba (V)	4.2 SE (2.6)
Walker (V)	5.2 SW (3.2)
Hammond's Corners (V)	5.8 SE (3.6)
Scriba (T)	6.5 SW (4.0)
Demster (V)	8.0 SE (5.0)
New Haven (T)	8.9 SW (5.5)
Lake View (SP)	1.5 SW (1.0)
Nine Mile Point (SP)	3.0 E (1.9)
Demster Beach (SP)	8.0 SE (5.0)

KEY: V = Village
T = Town
SP = Shore Point

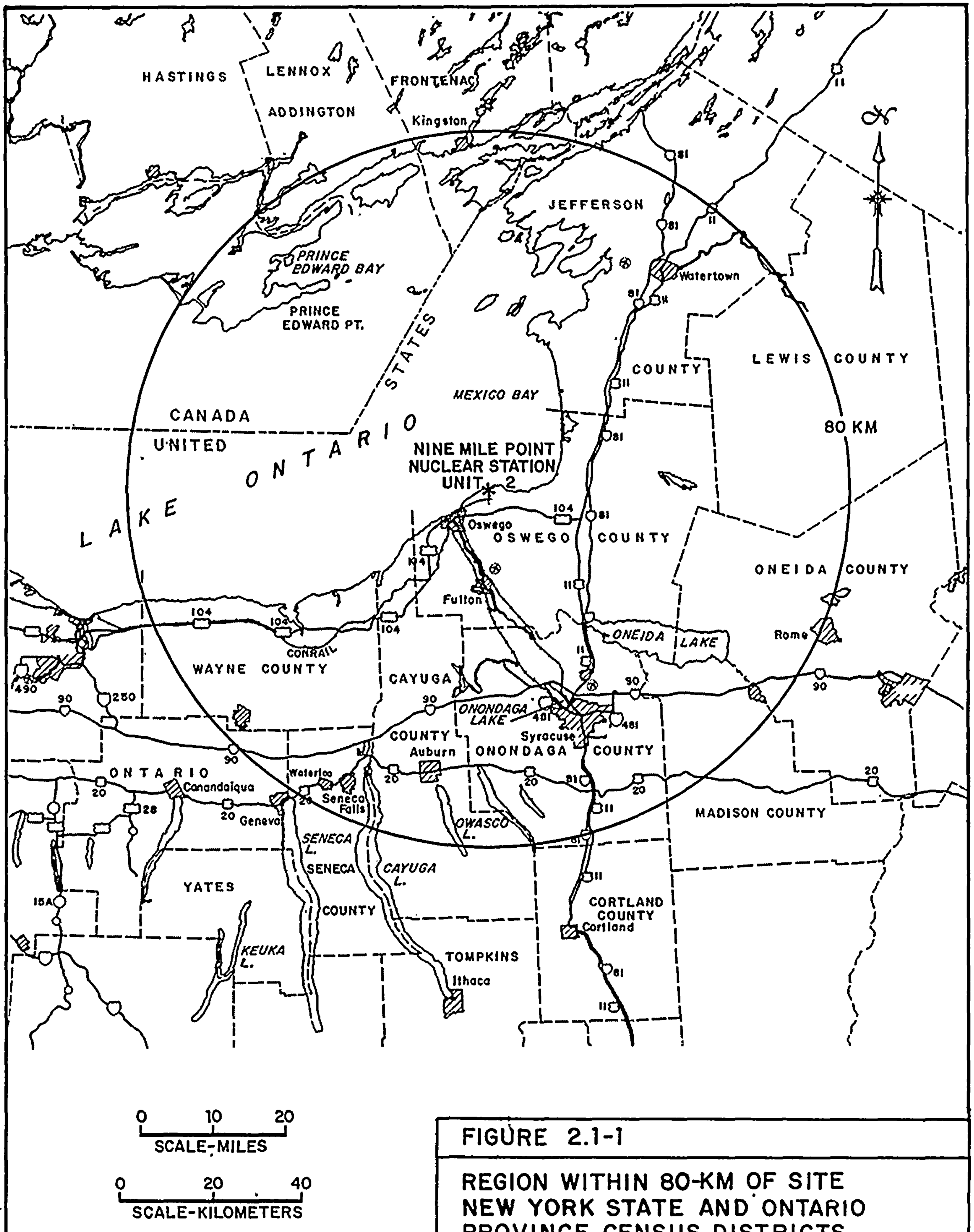


FIGURE 2.1-1

REGION WITHIN 80-KM OF SITE
NEW YORK STATE AND ONTARIO
PROVINCE CENSUS DISTRICTS

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

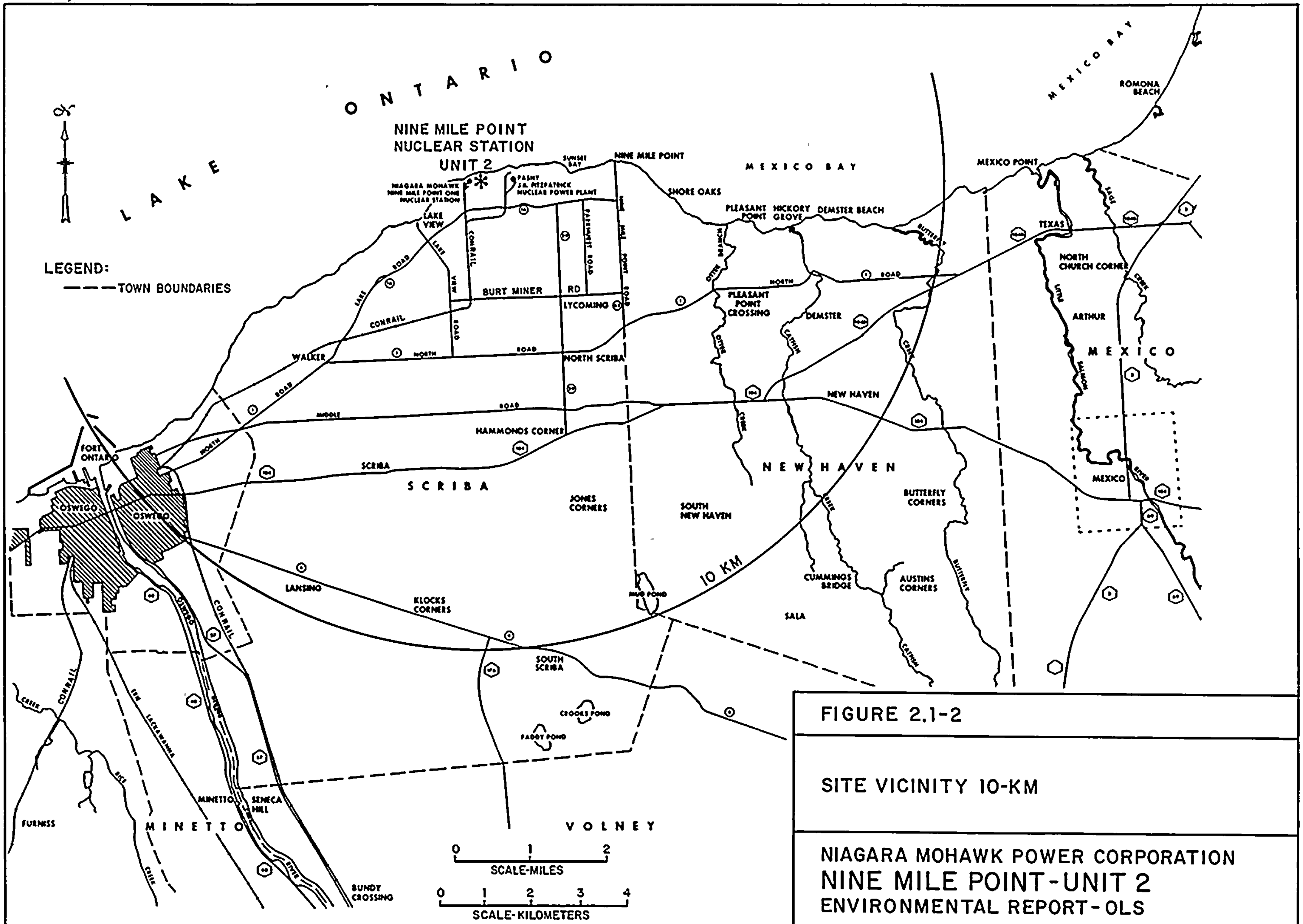


FIGURE 2.1-2

SITE VICINITY 10-KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

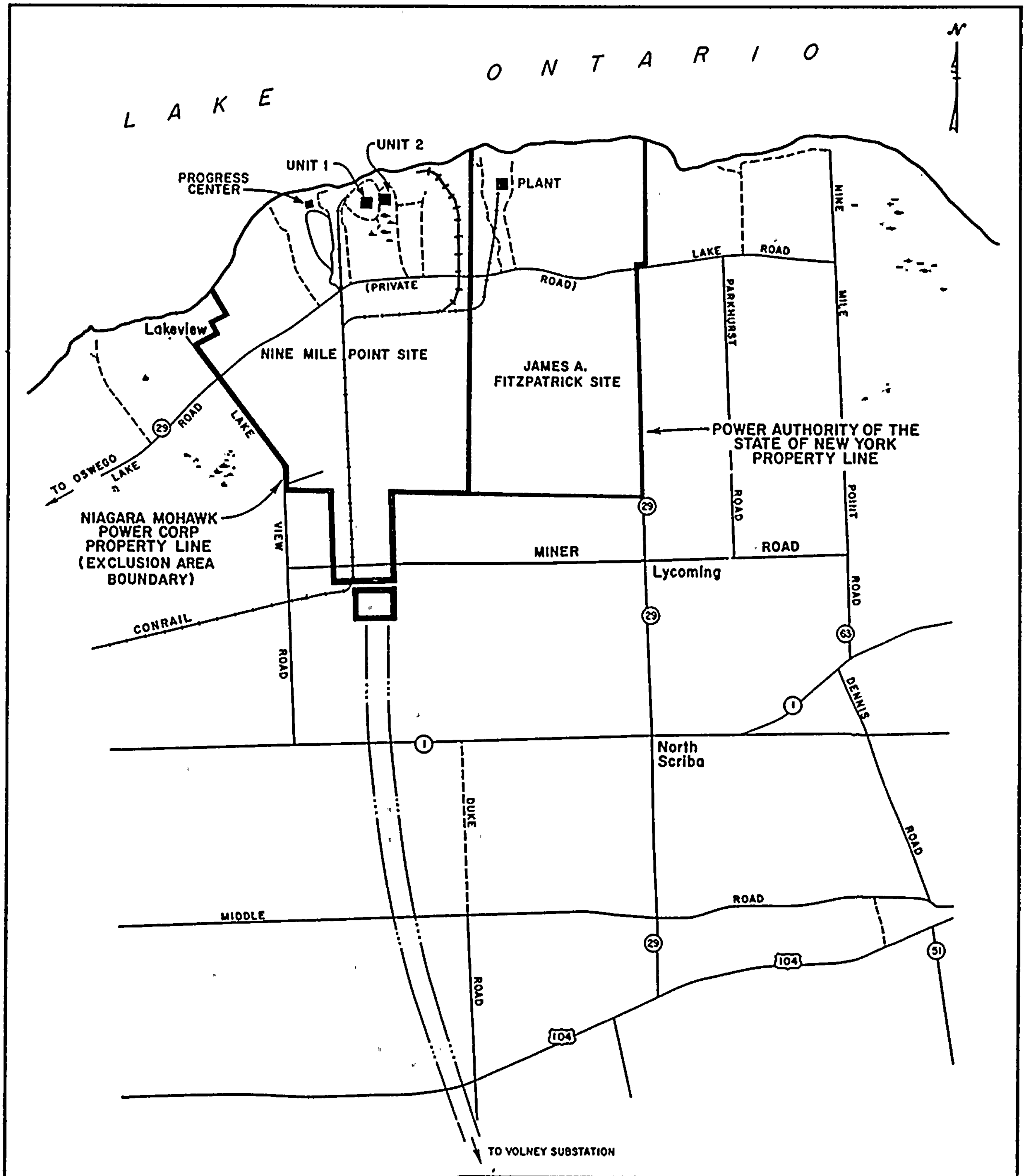


FIGURE 2.1-3

SITE BOUNDARIES AND TRANSPORTATION ROUTES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

2.2 LAND USE

2.2.1 The Site and Vicinity

2.2.1.1 Land Use Within the Site Boundary

The property for Unit 2 is located on a 364-ha (900-acre) site owned by Niagara Mohawk Power Corporation (NMPC) in the town of Scriba, Oswego County, NY. The site also includes Nine Mile Point Unit 1 (Unit 1). Approximately 21 percent of the site is classified industrial. Other major land uses within the site boundary are woodland (44 percent), communications (15 percent), inactive agricultural lands (12 percent), and wetlands (7 percent). The communications land use category includes electric power and telephone lines, microwave stations, and television and radio towers. The remainder of the site is a recreation area associated with the Nine Mile Point Energy Information Center and a small orchard. Table 2.2-1 and Figure 2.2-1 identify the land uses within the site boundary.

2.2.1.2 Land Use in the Site Vicinity

The town of Scriba is primarily rural with large areas of farmland. Residential and commercial developments are concentrated at major road intersections and along US Route 104, which crosses the town in an east-west direction. Several concentrations of residential development are located in the western area of the town, along the boundary of the city of Oswego. Seasonal residences are located along the shoreline of Lake Ontario.

The major industrial land use in the town of Scriba consists of Units 1 and 2, the James A. FitzPatrick (JAF) plant, and Alcan Aluminum Corporation.

Oswego County is primarily rural. Except for the power-generating facilities, the majority of the industrial land is concentrated around the cities of Oswego and Fulton, which are located approximately 10 km (6.2 mi) southwest and 20 km (12.4 mi) south of the site, respectively.

Land use in Oswego County is predominantly open space and agricultural. Forest, brushland, and wetlands encompass 62 percent of the county land area. Agricultural land encompasses 23 percent of the county land area. Approximately 30,000 ha (74,000 acres) are used for harvested cropland[1]. Table 2.2-2 provides agricultural characteristics for Oswego County. The number of farms in Oswego County has declined from 1974 to 1978. To encourage farmers to keep their land

in agricultural production, agricultural districts have been formed under the New York State Agricultural Districts Law of 1971. These agricultural districts are designated areas that are eligible for certain tax incentives if the land is kept in agricultural production. Oswego County has nine agricultural districts. Two of these districts encompass portions of the 10-km (6.2-mi) radius from the power plant. These two districts are Scriba, which includes Scriba and the city of Oswego, and Mexico, which includes Mexico, New Haven, and Richland[1].

Lake Ontario encompasses 19,846 ha (49,040 acres), or 63 percent of the 10-km (6.2-mi) radius from Unit 2. The 10-km (6.2-mi) radius is centered on the Unit 2 reactor, but the land uses identified do not include those land uses within the site boundary. Figure 2.1-2 identifies the 10-km (6.2-mi) radius of the site vicinity. The types and areas of land uses within the 10-km (6.2-mi) radius of the site are identified in Table 2.2-3 and Figure 2.2-2.

Although only 41 ha (101 acres) of recreational land areas exist within the 10-km (6.2-mi) radius of the site, Oswego County has a wide variety of recreational resources, including those associated with water recreation on Lake Ontario.

Within a 10-km (6.2-mi) radius of Unit 2, there are 11 recreational land areas. The nearest facility is the Energy Information Center located adjacent to Unit 1. The information center has educational exhibits, nature study trails, and a picnic area. The nearest park to the site is Scriba Park, located 8.1 km (5.0 mi) south-southwest of the site. The park encompasses 30 ha (74 acres) and has a picnic area, playground, and swimming facilities. Scriba Park has a capacity of 417 persons. Table 2.2-4 and Figure 2.2-3 identify recreational land areas within 10 km (6.2 mi) of Unit 2.

In the site vicinity, the principal transportation facilities are the road and railroad networks. A spur of the Conrail Corporation provides rail service to the site. Highway access to the site is via two county routes, Route 1A to the southwest and Route 29 to the east. A private east-west road crosses the site and connects with these two routes. Route 29 intersects County Route 1 approximately 4 km (2.5 mi) south-southwest of Unit 2. The site is accessible from Route 1 (North Road) via Routes 29, 1A, and Lake View Road. Daily traffic volume statistics include 1971 traffic counts of 1,050 vehicles on North Road, 4 km (2.5 mi) south-southwest of the site, and

1,840 vehicles on Route 1A, 4 km (2.5 mi) southwest of the site. Within 10 km (6.2 mi) of the site are 11 county roads and 2 state highways. The two state highways are Routes 104 and 104B, 6 km (3.7 mi) south and 8 km (5 mi) southeast of the site, respectively. County Route 29 connects with Route 104 at approximately 6 km (3.7 mi) south-southeast of the site. Daily traffic volume for Route 104 was 5,841 vehicles in 1979 and 7,000 vehicles in 1976[2]. Table 2.2-5 provides daily traffic volumes of county roads within the vicinity of the site. Figure 2.2-4 identifies major transportation corridors within the 10-km (6.2-mi) radius of Unit 2.

Approximately 72 km (45 mi) of the New York State Barge Canal system are located within Oswego County. The Oswego Canal, which is composed of the Oswego River and the Oneida River, flows north 38 km (24 mi) to Lake Ontario. The confluence of the Oswego River and Lake Ontario lies in the vicinity of the Nine Mile Point site.

The canal drops over 0.036 km (120 ft) from Oneida Lake to Lake Ontario through the use of seven locks, located at Brewerton, Phoenix, Fulton, Minetto, and Oswego. Lock 7 is located in the city of Oswego and within the site vicinity. The lock dimensions are 14 by 90 m (45 by 300 ft).

Commercial boats have priority over pleasure boats for passage through the canal. No other restrictions, however, are imposed on pleasure boat travel on the canal. The average operating season begins in mid-April and extends to the first week in December. Terminals for freight handling are located in the city of Oswego.

Within the 10-km (6.2-mi) radius of Unit 2 are four transmission corridors. Three of the corridors lead from Unit 1 and the JAF plant. Running south from Unit 1 are two 115-kV and two 345-kV lines. From the JAF plant is one 115-kV line running in a southerly direction and one 345-kV line running in a southeasterly direction. A corridor with two 115-kV lines, extending east to west, occupies approximately 7 percent of the Unit 2 site.

2.2.1.3 Local and Regional Land Use Plans for Site and Vicinity

The site and its immediate area have been designated for continued expansion of the electric power generating industry by the Oswego County Planning Board and zoning regulations. Other industrial growth is anticipated by the Oswego County Planning Board for the Oswego River Corridor

and in the vicinity of the cities of Oswego and Fulton. According to the 1985 and 2000 Land Use Plans for Oswego County, the area in the site vicinity has been designated primarily for rural/agricultural land uses. Future residential development in Oswego County has been designated along the Oswego River Corridor and the county's southern border[1]. The 1985 and 2000 Land Use Plans for Oswego County are identified on Figures 2.2-5 and 2.2-6, respectively.

According to the New York Statewide Comprehensive Recreation Plan, no state facilities are proposed within 10 km (6.2 mi) of the power station. The only future recreational activities proposed for Oswego County are park expansions at Selkirk Shores State Park and at Salmon River Reservoir in the town of Orwell[3].

The 10-km (6.2-mi) radius from Unit 2 encompasses portions of the towns of Scriba and New Haven, and a small portion of the city of Oswego. The towns of Scriba and New Haven presently have no zoning restrictions. The only existing land use controls for the two towns are building codes and floodplain regulations. The city of Oswego has zoning as well as building codes that apply to the use of city water and floodplain regulations[1].

As discussed in Section 2.2.1.2, the towns of Scriba and New Haven are part of agricultural districts in which designated agricultural lands are eligible for tax incentives if the land is kept in agricultural production.

2.2.2 Land Use: Transmission Corridors and Offsite Areas

2.2.2.1 Transmission Corridors

The new transmission line will extend from Unit 2 to the existing 345-kV Volney Station, 15 km (9.4 mi) south-southeast of the power plant. The new transmission line will parallel four existing lines: two 115-kV and two 345-kV lines. Two other 115-kV lines run perpendicular to the new line 1 km (0.62 mi) south of State Highway 104. The two transmission lines of the JAF plant are located approximately 1 km (0.62 mi) east of the new line. Figure 2.2-7 identifies the location of the existing and proposed transmission lines.

The existing transmission corridor has a width of 152.4 m (500 ft). This right-of-way (ROW) is owned by NMPC. The centerline of the new transmission line is located 30.5 m

(100 ft) east of the existing easternmost 345-kV line and within the ROW.

2.2.2.2 Access Routes and Offsite Areas

The new transmission line will cross nine roads: Lake Road, Burt Miner Road, County Route 1, Middle Road, U.S. Route 104, Delancy Airport Road (Lily Marsh Road), County Route 29, O'Connor Road, and Hall Road. Access to the proposed transmission structures will be from the existing access road that extends the length of the ROW. Access roads to the transmission structures will be a combination of earthen and gravel construction.

2.2.2.3 Existing Land Use

The new transmission line will extend 15 km (9.4 mi). Eight different land use categories will be crossed by the line. The predominant land use along the corridor is forest brushland (59 percent), defined as areas with more than 10 percent brush cover up to pole stands less than 30 ft in height and 40 to 50 yr of age. Table 2.2-6 identifies other land use categories crossed by the transmission line.

Within the vicinity of the transmission line, 2 km (1.2 mi) on each side of the transmission centerline, the predominant land use is forest brushland, which accounts for approximately 55 percent of the study area. Other major land uses within 2 km (1.2 mi) of the new transmission line include: inactive agricultural land, 15.1 percent; cropland/cropland pasture, 5.8 percent; mature forest, 5.2 percent; and wetlands, 9.2 percent. Table 2.2-7 and Figure 2.2-8 identify the existing land uses in the vicinity of the transmission line. No special land use classifications exist within the corridor and offsite area. No developed areas or residential structures are located on the existing ROW.

2.2.2.4 Land Use Restrictions

According to the Oswego County 1985 and 2000 Land Use Plans, prepared by the Oswego County Planning Board, transmission lines within the new corridors are compatible with area land uses. The area in the vicinity of the new transmission line is primarily designated rural/agricultural. The Land Use Plans designate the area in the vicinity of Nine Mile Point for continued expansion of electric power generation[1]. Figures 2.2-5 and 2.2-6 show the anticipated 1985 and 2000 land use.

The town of Scriba, NY, presently has no zoning restrictions. Building codes and floodplain restrictions on development within flood hazard areas exist as the only land use controls for the town of Scriba. The new transmission line will not pass through any flood hazard areas. Flood hazard areas exist within 1.6 km (1 mi) of the centerline of the ROW, but no structures would be affected by the flood hazard areas.

2.2.3 Land: The Region

The region, defined as an area within an 80-km (50-mi) radius from the site, but excluding the site and vicinity, encompasses portions of 10 New York counties: Cayuga, Jefferson, Lewis, Madison, Oneida, Onondaga, Ontario, Oswego, Seneca, and Wayne. The 80-km (50-mi) radius also includes small portions of Prince Edward, Amherst, and Wolfe Islands in Ontario, Canada. Approximately 35 percent of the 80-km (50-mi) radius encompasses a part of Lake Ontario. The region is shown on Figure 2.1-1.

The region has a number of dispersed urban centers surrounded by extensive farmlands, forests, and open areas. The city of Syracuse, located 53 km (32.8 mi) south of Unit 2, is the major urban center in the region. Approximately 58 percent of the land in the 10 counties within the 80-km (50-mi) radius is classified vacant/open space. Thirty-four percent of the land area in the region is in agricultural use. Other land uses within the region include: public, 3 percent; residential, 2 percent; and recreation, 1 percent. Less than 1 percent of the region's land area is classified industrial, commercial, extractive, or transportation. Table 2.2-8 identifies land uses for counties within the 80-km (50-mi) radius of Unit 2[1,4-11]. Figure 2.2-9 identifies existing land uses within the 80-km (50-mi) radius of Unit 2.

Land use plans for the 80-km (50-mi) radius area are shown on Figure 2.2-10. According to the counties' land use plans, development is anticipated primarily around existing population centers. Areas with prime agricultural land have been designated for preservation under the New York State Agricultural Districts Law of 1971.

2.2.3.1 Agriculture

The region is an active agricultural area. Agricultural land encompasses 7,450 sq km (2,876.4 sq mi) of the land area of the counties within 80 km (50 mi) of Unit 2. Approximately 46 percent of New York State's wheat crop is

harvested in these 10 counties. Within the 10-county region, Ontario County is the largest wheat producer, with approximately 8,701 ha (21,491.4 acres) harvested annually[12]. Of the state's corn crop harvested in this region, 39 percent is used for silage and 61 percent for grain and seed. Cayuga County produces the largest crop of corn in the region harvested for grain, with approximately 24,895 ha (61,490.6 acres) harvested annually. Jefferson County uses about 13,156 ha (32,495.3 acres) to produce the region's largest crop for corn silage[13]. Approximately 25 percent of the state's cattle is located in the region[14]. The 10-county region also produces 25 percent of New York's fruit crop[15]. Wayne County produces the largest fruit harvest in the region. Tables 2.2-9, 2.2-10, and 2.2-11 present agricultural statistics for the region[16].

2.2.3.2 Recreational Use

Seventeen state parks and one national wildlife refuge are located within the 80-km (50-mi) region. The nearest state park to Unit 2 is Selkirk Shores State Park. Selkirk Shores encompasses 397 ha (980.5 acres) and provides activities for 3,646 persons at maximum capacity[17]. Table 2.2-12 identifies the state parks and their facilities, capacities, and visitor counts within the 80-km (50-mi) radius area.

The Montezuma National Wildlife Refuge is in Seneca County. The wildlife refuge encompasses approximately 25 sq km (9.65 sq mi) and is located north of Cayuga Lake, 70 km (43.4 mi) southwest of Unit 2. Recreation areas within 80 km (50 mi) are shown on Figure 2.2-11[3].

2.2.3.3 Transportation

The city of Syracuse, located approximately 53 km (32.8 mi) south of Unit 2, is the transportation center for the region. The regional highway network consists primarily of county highways, with only four interstates and three state highways within the 80-km (50-mi) radius of the site. Syracuse marks the junction of two major interstates: the New York State Thruway and Interstate 81. Located 25 km (15.5 mi) east of Unit 2, Interstate 81 runs south from Canada. The New York State Thruway, Interstate 90, runs east-west through Syracuse, approximately 50 km (31 mi) south of Unit 2.

Two main rail lines, Conrail and Amtrak, run through the region. The main lines intersect at Syracuse and run parallel to Interstates 90 and 81. A line from the city of

Oswego provides access by rail to the site. Oswego is accessible from Syracuse and Rochester by rail.

Also connecting Syracuse and Oswego is the barge canal via the Oswego River and Onondaga Lake. The canal system permits interstate shipment via the Great Lakes and St. Lawrence Seaway.

The nearest commercial airport to Unit 2 is Hancock Airport near Syracuse, 50 km (31 mi) southeast of Unit 2. The nearest airfield to Unit 2 is the Oswego County Airport (Fulton Municipal Airport), located 20 km (12.4 mi) south of the site. Figure 2.2-12 identifies major transportation facilities within the 80-km (50-mi) radius of Unit 2.

2.2.4 References

1. Central New York Regional Planning and Development Board. Central New York Water Quality Management Program, Final Oswego County SubPlan, 1979.

2. Transmittal from Mr. Richard A. Lucas, Supervisor, Planning & Development Group, New York State Department of Transportation, November 2, 1979.

3. New York State Office of Parks and Recreation. New York Statewide Comprehensive Recreation Plan, Albany, NY, March 1978.

4. Central New York Water Quality Management Program, Final Onondaga County Subplan, 1979.

5. Central New York Water Quality Management Program, Final Cayuga County Subplan, 1979.

6. Central New York Water Quality Management Program, Final Madison County Subplan, 1979.

7. Seneca County Planning Board. General Development Plan, 1977.

8. Wayne County Planning Board. The General Plan, 1976.

9. Black River-St. Lawrence Regional Planning Board. Regional Land Use Plan, 1977.

10. Jefferson County Planning Board. Jefferson County Land Use Plan, 1978.

11. Herkimer-Oneida Counties Comprehensive Planning Program, Regional Land Use Plan, Herkimer-Oneida Counties, New York, 1977.

12. New York Crop Reporting Service. County Wheat Harvest - 1979, Albany, NY, 1980.

13. New York Crop Reporting Service. County Corn Harvest - 1979, Albany, NY, 1980.

14. New York Crop Reporting Service. Cattle Inventory by County - 1980, Albany, NY, 1980.

15. New York Crop Reporting Service. New York Orchard and Vineyard Survey - 1975, Albany, NY, 1976.

16. New York Crop Reporting Service. New York Argricultural Statistics - 1978, Albany, NY, 1979.

17. New York State Office of Parks and Recreation. Park Capacities-Oswego County. Albany, NY, July 18, 1977.

18. New York State Department of Transportation. Land Use and Natural Resource (LUNR) Map. 1968 and 1972.

19. Niagara Mohawk Power Corporation. Application for Proposed Nine Mile 2-Volney 765-kV Transmission Facility, March 1978.

20. Aerial Photographs, Scale 1 in = 1,000 ft, August 1978.

21. Oswego County Planning Board. Oswego County Data, 1977.

22. U.S. Department of Commerce, Bureau of the Census. 1978 Census of Agriculture, Preliminary Report to Oswego County, New York, 1980.

23. New York State Office of Parks and Recreation. New York State Outdoor Recreation Facilities Inventory. Albany, NY, March 9, 1978.

24. Transmittal from Mr. Martin Weiss, Oswego County Planning Board, November 7, 1979. Updated and verified, April 4, 1981.

25. Amended Article VII Application for Nine Mile 2-Volney. Niagara Mohawk Power Corporation, April 1982.

26. New York Crop Reporting Service. Milk Production - 1978, Albany, NY, 1979.

27. Telephone communication between K. Baraniak, Stone & Webster Engineering Corporation, and S. Y. Lee, New York State Office of Parks and Recreation, April 1981.

TABLE 2.2-1

LAND USE WITHIN THE SITE BOUNDARY

Land Use Category	No. of Hectares (acres)	Percent of Site*
Industrial		
Heavy manufacturing	76 (188)	21
Woodlands		
Forest	58 (143)	16
Brushland	101 (249)	28
Wetlands		
Shrub wetlands, bogs, marshes	10 (25)	3
Wooded wetlands	14 (35)	4
Active agriculture		
Orchards	<1 (2.5)	<1
Recreation	7 (17)	2
Communications		
Area of service facilities	54 (133)	15
Nonproductive		
Inactive agricultural lands	43 (106)	12

*Does not equal 100 percent due to rounding.

SOURCES: References 18, 19, and 20

TABLE 2.2-2

SELECTED AGRICULTURAL CHARACTERISTICS
OSWEGO COUNTY - 1974 AND 1978

	1974		1978	
Total number of farms	904		835	
With sales of $2,500 and over	538		555	
With sales less than $2,500	366		280	
Dairy farms with sales of $2,500 and over	273		225	
Value of dairy products sold	$ 9,648,000		$11,019,000	
Total land in farms, ha (acres)	60,860	(150,382)	57,285	(141,549)
Total cropland	33,642	(23,128)	33,098	(81,784)
Harvested croplands	21,785	(53,830)	20,626	(50,967)
Crop grain	1,624	(4,014)	1,457	(3,603)
Corn silage	3,337	(8,272)	3,348	(8,270)
Wheat	248	(612)	53	(130)
Oats (farms with sales of $2,500 and over)	837	(2,067)	666	(1,645)
Hay and grass silage	12,003	(29,647)	13,920	(34,395)
Alfalfa	2,678	(6,615)	3,822	(9,445)
Orchards	419	(1,035)	304	(751)
Vegetables, sweet corn, melons	1,787	(4,315)	2,118	(5,234)
Animals				
Milk cows	11,837		9,835	
Beef cows	2,969		1,759	
Hogs and pigs	1,827		1,179	
Sheep and lambs	360		252	
Chickens (3 months and older)	31,555		7,278	
Value of agricultural products sold	$18,189,000		$21,488,000	

SOURCES: References 21 and 22

TABLE 2.2-3

LAND USES WITHIN 10-KM (6.2-MI) RADIUS OF UNIT 2
(OUTSIDE SITE BOUNDARY)

Land Use Category	No. of Hectares	(acres)	Percent of Radius
Active Agriculture			
Cropland and cropland pasture	1,195	(2,951)	
Permanent pasture	86	(212)	
Specialty farms	2	(5)	
High-intensity cropland	138	(341)	
Orchard	58	(143)	
Total	1,479	(3,652)	5
Residential			
High density	60	(148)	
Medium density	32	(79)	
Low density	88	(217)	
Strip development	11	(27)	
Rural hamlet	127	(314)	
Shoreline cottage development	47	(116)	
Total	365	(901)	1
Industrial			
Light manufacturing	6	(15)	
Heavy manufacturing	104	(257)	
Total	110	(272)	<1
Public	59	(146)	<1
Recreation	41	(101)	<1
Commercial			
Strip development	17	(42)	
Shopping center	8	(20)	
Total	25	(62)	<1
Extractive			
Sand and gravel pits	100	(247)	<1
Transportation			
Railway facilities	4	(10)	<1

TABLE 2.2-3 (Cont)

Land Use Category	No. of Hectares	(acres)	Percent of Radius
Communications			
Area of service facilities	12	(30)	<1
Wetlands			
Wooded wetlands	690	(1,704)	
Shrub wetlands, bogs, marshes	331	(817)	
Total	1,021	(2,521)	2
Woodlands			
Forest land	460	(1,136)	
Forest plantation	61	(150)	
Forest brushland	6,026	(14,889)	
Total	6,547	(16,175)	21
Water			
Natural ponds and lakes	26	(64)	
Artificial ponds and reservoirs	2	(5)	
Marine lakes, rivers, and seas	19,846	(49,040)	
Total	19,874	(49,109)	63
Nonproductive			
Inactive agricultural lands	2,131	(5,262)	
Urban intensive	35	(86)	
Total	2,166	(5,348)	7

SOURCES: References 18, 19, and 20

TABLE 2.2-4

RECREATIONAL AREAS WITHIN 10 KM (6.2 MI) OF UNIT 2

Map No.	Recreational Area	Distance and Direction from Unit 2 km	Direction	mi	Operator	Type of Enterprise	Hectares (acres)	Activities, Facilities	Activity-Capacity (No. of People)	Total Capacity (No. of People)
1	Scriba Park	8.1	SSW	5	Town	Multipurpose publicly owned park	28 (69)	Picnicking (15 tables), playground, education	Picnic-48 Swim-291	417
2	Ontario Bible Conference	1.6	SSW	1.0	Quasi-public nonprofit community service organ.	Camping		Group camping, swimming pool 93 sq m (1,000 sq ft)	Swim-40	40
3	Nine Mile Point Energy Information Center	0.5	W	0.31	Commercial	Picnicking		Picnicking (10 tables) natural & scenic area	Picnic-32 Other-50	82
4	New Haven Town Park	9.0	ESE	5.6	Town	Court & field games	0.4 (1)	Playground, basketball (1 court)	Field-50	50
5	New Haven Elementary School	8.5	ESE	5.3	Town	Picnicking	0.4 (1)	Playground		
6	Charles Gallagher Pool	10.0	SW	6.2	Town	Multipurpose publicly owned park	0.8 (2)	Natural & scenic area, swimming pool 186 sq m (2,000 sq ft)	Other-50 Swim-80	130
7	Lock 7 Barge Canal & Marina	9.4	SW	5.8	State	Boat marinas & launch areas, boat rentals		Transient moorings (25), pier moorings	Boats-382	382
8	Ft. Ontario Park	10.0	SW	6.2	City	Multipurpose publicly owned park	6 (15)			

TABLE 2.2-4 (Cont)

Map No.	Recreational Area	Distance and Direction from Unit 2 km	Direction	mi	Operator	Type of Enterprise	Hectares (acres)	Activities, Facilities	Activity-Capacity (No. of People)	Total Capacity (No. of People)
9	Oswego Marina	10.0	SW	6.2	Commercial	Boat marinas & launch areas	4 (10)	Launch ramps (2), pier moorings (66), boat storage (160), equipment sales & repairs, restaurant	Boats-837	837
10	Oswego Speedway	8.3	SW	5.2	Commercial	Race track		0.97-km (0.6-mi) track, restaurant		12,000
11	Fort Ontario	10.0	SW	6.2	State/Dept. of Parks & Recreation	Multipurpose publicly owned park	15 (36)	Picnicking (15 tables), historic buildings (9), 457-m (1,500-ft) river frontage	Picnic-48 Other-50	98

SOURCES: References 17 and 23

TABLE 2.2-5

DAILY TRAFFIC VOLUME OF COUNTY HIGHWAYS WITHIN THE VICINITY OF UNIT 2

Highway	Daily Traffic Volume	Date of Survey	Distance and Direction from Unit 2 km	Direction	mi
County Rte 29					
Between Lake Rd and Rte 1	1,729	April 1978	2	ESE	1.2
Between Rte 1 and 104	2,856	May 1978	3	SE	1.9
Between Rte 51A and 4	1,229	April 1979	7	SSE	4.3
County Rte 63					
At Miner Rd	671	June 1978	4	SE	2.5
County Rte 1					
Between Lake Rd and Cremery Rd	1,341	April 1978	5	SW	3.1
Between Cremery Rd and Lakeview Rd	1,305	April 1978	4	SSW	2.5
Between Lakeview Rd and Rte 29	972	April 1978	4	S	2.5
Between Rte 29 and 44	1,312	July 1978	5	SE	3.1
Between Rte 44 and Hickory Grove Dr	1,312	July 1978	7	SSE	4.3
Between Hickory Grove Dr and Rte 104B	964	September 1978	8	SSE	5.0
Middle Rd					
Between Rte 1 and Cremery Rd	885	April 1979	6	SW	3.7
Cremery Rd					
Between Rte 1 and Middle Rd	1,011	April 1979	4	SW	2.5
Between Middle Rd and Rte 104	1,558	October 1979	6	SW	3.7
Kocher Rd					
Between Rte 1 and 104	3,068	April 1978	7	SSW	4.3
County Rte 53					
Between Rte 104 and 4	702	May 1978	7	SSW	4.3
Klocks Corner Rd					
Between Rte 104 and 4	826	April 1979	7	SSW	4.3
County Rte 51A					
Between Rte 104 and 29	792	October 1979	6	S	3.7
Between Rte 29 and 51	595	October 1979	7	SSE	4.3
County Rte 51					
Between Rte 104 and 51A	205	October 1979	6	SW	3.7
Between Rte 51A and Mud Lake Rd	402	October 1979	9	SSE	5.6

TABLE 2.2-5 (Cont)

Highway	Daily Traffic Volume	Date of Survey	Distance and Direction from Unit 2 km	Direction	mi
County Rte 6					
Between Rte 1 and 104B	602	April 1979	8	ESE	5.0
Between Rte 104 and 64	702	April 1979	8	SE	5.0

SOURCE: Reference 24

TABLE 2.2-6

EXISTING AND POSTCONSTRUCTION LAND USES
WITHIN THE TRANSMISSION LINE CORRIDOR

Land Use Category	Existing			Postconstruction		
	Hectares	(acres)	Percent of Total	Hectares	(acres)	Percent of Total
Forest brush-land	19.3	(47.0)	59.0	0		0
Brushland	7.1	(17.2)	21.6	30.0	(72.6)	90.6
Mature forest	3.0	(7.2)	9.0	0		0
Agriculture	2.0	(4.8)	6.0	2.0	(4.8)	6.0
Forest wet-land	1.0	(2.4)	3.0	0		0
Plantation	0.5	(1.3)	1.6	0		0
Wetland	0		0	1.0	(2.4)	3.0
Transmission lines ROW	0.1	(0.2)	0.2	0.1	(0.2)	0.2
Transporta-tion	0.1	(0.2)	0.2	0.1	(0.2)	0.2
Total	33.1	(80.3)	100.6*	33.2	(80.2)	100.00

*Rounding of some of the values results in a total of 100.6 percent.

SOURCE: Reference 25

TABLE 2.2-7

LAND USE WITHIN THE VICINITY
OF THE TRANSMISSION LINE

Land Use Category	Hectares	Percent of Study Area
Woodland		
Forest brushland	3,939	55.4
Mature forest	371	5.2
Forest plantation	30	0.4
Total	4,340	61.0
Agriculture		
Inactive agriculture	1,073	15.1
Cropland/cropland pasture	415	5.8
High-intensity cropland	138	1.9
Permanent pasture	20	0.3
Total	1,646	23.1
Residential		
Rural hamlet	82	1.2
High density	7	0.095
Shoreline development	7	0.095
Strip development	2	0.032
Total	98	1.422
Public	11	0.16
Industrial	108	1.5
Extractive		
Sand and gravel	136	1.9
Communications		
Area of service facilities	46	0.65
Outdoor recreation	7	0.095
Wetland		
Shrub wetlands, bogs, marshes	139	2.0
Wooded wetlands	515	7.2
Total	654	9.2
Water		
Natural ponds and reservoirs	61	0.9
Artificial ponds and reservoirs	1	0.016
Total	62	0.916
Total	7,108	99.943

TABLE 2.2-8

REGIONAL LAND USES

(sq km)

Land Use Category	Cayuga County	Jefferson County	Lewis County	Madison County	Oneida County	Onondaga County	Ontario County	Oswego County	Seneca County	Wayne County	Region Total
Active agriculture	901	1,363	600	655	985	540	822	430	481	673	7,450
Residential	34	48	15	30	106	139	33	44	21	36	506
Commercial	3	8	1	14	14	13	5	2	2	4	66
Industrial	4	2	1	4	7	75	7	3	2	4	109
Extractive	5	9	4	3	9	25	7	10	1	5	78
Public/semipublic	9	365	79	9	46	20	9	11	48	7	603
Outdoor recreation	5	18	5	12	24	48	11	7	10	5	145
Transportation	6	13	1	38	19	31	6	15	6	5	140
Vacant/open space	834	1,462	2,583	912	1,982	1,088	787	1,960	258	832	12,698
Total	1,801	3,288	3,289	1,677	3,192	1,979	1,687	2,482	829	1,571	21,795

SOURCES: References 1, 4 through 11, and 18

TABLE 2.2-9

REGIONAL AGRICULTURAL STATISTICS
CROPS HARVESTED

Location	Corn for Grain/Seed (ha)	Yield (bu/ha)	Production (bu)	Corn for Silage (ha)	Yield (tons/ha)	Production (tons)	Wheat (ha)	Yield (bu/ha)	Production (bu)
Cayuga County	26,306	212.1	5,580,100	7,689	35.8	275,000	4,856	102.8	499,100
Jefferson County	4,533	202.6	918,400	12,667	29.7	375,600	202	86.6	17,500
Lewis County	81	185.2	15,000	5,666	30.9	175,000	-	-	-
Madison County	2,631	197.6	520,000	8,701	29.7	258,000	162	91.3	14,800
Oneida County	4,290	205.1	879,800	10,118	29.7	300,000	567	91.4	51,800
Onondaga County	13,153	205.1	2,697,500	5,059	33.4	168,750	1,983	93.9	186,200
Ontario County	18,657	224.9	4,195,600	5,261	34.6	182,000	8,701	98.8	860,000
Oswego County	2,104	210.1	442,000	3,238	32.1	104,000	4,452	99.8	440,000
Seneca County	11,332	215.0	2,436,000	1,417	23.4	47,250	6,678	101.4	677,000
Wayne County	13,557	215.0	2,914,500	2,833	33.4	94,500	2,024	98.8	200,000
Region	96,644	207.3	20,598,900	62,649	31.3	1,980,100	29,625	86.5	2,946,400
State	263,055	210.0	55,250,000	252,938	32.1	8,125,000	64,752	101.3	6,560,000

SOURCES: References 12 and 13

TABLE 2.2-10

REGIONAL AGRICULTURAL STATISTICS FRUIT HARVESTED

(hectares)

Location	Apples	Grapes	Peaches	Pears	Cherries	Plums/ Prunes	All Fruit
Cayuga County	134	-	2	20	-	4	160
Jefferson County	-	-	-	-	-	-	-
Lewis County	-	-	-	-	-	-	-
Madison County	69	<2	-	-	-	-	70
Oneida County	79	9	-	<2	-	<2	90
Onondaga County	436	8	-	<2	-	-	444
Ontario County	130	761	19	13	17	2	943
Oswego County	271	<2	<2	64	6	<2	342
Seneca County	73	289	16	2	5	<2	386
Wayne County	8,001	190	134	388	1,340	116	10,168
Region	9,193	1,261	173	491	1,368	126	12,603
State	27,017	17,266	921	1,733	2,709	578	50,224

SOURCE: Reference 15

TABLE 2.2-11

REGIONAL AGRICULTURAL STATISTICS
CATTLE AND MILK PRODUCTION

	All Cattle and Calves	Beef Cows	Milk Cows	Average Milk Production/Cow (lb)
Cayuga County	51,000	2,200	25,000	12,200
Jefferson County	84,000	2,600	44,000	11,100
Lewis County	59,000	600	32,500	12,300
Madison County	60,000	1,600	35,500	11,800
Oneida County	65,000	2,500	33,500	11,300
Onondaga County	32,500	2,500	17,000	13,200
Ontario County	33,000	1,600	11,500	11,900
Oswego County	25,500	2,300	11,500	11,400
Seneca County	11,500	1,000	4,300	11,200
Wayne County	19,000	1,800	8,500	10,400
Region	440,500	18,700	223,300	11,680
State	1,780,000	85,000	912,000	11,488

SOURCES: References 14, 16, and 26

TABLE 2.2-12

RECREATIONAL AREAS IN THE REGION

Map No.	Park	Distance and Direction From Unit 2 (km)	County	Acreage	Activities/Facilities	Total Capacity (No. of People)	Visitor Count April 1979 - March 1980
1	Selkirk Shores	15.8 NE	Oswego	980	Camping, picnicking, hiking, swimming	3,646	305,000
2	Battle Island	16.9 S	Oswego	235	Golfing, fishing, hiking	303	40,000
3	Frenchman Island	42.9 SE	Oswego	26	Fishing, hiking, picnicking, boating	100	*
4	Fair Haven Beach	29.5 SW	Cayuga	845	Camping, picnicking, boating, fishing	6,247	352,000
5	Southwick Beach	30.8 NE	Jefferson	472	Camping, picnicking, boating, fishing, swimming, hiking	4,401	70,000
6	Westcott Beach	47.2 NE	Jefferson	319	Camping, picnicking, boating, fishing, swimming, hiking	4,494	72,000
7	Long Point	58.0 NE	Jefferson	23	Camping, picnicking, boating, fishing, swimming	754	9,000
8	Cedar Point	77.0 NE	Jefferson	48	Camping, picnicking, boating, fishing, swimming	1,853	60,000
9	Burnham Point	73.0 NE	Jefferson	12	Camping, picnicking, boating, fishing, swimming	553	15,000
10	Whetstone Gulf	77.2 ENE	Lewis	2,000	Camping, picnicking, swimming, hiking	1,981	28,000
11	Chittenago Falls	76.0 ENE	Madison	183	Camping, picnicking, hiking	699	115,000
12	Verona Beach	67.5 SE	Madison	1,735	Picnicking, swimming	4,374	305,000

TABLE 2.2-12 (Cont)

Map No.	Park	Distance and Direction From Unit 2 (km)	County	Acreage	Activities/Facilities	Total Capacity (No. of People)	Visitor Count April 1979 - March 1980
13	Lock 23 - Brewerton	34.8 SSE	Onondaga	*	Picnicking, boating	119	*
14	Green Lakes	62.2 SSE	Onondaga	1,101	Camping, picnicking, hiking, boating, fishing, swimming	3,361	1,015,000
15	Clark Reservation	63.0 SSE	Onondaga	290	Picnicking, hiking, playground	1,255	356,000
16	Cayuga Lake	73.5 SSW	Seneca	135	Camping, picnicking, swimming, boating, playground	3,270	129,000
17	Chimney Bluffs	49.5 WSW	Wayne	597	Camping, picnicking, swimming, boating, playground	1,036	30,000

*Not available

NOTE: All facilities are seasonal (summer).

SOURCES: References 3, 17, 23, and 27

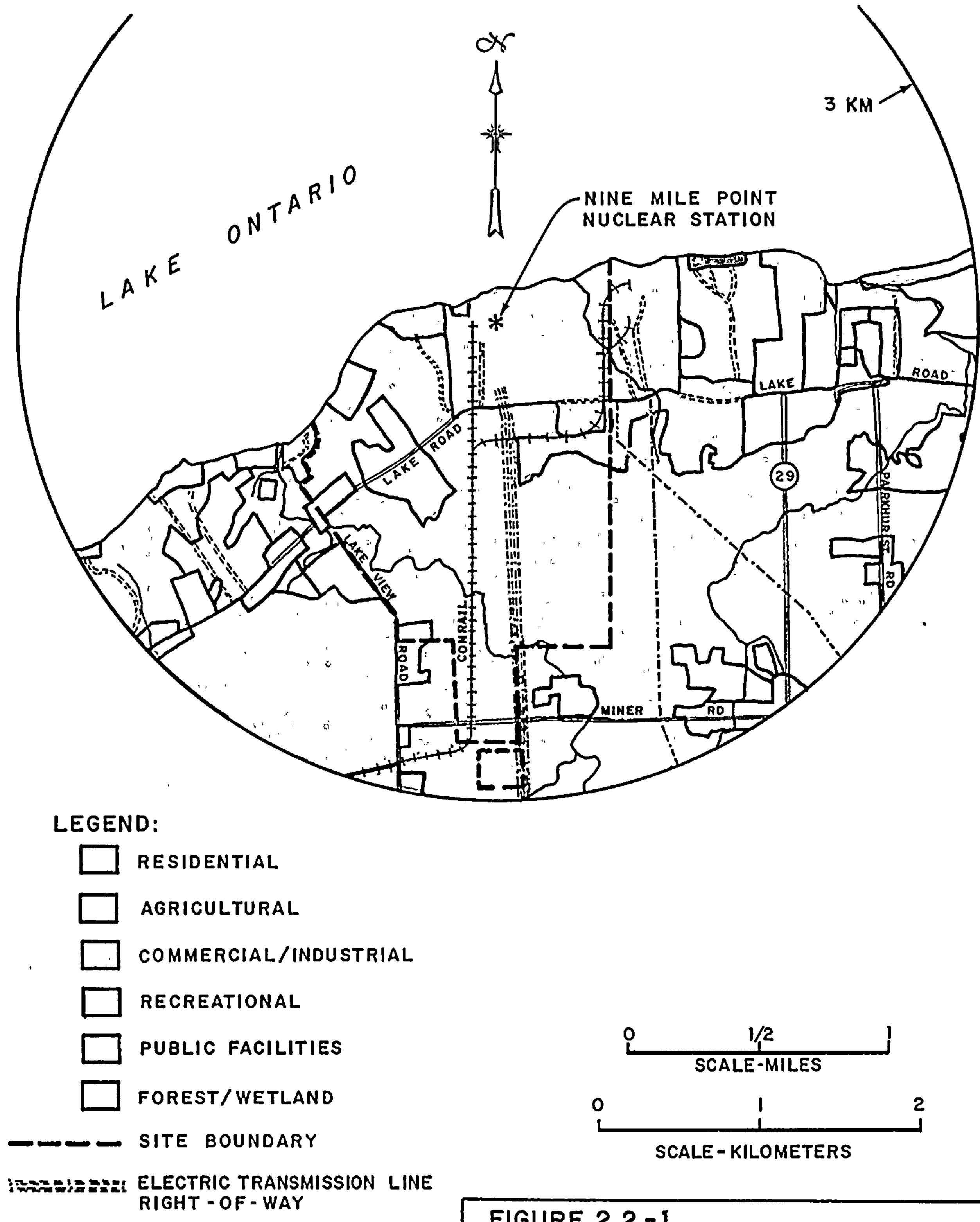


FIGURE 2.2-1

LAND USE WITHIN SITE VICINITY

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

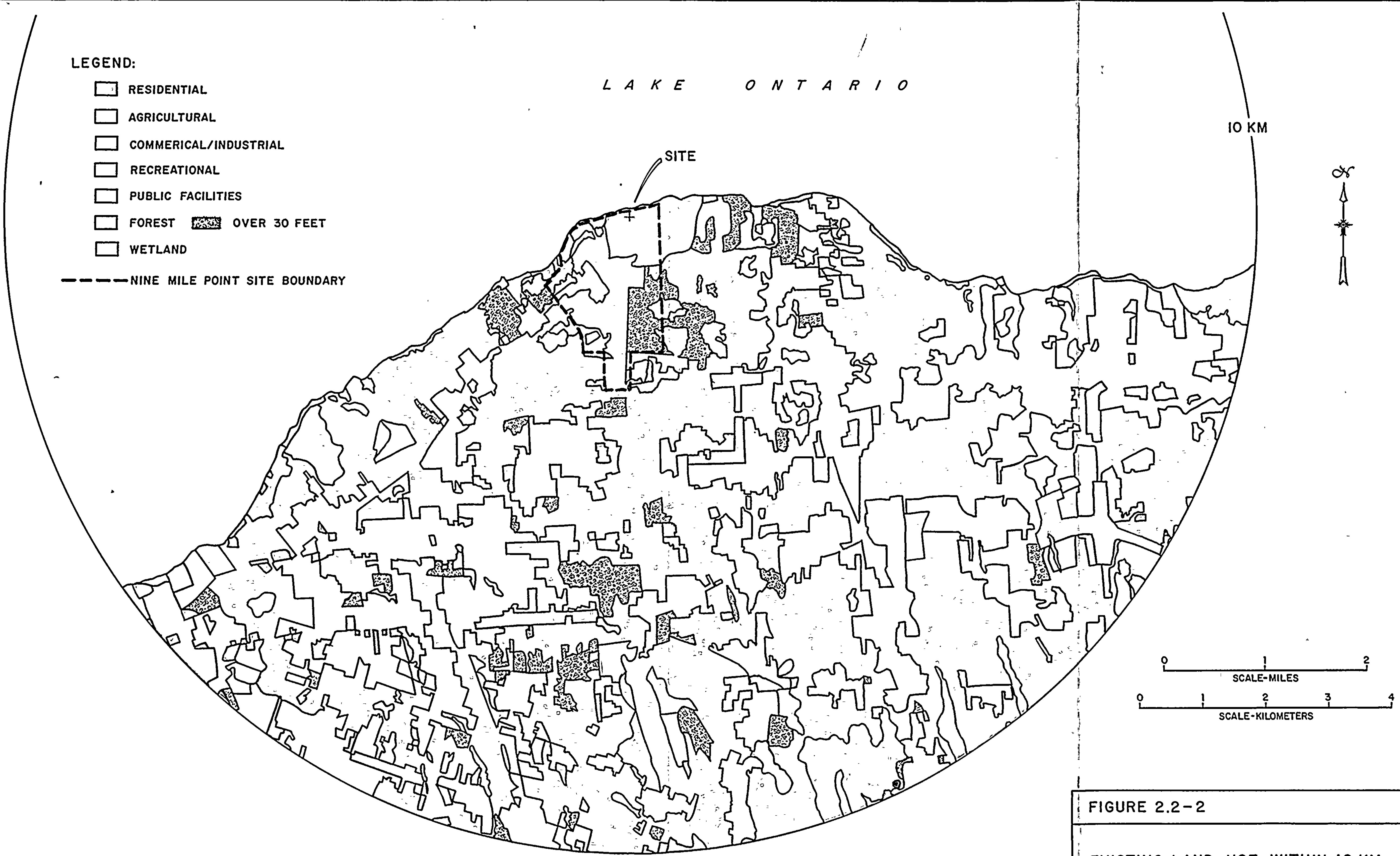
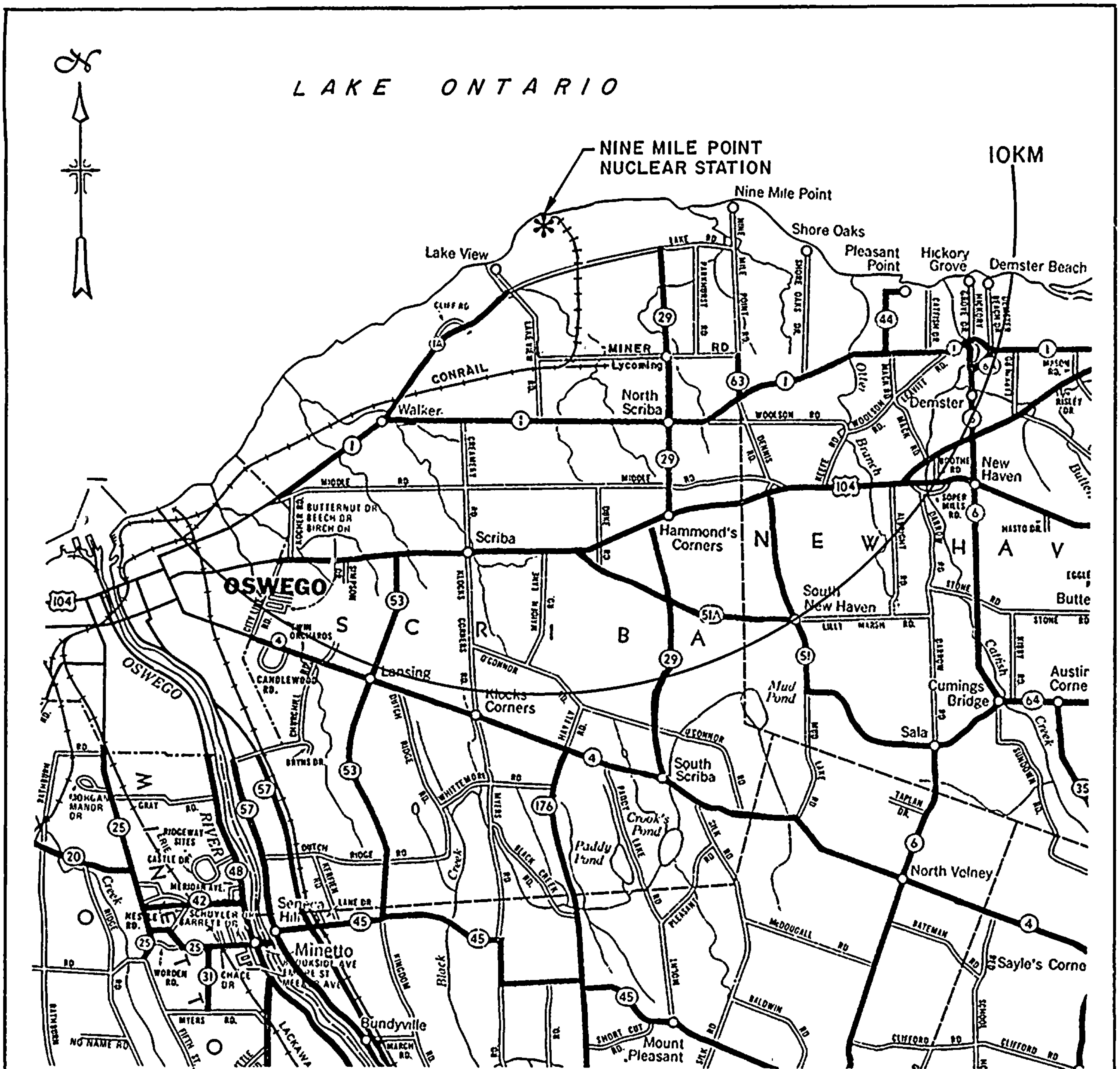


FIGURE 2.2-2

EXISTING LAND USE WITHIN 10 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



LEGEND:

U.S. HIGHWAYS

STATE AND COUNTY ROADS

TOWN ROADS

RAILROADS

* SITE LOCATION

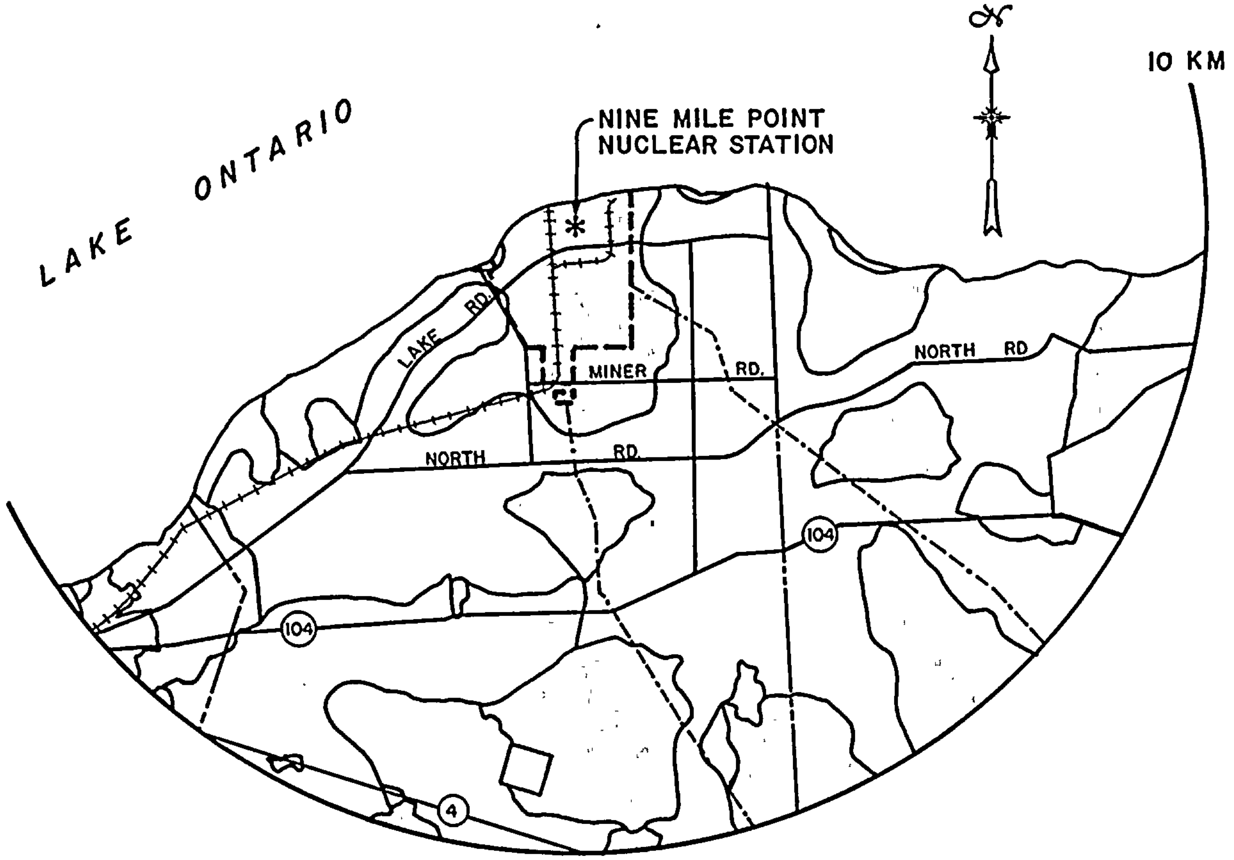
0 1 2 3 4
SCALE-MILES

0 2 4 6 8
SCALE-KILOMETERS

FIGURE 2.2-4

TRANSPORTATION ROUTES WITHIN A 10-KM RADIUS OF UNIT 2

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



LEGEND:

- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL/INDUSTRIAL
- RECREATIONAL
- PUBLIC FACILITIES
- FOREST/WETLAND

SCALE-MILES: 0 1 2

SCALE-KILOMETERS: 0 1 2 3 4

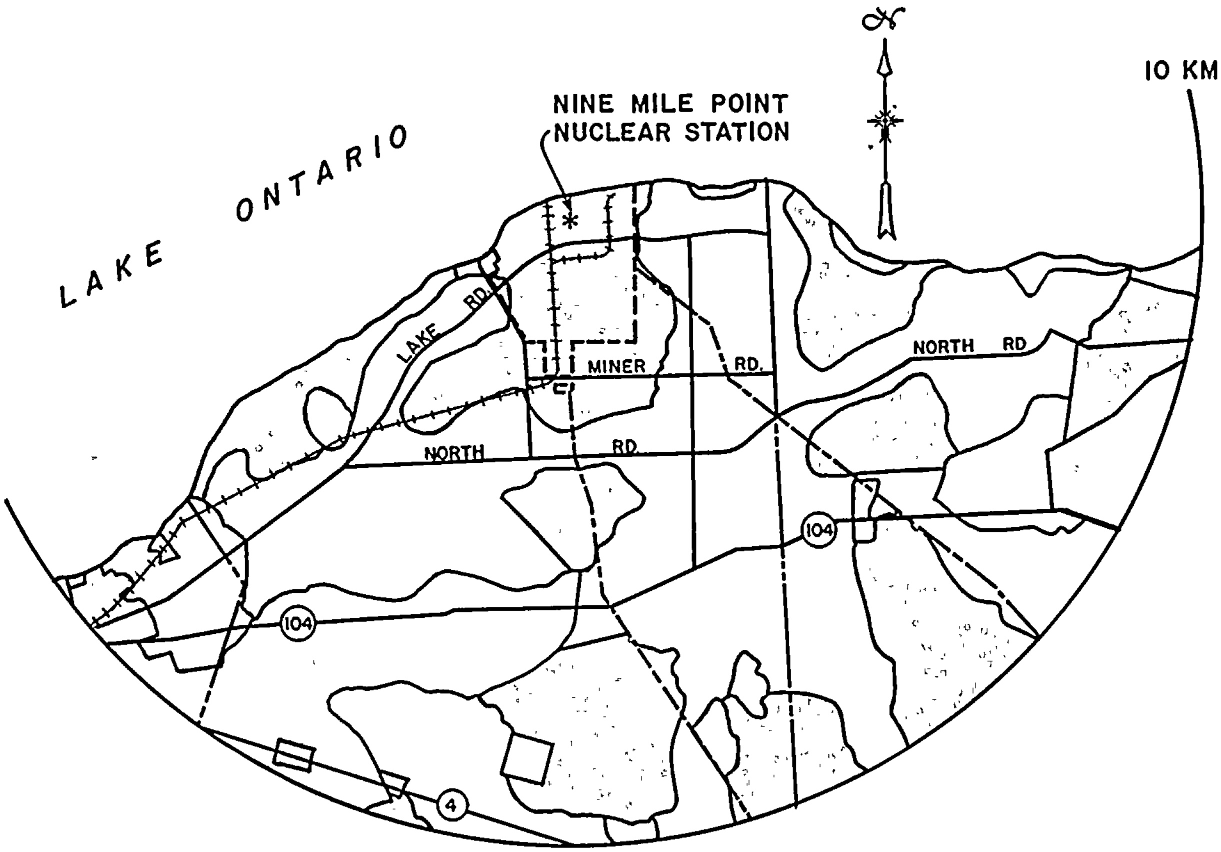
- - - - - SITE BOUNDARY

-·-·-·- EXISTING TRANSMISSION CORRIDORS

FIGURE 2.2-5

LAND USE IN THE YEAR 1985
OSWEGO COUNTY PLAN

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



LEGEND:

- RESIDENTIAL
- AGRICULTURAL
- COMMERCIAL/INDUSTRIAL
- RECREATIONAL
- PUBLIC FACILITIES
- FOREST/WETLAND

---- SITE BOUNDARY

_._._. EXISTING TRANSMISSION CORRIDORS

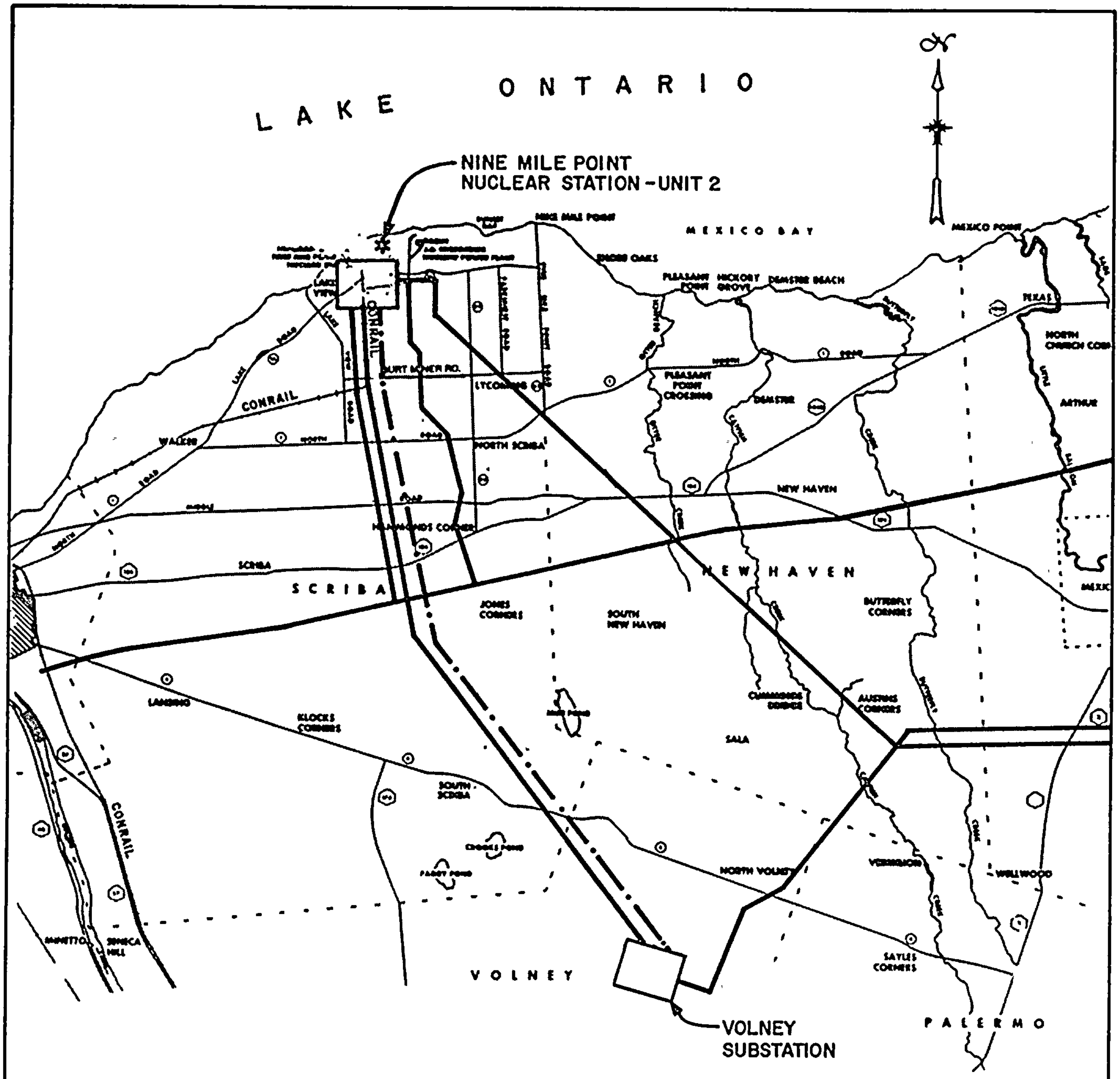
0 1 2
SCALE-MILES

0 1 2 3 4
SCALE-KILOMETERS

FIGURE 2.2-6

LAND USE IN THE YEAR 2000
OSWEGO COUNTY PLAN

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



LEGEND

- - - - - TOWN BOUNDARIES

——— EXISTING ELECTRIC TRANSMISSION LINES

—·—·— NINE MILE 2 TO VOLNEY PLANNED

0 1 2

SCALE-MILES

0 1 2 3 4

SCALE IN KILOMETERS

FIGURE 2.2-7

LOCATION OF TRANSMISSION LINES

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT-UNIT 2

ENVIRONMENTAL REPORT-OLS

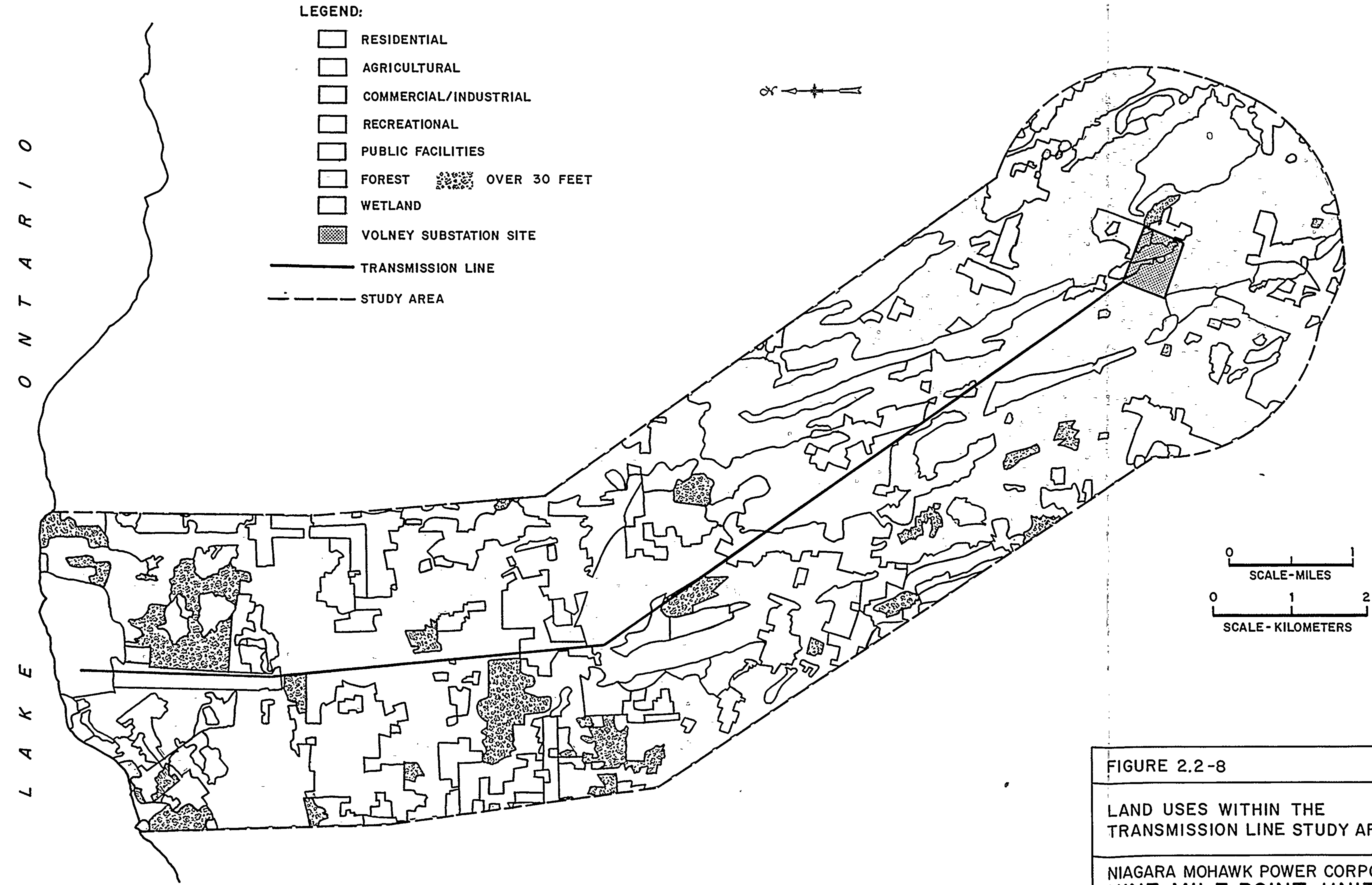


FIGURE 2.2-8

LAND USES WITHIN THE TRANSMISSION LINE STUDY AREA

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

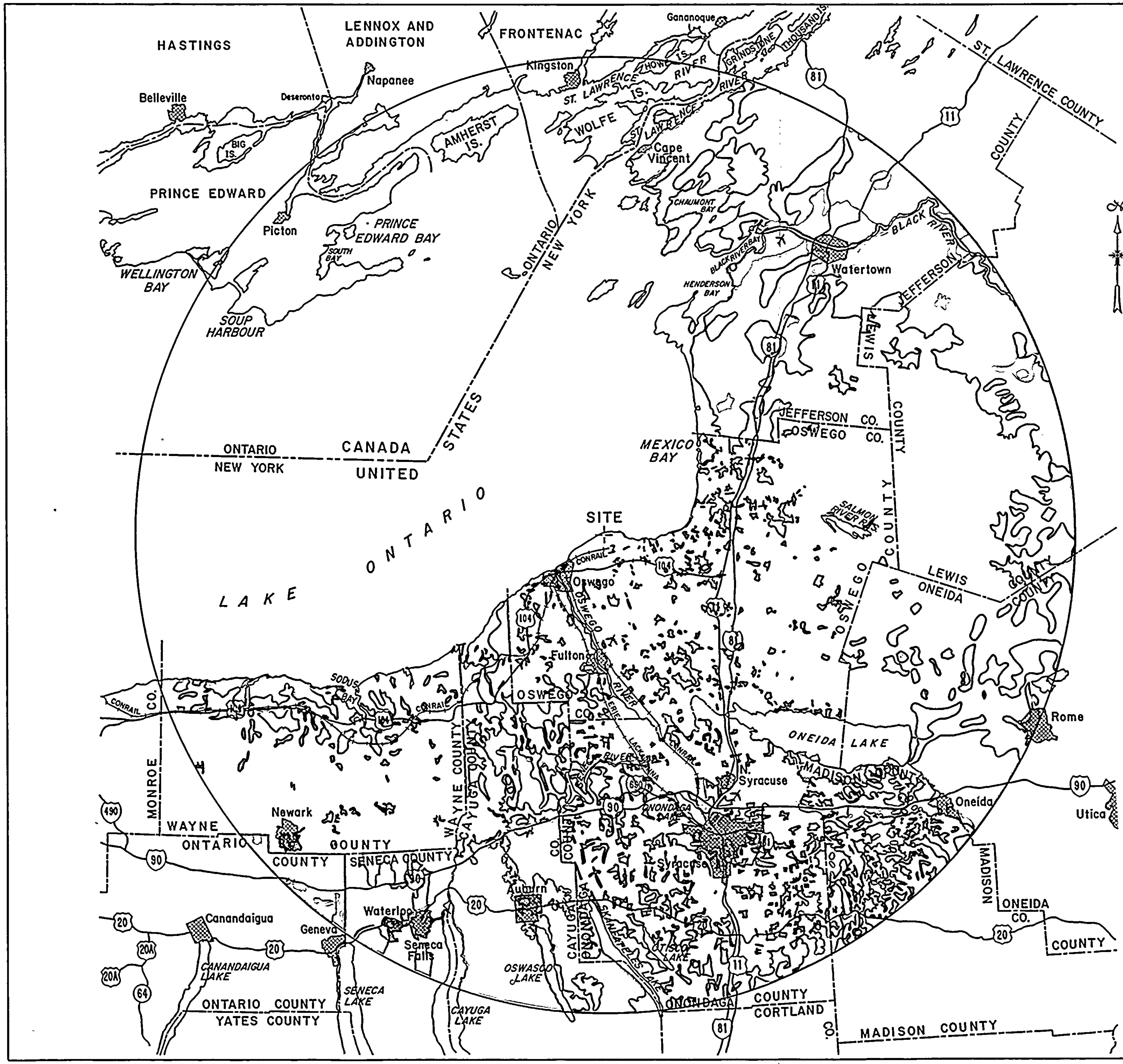
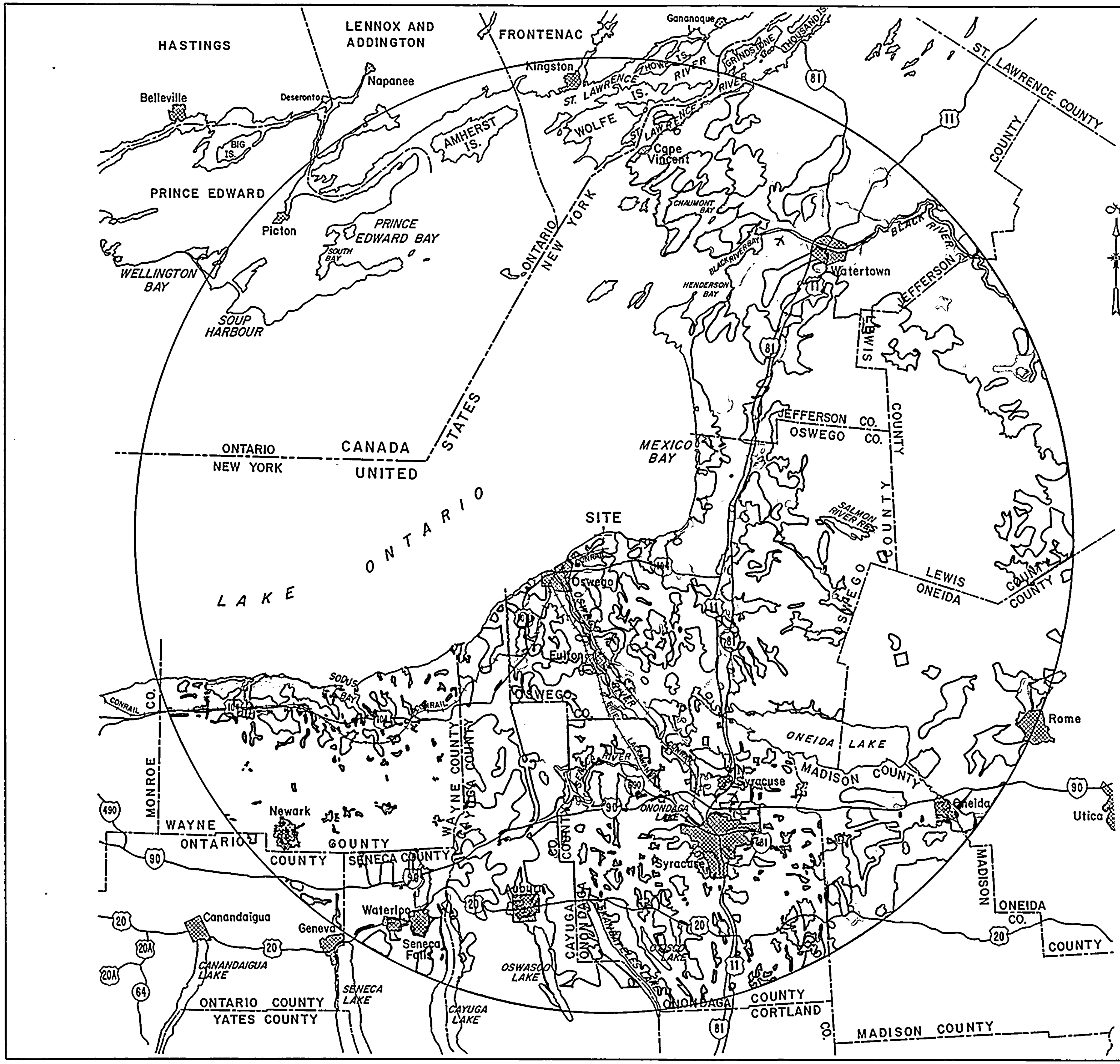


FIGURE 2.2-9

PRESENT LAND USES WITHIN 80-KM REGION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT



LEGEND:

INDUSTRIAL-COMMERCIAL

RESIDENTIAL

AGRICULTURAL

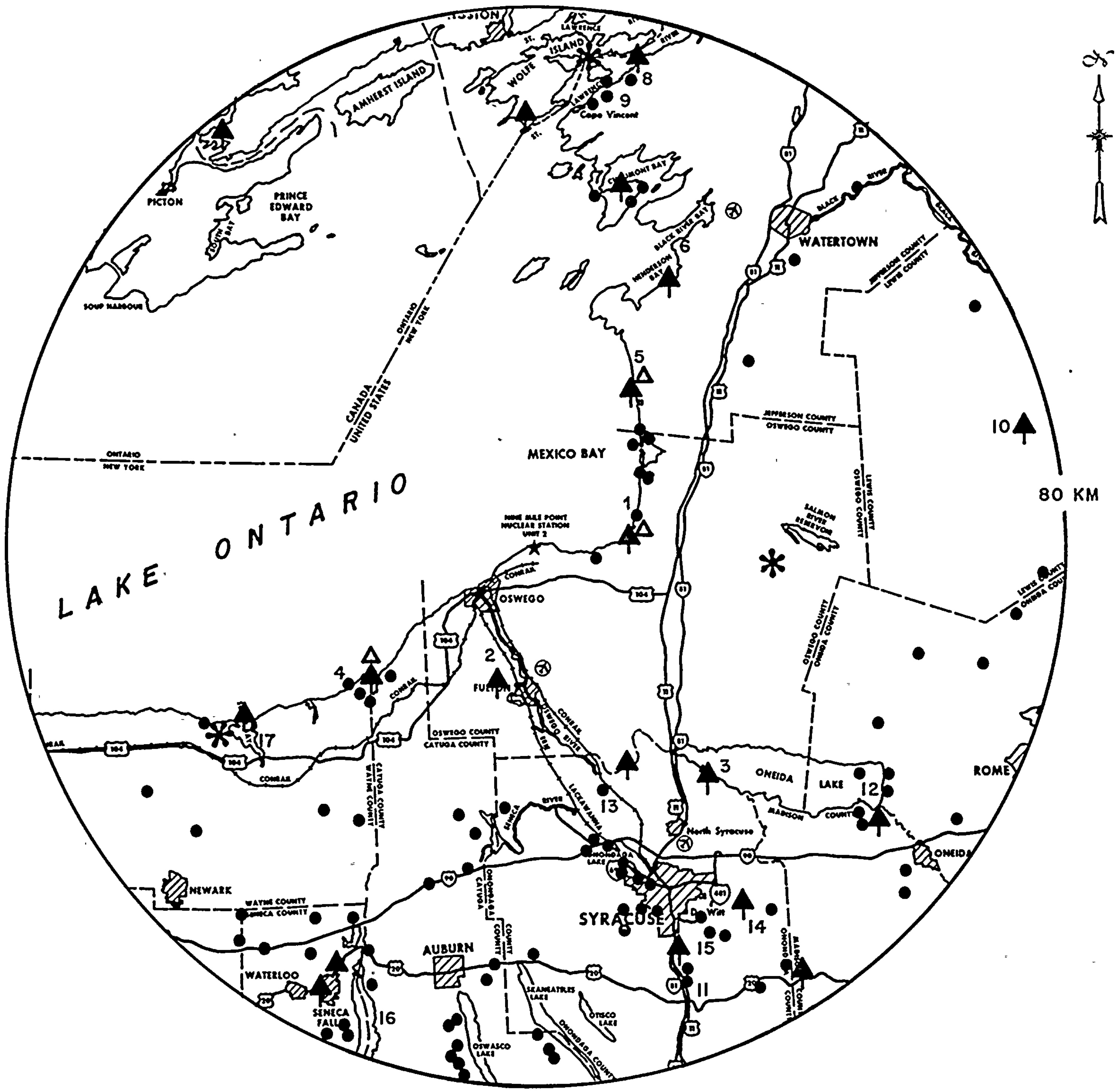
0 5 10 15 20
SCALE-MILES

0 10 20 30 40
SCALE-KILOMETERS

FIGURE 2.2-10

PLANNED LAND USES WITHIN 80-KM REGION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT



MAP NO.	PARK
1.	SELKIRK SHORES
2.	BATTLE ISLAND
3.	FRENCHMAN ISLAND
4.	FAIR HAVEN BEACH
5.	SOUTHWICK BEACH
6.	WESTCOTT BEACH
7.	LONG POINT
8.	CEDAR POINT
9.	BURNHAM POINT
10.	WHETSTONE GULF
11.	CHITTENAGO FALLS
12.	VERONA BEACH
13.	LOCK 23 - BREWERTON
14.	GREEN LAKES
15.	CLARK RESERVATION
16.	CAYUGA LAKE
17.	CHIMNEY BLUFFS

LEGEND:

- ▲ STATE PARKS
- ● LARGE MUNICIPAL AND PRIVATE RECREATION FACILITIES
- ✱ POTENTIAL NEW STATE PARK AREAS
- △ POTENTIAL STATE PARK EXPANSION OR IMPROVEMENT AREAS

NOTE

✱ FOR MORE DETAILED INFORMATION REFER TO TABLE 2.2-12 STATE PARKS WITHIN 80 KM OF UNIT 2

REF. 17

FIGURE 2.2-11

RECREATION AREAS WITHIN THE 80-KM REGION OF UNIT 2*

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

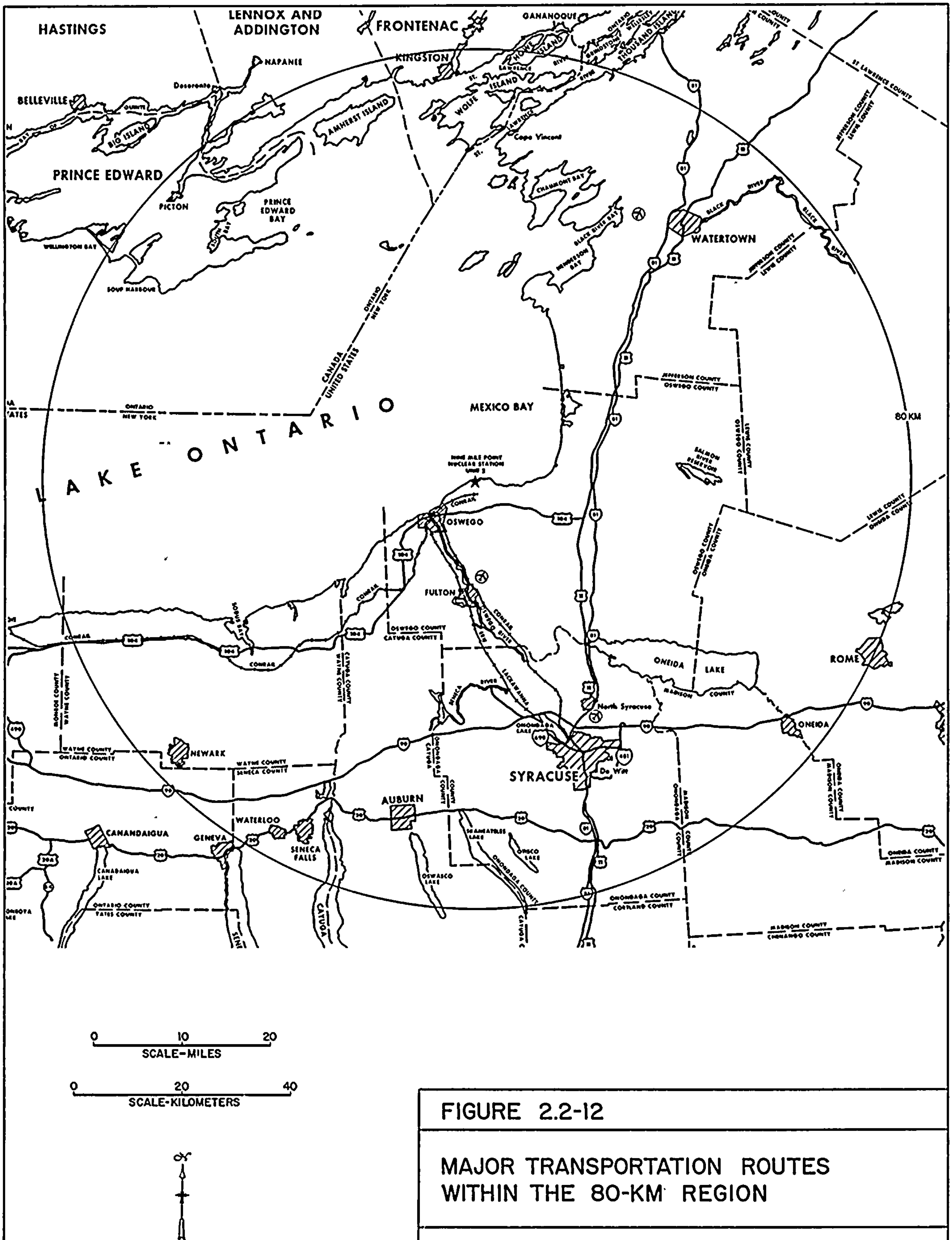


FIGURE 2.2-12

MAJOR TRANSPORTATION ROUTES WITHIN THE 80-KM REGION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

2.3 WATER

2.3.1 Hydrology

2.3.1.1 Surface Water

2.3.1.1.1 Seasonal Temperature Structure of Lake Ontario

Lake Ontario is a large temperate lake that experiences seasonal changes in its thermal structure, which, in turn, alters its circulation patterns. The changes in stratification result from atmospheric heat exchange and wind-induced mixing.

Natural warming of the lake begins in mid-March and continues until mid-September. At the onset of warming, the surface water temperature in the shallow littoral zone rises more rapidly than in regions just offshore. The disappearance of an offshore surface temperature of 4°C (39.2°F) in late June signals the start of the summer season in the lake. In general, vertical stratification over the entire basin is established at this time by the combined effects of lake warming and the advection of the warmer, nearshore water. The lake's mean surface temperature reaches 21°C (69.8°F), and the temperature of the hypolimnion varies with depth, ranging between 3.8°C and 4.0°C (38.8°F and 39.2°F)[1].

In late September the warming process ends. The lake's mean surface temperature drops rapidly to below 17°C (62.6°F), and the thermocline begins to weaken. The vertical temperature gradient decreases as the surface layer and deeper water effectively mix. (Mixing is the consequence of convection caused by cooling at the surface and is enhanced by the weakening of the thermocline, which permits wind-induced turbulence to extend to greater depths.) The fall cooling process resembles spring warming but in reverse. The breakdown of temperature stratification throughout the lake marks the onset of the winter season. The date of overturn differs from year to year, depending on the occurrence of storms. The lake surface is cooled below 4°C (39°F), and surface isotherms tend to be parallel to shore. With continued cooling, ice forms in the nearshore region.

2.3.1.1.2 Water Circulation in Lake Ontario

The annual average large-scale circulation pattern of Lake Ontario is counterclockwise (cyclonic flow), with flow to the east along the south shore in a relatively narrow band and a somewhat less pronounced flow to the west along the

north shore. The conceptual model explaining this general circulation pattern is presented in detail in the James A. FitzPatrick Nuclear Power Plant (JAF) 316(a) Demonstration[2].

The general circulation described above has been documented by observations collected over long periods (months). The circulation patterns that are observed at a specific time, however, are more complex as a result of the lake's response to the shifting winds. At times, a major shift in wind distribution can alter the currents in a matter of hours, while at other times, some features of the current pattern can continue even with an opposing wind[3].

Two important examples of wind-induced changes in the general circulation pattern are upwelling and internal oscillations. Upwelling is characterized by the rising of colder, heavier, bottom water toward the surface. A variety of mechanisms has been proposed to account for the observed oscillations of the thermocline. The most direct explanation is that an upwelling displaces the thermocline from equilibrium by converting kinetic energy of the wind to potential energy of the thermocline position. When the wind stress is removed, internal waves are set in motion and contribute to the dissipation of this energy. Internal waves increase in amplitude after storms, and in Lake Ontario the oscillations have a period of nearly 17.5 hr, roughly three complete oscillations every 2 days. These oscillations are a common feature of lake temperature records and are prominent in intake temperature records such as those of Nine Mile Point Unit 1 (Unit 1) and the JAF plant.

2.3.1.1.3 Geomorphology at Nine Mile Point

Nine Mile Point is a slight promontory along the south shore of Lake Ontario. The offshore slope at the plant is steep (5-10 percent grade) at the beach and flattens to 2-3 percent grade to the 5-m (15-ft) depth, then steepens to a 4-percent slope lakeward. The slope at the 6-m (20-ft) depth contour is steeper at the plant than to the east or west of the plant.

A number of observations of the bottom sediments along the south shore of Lake Ontario have been made. Sutton et al[4] examined nearshore bottom sediments (0-33 m [0-108 ft]) in 1968 and 1969 between Rochester and Stony Point, and stated several conclusions relevant to the Nine Mile Point site:

1. There is generally a west-to-east transport of sediment.

2. Sites of sediment accumulation occur in nearshore shallow areas where the shoreline is irregular and where there are local deviations from the above transport pattern.

3. In general, the coarser sands, boulders, pebbles, and cobbles lie in the beach or nearshore area, and finer sediments are found lakeward.

4. Several small patches of sand occur offshore between Oswego and Mexico Bay, and it is hypothesized that these originate from the Oswego River.

Visual observations made in the Nine Mile Point vicinity during the 1973-1976 aquatic programs (Section 6.5.2.1.2.7) corroborate the earlier observations of Sutton et al[4].

2.3.1.1.4 Currents at Nine Mile Point

Current measurements were made off the Nine Mile Point promontory from May to October 1969 and from July to October 1970[2,5]. Two fixed underwater towers were placed in the lake, one in 7.3 m (24 ft) of water and one in 14.0 m (46 ft) of water, and provided average hourly current speed and direction data. In addition, two drogue surveys were conducted in 1969 to obtain the overall current pattern at the site. Results from these studies are presented in the JAF 316(a) Demonstration[2] and are summarized in the following paragraphs. Methods used in these studies are described in Section 6.3.1.

The wind speed-frequency data indicate that over the year a speed in excess of 9 m/s (20 mph) occurs 21.6 percent of the time, based on readings averaged over a 6-hr period. From June through September, winds in excess of 9 m/s (20 mph) occur 13.9 percent of the time. The current speed of 6-hr duration exceeded with comparable frequency (June-September) at the 6-m (19-ft) depth is about 0.06 m/s (0.2 fps).

The predominant current direction in the preceding studies is alongshore. On those occasions when onshore or offshore currents were observed, their magnitudes were substantially less than those of alongshore currents. Based on this near-field data, alongshore currents from the east are just slightly more likely to occur than from the west. Overall lake circulation patterns are typically west to east along the south shore of Lake Ontario (Section 2.3.1.1.3). Onshore and offshore currents each account for only about 5 percent of the observations. Approximately 30 percent of

the observations were below the meter threshold, 0.03 m/s (0.08 fps).

2.3.1.1.5 Ambient Thermal Structure at Nine Mile Point

Data on the thermal structure of the lake in the vicinity of Nine Mile Point are available from studies conducted from 1969 through 1978 in the Oswego and/or Nine Mile Point areas. Temperature data were gathered as part of all monitoring studies; however, the frequency of sampling and locations sampled varied during the years. A complete description of the sampling programs is presented in Section 6.1.1 and the yearly reports[6-11]. The results of these studies are also provided in the yearly reports[6-11] and are summarized in the following paragraphs.

Vertical temperature profiles revealed the existence of transient thermal gradients equal to or greater than 1°C/m (1.8°F/3.3 ft) throughout the study area. The gradients existed primarily in the summertime. They were not seasonally stable, since they were generated and destroyed by surface heating and cooling and mixing within the water column over periods dependent upon meteorological conditions. Although gradients were observed in sequential weeks for up to 3- to 4-week periods, the gradients observed were at different temperatures and at different depths from week to week and therefore were not persistent. When the gradients were observed, they appeared to be uniform from station to station.

The temperature data recorded during June through September (1968-1972) in the existing intake of the Oswego Steam Station were statistically analyzed and show that temperatures in excess of 22.0°C (74°F) occurred only 12 percent of the time during June through September and, hence, less than 4 percent of the time on an annual basis. Since the lake is generally isothermal in the top 6 m (20 ft), the temperature obtained at the intake depth of 4.9 m (16 ft) can be considered to be representative of the surface water temperature.

The natural seasonal progression of temperatures in the Nine Mile Point vicinity from mid-April through December 1976 is shown on Figure 2.3-1 for the 12-m (40-ft) depth contours at the NMPE control transect (approximately 32 km [20 mi] east of Unit 2)[2]. The maximum surface temperatures recorded at the 6- and 12-m (20- and 40-ft) contours were 23.2°C (73.8°F) and 22.3°C (72.1°F) on August 23 and 25, 1976, respectively. The minimum surface temperature at both locations was 1.1°C (34.0°F) during mid-December. The plot

(Figure 2.3-1) shows approximately 10 occurrences of cold water intrusions during the sampling period. The largest observed intrusions during the sampling year occurred on August 2 and 10. A secondary intrusion occurred on or about August 25.

2.3.1.1.6 Existing Thermal Plumes

2.3.1.1.6.1 Nine Mile Point Unit 1 Thermal Plume Surveys

Thermal surveys of the Unit 1 plume were made during the first 6 yr of the plant's operation (1970-1975). A total of 29 field surveys of the plumes resulting from the discharge of heated condenser cooling water into Lake Ontario have been conducted[12-17]. Section 6.1.2 provides descriptions of the methods used in these surveys. The results are summarized in Table 2.3-1. An examination of these data covering a 6-yr period shows that the plume extent and direction are strongly dependent on wind-induced lake currents, wave action, and upwelling. However, the extent of the plume has no direct relationship with the actual wind speed; that is, high winds do not necessarily cause the longest plumes. Comparisons of plume surveys conducted during days of similar ambient temperatures show no definite relationship between the heat load and the area of thermal influence. Also, there is no simple relationship between the heat load and the plume's offshore extent, even for the same wind speed and direction. These observations indicate the stochastic nature of the plumes, as influenced by the hydrodynamic characteristics of the lake.

The EPA guidance for 316(a) demonstrations recommends a discharge zone description and defines the discharge zone as "that portion of the receiving waters which falls within the 2°C isotherm of the plume 30% or more of the time"[18]. A cumulative frequency distribution analysis of the 29 sets of data (Table 2.3-1) was performed to define the surface plume area. The measured surface areas within the 2°C (3.6°F) isotherm were arranged in a series of descending sizes. The area that is exceeded with a selected frequency is then obtained from the resulting cumulative frequency curve (Figure 2.3-2). As shown in the figure, the surface plume area is greater than 81 ha (200 acres) 30 percent of the time.

A similar analysis was performed for the estimated volumes of the plume within the 2°C (3.6°F) rise isotherm. The cumulative frequency curve is shown on Figure 2.3-3. The volume exceeds 5.2 x 10^5 cu m (420 acre-ft) 30 percent of the time. Thus, the calculated mean depth of the dis-

charge zone based on the estimated surface area and the estimated volume is 0.64 m (2.1 ft).

Due to the stochastic nature of the plume, the actual shape of a plume which extends over an area of 81 ha (200 acres) cannot be readily determined. The four surveys with 2°C (3.6°F) isotherms closest to the 81-ha (200-acre) size have common areas almost symmetrical around the point of discharge along the plant transect (NMPP). A representative area enclosing the common area of all the plumes around the discharge point is illustrated as the discharge zone in Figure 2.3-4. The representative discharge zone extends about 572 m (1,875 ft) on each side of the discharge point along the shore, and to a maximum of about 721 m (2,365 ft) offshore.

2.3.1.1.6.2 James A. FitzPatrick Plant Thermal Plume Surveys

Triaxial hydrothermal field surveys of the JAF plant thermal plume were conducted during June, August, and October of 1976 and in April, June, and November of 1977[19]. The surveys included simultaneous triaxial measurements of temperature and dye concentration along fixed transects in the vicinity of the JAF and Unit 1 plants. Lake currents at three depths, lake level, and wind speed and direction were also continuously monitored before and during each survey. Section 6.1.1.3 provides a description of the survey procedures.

Table 2.3-2 contains the maximum observed ΔT, the ambient temperature, a summary of the pertinent plant operating data, and prevailing lake conditions during each of the 19 triaxial surveys. The 1976 and 1977 surveys were conducted under plant generating loads ranging between 702 and 822 MWe (86 and 100 percent of capacity).

Current velocities were generally low, as evidenced by the fact that the lake current exceeded 15 cm/sec (0.5 fps) during only one of the surveys.

The surveys were performed during April, June, August, October, and November. These time periods are indicative of conditions during late winter to early spring, late spring to early summer, summer, fall, and late fall to early winter.

The results of the 19 postoperational hydrothermal surveys indicate that isothermal conditions prevail in the study area throughout most of the year due to the mechanical

mixing induced by winds, the relative shallowness of the water, and the absence of an ice cover. Short-term modifications can be attributed to solar heating on calm days and upwelling during periods of offshore winds. Sinking plumes can be observed when ambient water temperatures are below 4°C (39.2°F). The temperature of the plume at the surface is less than the ambient lake surface temperature when solar heating warms only the surface layers of the receiving water body or during winter upwelling periods. Temperature rise isotherms are more pronounced at the surface during periods of summer upwelling.

The presence of natural thermal gradients (both horizontal and vertical) in the vicinity of the discharge, as well as possible interaction with the Unit 1 plume, complicates the determination of an ambient temperature from which plume temperature rises can be calculated. In those cases where an ambient temperature was determined, it was obtained by averaging temperatures in the vicinity of the diffuser along transects outside the dye plume.

The thermal influence of the Unit 1 plume in the vicinity of the JAF plant discharge prevented the determination of an ambient temperature for some of the surveys. The JAF plant discharge had a cooling effect on the surface waters in the vicinity of the discharge during at least three of the surveys. Thus, the interaction of the Unit 1 plume with the JAF plant plume under these conditions resulted in a reduction of the temperature in the Unit 1 plume through dilution with the cooler JAF plant plume.

In summary, the field survey results of the JAF plant plume show maximum surface temperature rises of 3.6°C (6.6°F) based on recorded temperature data. During periods of vertical stratification in the vicinity of the discharge resulting from either natural causes or the influence of the Unit 1 discharge, the surface temperature rises attributable to the JAF plant discharge are reduced and may, under conditions of Unit 1 plume interaction, actually reduce temperatures in the Unit 1 plume. The survey data indicate that increasing lake velocities can decrease the dilution achieved by the diffuser, and can increase the areal extent of the intermediate field isotherms.

2.3.1.2 Groundwater

Detailed information on this area of hydrology as it pertains to the site is provided in FSAR Section 2.4.13.

2.3.2 Water Use

2.3.2.1 Surface Water Supply

Lake Ontario is the surface water body utilized by Unit 2 for cooling water. The 16 United States and 10 Canadian municipal water supplies and industrial users within 80 km (50 mi) of the site that withdraw water directly from Lake Ontario are shown on Figure 2.3-5[20,21].

United States withdrawals from Lake Ontario total approximately 9,717,000 cu m/day (2,567 mgd). Of this amount, 151,400 cu m/day (40 mgd), or approximately 2 percent, is withdrawn by municipal suppliers who serve a total population of 173,000 in four New York State counties[22-33]. Production capacity in 1981 for all drinking water supply systems within 80 km (50 mi) totaled 208,200 cu m/day (55 mgd). Average withdrawals represent 73 percent of production capacity. All water supply systems and industrial users drawing from U.S. waters on Lake Ontario are listed in Table 2.3-3.

Population throughout the 80-km (50-mi) radius area is expected to increase slowly, and only one expansion of a water supply system is known to be planned or underway. The Metropolitan Water Board of Onondaga County is expected to increase in capacity by 50 percent (from 136,300 to 204,400 cu m/day [36 to 54 mgd]) by the end of 1982 to meet long-term future growth[22].

Industries with intakes in U.S. waters of Lake Ontario within 80 km (50 mi) represent 98 percent of all withdrawals. Each industry withdraws water for cooling and returns it to the lake in a once-through cooling process. All other industries in the area use water from municipal supplies[22-33].

Canadian water intakes on Lake Ontario within 80 km (50 mi) of Unit 2 are permitted by the Ontario Ministry of the Environment to withdraw a total of 324,100 cu m/day (85.63 mgd). Public water supplies account for approximately 37 percent of withdrawals, and industries about 63 percent. All intakes are located more than 70 km (44 mi) from Unit 2. Data on Canadian water suppliers and industrial users are provided in Table 2.3-4.

In New York State, total water use from Lake Ontario for irrigation is approximately 37,900 cu m/day (10 mgd). United States irrigation intakes and their locations are identified in Table 2.3-5.

The Ontario Ministry of the Environment permits a total of approximately 24,200 cu m/day (6.4 mgd) to be withdrawn from Lake Ontario for irrigation (Table 2.3-6).

2.3.2.2 Groundwater

Since general groundwater gradient in the site vicinity is toward the lake, no groundwater supplies are expected to be affected by station effluents. All onsite wells are owned by Niagara Mohawk Power Corporation (NMPC) and are no longer in use. No offsite effects are expected from station dewatering. Groundwater is further discussed in FSAR Section 2.4.13.

2.3.2.3 Lake Ontario Fisheries

2.3.2.3.1 Commercial Fish Harvest

United States and Canadian commercial fish harvests for the years 1976 through 1980 are listed by species in Table 2.3-7. The total commercial fish harvest for the 5-yr period was 5.6 million kg (12.3 million lb), of which more than 90 percent was taken in Canadian waters[34-37]. Canadian commercial fisheries are located along the eastern third of the northern Ontario shoreline.

Most of the U.S. commercial fish harvest is caught in the Eastern Basin of Lake Ontario, with more than half the catch coming from the Chaumont Bay region. Major ports of landing are Chaumont and Oswego.

2.3.2.3.2 Sport Fish Catches

Sport fish catches on Lake Ontario in U.S. waters are given in Table 2.3-8 by major species groups. Within Canadian waters of Lake Ontario, approximately 6,330,000 fish were caught by anglers in 1980. Approximately 80 percent of these fish were kept and 56 percent were eaten. Table 2.3-9 presents data regarding fish caught, kept, and eaten by anglers in the Canadian waters of Lake Ontario between Salmon Point and Kingston, an area which roughly corresponds to the Canadian waters within the 80-km (50-mi) radius. Data on total fish caught in Canadian waters of Lake Ontario are provided in Table 2.3-10[38].

2.3.2.4 Recreation

Recreational use of Lake Ontario includes boating, swimming, and fishing. Recreational opportunities in the site vicinity are discussed in Section 2.5.2.

2.3.2.5 Navigation

Oswego Harbor serves as both the easternmost port on Lake Ontario and a terminus of the New York State barge canal system. Tonnage handled by the New York State Barge Canal is provided in Table 2.3-11. The location of Unit 2 on the south shore of Lake Ontario is well outside any normal ship traffic lanes.

2.3.3 Water Quality

2.3.3.1 Introduction

Lake Ontario is the only makeup water source and receiving water body for Unit 2. All other surface water and groundwater in the site vicinity are upgradient from the station and are not affected by station operation. Water quality analysis is thus limited to Lake Ontario in this report.

2.3.3.2 Historical Review of Water Quality Data for the Site and Vicinity

Comprehensive water quality studies have been conducted by state, federal, and international agencies mostly after 1960. In addition, several investor-owned utilities have studied water quality near their existing or planned facilities[39].

The International Joint Commission (IJC) reported lakewide water chemistry data collected during 1965 by the Federal Water Pollution Control Administration (FWPCA). The IJC report also included data from other investigations, including the 1966-1967 studies conducted by the Canadian Department of National Health and Welfare (CDNHW)[39,40].

Allen summarized the chemical characteristics of Lake Ontario prior to 1972 and included historical trends from the late 1800s[41].

The EPA summarized data from water quality surveys in their STORET system[42]. Data from 1965 to 1976 for eastern Lake Ontario were accessed. STORET system data included results from studies by the U.S. Geological Survey (USGS), the New York State Department of Environmental Conservation (NYSDEC), the EPA (Rochester Field Office), the Canadian Center for Inland Waters (CCIW), and the International Field Year for the Great Lakes (IFYGL). A survey of Mexico Bay, located approximately 5.6 km (3.5 mi) east of the Nine Mile Point study area, was conducted by the FWPCA-Rochester Office in 1965[39].

Several studies have been conducted by investor-owned utilities, including a 1973 survey performed by Rochester Gas and Electric Company at the Sterling site, approximately 35 km (22 mi) west of Nine Mile Point[43]. A comprehensive water quality investigation was conducted in the Mexico Bay area by New York State Electric and Gas Corporation during April 1977 to March 1978[39]. NMPC and the Power Authority of the State of New York (PASNY) sponsored water quality surveys in the Nine Mile Point study area from 1973 through 1978[6-11]. Less extensive water quality monitoring reports were compiled in 1979 and 1980 by NMPC[44,45]. The 1978 NMPC/PASNY survey provides the latest extensive data base and is used in this report for analysis of seasonal trends and for comparison with previous studies for long-term water quality trends[11].

2.3.3.3 Lake Ontario Water Quality Overview

Lake Ontario has been designated by NYSDEC as Class A - Special Waters (International Boundary Waters), 6NYCRR702.1[46] Its waters are suitable for use as public water supplies, for culinary or food-processing purposes, and for primary contact recreation. In general, the water in Lake Ontario near Nine Mile Point has been found to be of good quality, with relatively low nutrient concentrations, low bacterial densities, and little industrial contamination. Relatively high levels of dissolved oxygen, more than adequate for most aquatic organisms, were found during all seasons. The total dissolved solids (TDS) concentrations in Lake Ontario have increased since the early 1900s and are now above the New York State Water Quality Standard[42].

Quality of the water in the Nine Mile Point study area was determined to be similar to the general water quality previously reported for the lake. Spatial and temporal variations in water quality have been attributed to natural thermal stratification, action of wind and storms, the Oswego River, west-to-east longshore currents, and hypolimnetic upwellings of cold, often nutrient-rich waters[11].

2.3.3.4 Water Quality Parameters Monitored in Nine Mile Point Region Waters

The 45 water quality parameters measured in the Nine Mile Point site studies and reported in this section are listed in Table 2.3-12. Parameters 1 through 17 were used to assess the general chemical quality of the water. Parameters 18 through 24 are the major nutrients necessary for algal growth and are useful in identifying any potential influence

from agricultural and sanitary waste discharges. Parameters 25 through 31 are generally used to indicate contamination of waters by sanitary and industrial wastes. Trace metals analyses, parameters 32 through 45, provide a basis for the evaluation of toxicity impacts on aquatic life (Section 5.5) and were included to characterize ambient water quality relative to criteria based on toxicity to aquatic life. The sampling locations, survey designs, and analytical procedures utilized in the Nine Mile Point studies conducted for NMPC and PASNY are described in Section 6.6.

2.3.3.5 Water Quality in the Nine Mile Point Region of Lake Ontario

Table 2.3-13 summarizes the water quality data for Lake Ontario in the vicinity of Nine Mile Point. An 8-yr record of water quality is presented. In addition to year-to-year trend description, data in Table 2.3-13 cover historical high and low values for the Nine Mile Point region and yearly mean, maximum, and minimum values for each sampling year. Significant spatial water quality variability in Lake Ontario waters of the Nine Mile Point region was not evident in the raw transect data, excepting solids and temperature. Trends evident in important selected water quality parameter subsets are summarized in the following paragraphs.

<u>Water Temperature</u>

Water temperature influences the kinetics of chemical and biochemical reactions. This parameter displays seasonal variations directly related to air temperature. Water temperature was measured monthly or twice monthly in Lake Ontario in the water quality monitoring program. In addition, continuous in situ monitoring was conducted[1]. Long-term trends indicate no significant change in water temperature over time. Seasonal water temperature variations are illustrated on Figure 2.3-6.

Spatial temperature variations are evident in the raw data presented in References 6 through 11 and 44 and 45. The Nine Mile Point Unit 1 (Unit 1) discharge elevates lake surface temperature, particularly in the nearshore region. The JAF plant has less of a temperature effect, as evidenced by data taken from the water column in the vicinity of its discharge (Section 2.3.1.1.1).

Dissolved Oxygen (DO)

Dissolved oxygen is derived from the atmosphere and photosynthesis. It is essential for the respiration of aquatic organisms and for bacterial oxidation of organic matter. The solubility of oxygen is inversely related to temperature.

The New York State standard for Class A - Special Waters requires a dissolved oxygen concentration not less than 6 mg/l. Dissolved oxygen levels were above this standard during all sampling at all locations, except the minimum value reported in 1973 of 5.8 mg/l DO. Dissolved oxygen levels were above the EPA (1976) criterion of not less than 5 mg/l for the protection of aquatic life[39,47].

pH

The pH of water is the negative logarithm of its hydrogen ion concentration. The pH of most natural waters ranges from 4 to 9, with the majority being basic (greater than 7) due to the presence of carbonates and bicarbonates[48]. The pH of a system may be altered by pollution or by natural processes. The photosynthetic process uses carbon dioxide, which causes an increase in pH. Respiration generates carbon dioxide and causes the pH to decrease. Nine Mile Point data indicate a maximum variation of 2.5 pH units seasonally, with no apparent long-term trends (Table 2.3-13). The New York State standard for Class A - Special Waters requires a pH range of 6.7 to 8.5. All yearly mean values are in the range of 8.0 to 8.4 (slightly alkaline), which is typical of the results from other Lake Ontario studies[42]. Annual maximum pH values have consistently exceeded the classification upper bound of 8.5. It is likely that the high pH data reflect photosynthetic activity near the water surface.

Specific Conductance

Specific conductance is the measure of a solution's ability to conduct an electric current. Conductance in water depends on the total concentration of ionized substances in solution and the temperature. Specific conductance is measured in units of micromhos/cm at a standard temperature of 25°C (45°F). The conductivity of potable waters in the United States varies from 50 to 1,500 micromhos/cm[39,48]. Data presented in Table 2.3-13 indicate an increase in specific conductance over the 6 yr reported. Specific conductance of Lake Ontario water has been increasing yearly at a rate of 13 micromhos/cm per decade over the last

30 yr[41]. Casey et al found that specific conductance ranged from 312 to 323 micromhos/cm[39,49]. The Nine Mile Point data reflect the preceding trend of increasing specific conductance over time.

Turbidity

Turbidity is an expression of the scattering and absorption of light in a water sample. It is caused by suspended matter, such as clay, silt, organic and inorganic matter, plankton, and other microorganisms[48]. Turbidity is measured in nephelometric turbidity units (NTU). Turbidity values collected during the 6-yr sampling program indicate no trend in the season-to-season measured turbidity. Annual variations in turbidity are generally restricted in range, with the exception of the 0 to 52 NTU range reported in 1973. Turbidity variations can be attributed to spring and fall overturns, and algal blooms in the summer season. During 1967, turbidity values for Lake Ontario ranged from 0.2 to 2.5 NTU; increases followed phytoplankton blooms[39,40]. From 1965 to 1975, the overall mean turbidity value based on several studies in eastern Lake Ontario was 0.87 NTU[39,42]. The Nine Mile Point data indicate a higher yearly mean and maximum value for turbidity than the data reported from other studies.

Total Dissolved Solids

Total dissolved solids (TDS) or total filterable residue is a measurement of the material that passes through a glass fiber filter and remains after evaporation and drying at 103°C to 105°C (217°F to 221°F)[48]. Dissolved solids in natural freshwater lakes include anions such as carbonate, sulfate, and chloride and metallic cations such as calcium, sodium, potassium, magnesium, and iron. Certain elemental subsets of dissolved solids serve as nutrients in aquatic biota; their concentrations are significant factors in determining the variety and abundance of life in the ecosystem. Lakewide data indicate TDS levels have remained stable since 1971[50]. All mean TDS concentrations for 1973 through 1978 have been in excess of the 200 mg/l standard for New York State Class A - Special Waters. Values near or above 200 mg/l could be expected; Beeton reported that TDS levels have increased about 50 mg/l over the past 50 yr[51]. From 1906 to 1907, Sweeney reported the average TDS level was 134 mg/l; however, by the early 1960s, TDS levels had increased to 180 mg/l, and Allen reported a mean of 196 mg/l for a 1966 to 1967 study[39-41,52]. For 1980, the lake as a whole was in excess of the 200 mg/l standard for TDS. Lake Ontario's downstream position in the Great Lakes chain is

thought to explain its relatively elevated TDS levels. A recent IJC publication stated, "It must be stressed that Lake Ontario waters will continue to exceed the TDS objectives until the TDS concentration in Lake Erie is lowered or until the objective is changed."[50]

TDS concentrations measured in the Nine Mile Point studies exhibited seasonal fluctuations, with spring peaks, and failed to indicate any impact due to power plants' discharges on regional TDS values. Spatial distributions indicate that the Oswego River discharge plume elevates TDS values in the western (NMPW transect, see Section 6.6.2) region of the Nine Mile Point study area.

Total Suspended Solids

Total suspended solids (TSS) or total nonfilterable residue is the material retained on a glass fiber filter after filtration of a water sample[48]. TSS in natural waters normally consist of organic matter and plankton[53]. High levels of suspended solids may reduce the aesthetic appearance of water and interfere with photosynthesis[39]. While the minimum and maximum values of TSS have shown a decrease over the last year of the sampling period, no trends are evident from the 1973 to 1978 mean yearly TSS data presented in Table 2.3-13.

Cations and Anions

Cations include calcium, magnesium, potassium, and sodium; they comprise a fraction of the dissolved solids. Cations are indicative of general water quality. Annual and season-to-season trends for selected cations are presented in Tables 2.3-13 and 2.3-14. No significant change with time for cations in the study area are evident, with the exception of unusually high concentrations of sodium and potassium in 1974.

Anions monitored during the study included total alkalinity, chlorides, fluorides, and sulfates. Alkalinity is a measure of the buffering capacity of a water system. Buffering capacity is important for protection of fish and other aquatic life against pH changes that may occur. Components of alkalinity, such as carbonate and bicarbonate, can reduce the toxicity of heavy metals by forming complexes. No important long-term or seasonal trends were observed for anions in the study area (Table 2.3-13).

Aquatic Nutrients

Aquatic nutrients are substances that are necessary for aquatic life forms. Their availability will determine the biological activity in the water body[54]. Required aquatic nutrients include nitrogen, phosphorus, and silica compounds. However, concentrations of these nutrients in excess of requirements can promote degradation of water quality. Species of nitrogen measured during these studies included ammonia, nitrate, and organic nitrogen. Phosphorus species included total orthophosphate and total phosphorus. The relative concentrations of nitrogen, phosphorus, and silica compounds provide important data for assessing the availability of these nutrients for primary production[39]. The New York State Class A - Special Waters standard for ammonia is 2.0 mg/l. All values reported in 1973 through 1978 for the study area are well below this standard. Long-term trends indicate a decrease in mean yearly ammonia from 1973 through 1978, paralleled by a decrease in higher values of NH_3N, as reflected in yearly maximum values reported in Table 2.3-13. Seasonally, nitrate concentrations were at their lowest levels during the summer months, which may be attributed to uptake by plankton, and no season-to-season trends were apparent for nitrate over the 6-yr sampling program (Table 2.3-14).

Nitrate concentrations in Lake Ontario appear to be slightly lower in recent years than in the 1960s; however, the long-term trend indicates a gradual increase[50]. A mean of 0.3 mg/l-N was reported for lakewide nitrate values in 1965[39,40]. Values reported for Mexico Bay in 1965 ranged from 0.1 to 0.47 mg/l-N, with a mean of 0.28 mg/l-N[39]. Total organic nitrogen values were reported in 1973, 1976, 1977, and 1978. Data indicate an apparent decrease in total organic nitrogen in Nine Mile Point waters during this period. Total nitrogen concentration (Table 2.3-13), the sum of ammonia, nitrate, and total organic nitrogen species, remained relatively constant over the 6-yr sampling program. In general, it appears that total nitrogen concentrations in the study area have remained at a nearly constant level throughout the sampling program.

Phosphorus

Aquatic organisms utilize soluble orthophosphate in metabolic processes. Much of the phosphorus in a lake is bound to sediments as insoluble (occluded) phosphate. Solubility of phosphate salts is influenced by both physicochemical factors and bacterial metabolism[55]. Very low concentrations of phosphorus may be a limiting factor to the

growth of organisms[56]. When phosphorus is present in relatively larger concentrations, blooms of algae are encouraged. A concentration of 0.01 mg/l of inorganic phosphate has been proposed as the maximum value permissible without supporting undesirable growths, and 0.025 mg/l total phosphorus as the maximum allowable concentration[39,47,53]. Lake Ontario water column phosphorus concentrations have been decreasing in a stepwise manner for 10 yr. From 1972 to 1974, 1975 to 1977, and 1978 to 1980, phosphorus concentrations did not change significantly. Historically, these plateaus were followed by definite decreases in phosphorus concentrations[50]. Table 2.3-13 presents a 6-yr record of total orthophosphate and total phosphorus concentrations in Nine Mile Point regional waters. No long-term trends are evident in these data. Orthophosphate exhibited minimum values during the summer and fall months, as would be expected due to phytoplanktonic nutrient utilization (Table 2.3-14). Total phosphorus measurements varied irregularly throughout the sampling period, but were near to the above-mentioned recommended limit. Mean ambient orthophosphate concentrations during the last 2 yr of the monitoring program were consistently below the recommended limits.

Indicators of Contamination

Indicators of contamination include those constituents that are indicators of the effects of human activity on the lake. These contaminants are introduced primarily through industry, municipalities, agriculture, and individuals. The indicators of contamination include: bacteria, biochemical and chemical oxygen demand, organic carbon, cyanide, and phenols[39].

Bacterial Indicators of Pollution Coliform bacteria have been used as indicators for sanitary water quality since 1880, when it was demonstrated that E. coli were part of fecal discharges. Total coliform bacteria are listed in the National Interim Primary Drinking Water Regulations as the standards for bacterial quality of drinking waters[57].

Fecal coliform bacteria originate in warm-blooded animals. Geldreich stated that fecal coliforms represent over 96 percent of the coliform bacteria derived from human feces, and feces from other warm-blooded animals contain 93 to 98 percent fecal coliforms[39,58]. The New York State standard for coliforms is less than 1,000/100 ml total coliforms and less than 200/100 ml fecal coliforms. It is evident from data presented in Table 2.3-13 that the Lake

Ontario study area is well within the coliform bacteria standards on an annual average basis.

<u>Other Organic Pollutant Load Indicators</u> Biochemical oxygen demand (BOD), chemical oxygen demand (COD), and total organic carbon (TOC) are three constituents used to indicate the organic pollution load. BOD is a measure of biodegradable organic material; COD measures both biodegradable and nonbiodegradable material. Both are expressed in oxygen equivalents. TOC measures all organic material. The BOD (i.e., 5-day BOD) concentrations remained extremely low throughout the 1973 through 1978 study period. The 6-yr mean concentration of 1.9 mg/l is comparable with the lakewide mean of less than 2 mg/l reported by Allen[41]. Chemical oxygen demand concentrations were similarly low; the maximum yearly mean was 13 mg/l, which is less than the 17 mg/l mean concentration reported for eastern Lake Ontario from 1965 through 1972[42]. Total organic carbon concentrations were also very low, indicative of little organic pollution of Lake Ontario water within the study area.

<u>Cyanide</u> Cyanide concentrations were usually below detection limits throughout the water quality monitoring period of 1973 through 1978. The maximum reported value of 7 ug/l is well within the 100 ug/l state standard.

<u>Phenols</u> Phenol concentrations were present in trace quantities, usually at or below the detection limit, from 1967 through 1978. The data indicate no significant phenol flux to the Nine Mile Point regional waters.

<u>Trace Constituents</u>

Trace constituents measured during the studies are summarized in Table 2.3-13. The New York State standards for Class A - Special Waters are listed with the appropriate water quality parameters in Table 2.3-15. Selected constituents are discussed below.

<u>Cadmium</u> Cadmium concentrations were observed to be at or below the laboratory detection limits during the last 5 yr of the sampling program (Table 2.3-13). The 1973 data indicated the maximum value of 67 ug/l, well within the 300 ug/l standard.

<u>Copper</u> With the exception of 1974, all yearly mean concentrations were less than the 200 ug/l standard. For 1974, sample contamination was reported to have occurred during analysis. Maximum values reported from 1975 through 1978 were well below the 200 ug/l copper limit.

Iron All mean annual iron concentrations in the study area are less than the standard of 300 ug/l. Maximum iron concentrations reported from 1973 through 1977 exceeded the standard. Near the end of the monitoring program, a trend toward decreasing iron concentrations can be noted, with the 1978 maximum of 220 ug/l.

Zinc Sample contamination has previously been noted for the 1974 data. Excluding 1974 data, zinc concentrations ranged, on an average yearly basis, from less than 14 ug/l to 50.6 ug/l. No long-term trends were evident in the data. Maximum zinc concentrations in 1973 and 1978 exceeded the state standard of 300 ug/l.

2.3.3.6 Wastewater Discharges

The major waste constituent released to Lake Ontario as a result of site and vicinity water usage is heat. Unit 1 and the JAF plant use Lake Ontario water for cooling. Heated cooling water discharges are rapidly assimilated and cooled to ambient water temperatures outside defined mixing zones (Section 2.3.1.1.1).

Waste discharges from the preceding facilities plus effluents from the Unit 2 site contribute minor amounts of TDS to the Lake Ontario Nine Mile Point regional waters.

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TABLE 2.3-1

SURFACE AREA AND VOLUME OF WATER ENCLOSED WITHIN 2°C (3.6°F) ABOVE AMBIENT ISOTHERMS
THREE-DIMENSIONAL THERMAL SURVEYS - NINE MILE POINT VICINITY

Survey Date	Surface Area		Volume[1]		Mean Depth[2]		Wind Speed		Wind Direction
	(acres)	(ha)	(acre-ft)	(cu m x 10^3)	(ft)	(m)	(mph)	(km/h)	
1975									
June 2	294	119	1,389	1,713.3	4.73	1.44	20-10	32-16	W
June 26	63	25	184	226.4	2.92	0.89	10	16	ENE
July 8	236	96	893	1,101.2	3.78	1.15	15	24	WNW
August 21	124	50	314	387.7	2.54	0.77	18	29	S
1974									
August 8	370	150	1,229	1,516.0	3.33	1.01	8-12	13-19	W/NW
September 5	72	29	235	290.1	3.27	1.00	5	8	E/SE
October 15	52	21	54	66.6	1.04	0.32	8-10	13-16	NW
1973									
June 27	76	31	116	143.3	1.57	0.48	15-20	24-32	S
August 3	143	58	394	486.1	2.76	0.84	10-12	16-19	NW
September 5	220	89	341	420.0	1.55	0.47	10-15	16-24	S
October 12	178	72	487	600.8	2.74	0.84	3-5	5-8	S
1972									
July 21	109	44	168	207.0	1.54	0.47	20	32	W
August 2	125	51	369	454.6	2.94	0.90	5-10	8-16	S/SE
August 16	117	47	301	371.8	2.57	0.78	5-8	8-13	S/SE
August 31	53	21	90	110.6	1.70	0.52	9	14	SW
October 20	138	56	195	240.8	1.42	0.43	10	16	NW
1971									
June 29	73	30	103	127.4	1.42	0.43	15-20	24-32	W/SW
July 13	43	18	84	103.0	1.92	0.59	10-15	16-24	S/SW
July 23	365	148	744	918.1	2.04	0.62	6-8	10-13	S/SW
July 30	161	65	220	271.1	1.36	0.41	0-5	0-8	E
August 16	84	34	198	244.2	2.36	0.72	5-10	8-16	N
August 25	106	43	325	400.7	3.05	0.93	0-10	0-16	S/SW
November 3	46	19	141	174.4	3.05	0.93	5-15	8-24	NW
November 16	268	108	1,005	1,240.0	3.76	1.15	5-10	8-16	NW

TABLE 2.3-1 (Cont)

Survey Date	Surface Area (acres)	Surface Area (ha)	Volume[1] (acre-ft)	Volume[1] (cu m x 10^3)	Mean Depth[2] (ft)	Mean Depth[2] (m)	Wind Speed (mph)	Wind Speed (km/h)	Wind Direction
1970									
July 22	136	55	315	388.2	2.31	0.70	NA	NA	W
August 14	311	126	777	958.0	2.50	0.76	NA	NA	NA
August 16	81	33	132	162.7	1.63	0.50	NA	NA	NA
September 23	183	74	339	418.1	1.85	0.56	NA	NA	NA
October 21	34	14	95	117.3	2.82	0.86	NA	NA	NA

(1) Obtained from surface area x mean depth.
(2) Estimated from depth temperature profiles.

SOURCES: References 12 through 18

TABLE 2.3-2

SUMMARY OF HYDROTHERMAL FIELD SURVEY DATA
JAMES A. FITZPATRICK NUCLEAR POWER PLANT - 1976-1977

Survey Date	Time	Plant Load MWe	Lake Current Velocity fps	Lake Current Velocity m/s	Lake Current Direction	Maximum Observed ΔT at Surface °F	Maximum Observed ΔT at Surface °C	Ambient Temperature °F	Ambient Temperature °C
June 4, 1976	0657-0818	779	0.25(1)	0.08	SW	2.3	1.3	53.3	11.8
June 13, 1976	0638-0801	782	<0.05(1)	<0.02	W	0.8	0.4	51.7	10.9
	1032-1152	782	<0.05(1)	<0.02	W	1.6	0.9	48.5	9.2
	1446-1623	780	0.08(1)	0.02	SW	2.3	1.2	47.3	8.5
August 19, 1976	0806-0949	788	0.46(1)	0.14	WSW	2.6	1.4	68.9	20.5
	1229-1358	793	0.33(1)	0.10	W	ND	ND	ND	ND
	1603-1743	791	0.26(1)	0.08	SW	ND	ND	ND	ND
August 20, 1976	0818-0949	793	0.17(1)	0.05	SW	ND	ND	ND	ND
	1231-1344	792	0.24(1)	0.07	W	ND	ND	ND	ND
	1610-1722	791	0.25(1)	0.08	W	ND	ND	ND	ND
October 7, 1976	0828-1004	726	0.40(1)	0.13	E	4.2	2.4	61.1	16.0
	1502-1615	726	<0.10(1)	<0.03	E	4.3	2.3	60.9	16.0
October 8, 1976	1642-1759	725	0.50(1)	0.15	W	3.5	2.0	60.0	15.6
April 13, 1977	0942-1104	724	0.12(2)	0.04	ESE	4.6	2.5	35.2	1.8
	1445-1616	727	0.42(2)	0.13	ESE	5.9	3.3	36.3	2.4
April 14, 1977	0800-0923	729	0.30(2)	0.09	ESE	6.0	3.3	35.4	1.9
	1309-1428	728	0.34(2)	0.10	ESE	6.6	3.6	36.3	2.4
June 14, 1977	0950-1130	702	0.15(2)	0.05	E	2.0	1.0	53.5	11.9
November 3, 1977	0853-1030	822	0.25(2)	0.08	WNW	4.0	2.0	51.8	11.0

(1)Lake current at 3 m depth.
(2)Lake current at 4.5 m depth.

KEY: ND = Ambient temperature not determined due to influence of Unit 1.

TABLE 2.3-3

PUBLIC AND PRIVATE WATER SUPPLY SYSTEMS IN THE UNITED STATES DRAWING FROM LAKE ONTARIO WITHIN 80 KM (50 MI) OF UNIT 2

Map No.*	Name of System (Intake County)	Distance (km/mi) and Direction from Unit 2	Distance (km/mi) by Water from Unit 2	Average Withdrawal Rate 1980-81 cu m/day	mgd	Type of Use	Population Served	Production Capacity cu m/day	mgd	Comments
1	Rochester Gas & Electric - Robert E. Ginna Nuclear Power Plant (Wayne County)	78/49 WSW	78/49	2,180,160	576.00	Industrial cooling	-	2,180,160	576.00	-
2	Ontario Town Water District (Wayne County)	74/46 WSW	74/46	11,355	3.00	Domestic, industrial	5,000	11,355	3.00	Expanded system startup summer 1981
3	Williamson Water District (Wayne County)	66/41 WSW	66/41	6,813	1.80	Domestic, industrial	4,700	14,762	3.90	Apr-Jun (avg) 4,921 cu m/day (1.3 mgd); Sep-Dec can reach 9,463 cu m/day (2.5 mgd)
4	Sodus Village (Wayne County)	58/36 WSW	58/36	984	0.26	Domestic, industrial	1,800	3,785	1.00	Jan-Jun lows of 265 to 492 cu m/day (0.07 to 0.13 mgd); Aug-Nov 1 highs of 3,747 cu m/day (0.99 mgd)
5	Sodus Point (Wayne County)	53/33 SWS	53/33	757	0.20	Domestic	4,500	2,839	0.75	Winter min. 454 cu m/day (0.12 mgd); peak in dry summer weather 1,703 cu m/day (0.45 mgd)

TABLE 2.3-3 (Cont)

Map No.*	Name of System (Intake County)	Distance (km/mi) and Direction from Unit 2	Distance (km/mi) by Water from Unit 2	Average Withdrawal Rate 1980-81 cu m/day	Average Withdrawal Rate 1980-81 mgd	Type of Use	Population Served	Production Capacity cu m/day	Production Capacity mgd	Comments
6	Wolcott Village (Wayne County)	41/25 WSW	41/25	908	0.24	Domestic, industrial	2,500	3,785	1.00	Avg. winter usage (Jan-Mar) approx. 681 cu m/day (0.18 mgd); avg. peak usage Jun-Nov 1,363 cu m/day (0.36 mgd)
7	NMPC Oswego Steam Station - Unit 5 (Oswego County)	15/10 WSW	15/10	1,558,814	411.84	Industrial cooling	-	1,558,814	411.84	-
8	NMPC Oswego Steam Station - Units 1-4 (Oswego County)	15/10 WSW	15/10	452,383	119.52	Industrial cooling	-	452,383	119.52	-
9	NMPC Oswego Steam Station - Unit 6 Oswego County)	15/10 WSW	15/10	1,771,380	468.00	Industrial cooling	-	1,771,380	468.00	-
10	City of Oswego (Oswego County)	17/11 WSW	17/11	37,850	10.00	Domestic, industrial	32,000	60,560	16.00	Winter, 30,280 cu m/day (8 mgd); summer, 37,850 cu m/day (10 mgd)

TABLE 2.3-3 (Cont)

Map No.*	Name of System (Intake County)	Distance (km/mi) and Direction from Unit 2	Distance (km/mi) by Water from Unit 2	Average Withdrawal Rate 1980-81 cu m/day	mgd	Type of Use	Population Served	Production Capacity cu m/day	mgd	Comments
11	Metropolitan Water Board of Onondaga County, Syracuse, NY (Oswego County)	13/8 WSW	13/8	90,840	24.00	Domestic, industrial	120,000	136,260	36.00	Winter 75,700 cu m/day (20.0 mgd); summer, 98,410-105,980 cu m/day (26.0-28.0 mgd); to Onondaga County Water Authority; remainder to city of Syracuse
12	NMPC, Scriba, NY, Unit 1 (Oswego County)	-	750 ft (Unit 2 discharge to Unit 1 intake)	1,444,356	381.60	Industrial cooling	-	1,444,356	381.60	-
13	Power Authority of the State of New York, Scriba, NY (Oswego County)	-	3,500 ft (Unit 2 discharge to FitzPatrick intake)	2,158,358	570.24	Industrial cooling	-	2,158,358	570.24	-
14	Sackets Harbor Village (Jefferson County)	49/31 NNE	51/32	568	0.15	Domestic	1,200	1,893	0.50	Withdrawals fluctuate in summer from 492 cu m/day (0.13 mgd) in Jun to 681 cu m/day (0.18 mgd) in Aug and Sep

TABLE 2.3-3 (Cont)

Map No.*	Name of System (Intake County)	Distance (km/mi) and Direction from Unit 2	Distance (km/mi) by Water from Unit 2	Average Withdrawal Rate 1980-81 cu m/day	mgd	Type of Use	Population Served	Production Capacity cu m/day	mgd	Comments
15	Chaumont Village (Jefferson County)	60/37 NNE	61/38	265	0.07	Domestic	550	908	0.24	Winter (Dec-Mar) usage is approx. 189 cu m/day (0.05 mgd); summer usage (Jun-Sep) avg. 341 cu m/day (0.09 mgd)
16	Cape Vincent Village (Jefferson County)	65/41 N	65/41	757	0.20	Domestic	750	908	0.24	Withdrawals fluctuate between Jun and Sep from 473 to 1,136 cu m/day (0.125 to 0.3 mgd)

*Locations corresponding to map numbers are shown on Figure 2.3-4.

SOURCES: References 20, 22, 24, 25, and 28

TABLE 2.3-4

CANADIAN WATER SUPPLIERS AND INDUSTRIAL USERS
DRAWING FROM LAKE ONTARIO WITHIN 80 KM (50 MI) OF UNIT 2

Map No.*	Name of System (Intake Location)	Approximate Distance (km/mi) and Direction from Unit 2	Approximate Distance (km/mi) by Water from Unit 2	Permitted Withdrawal Rate (gpm)	Permitted Withdrawal Amount cu m/day	Permitted Withdrawal Amount mgd	Type of Use
17	R. J. Sweezey (Township of Pittsburgh, Frontenac County)	75/47 N	79/49	120	114	0.03	Domestic
18	Public Utilities Commission of the City of Kingston (Frontenac County)	75/47 N	75/47	18,358	81,832	21.62	Domestic
19	Township of Kingston (Frontenac County)	74/46 N	74/46	10,008	27,290	7.21	Domestic
20	DuPont of Canada (Kingston Township, Frontenac County)	74/46 N	74/46	15,006	81,491	21.53	Industrial, air conditioning, and cooling
21	Township of Ernestown (Lennox and Addington County)	75/47 NNW	77/48	120	719	0.19	Domestic
22	Canada Cement LaFarge Ltd. (Ernestown Township, Lennox and Addington County)	75/47 NNW	77/48	2,252	12,263	3.24	Industrial, cooling, processing, and sanitary purposes
23	Millhaven Fibres Ltd. (Ernestown Township, Lennox and Addington County)	75/47 NNW	77/48	20,021	109,084	28.82	Industrial
24	Permanent Concrete Ltd. (Ernestown Township, Lennox and Addington County)	75/47 NNW	77/48	60	151	0.04	Industrial
25	Sandhurst Water Works Ltd. (South Fredericksburgh Township, Lennox and Addington County)	75/47 NNW	77/48	120	265	0.07	Domestic
26	Picton Public Utilities (Prince Edward County)	77/48 NW	97/61	NA	10,901	2.88	Domestic

*Map numbers refer to Figure 2.3-5.

SOURCE: Reference 21

TABLE 2.3-5

UNITED STATES IRRIGATION INTAKES ON LAKE ONTARIO WITHIN 80 KM (50 MI) OF UNIT 2

Farmer	Location of Intake (County)	Distance in km(mi) by Water from Discharge	Area in ha (acres)	Average Water Use cm/ha (in/acre)	Average Water Use l/ha (gal/acre)	Total Water Use/ Application cu m (mgd)	Frequency of Application
J. Simplaar[1] Mexico, NY	On Lake Ontario, between Demster Beach Road and Hickory Grove Road (Oswego County)	8.2 (5.1)	24.3 (60)	7.6 (3)	762,000 (81,463)	18,510 (4.89)	Once per year, 1 year in 4
L. Hurlbutt[2] Mexico, NY	South side of Butterfly Swamp (Oswego County)	9.9 (6.2)	8.1 (20)	7.6 (3)	762,000 (81,463)	6,170 (1.63)	Once per year, dry weather only
D. Ouellette[3] Sterling, NY	East Branch of Sterling Creek (Cayuga County)	38.6 (24.1)	28.3 (70)	5.1 (2)	508,000 (54,308)	14,380 (3.80)	Once per year, 1 year in 5

NOTE: Irrigated crop at each location, apples.

SOURCES: [1]Reference 59

[2]Reference 60

[3]Reference 61

TABLE 2.3-6

CANADIAN IRRIGATION INTAKES ON LAKE ONTARIO WITHIN 80 KM (50 MI) OF UNIT 2

Name	Location	Rate Not to Be Exceeded lpm	Rate Not to Be Exceeded gpm	Amount Not to Be Exceeded cu m/day	Amount Not to Be Exceeded mgd
Picton Golf and Country Club	Hallowell Township	454	120	189	0.05
G. Vader	Athol Township	2,044	540	1,136	0.30
K. Perry	Athol Township	1,249	330	1,173	0.31
R. K. Hicks	North Marysburgh Township	1,423	376	2,044	0.54
Windy Acres Farms	Hallowell Township	1,635	432	1,363	0.36
B. McArthur (West Lake Farms Ltd.)	Hallowell Township	908	240	984	0.26
C. Foster	Hallowell Township	1,703	450	1,438	0.38
G. Bosma	South Marysburgh Township	568	150	530	0.14
Point Pleasant Farms, Ltd.	North Marysburgh Township	1,703	450	2,460	0.65
Waupoos Canning Co., Ltd.	North Marysburgh Township	1,703	450	2,044	0.54
J. Carter	North Marysburgh Township	2,502	661	2,233	0.59
R. & K. Carson	North Marysburgh Township	1,703	450	1,438	0.38
E. Vowinckel	South Marysburgh Township	2,275	601	3,255	0.86
R. R. Dodokin	South Marysburgh Township	454	120	681	0.18
W. Hicks	South Marysburgh Township	908	240	227	0.06
C. A. McCormack	South Marysburgh Township	840	222	757	0.20
Cataraqui Golf and Country Club	Kingston	1,590	420	2,271	0.60

SOURCE: Reference 21

TABLE 2.3-7

TOTAL COMMERCIAL FISH BY SPECIES IN KILOGRAMS (AND POUNDS)
HARVESTED FROM LAKE ONTARIO (U.S. AND CANADIAN WATERS)

	1976		1977		1978		1979		1980	
Species	U.S.[1]	Canada[2]	U.S.[3]	Canada[2]	U.S.[3]	Canada[2]	U.S.[3]	Canada[4]	U.S.[3]	Canada[2]
Bowfin							136	984 (2,170)		54 (119)
Bullhead & Catfish	9,707 (21,404)	158,000 (348,390)	21,455 (47,308)	183,000 (403,515)	17,237 (38,008)	164,000 (361,620)	12,292 (27,104)	144,858 (319,412)	15,332 (33,807)	100,071 (220,657)
Burbot								55 (121)		
Carp	2,268 (5,001)	193,000 (425,565)	862 (1,901)	107,000 (235,935)	363 (800)	9,000 (19,845)		3,791 (8,359)	454 (1,001)	
Common Eel	16,103 (35,507)	154,000 (339,570)		186,000 (410,130)	19,142 (42,208)	229,000 (504,945)	18,144 (40,008)	211,041 (487,395)	29,847 (65,813)	161,963 (357,128)
Crappie	1,406 (3,100)		1,179 (2,600)		544 (1,200)		590 (1,301)	6,081 (13,409)	726 (1,601)	7,882 (17,380)
Freshwater Drum	136 (300)						136 (300)	28 (62)	227 (501)	
Lake Herring		7,000 (15,435)		5,000 (11,025)		6,000 (13,230)		13,494 (29,754)		4,510 (9,945)
Lake Whitefish								1,268 (2,796)		4,133 (9,113)
Northern Pike								18,890 (41,652)		19,916 (43,915)
Rock Bass	3,266 (7,202)		5,489 (12,103)		4,672 (10,302)		1,633 (3,601)	10,264 (22,632)	2,676 (5,901)	6,176 (13,618)
Smelt	5,579 (12,302)	41,000 (90,405)	5,988 (13,204)	23,000 (50,715)	20,185 (44,508)	27,000 (59,535)	4,717 (10,401)	24,942 (54,997)		22,402 (49,396)
Sturgeon								12 (26)		61 (135)
Suckers	1,860 (4,101)		1,043 (2,300)		1,905 (4,201)		590 (1,301)	7,606 (16,771)	227 (501)	3,719 (8,200)

TABLE 2.3-7 (Cont)

Species	1976 U.S.[1]	1976 Canada[2]	1977 U.S.[3]	1977 Canada[2]	1978 U.S.[3]	1978 Canada[2]	1979 U.S.[3]	1979 Canada[4]	1980 U.S.[3]	1980 Canada[2]
Sunfishes	3,084 (6,800)	102,000 (224,910)	4,128 (9,102)	77,000 (169,785)	2,812 (6,200)	67,000 (147,735)	2,313 (5,100)	62,024 (136,763)		68,867 (151,852)
Walleye	136 (300)		318 (701)		1,905 (4,201)		91 (201)	23,917 (52,737)	272 (600)	51,767 (114,146)
White Bass	91 (201)		91 (201)				45 (99)	1,331 (2,935)	45 (99)	3,321 (7,323)
White Perch	20,503 (45,209)	328,000 (723,240)	31,026 (68,412)	191,000 (421,155)	9,888 (21,803)	226,000 (498,330)	7,439 (16,403)	46,520 (102,577)	16,602 (36,607)	55,330 (122,003)
Yellow Perch	23,814 (52,510)	258,000 (568,890)	22,181 (48,909)	263,000 (579,915)	6,260 (13,803)	318,000 (701,190)	10,161 (22,405)	297,754 (656,548)	6,487 (14,304)	267,289 (589,372)
Others		71,000 (156,555)		72,000 (158,760)		66,000 (145,530)		7,045 (15,534)		1,341 (2,957)
Total	87,953 (193,936)	1,312,000 (2,892,960)	93,760 (206,741)	1,107,000 (2,440,935)	84,913 (187,233)	1,112,000 (2,451,960)	58,287 (128,523)	881,905 (1,944,601)	72,895 (160,733)	778,802 (1,717,258)

SOURCES: [1]Reference 34

[2]Reference 36

[3]Reference 35

[4]Reference 37

TABLE 2.3-8

ESTIMATED FISH HARVEST BY ANGLERS
IN NEW YORK STATE WATERS OF LAKE ONTARIO IN 1976-1977

Species	Estimated Number of Fish
Trout/Salmon - Lake trout, rainbow trout, brown trout, brook trout, other trout, chinook salmon, kokanee salmon, splake, Atlantic salmon, coho salmon	239,500
Black Bass - Smallmouth bass, largemouth bass	718,000
Walleye/Sauger	32,690
Yellow Perch	1,710,000
Panfish - Sunfish (including bluegill, pumpkinseed, and rock bass), crappies, white perch, white bass	1,382,000
Esocids - Northern pike, chain pickerel, muskellunge, tiger musky, other esocids	131,000
Bullheads/Catfish	685,400
Total	4,898,590

SOURCE: Reference 62

TABLE 2.3-9

ESTIMATED FISH HARVEST BY ANGLERS IN CANADIAN WATERS OF LAKE ONTARIO BETWEEN SALMON POINT AND KINGSTON, ONTARIO, IN 1980

Species	Number of Fish* Caught	Kept	Eaten
Bass (General)	25,300 (25.3)	19,754 (49.9)	7,626 (19.7)
Bass (Largemouth)	13,784 (20.6)	12,173 (27.5)	9,432 (23.0)
Bass (Rock)	15,713 (9.4)	-	-
Bass (Smallmouth)	24,730 (28.5)	20,830 (37.0)	20,830 (39.5)
Bullhead	15,891 (17.8)	15,891 (54.9)	15,891 (54.9)
Lake Whitefish	23,116 (57.5)	-	-
Muskellunge (Maskimonge)	2,210 (79.2)	-	-
Northern Pike	23,676 (22.7)	12,225 (23.7)	10,761 (22.6)
Perch	76,154 (22.3)	43,262 (21.4)	39,794 (21.0)
Pickerel	27,313 (18.9)	15,787 (13.9)	14,444 (13.0)
Sunfish	4,043 (4.8)	-	-
Trout (General)	5,779 (55.7)	1,444 (54.4)	1,444 (54.4)

TABLE 2.3-9 (Cont)

Species	Number of Fish* Caught	Number of Fish* Kept	Number of Fish* Eaten
Salmon (Chinook)	242 (0.1)	242 (2.3)	-
All Species	257,951	141,638	120,222

*Numbers in parentheses indicate percentage of all Lake Ontario species (Table 2.3-10) in each category which were caught in lake region between Salmon Point and Kingston. Dashes indicate data not available.

SOURCE: Reference 38

TABLE 2.3-10

ESTIMATED TOTAL FISH HARVEST BY ANGLERS
IN CANADIAN WATERS OF LAKE ONTARIO IN 1980

Species	Number of Fish Caught	Kept	Eaten
Bass (General)	99,779	39,570	38,360
Bass (Largemouth)	66,867	44,527	41,018
Bass (Rock)	166,216	63,182	63,182
Bass (Smallmouth)	86,703	56,245	52,786
Bass (Striped)	-	-	-
Bass (White)	17,572	6,514	6,514
Black Eel	1,741	288	288
Bullhead	89,043	28,897	28,897
Carp	38,497	2,984	2,742
Catfish	40,422	2,945	2,945
Channel Catfish	1,258	-	-
Chub	2,906	1,211	1,211
Lake Whitefish	31,883	726	726
Muskellunge	2,788	578	578
Suckers	15,741	726	726
Northern Pike	104,475	51,607	47,513
Pan Fish	6,053	6,053	6,053
Perch	341,387	201,590	189,404
Pickerel	144,903	113,166	111,004
Sunfish	84,236	31,871	31,871
Shad	4,843	-	-
Sheepshead	17,972	1,061	-
Smelt	4,694,032	4,218,685	2,815,819
Crappies	264	264	264
Trout (General)	10,379	2,655	2,655
Trout (Brook)	1,351	1,351	1,351
Trout (Brown)	10,116	6,483	4,545
Trout (Lake)	13,042	5,786	5,302
Trout (Rainbow)	32,229	21,970	16,643
Trout (Splake)	242	242	242
Salmon (General)	24,758	21,367	18,703
Salmon (Chinook)	22,467	10,222	6,108
Salmon (Coho)	121,365	81,610	57,213
Multi Species	34,291	6,372	6,372
All Species	6,329,821	5,030,748	3,561,035

SOURCE: Reference 38

TABLE 2.3-11

TONNAGE ON THE NEW YORK STATE BARGE CANAL
IN THE VICINITY OF UNIT 2
(1963-1976)

Year	Tonnage
1963	307,378
1964	303,273
1965	337,875
1966	446,229
1967	423,294
1968	407,828
1969	377,699
1970	383,641
1971	262,768
1972	281,383
1973	204,503
1974	404,514
1975	233,291
1976	230,790

SOURCE: Reference 63

TABLE 2.3-12

WATER QUALITY PARAMETERS MEASURED
IN THE NINE MILE POINT STUDY AREA

General Water Quality	Aquatic Nutrients	Indicators of Contamination	Trace Metals
1. Alkalinity, total	18. Ammonia	25. Bacteria, total coliform	32. Aluminum
2. Calcium	19. Nitrate	26. Bacteria, fecal coliform	33. Arsenic
3. Chloride	20. Nitrogen, total	27. Biochemical oxygen demand (5-day)	34. Beryllium
4. Color, true	21. Organic nitrogen, total	28. Chemical oxygen demand	35. Cadmium
5. Conductance, specific	22. Orthophosphate, total	29. Cyanide, total	36. Chromium
6. Fluoride	23. Phosphorus, total	30. Organic carbon, total	37. Copper
7. Magnesium	24. Silica, soluble	31. Phenols	38. Iron
8. Oxygen, dissolved			39. Lead
9. pH			40. Manganese
10. Potassium			41. Mercury
11. Residue, filterable (total dissolved solids)			42. Nickel
12. Residue, nonfilterable (total suspended solids)			43. Selenium
13. Residue, total (total solids)			44. Vanadium
14. Sodium			45. Zinc
15. Sulfate			
16. Temperature			
17. Turbidity			

TABLE 2.3-13

HISTORICAL COMPARISON OF WATER QUALITY
IN THE VICINITY OF NINE MILE POINT

Constituent	Study	1973[1]	1974[2]	1975[3]	1976[4]	1977[5]	1978[6]	1979[7]	1980[8]
General Water Quality									
Temperature (°C)	$\overline{X}$	14.8	11.5	13.6	12.5	12.6	13.2	11.7	13.1
	X_{min}	4.4	1.9	2.3	0.4	1.8	3.0	1.6	4.1
	X_{max}	39.4	25.1	24.5	20.6	26.0	24.9	24.7	22.7
	n	217	32	36	36	54	54	36	32
Oxygen, dissolved (mg/l)	$\overline{X}$	9.8	10.5	10.5	10.5	10.9	11.4	11.2	10.9
	X_{min}	5.8	8.3	8.2	8.6	9.0	8.2	8.7	8.3
	X_{max}	13.8	12.3	13.8	13.3	14.1	15.5	13.7	14.0
	n	210	36	36	36	53	54	36	36
pH	$\overline{X}$	8.2	8.0	8.3	8.2	8.3	8.4	NM	NM
	X_{min}	6.6	6.9	8.0	7.9	7.9	7.9		
	X_{max}	9.1	8.8	8.7	8.5	9.4	8.7		
	n	230	36	36	36	54	54		
Conductance, specific (umhos/cm)	$\overline{X}$	279.0	286.8	331	366.6	316	365	NM	NM
	X_{min}	80.0	220.0	296	296.0	200	310		
	X_{max}	490.0	350.0	440	590.0	380	510		
	n	190	28	36	36	36	36		
Alkalinity, total (mg/l - $CaCO_3$)	$\overline{X}$	89	85.6	89.1	95.4	95.7	94.2	NM	NM
	X_{min}	73	70.0	78	89	89	80		
	X_{max}	120	107.0	106	105	105	112		
	n	75	36	36	36	36	36		
Calcium (mg/l)	$\overline{X}$	NM	47.8	43.0	44.1	43.2	41.7	NM	NM
	X_{min}		13.1	34.2	32.3	27.5	32.8		
	X_{max}		105.0	111.8	56.8	51.9	50.6		
	n		36	36	36	36	36		
Chloride (mg/l)	$\overline{X}$	37.5	32	33	38.7	32.8	35.4	NM	NM
	X_{min}	26	0	24	25	26.1	26.5		
	X_{max}	70	108	59	89	53.2	64.5		
	n	75	36	36	36	36	36		
Color, true	$\overline{X}$	6.5	10	9	14	1	1	NM	NM
	X_{min}	0	5	5	5	1	1		
	X_{max}	45	35	20	40	1	1		
	n	59	36	36	36	36	36		

TABLE 2.3-13 (Cont)

Constituent	Study	1973[1]	1974[2]	1975[3]	1976[4]	1977[5]	1978[6]	1979[7]	1980[8]
General Water Quality (Cont)									
Fluoride (mg/l)	$\bar{X}$	0.1	0.1	-b	<0.24+	<0.1+	0.15	NM	NM
	X_{min}	0.1	0.0	<0.2	<0.2	<0.05	0.06		
	X_{max}	0.2	0.2	0.2	0.6	0.2	0.24		
	n	38	36	36	36	36	36		
Magnesium (mg/l)	$\bar{X}$	8.0	8.0	7.8	10.5	8.2	7.95	NM	NM
	X_{min}	0.3	6.2	6.7	7.8	6.0	6.70		
	X_{max}	10.1	11.9	11.2	17.6	9.7	9.93		
	n	52	36	36	36	36	36		
Potassium (mg/l)	$\bar{X}$	1.9	54.0	2.3	1.9	1.7	1.61	NM	NM
	X_{min}	1.3	40.0	1.7	1.3	0.8	1.20		
	X_{max}	2.5	66.6	3.5	3.6	2.9	2.10		
	n	74	36	36	36	36	36		
Residue, filterable (TDS) (mg/l)	$\bar{X}$	240	228	209	224.3	210	202	NM	NM
	X_{min}	135	180	179	181	135	146		
	X_{max}	525	460	297	366	324	295		
	n	75	36	36	36	36	36		
Residue, nonfilterable (TSS) (mg/l)	$\bar{X}$	8.6	8	5	10.6	<2.3+	<3.7+	NM	NM
	X_{min}	0.0	1	1	2	<0.1	<0.1		
	X_{max}	260	63	26	69	11.4	20.2		
	n	240	36	36	36	35	36		
Residue, total (mg/l)	$\bar{X}$	237	236	214	235	213	206	NM	NM
	X_{min}	145	195	185	185	141	146		
	X_{max}	530	470	301	392	326	299		
	n	240	36	36	36	36	36		
Sodium (mg/l)	$\bar{X}$	16.4	37.6	15.8	21.2	14.3	16.0	NM	NM
	X_{min}	8.8	9.7	10.8	9.9	6.6	11.9		
	X_{max}	31.6	216.0	27.8	37.7	19.3	28.6		
	n	74	36	36	36	36	36		
Sulfate (mg/l)	$\bar{X}$	28.7	35	30	29.6	28.6	30.5	NM	NM
	X_{min}	22	22	22	23	20.7	24.4		
	X_{max}	39	53	74	41	36.7	42.0		
	n	75	36	36	36	36	36		

TABLE 2.3-13 (Cont)

Constituent	Study	1973[1]	1974[2]	1975[3]	1976[4]	1977[5]	1978[6]	1979[7]	1980[8]
General Water Quality (Cont)									
Turbidity (NTU)	$\bar{X}$	4.4	3.8	3	4.5	2.1	3.0	NM	NM
	X_{min}	0.0	1	1	1.0	0.7	1.4		
	X_{max}	52	22	8	26.0	7.9	7.8		
	n	240	36	36	36	36	36		
Aquatic Nutrients									
Ammonia (mg/l-N)	$\bar{X}$	0.0	0.2	0.1	0.3	0.04	0.033+	NM	NM
	X_{min}	0.0	0.0	0.1	0.1	0.01	<0.002		
	X_{max}	0.2	0.8	0.5	0.4	0.1	0.084		
	n	62	36	36	36	36	36		
Nitrate (mg/l-NO_3)	$\bar{X}$	0.1	0.15	0.17	0.2	0.2	<0.18+	NM	NM
	X_{min}	0.0	0.02	0.01	0.0	0.0	0.01		
	X_{max}	0.4	0.46	0.48	0.5	0.3	0.33		
	n	240	36	36	36	36	36		
Organic nitrogen, total, (mg/l)	$\bar{X}$	0.3	NM	NM	0.4	0.15	0.23	NM	NM
	X_{min}	0.0			0.0	0.07	0.01		
	X_{max}	1.0			1.2	0.31	0.63		
	n	38			31	36	36		
Nitrogen, total (TKN) (mg/l)	$\bar{X}$	0.5	0.5	0.40	0.6	0.2	0.27	NM	NM
	X_{min}	0.0	0.0	0.19	0.2	0.1	0.03		
	X_{max}	1.4	1.0	0.90	1.5	0.4	0.66		
	n	200	35	36	35	36	36		
Orthophosphate, total, (mg/l-P)	$\bar{X}$	0.0092	0.01	0.004	0.012	<0.006+	<0.007+	NM	NM
	X_{min}	0.0	0.00	0.00	0.002	<0.002	0.002		
	X_{max}	0.080	0.03	0.02	0.058	0.012	0.022		
	n	240	36	36	36	36	36		
Phosphorus, total (mg/l-P)	$\bar{X}$	0.053	0.03	0.024	0.022	0.021	0.027	NM	NM
	X_{min}	0.0	0.01	0.00	0.004	0.007	0.005		
	X_{max}	0.91	0.08	0.07	0.066	0.047	0.106		
	n	240	36	36	101	36	36		
Silica, soluble (mg/l-SiO_2)	$\bar{X}$	1.0	0.4	<0.7+	<0.96+	<0.30+	<0.20+	NM	NM
	X_{min}	0.0	0.0	<0.1	<0.04	<0.05	<0.05		
	X_{max}	7.0	1.2	2.0	1.68	0.56	0.37		
	n	31	35	36	36	36	36		

TABLE 2.3-13 (Cont)

Constituent	Study	1973(1)	1974(2)	1975(3)	1976(4)	1977(5)	1978(6)	1979(7)	1980(8)
Indicators of Contamination									
Biochemical oxygen demand, 5-day (mg/l)	$\bar{X}$	1.8	3	2	1.2	1.6	1.7	NM	NM
	X_{min}	0.0	1	1	1.0	0.0	0.0		
	X_{max}	6.0	5	4	5.0	3.6	4.0		
	n	223	36	36	36	36	36		
Bacteria, total coliform (no./100 ml)	$\bar{X}$	63.8	18	19	-d	>137††	<248†	NM	NM
	X_{min}	0.0	0	0	8	2.2	<2		
	X_{max}	430	100	121	772	2,400.0	1,800		
	n	61	36	36	32	36	36		
Bacteria, fecal coliform (no./100 ml)	$\bar{X}$	13.4	9	6	27.7	43†,††	<54†	NM	NM
	X_{min}	0.0	0	0	1.0	<2.0	<2		
	X_{max}	550	107	76	166	>300.0	550		
	n	59	36	36	36	36	36		
Organic carbon, total, (mg/l)	$\bar{X}$	5.2	11	NM	<7.3†	11.0	NM	NM	NM
	X_{min}	0.0	3		<1.0	6.6			
	X_{max}	18	62		15	19.5			
	n	38	34		24	16			
Phenol. (mg/l)	$\bar{X}$	0.03	0.001	0.002	<0.0033†	-b	-b	NM	NM
	X_{min}	0.0	0.000	0.00	<0.001	<0.005	<0.005		
	X_{max}	0.169	0.018	0.05	0.018	0.005	0.018		
	n	67	36	36	36	36	36		
Chemical oxygen demand (mg/l)	$\bar{X}$	13	11	9	11.4	<6.8†	<5.3†	NM	NM
	X_{min}	0	0	2	5	<2.0	<2.0		
	X_{max}	65	26	19	22	10.8	9.6		
	n	230	36	36	36	36	36		
Cyanide, total CN (mg/l-CN)	$\bar{X}$	0	0	0	-b	-b	-b	NM	NM
	X_{min}	0	0	0	<0.02	<0.005	<0.005		
	X_{max}	0	0	0	<0.02	<0.005	0.007		
	n	46	36	36	28	36	36		
Trace Constituents									
Aluminum Al (ug/l)	$\bar{X}$	16	2,831	<130	<190	74	112	NM	NM
	X_{min}	0	0	<20	<20	1	22		
	X_{max}	27	87,500	1,660	670	238	275		
	n	47	36	36	36	36	36		

TABLE 2.3-13 (Cont)

Constituent	Study	1973(1)	1974(2)	1975(3)	1976(4)	1977(5)	1978(6)	1979(7)	1980(8)
Trace Constituents (Cont)									
Lead	$\overline{X}$	23.2	70c	-b	-b	<8+	-b	NM	NM
Pb (ug/l)	X_{min}	0	0	<80	<50	<1	<1		
	X_{max}	240	750c	<80	<50	44	15		
	n	55	36	36	36	36	36		
Manganese	$\overline{X}$	57.8	4	-b	<14+	<11+	18+	NM	NM
Mn (ug/l)	X_{min}	0	0	<20	<10	<1	<1		
	X_{max}	360	40	80	60	92	97		
	n	58	32	36	36	36	36		
Mercury	$\overline{X}$	0	1	-b	<1.7	-b	-b	NM	NM
Hg (ug/l)	X_{min}	0	0	<2	<1	<0.2	<0.2		
	X_{max}	0	24	6	5	<0.5	<0.5		
	n	24	36	32	36	36	36		
Nickel	$\overline{X}$	31.3	15c	-b	-b	<8+	<4+	NM	NM
Ni (ug/l)	X_{min}	0	0	<50	<20	<2	<1		
	X_{max}	200	256c	50	30	50	10		
	n	66	36	36	36	36	36		
Arsenic	$\overline{X}$	0.4	0	-b	-b	<3.4+	<0.5	NM	NM
As (ug/l)	X_{min}	0	0	<28	<2	<0.5	<0.2		
	X_{max}	0.6	0	<28	<28	21	0.0016		
	n	14	36	36	36	36	36		
Beryllium	$\overline{X}$	4.9	0	-b	-b	-b	-b	NM	NM
Be (ug/l)	X_{min}	0	0	5	<5	<1	<1		
	X_{max}	51	0	<5	<5	<1	<1		
	n	74	36	36	36	36	36		
Cadmium	$\overline{X}$	4	0	-b	-b	-b	-b	NM	NM
Cd (ug/l)	X_{min}	0	0	<20	<2	<1	<1		
	X_{max}	67	0	<20	<4	1	≤1		
	n	74	36	36	36	36	36		
Chromium	$\overline{X}$	12.3	40	-b	-b	-b	-b	NM	NM
Cr (ug/l)	X_{min}	0	0	<100	<20	<1	<1		
	X_{max}	160	590	<100	190	1	2		
	n	73	36	36	36	36	36		

TABLE 2.3-13 (Cont)

Constituent	Study	1973[1]	1974[2]	1975[3]	1976[4]	1977[5]	1978[6]	1979[7]	1980[8]
Trace Constituents (Cont)									
Copper	$\bar{X}$	64.4	1,390c	-b	-b	<8+	<19+	NM	NM
Cu (ug/l)	X_{min}	0	0	<30	<10	<1	<1		
	X_{max}	410	15,100c	50	<10	36	116		
	n	74	36	36	36	36	36		
Iron	$\bar{X}$	176	289	<80+	<132+	116	91	NM	NM
Fe (ug/l)	X_{min}	0	0	<20	<20	3	6		
	X_{max}	1,920	1,200	470	460	613	220		
	n	75	36	36	36	36	36		
Selenium	$\bar{X}$	0	0	NM	<24.1	<1.4+	<7+	NM	NM
Se (ug/l)	X_{min}	0	0		<1	<0.3	<0.2		
	X_{max}	0	0		82	4.1	20		
	n	21	12		36	36	36		
Vanadium	$\bar{X}$	23.5	0	-b	-b	<2+	-b	NM	NM
V (ug/l)	X_{min}	0	0	<20	<0.2	<1	<2		
	X_{max}	300	0	<200	<0.2	2	<2		
	n	51	36	36	36	36	36		
Zinc	$\bar{X}$	45.3	958	<17+	<14+	<19+	<48+	NM	NM
Zn (ug/l)	X_{min}	0	0	<10	<5	<1	<1		
	X_{max}	638	9,800	91	120	77	675		
	n	67	36	36	36	36	36		

KEY:

$\bar{X}$ = mean value
X_{min} = minimum value reported
X_{max} = maximum value reported
n = number of values reported used to calculate the mean value
+ = "less than" table entries for raw data were input to calculated means as equal to the detection limit
++ = "greater than" table entries for raw data were input to calculated means as equal to the detection limit
NM = not measured
b = mean not calculated when >75 percent of the entry values were below the detection limits
c = mean and sample influenced by contamination of the sample or samples
d = April sample too numerous to count

TABLE 2.3-13 (Cont)

NOTE: Data presented is the maximum, minimum, and average values of four samples, one each from the surface and bottom of the water column at the 8- and 14-m (25- and 45-ft) contours on the NMPP/FITZ transect in the Nine Mile Point vicinity each month (Section 6.6.2). The sampling year was generally from April to December. The more extensive 1973 data is the product of all monthly and bimonthly water quality surveys performed that year. Certain latter years' data sets with n>36 reflect use of monthly surface values at the 6- and 12-m (20- and 40-ft) contours of the NMPW, FITZ, and NMPE transects.

SOURCES: (1)Reference 6

(2)Reference 7

(3)Reference 8

(4)Reference 9

(5)Reference 10

(6)Reference 11

(7)Reference 44

(8)Reference 45

TABLE 2.3-14

MONTHLY VARIATION IN SELECTED WATER QUALITY PARAMETERS COLLECTED IN THE VICINITY OF NINE MILE POINT, 1978

Parameter	Unit		April	May	June	July	August	September	October	November	December
Dissolved oxygen	mg/l-DO	Mean	14.9	15.1	13.1	8.8	8.6	9.3	9.1	10.7	13.6
		Range	14.2-15.5	14.2-16.7	12.0-14.6	8.3-9.7	7.4-9.0	8.5-11.1	8.8-9.7	10.2-11.3	13.3-14.0
		SD*	0.5	0.6	1.0	0.5	0.6	1.0	0.3	0.4	0.2
		No	18	18	18	18	18	18	18	18	18
Nitrate	mg/l-N	Mean	0.31	0.26	0.18	0.03	<0.04	0.13	0.14	0.18	0.29
		Range	0.28-0.38	0.20-0.35	0.15-0.27	<0.01-0.06	<0.04	0.05-0.17	0.12-0.19	0.16-0.22	0.27-0.33
		SD	0.04	0.05	0.03	0.02	0.00	0.04	0.02	0.02	0.02
		No	16	16	16	16	16	16	16	16	16
Total phosphorus	mg/l-P	Mean	0.021	0.018	0.024	0.028	0.012	0.013	0.027	0.012	0.038
		Range	0.005-0.048	0.008-0.033	0.018-0.033	0.017-0.044	0.004-0.022	0.008-0.020	0.016-0.048	0.005-0.022	0.008-0.110
		SD	0.009	0.008	0.005	0.007	0.005	0.003	0.010	0.004	0.030
		No	22	22	22	22	22	22	22	22	22
Ortho-phosphorus	mg/l-P	Mean	0.009	0.011	0.004	0.004	0.004	0.003	0.002	0.004	0.008
		Range	0.004-0.019	0.006-0.018	0.003-0.006	<0.002-0.008	<0.002-0.012	<0.002-0.004	<0.002-0.006	<0.002-0.006	<0.003-0.022
		SD	0.004	0.005	0.001	0.002	0.004	0.001	0.001	0.002	0.007
		No	16	16	16	16	16	16	16	16	16
Silica	mg/l-SiO_3	Mean	0.37	0.08	0.11	0.19	0.18	0.21	0.14	0.18	0.29
		Range	0.31-0.49	<0.05-0.13	<0.05-0.17	0.09-0.30	0.11-0.30	0.13-0.27	0.10-0.17	0.11-0.25	0.14-0.37
		SD	0.08	0.03	0.05	0.08	0.07	0.05	0.02	0.04	0.07
		No	16	16	16	16	16	16	16	16	16
Calcium	mg/l-Ca	Mean	37.0	41.3	41.9	44.7	40.9	33.0	36.7	41.0	34.6
		Range	33.1-38.4	36.4-50.6	39.2-45.3	37.5-53.8	38.8-43.8	30.7-37.8	30.5-50.0	36.4-47.0	28.6-43.0
		SD	1.9	5.7	2.1	4.6	2.0	2.2	7.1	3.6	6.0
		No	10	10	10	10	10	10	10	10	10
Sulfate	mg/l-SO_4	Mean	33.4	31.5	27.9	25.0	25.8	27.9	28.8	31.1	27.6
		Range	27.7-40.7	27.2-42.0	25.8-30.9	24.3-25.9	23.7-28.2	24.6-30.7	27.6-29.7	29.9-32.9	25.8-30.8
		SD	5.9	5.8	1.7	0.5	1.8	1.9	0.8	1.2	1.7
		No	10	10	10	10	10	10	10	10	10

TABLE 2.3-14 (Cont)

Parameter	Unit		April	May	June	July	August	September	October	November	December
Total solids	mg/l-TS	Mean	204	251	212	168	185	233	202	226	217
		Range	146-248	176-419	167-251	136-222	147-211	163-316	160-225	196-266	178-249
		SD	29	62	20	25	34	55	14	17	18
		No	22	22	22	22	22	22	22	22	22
Total suspended solids	mg/l-TSS	Mean	1.6	3.1	1.4	4.8	1.1	0.3	1.1	2.0	7.3
		Range	<0.1-4.0	0.8-15.8	0.2-4.0	0.6-7.4	<0.1-4.0	<0.1-1.2	<0.1-3.8	<0.1-7.6	<0.1-21.0
		SD	1.3	3.5	0.9	2.3	1.0	0.5	0.9	2.2	8.0
		No	22	22	22	22	22	22	22	22	22

*Standard deviation

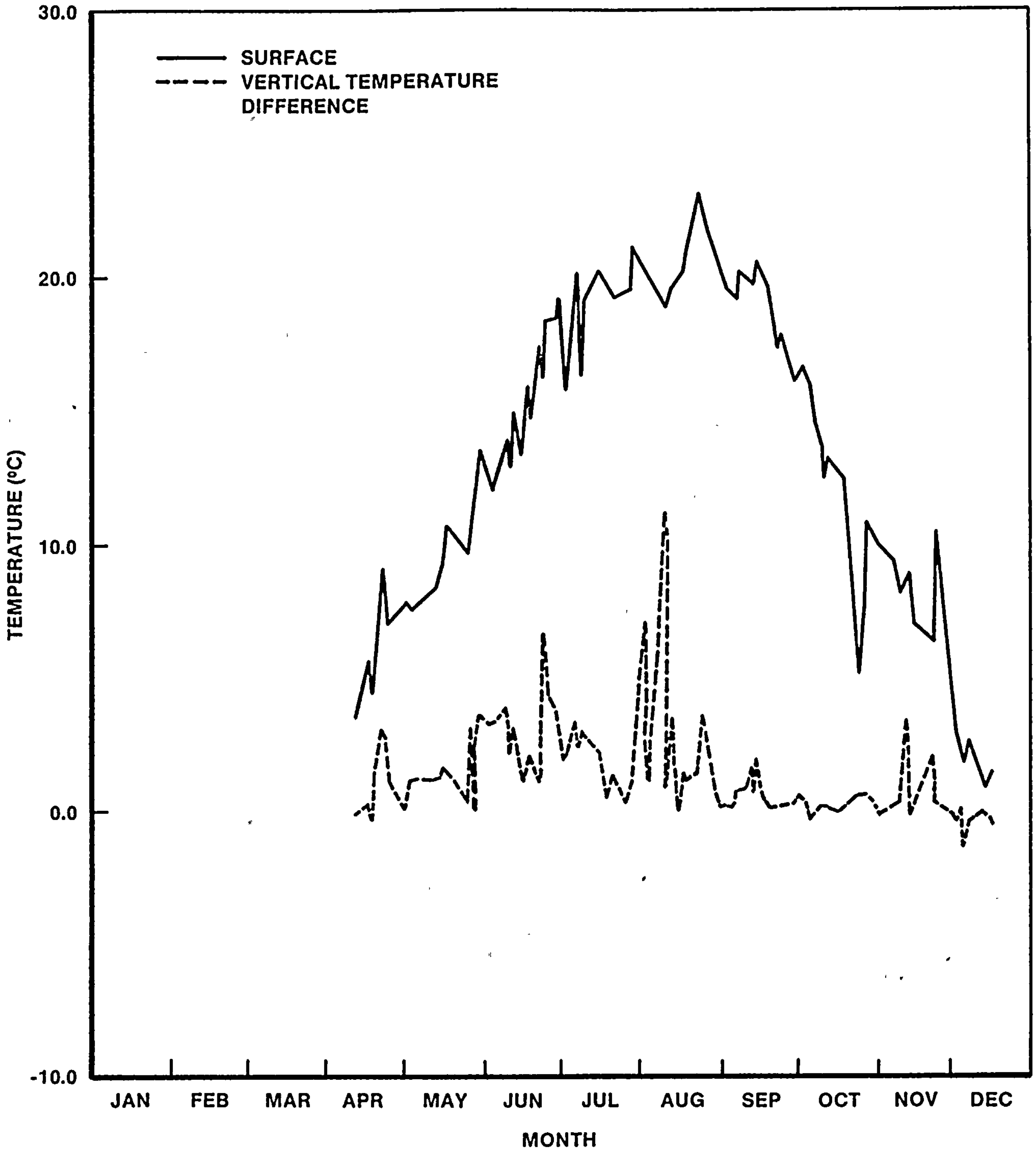
SOURCE: Reference 11

TABLE 2.3-15

TRACE CONSTITUENTS LISTED IN NEW YORK STATE STANDARDS FOR CLASS A - SPECIAL WATERS

Trace Constituent	State Standard*
Cadmium	300 ug/l
Copper	200 ug/l
Iron	300 ug/l
Zinc	300 ug/l
Cyanide	100 ug/l

*Values are taken from Conservation Law Title 6, Part 702.1, Class A - Special Waters, Standards, New York State Department of Environmental Conservation. The values are guidelines, not criteria, based on ambient alkalinity levels.



SURFACE TEMPERATURE = MEAN OF ALL SURFACE TEMPERATURES RECORDED WITH THE BIOLOGICAL SAMPLING PROGRAMS PER DATE

VERTICAL TEMPERATURE DIFFERENCE = DIFFERENCE BETWEEN THE MEAN SURFACE AND BOTTOM TEMPERATURES

FIGURE 2.3-1

TEMPERATURE AT NMPE 12-M (40-FT) STATION, NINE MILE POINT VICINITY-1976

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

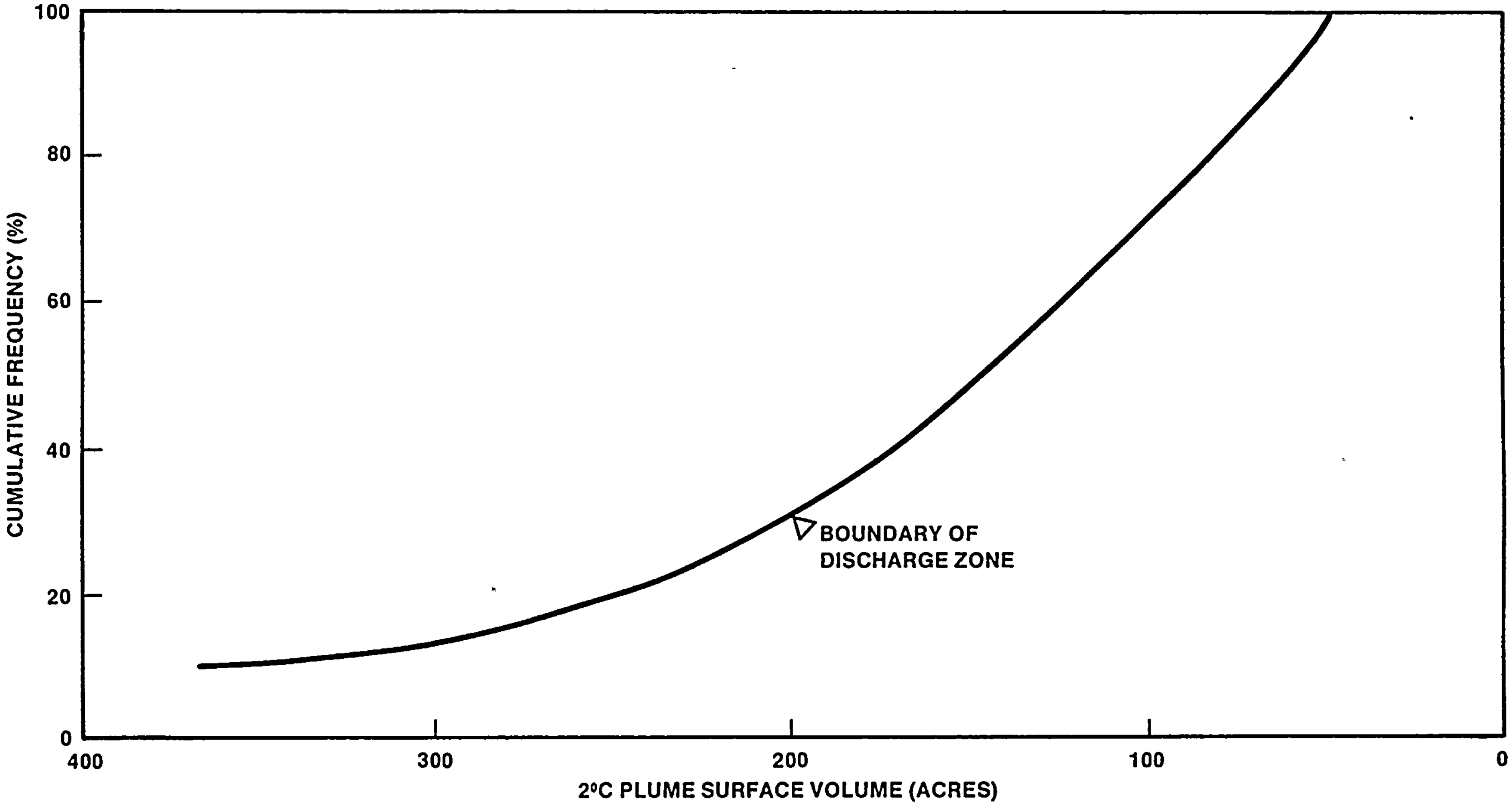


FIGURE 2.3-2

CUMULATIVE FREQUENCY OF PLUME SURFACE AREAS WITHIN THE 2°C ISOTHERM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

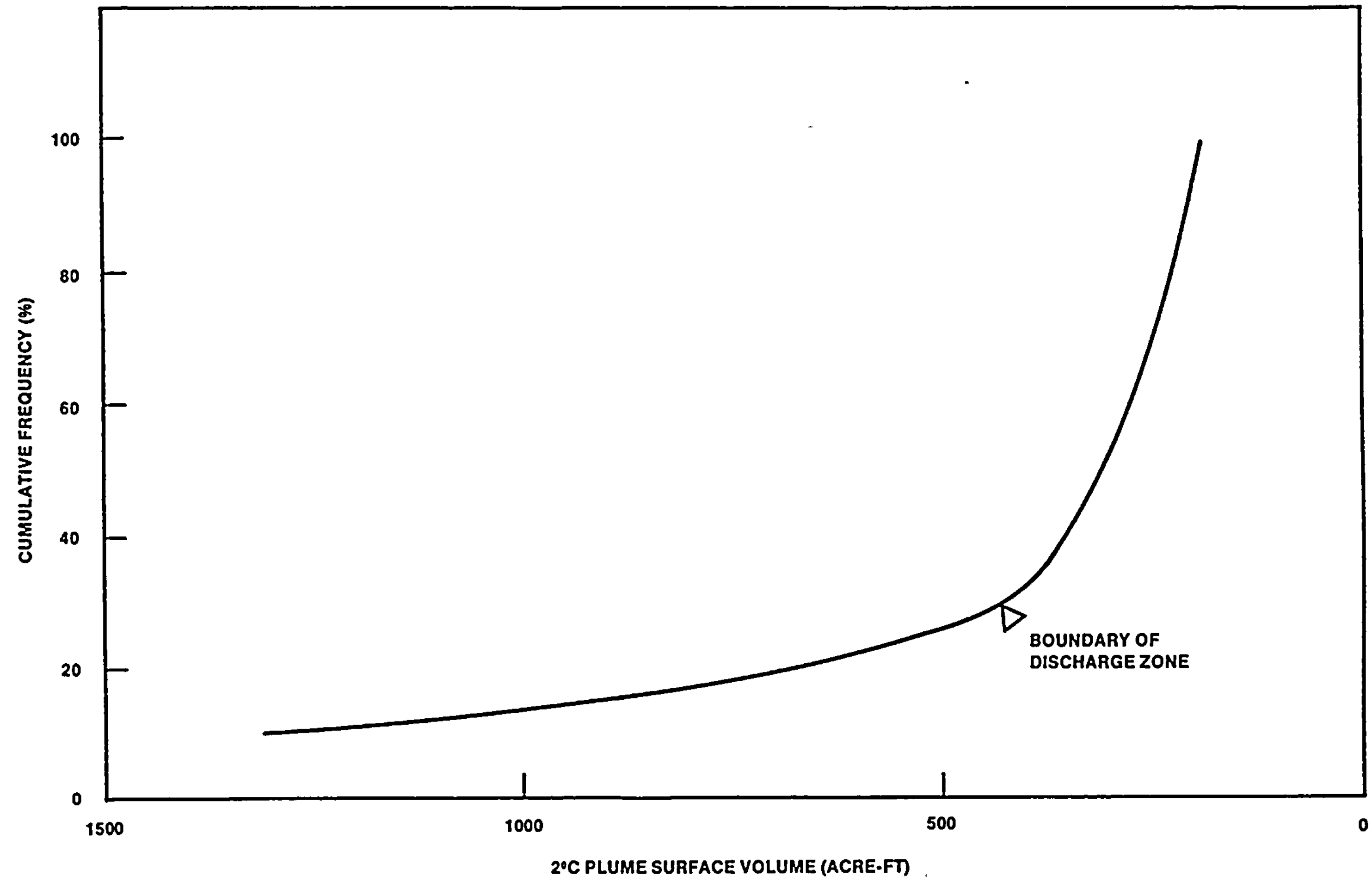


FIGURE 2.3-3

CUMULATIVE FREQUENCY OF PLUME VOLUMES WITHIN THE 2°C ISOTHERM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

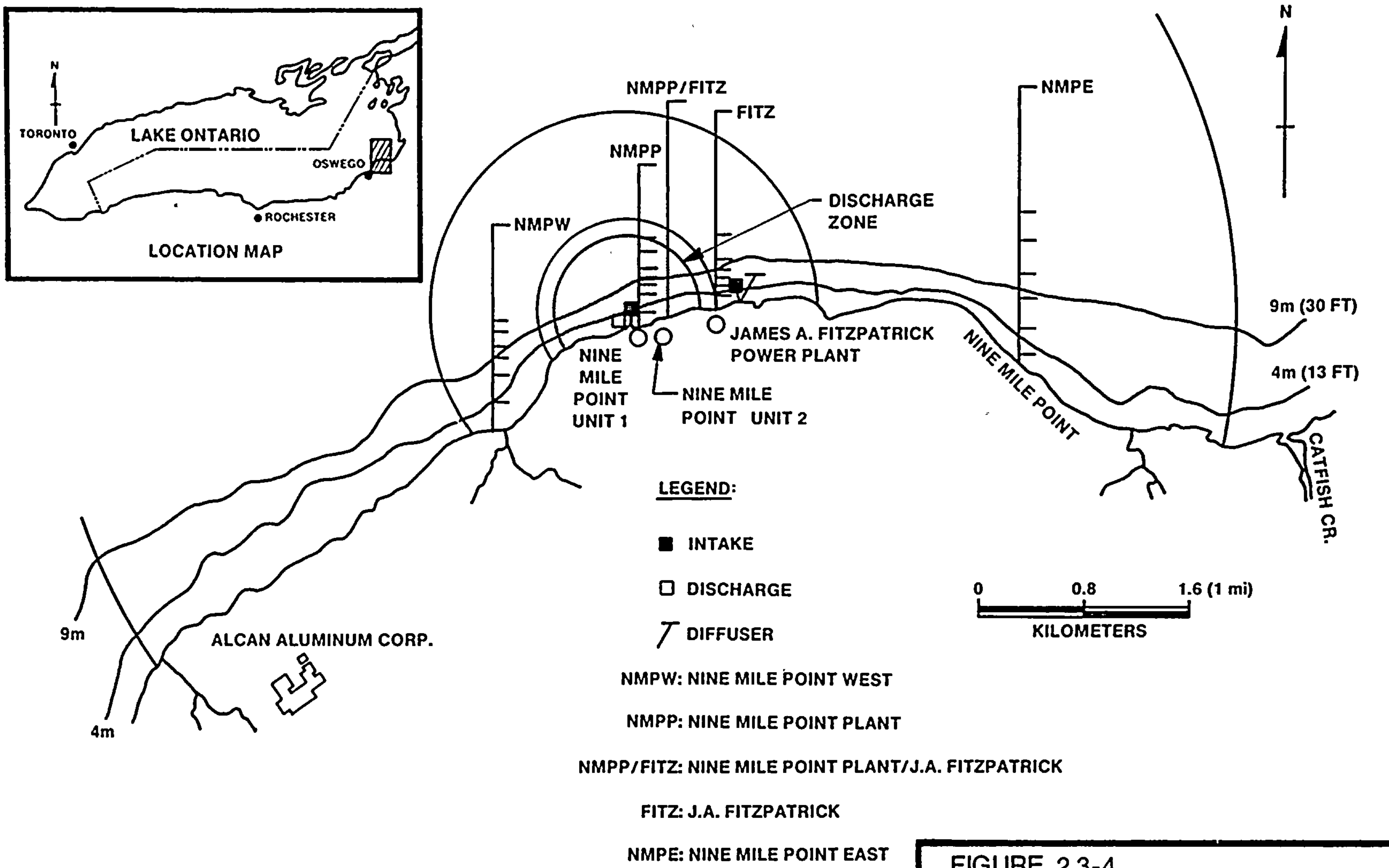
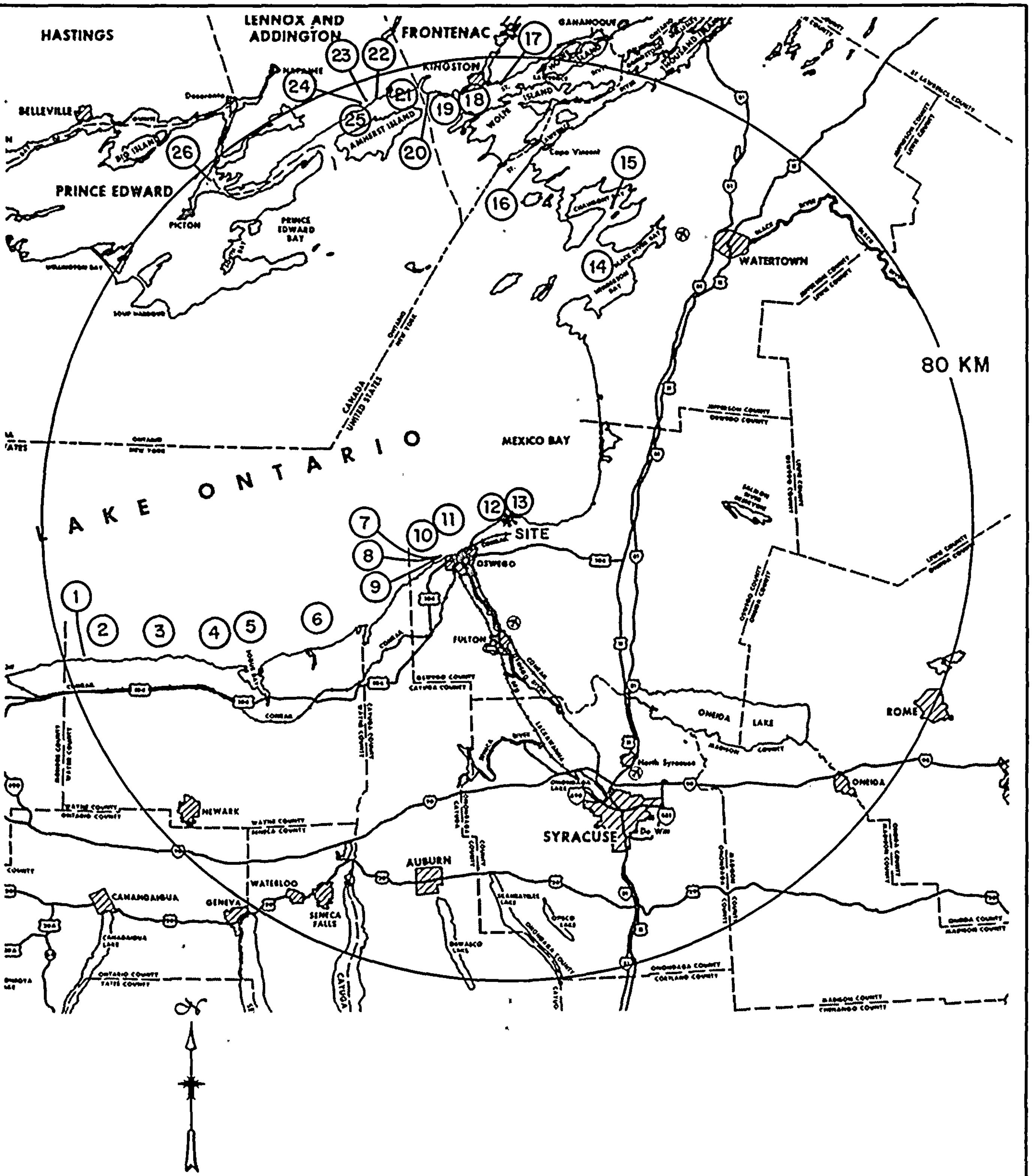


FIGURE 2.3-4

DISCHARGE ZONE AT NINE MILE POINT UNIT 1

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



NOTE
NUMBERS REFER TO TABLES 2.3-3 AND 2.3-4.
* SITE

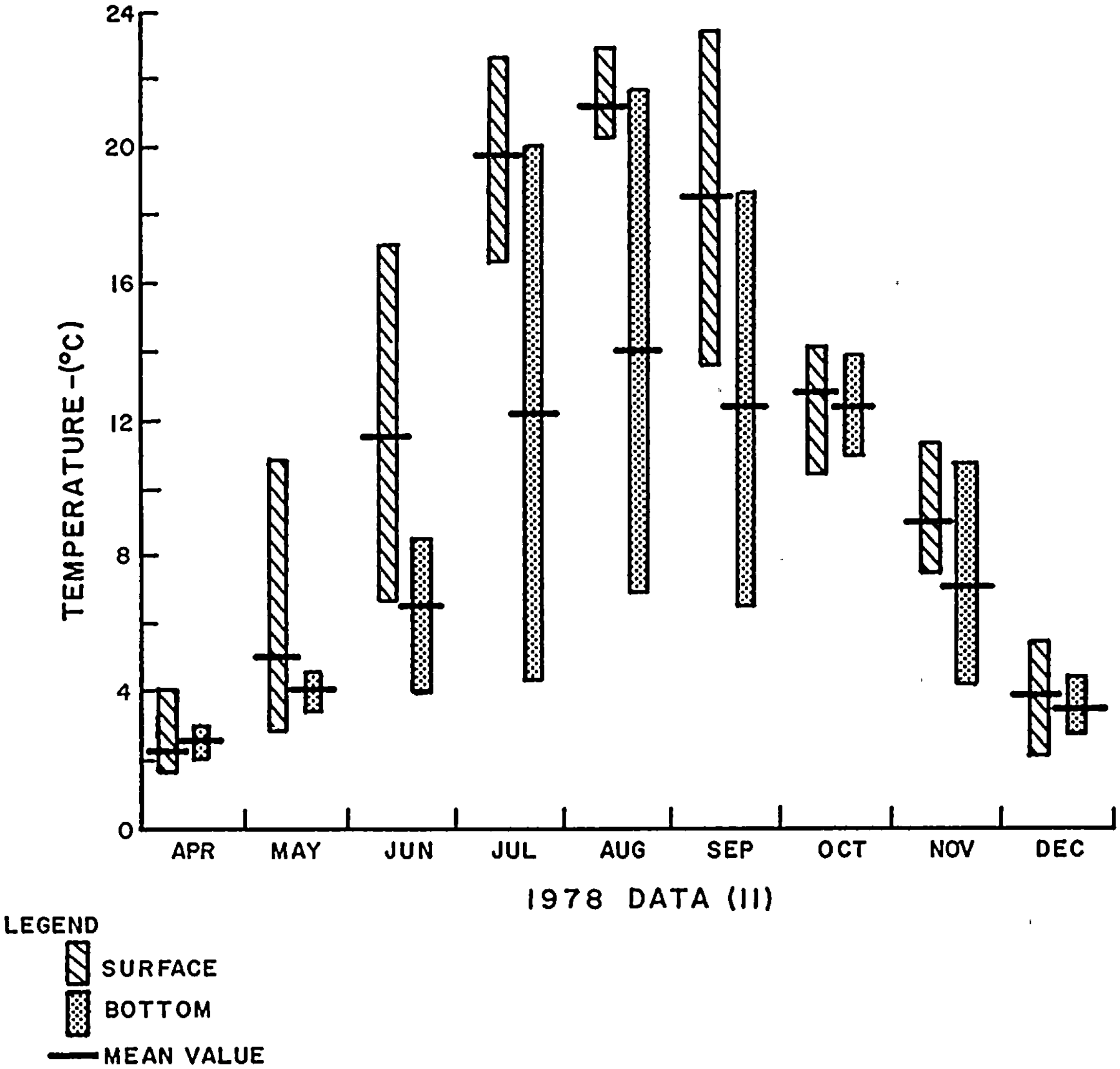
0 10 20
SCALE-MILES

0 20 40
SCALE-KILOMETERS

FIGURE 2.3-5

WATER SUPPLIES AND INDUSTRIAL USERS ON LAKE ONTARIO WITHIN 80-KM REGION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



NOTE: MONTHLY MEANS AND RANGE OF WEEKLY VALUES FOR THE NMPW, NMFP AND NMPE TRANSECTS. SURFACE (0.9m [3 FOOT]) AND BOTTOM (30m [100 FOOT]) STRATA ALONG THE 30m (100 FOOT) DEPTH CONTOUR.

FIGURE 2.3-6

SEASONAL VARIATION IN WATER TEMPERATURES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

2.4 ECOLOGY

2.4.1 Terrestrial Ecology

2.4.1.1 Site and Vicinity

The following description of the existing terrestrial ecosystems in the vicinity of Unit 2 is derived primarily from 1) 1979 aerial photographs, 2) a 1979 terrestrial field survey (see Section 6.5.1 for methodology), and 3) review of pertinent literature as referenced.

Stereoscopic false color infrared and true color aerial photographs of the Unit 2 site were taken in August 1979 to delineate areas of existing environmental stress and to facilitate vegetative mapping (Figures 2.4-1 and 2.4-2). In addition, a terrestrial field survey was conducted in September 1979 to provide quantitative and qualitative descriptions of the floral and faunal communities within 1.6 km (1.0 mi) of the geographic center of the Unit 2 site (Figure 2.4-2). To provide information in the general vicinity of the site, up to 80 km (50 mi), data were obtained from the habitat and wildlife inventory of the Oswego County Coastal Zone, conducted in 1976, the Port Ontario Harbor terrestrial vertebrate study, conducted in 1977, the Napanee District Land Use Strategy Plan, and from communication with state and local wildlife personnel[1,2,3].

2.4.1.1.1 General Site Characteristics

Unit 2 is located within the Oneida Plain physiographic region of Oswego County, NY[1]. The site also lies within the 93.8-sq km (36.2-sq mi) area defined by the St. Lawrence Eastern Ontario Commission as the Oswego County Coastal Zone[1]. The topography of the Oneida Plain, which extends south of Lake Ontario, is most appropriately described as a series of undulating hills[1]. The lake plain rises from a minimum of 76.2 m (250 ft) above sea level in the numerous wetlands along the Lake Ontario shoreline to a maximum of 93.9 m (308 ft) above sea level at Derby Hill in the town of Mexico[1]. The south shore of Lake Ontario is basically underlain by Oswego sandstone.

The closest state or federal wildlife management area is the Deer Creek Marsh Wildlife Management Area, operated by the New York State Department of Environmental Conservation (NYSDEC), located about 31 km (19 mi) east-southeast of the site. The closest area to the north is the Point Petre Provincial Wildlife Area in Prince Edward County (Athol, Ontario) about 69 km (43 mi) from the site[4]. The only

other wildlife management area in the vicinity of the site is an Audubon bird sanctuary located 3 km (1.9 mi) from the site on the Lake Ontario shore, east of Nine Mile Point Road (Figure 2.4-3). This is the closest protected wildlife area to the site, and management consists primarily of the erection of nest boxes and the maintenance of visitor trails.

2.4.1.1.2 Terrestrial Communities and Their Interactions With Their Environment

The coastal zone of Oswego County lies in a transitional area between boreal forest and northeastern hardwood forest[1]. The proximity of Lake Ontario appreciably modifies the climate, and thus has a significant effect on the floral and faunal associations of the region[1]. The climax community is a deciduous forest with an extensive herbaceous ground cover. The biota of the area are characteristic of a transitional zone with high species diversity[1].

Two basic ecosystems are present in the coastal zone: wetlands and upland areas. The wetlands generally result from disruption of drainage caused by the drumlin topography of the region[1]. They are generally transitional and include shallow ponds, shrub swamps, wood swamps, and intermittently wet bottomland-like forests.

Much of the original mature forest land of the Oneida Plain was cleared in the past for farming, but a great deal has since been abandoned[2]. As such, the uplands are mostly second-growth communities in a variety of successional stages. For this region, the mature climax hardwood community is composed of the beech-maple-hemlock association. Ironwood (Carpinus caroliniana), witch hazel (Hamamelis virginiana), striped maple (Acer pennsylvanicum), and hophornbeam (Ostrya virginiana) are common components of the understory. Ground cover, although generally sparse due to the closed canopy, consists of false Solomon's seal (Smilacina racemosa), Christmas fern (Polystichum acrostichides), white baneberry (Actaea pachypoda), jack-in-the-pulpit (Arisaema triphyllum), and may apple (odophyllum peltatum)[1].

The vegetation in the vicinity of the site may be divided into a number of distinct community types (Figure 2.4-2). The forested cover types described in the following paragraphs were sampled quantitatively along three transects using a point-quarter sampling technique (Section 6.5.1.1) during the 1979 field survey. The remaining cover types are described qualitatively, based on observations made during

the 1979 survey. A phylogenetic species list of the flora recorded during the field investigation is provided in Table 2.4-1. A brief description of the major communities within a 1.6-km (1-mi) radius of Unit 2 is given in the following paragraphs.

Early Second-Growth Forest Cover Type (Transect 1)

White ash (Fraxinus americana) is the dominant overstory species along Transect 1 (Figure 6.5-1), with an Importance Value (IV = Relative Dominance + Relative Density + Relative Frequency) of 171.2 (Table 2.4-2). Dominance is reflected by the high density (224 stems/ha), high frequency of occurrence (91), and basal area (5.49 sq m/ha). Diameter at breast height (dbh) measurements range from 10.2 to 48.2 cm (4 to 19 in), with a mean of 17.7 cm (7 in).

Other components of the canopy include apple (Malus sp.), quaking aspen (Populus tremuloides), and hawthorn (Crataegus sp.), with IVs of 62.8, 45.5, and 19.9, respectively. Crown cover along Transect 1 is estimated to be 50 to 75 percent.

The shrub stratum along Transect 1 is dominated by silky dogwood (Cornus amomum), arrowwood (Viburnum dentatum), hawthorn, juneberry (Amelanchier sp.), and grape (Vitis sp.). Generally, arrowwood dominates those areas where the canopy is mostly complete, while dogwood and grape are abundant in open areas. Both dogwood and grape are characteristic of advanced old field communities. Additional understory components include alder (Alnus sp.) in wetter areas and occasional saplings of quaking aspen and white ash.

West of the road leading to the meteorological tower, there is a distinct transition from forest to a shrub community. This area is characterized by a very dense, 1.8- to 2.4-m (6- to 8-ft) shrub layer, consisting of dogwood, alder, staghorn sumac (Rhus typhina), and apple. Wild grape is also present, often replacing the sumac. The presence of large apple trees and also a scattering of maple and oak (Quercus sp.) suggests that this community was formerly cropland or orchard and is again advancing toward a mature climax community.

Ground cover along Transect 1 consists primarily of poison ivy (Rhus radicans) and grasses (Graminea). In the wooded areas, poison ivy dominates, while grasses are more abundant in open areas.

Mixed Forest and Shrublands Cover Type (Transect 2)

White ash and black cherry (Prunus serotina) are codominant overstory species along Transect 2 with IVs of 76.2 and 66.0, respectively. White ash exhibits the highest density (155 stems/ha), while black cherry occurs with greater frequency (Table 2.4-3). Mean dbh of white ash and black cherry is 13.6 and 15.6 cm (5.4 and 6.1 in), respectively. Sugar maple (Acer saccharum) is also an important component of the overstory by virtue of its large basal area (3.57 sq m/ha). Associates of the canopy also include apple, quaking aspen, hemlock (Tsuga canadensis), black oak (Quercus velutina), and gray birch (Betula populifolia). Mean dbh of sugar maple and eastern hemlock is 32.0 and 27.7 cm (12.6 and 10.9 in), respectively.

The shrub stratum consists primarily of species occurring in the overstory. Components include arrowwood, black cherry, quaking aspen, apple, maple, and in more open areas, staghorn sumac and black gum (Nyssa sylvatica). Ground cover is generally less abundant than that found along Transect 1, due to a fairly dense canopy. Poison ivy is abundant. Seedlings of the overstory species are also common.

As in the case of the vegetative communities along Transect 1, the presence of apple suggests that this community was formerly cleared for orchard or pastureland and is presently advancing toward a northern hardwood climax forest. Fingers of northern hardwood forest extend into the shrublands from adjacent areas (Figure 2.4-2). Also, the dominance of overstory species in the understory suggests that the community is maturing and reproducing itself. Compared to the forested habitat along Transect 1, this appears to be a more successionally advanced community.

Mixed Hardwood Forest Cover Type (Transect 3)

Sugar maple is the dominant overstory species in this community (Transect 3), with an IV of 106.7 (Table 2.4-4). Density for the species averages 373 stems/ha. It is also the most frequently occurring tree species, with a mean dbh of 37.1 cm (14.6 in). Quaking aspen is an important component of the canopy with an IV of 66.4, primarily the result of its large basal area (8.2 sq m/ha). Other components of the overstory include white ash, yellow birch (Betula alleghaniensis), beech (Fagus grandifolia), and gray birch. The IV of beech (25.8) was essentially the result of the large mean dbh (35.9 cm [14.1 in]) which contributes to a moderately large basal area (25.8 sq m/ha).

Mature black cherry and hemlock trees are also present along Transect 3. Portions of the transect are intermittently wet, and the hydric nature of these areas is reflected by the presence of black willow (Salix nigra) and red maple (Acer rubrum).

The understory is dominated by saplings of the overstory species. In addition, striped maple, hackberry, hophornbeam, ironwood, black cherry, and arrowwood are present.

Ground cover consists of partridgeberry (Mitchella repens), poison ivy, Solomon's seal (Polygonatum sp.), trillium (Trillium sp.), haircap moss (Polytrichum sp.), ground pine (Lycopodium sp.), and ferns (Polypodiaceae).

The mixed hardwood forest is the most advanced successional stage onsite. Within this community, subclimax areas are maintained by differences in edaphic conditions (e.g., low-lying wet areas support red maple and willow stands). Dominance of the understory by saplings of overstory species suggests that this community is reproducing and continuing to mature.

Old Field Community

In terms of secondary ecological succession, the old field community typically is the first sere, or successional stage, to develop after abandonment of farmland or cleared land. One to three years after a field is abandoned, annual weeds such as ragweed (Ambrosia sp.) and crabgrass (Digitaria sp.) become established. As succession proceeds, the annuals are replaced by more vigorous perennials such as aster (Aster spp.) and goldenrod (Solidago spp.). The perennial weed stage, persisting from 3 to 7 yr after abandonment, eventually yields to a more advanced successional stage, characterized by aggressive, adaptable perennial grasses such as Andropogon sp. Subsequent successional stages depend on edaphic conditions, such as moisture, fire, light availability, and soil characteristics as well as overall climate and regional physiognomy.

At the Unit 2 site, two distinct open field communities are present. The first consists of areas that are maintained by Unit 2 personnel. One such area is used annually for snow dumping from the plant area. This field is seeded each spring with a mixture of grasses. Another, a spoil area, is generally in grasses when not in use.

The second type of open field community consists of areas that are proceeding through natural succession after abandonment. Several open field communities are found near Unit 2. Grasses and forbs such as ragweed, wood-sorrel (Oxalis sp.), goldenrod, and asters dominate these communities, depending on their successional stage (i.e., sere).

Transmission Corridor

Maintenance of the transmission corridor in accordance with right-of-way (ROW) specifications has resulted in a diversity of vegetation. As a consequence of cutting the corridor (near Unit 2) through a mature forest community, species occurring in the bordering stands are expected to be found in addition to the early successional species normally associated with disturbed areas. The undulating topography along the ROW creates a variety of moisture levels, and thereby contributes to the diversity of plant species found along the ROW.

Among those species commonly occurring along the ROW within the site area are numerous grasses (Gramineae), sedges (Carex spp.), and forbs such as mullein (Verbascum thapsus), sheep sorrel (Rumex acetosella), boneset (Eupatorium sp.), wild strawberry (Fragaria sp.), dwarf cinquefoil (Potentilla canadensis), jewelweed (Impatiens caepensis), toadflax (Linaria vulgaris), blackberry (Rubus sp.), smartweed (Polygonum sp.), goldenrod, wild carrot (Daucus carota), bracken fern (Pteridium acquilinum), hay-scented fern (Dennstaedtia punctilobula), sensitive fern (Onoclea sensibilis), black cherry, and quaking aspen. Transmission corridor vegetation is discussed further in Section 2.4.1.2.

Management of the ROW (Section 5.6.1) will restrict its development to its present level of succession.

Important Species

No plant species listed by the U.S. Fish and Wildlife Service as endangered or threatened have been found at the site[5,6]. Several plants classified by NYSDEC as protected have been identified at the site (Table 2.4-1). These plants are listed because they are attractive and are not considered rare or endangered in New York State[7].

2.4.1.1.3 Fauna

The fauna of the Oswego County Coastal Zone is typical of that found throughout the northeastern United States[1].

The proximity of Lake Ontario modifies the climate and tends to extend northward ranges of a number of species with southern affinities[1].

2.4.1.1.3.1 Mammals

Most of the mammalian species that occur in this coastal zone are wide-ranging species with no regional affinity[1]. The remainder are primarily northern or northeastern species approaching the southern and western limits of their ranges in the area[1]. A few mammals are southern species approaching the northernmost extension of their range in Oswego County.

Past clearing of land for agriculture and urban/industrial development has appreciably affected the species composition and abundance of mammals. Clearing of land has favored species such as opossum, eastern cottontail, and prairie deer mouse. However, reduction of forested habitat and increased hunting and trapping pressure have significantly reduced or eliminated populations of larger mammals such as black bear, bobcat, mountain lion, fisher, marten, wolf, coyote, and river otter[1].

Small Mammals

The small-mammal trapping program conducted in September 1979 (Section 6.5.1) yielded five species of mammals collected from four locations on the Unit 2 site (Table 2.4-5). The two most commonly collected species were the white-footed mouse (Peromyscus leucopus) and the deer mouse (P. maniculatus), accounting for 40 and 30 percent, respectively, of all small mammals captured. Other species captured included the meadow jumping mouse (Zapus hudsonius), meadow vole (Microtus pennsylvanicus), and red squirrel (Tamiasciurus hudsonicus).

Habitat Utilization - Habitat utilization for a given area is defined as the proportion of animals captured within each habitat type. To equalize trapping effort among communities, the number of mammals captured per 100 trap-nights was used to calculate habitat utilization rather than the actual number of organisms captured.

Data for the trapping period indicate that the mixed hardwood forest (the most mature successional community onsite is Transect 3) receives the greatest habitat utilization: 50.0 percent. The early second-growth hardwood forest (along Transect 1) is also an important habitat, with 24.9 percent of the utilization. Habitat utilization is lowest

in the transmission corridor (15.0 percent) and open field (9.9 percent) habitats (Table 2.4-5).

As previously stated, the white-footed mouse and deer mouse constitute the greatest percentage of small mammals captured. The white-footed mouse is found in a variety of habitats. It is a nocturnal mouse which nests in cavities such as stone walls and hollow trees[8]. Its breeding season extends from April to October. All captures of this species occurred in areas of preferred habitat (i.e., forested areas).

The deer mouse was captured most frequently from the mixed hardwood forest, indicative of its preference for coniferous and deciduous habitats. It nests in burrows in the ground, as well as in trees, stumps, and buildings. Its usual breeding time is from February to November. Its home range is 0.2 to 1.2 ha (0.5 to 3.0 acres) or more[8].

The meadow vole prefers low, moist areas of grasslands with rank growths of herbaceous vegetation[1,8]. All specimens were taken in the old field community, where herbaceous vegetation is dominant.

The meadow jumping mouse prefers areas closely associated with moist shrub-herbaceous communities; however, Burt and Grossenheider indicate that the meadow jumping mouse is unrestricted in various land habitats[8]. This species was collected from the transmission corridor. It is primarily nocturnal with a home range of 0.2 to 0.8 ha (0.5 to 2.0 acres)[8]. It hibernates in October or November, emerging in April or May.

One red squirrel (<u>Tamiasciurus hudsonicus</u>) was trapped in the early second-growth hardwood forest. Red squirrels in Oswego County are not as common as gray squirrels (<u>Sciurus carolinensis</u>), because the red squirrel is a northern species approaching the southern limit of its range in this area[1]. Within the coastal zone, they are most closely associated with the beech-maple-hemlock forests.

In addition to those small mammals trapped at the Unit 2 site, a variety of other species are likely to occur. Table 2.4-6 lists those small mammals that are most likely to occur in this area, based on the wildlife inventory of the coastal zone conducted in 1976[1].

Medium- and Large-Sized Mammals

Observations of medium- and large-sized mammals (carnivores, large rodents, lagomorphs, and even-toed ungulates) and/or their signs were made during the field investigations of the Unit 2 site in 1979, but few sightings were recorded. However, two woodchucks (Marmota monax) were observed along the roadside. Tracks of the white-tailed deer (Odocoileus virginianus) were observed throughout the study area, and one bedding area was noted along Transect 1 in the early second-growth hardwood forest.

Based on data collected during the wildlife inventory of the coastal zone in 1976, 14 species of medium to large mammals are expected to occur within the region (Table 2.4-6): red fox (Vulpes fulva), gray fox (Urocyon cinereoargenteus), bobcat (Lynx rufus), coyote (Canis latrans), river otter (Lutra canadensis), eastern cottontail (Sylvilagus floridanus), varying hare (Lepus americanus), striped skunk (Mephitis mephitis), porcupine (Erethizon dorsatum), muskrat (Ondatra zibethica), opossum (Didelphis marsupialis), beaver (Castor canadensis), white-tailed deer (Odocoileus virginianus), and raccoon (Procyon lotor). Table 2.4-6 lists those species of mammals that are most likely to occur near the Unit 2 site, based on the availability of suitable habitat, data on habitat preference, geographic range, and historical records (hunting, trapping, scientific studies, etc).

Important Mammalian Species

Several mammalian species are considered important because: 1) they are endangered or threatened species protected by state and/or federal legislation, 2) they are valuable commercially or recreationally, 3) they exert a significant influence on ecosystem dynamics, or 4) they are biological indicators of radionuclides[9]. Biological indicators of radionuclides are discussed in Section 5.4.

Endangered or Threatened Species - New York State lists the Indiana bat (Myotis sodalis) as endangered. This species is also protected under the Federal Endangered Species Act of 1973, amended in 1978[5].

The Indiana bat is a medium-sized bat closely resembling the little brown bat. It is associated with the major cavernous limestone areas of the midwest and eastern United States, where it overwinters in hibernaculum (caves used as winter roosts). Little is known about the behavior of this bat in summer except that it disperses and has been found up to

644 km (400 mi) away from its winter roosts[10]. Populations are thought to be declining due to bio-accumulation of insecticides and to disruption of their hibernacula[2,11]. There are two winter roosts within 80 km (50 mi) of the Unit 2 site: the Jefferson County hibernaculum located approximately 69 km (43 mi) north of Unit 2 and the Syracuse hibernaculum located approximately 72 km (45 mi) south[10]. Although it is possible that the Indiana bat could occur at the site during the summer months, it was not recorded from the coastal zone during the habitat and wildlife inventory in 1976 or other recent studies[1,12]. In addition, there are no known caves that would serve as winter roosting sites in the Unit 2 site area, and because of the Indiana bat's dispersed summer ranges, it is not particularly susceptible to the clearing of small land parcels.

Commercially and Recreationally Important Species - Commercially and/or recreationally important game species in Oswego County include the eastern cottontail (*Sylvilagus floridanus*), gray squirrel, varying hare (*Lepus americana*), and white-tailed deer (Table 2.4-7)[2]. Furbearing species of importance include mink (*Mustela vison*), muskrat (*Ondatra zibethica*), beaver (*Castor canadensis*), raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), red fox (*Vulpes fulva*), and gray fox (*Urocyon cinereoargenteus*)[2].

2.4.1.1.3.2 Avifauna

The coastal zone of Oswego County supports a large number of avian species. Numerous bird species breed in the area. In addition, there is a large influx of spring and fall migrants traveling through the region, since the area is part of the Atlantic Flyway[1].

During the winter, large numbers of waterfowl and waterbirds congregate along the coastal areas of Lake Ontario (Figure 2.4-3). The overwintering population from the Salmon River west of the city of Oswego consists primarily of diving ducks. Dominant birds include greater scaup (*Aythya marila*), goldeneye (*Bucephala clangula*), and merganser (*Mergus merganser*). Lesser numbers of canvasbacks (*Aythya valisineria*) and oldsquaw (*Clangula hyemalis*) are also found in this area[1,2]. During years of heavy ice these waterfowl generally move out into deeper, ice-free water[13].

Observations of avian species were made primarily along transect routes during vegetation sampling and small-mammal trapping. In addition, records were kept of incidental

sightings made in the vicinity of Unit 2 (in disturbed areas, along roadsides, ecotones, or the transmission ROW).

Ten species of birds were recorded at the Unit 2 site during the 1979 field investigations. These included black-capped chickadee (Parus atricapillus), white-breasted nuthatch, (Sitta carolinensis), mourning dove (Zenaidura macroura), blue jay (Cyanocitta cristata), common yellow-throat (Geothlypis trichas), catbird (Dumetella carolinensis), song sparrow (Melospiza melodia), American goldfinch (Carduelis tristis), and killdeer (Charadrius vociferus). In addition, a redtailed hawk (Buteo jasmaicensis) was observed along the transmission corridor.

In addition to those species observed during the field reconnaissance, numerous other species are likely to occur in the area. Table 2.4-8 provides a list of species recorded from the Oswego County Coastal Zone[1]. Tables 2.4-9 and 2.4-10 provide generalized habitat associations for major breeding and nonbreeding species. Table 2.4-11 lists the results of a roadside count and breeding bird strip census for areas adjacent to the Unit 2 site, conducted in 1976[1].

Important Avian Species

A number of avian species are considered "important" in accordance with Regulatory Guides 4.2 and 4.11 because they: 1) are endangered or threatened species, 2) are valued commercially or recreationally as game species, or 3) exert a significant influence on ecosystem dynamics[9].

Endangered or Threatened Species - The osprey (Pandion haliaetus), bald eagle (Haliacetus leucocephalus), and peregrine falcon (Falco peregrinus) are listed as endangered in New York State[2]. Both the bald eagle and peregrine falcon are also listed on the U.S. Fish and Wildlife Service's list of endangered species[5].

The osprey is a fairly common spring and fall migrant along the shoreline of Lake Ontario. The breeding territory nearest to Unit 2 is the area along the St. Lawrence River (the Indian River Lakes region, encompassing portions of northeastern Jefferson and southwestern St. Lawrence Counties) about 100 km (62 mi) northeast of the site. The 1976 nesting season showed the largest increase in successful nesting for the osprey within the past 20 yr[2].

The bald eagle was formerly a fairly common spring and fall migrant along the shores of Lake Ontario, nesting locally at

Selkirk Shores in the past[2]. Presently, observations of this raptor are rare, and nesting at Selkirk Shores has not occurred since 1955. The nearest active nest is located at the south end of Hemlock Lake in Livingston County about 135 km (85 mi) southwest of the site[2]. At present, NYSDEC and Cornell University are participating in a cooperative program to reestablish the bald eagle as a breeding raptor in New York[2,14]. Forty-four bald eagles were hatched and released in western New York State between 1976 and 1981. Release points included the Montezuma National Wildlife Refuge, 32 km (20 mi) southwest of the site; and the Oak Orchard State Wildlife Refuge, 160 km (100 mi) west-southwest of the site. Many of these birds have moved north to the Lake Ontario shore, and some have been sighted east and north of Oswego[14,15].

The peregrine falcon is a rare inland migrant, occasionally observed along the shores of Lake Ontario. Formerly a common breeding species in New York State, the peregrine falcon has not nested in New York since 1961[2]. Its decline has been attributed to pesticide toxicity. As in the case of the bald eagle, NYSDEC is cooperating with Cornell University to reestablish the peregrine falcon as a breeding raptor in New York State[2,16].

Commercially and Recreationally Important Species - A large number of hawks, eagles, falcons, and ospreys migrate each spring along the shore of Lake Ontario and swing north along the eastern end of the lake. As many as 55,000 of these birds have been observed per season from Derby Hill, an observation area north of Mexico, NY[17].

Table 2.4-12 lists the bird of prey nesting locations for the Oswego County Coastal Zone.

Other commercially or recreationally important avian species in Oswego County include ruffed grouse (Bonasa umbellus), woodcock (Scolopax minor), ring-necked pheasant (Phasianus colchicus), common snipe (Capella gallinago), Virginia rail (Rallus limicola), Sora rail (Porzana carolina), gallinule (Gallinula chlaropus), and crow (Corus brachyrhynchas), in addition to 28 species of waterfowl (Table 2.4-7).

2.4.1.1.3.3 Herpetofauna

The reptilian and amphibian faunas of the coastal zone are sparse, with the majority of the species widely distributed throughout the area[1]. About 40 species of reptiles and amphibians are believed to inhabit portions of Oswego

County, but only 21 have been observed from the coastal zone[1].

During the 1979 field investigation, two species of amphibians were observed. The wood frog (Rana sylvatica) was recorded from the mixed hardwood forest community (Transect 3). This amphibian prefers moist deciduous or coniferous woods; however, it may frequently be found considerable distances from water[18]) Breeding occurs near the end of March, usually in small, shallow ponds. The tadpole stage lasts 2 to 3 months. In the fall, the wood frog begins hibernation under leaves, stones, stumps, or in swamps[18].

Numerous leopard frogs (Rana pipiens) were observed in disturbed areas of the Unit 2 site. The frog is most commonly found in meadows and fields[18]. Eggs are laid in shallow water in the spring and hatch in 4 to 6 days. The northern leopard frog is less common than the green frog (R. clamitans) or bullfrog (R. catesbeiana) in Oswego wetlands; however, large numbers of juveniles have been found in the area in August[1].

One unidentified snake was observed at the Unit 2 site during the 1979 field reconnaissance.

Table 2.4-13 lists those species of herpetofauna which are most likely to occur onsite or in adjacent areas. This list was compiled from available literature and takes into consideration factors such as availability of suitable habitat, geographic range, and historical records.

Important Reptiles and Amphibians

A number of herpetofauna are considered important vertebrate species based on their status as endangered or threatened species. With respect to amphibians, none are presently listed as endangered or threatened.

Of the reptiles, the bog turtle (Clemmys muhlenbergii) is listed as endangered by the state of New York[2]. Its present status along Lake Ontario is unknown[2]. Records indicate that the bog turtle prefers sphagnaceous bogs, swamps, and wet meadows traversed by clear, slow-moving streams. Although the bog turtle has not been recorded from the Oswego County Coastal Zone, there is a possibility that this species may occur in Deer Creek Marsh, a wetland associated with the Salmon River about 32 km (20 mi) southeast of the site[19].

2.4.1.1.4 Significant Habitats

Two areas within the Oswego County Coastal Zone near the Unit 2 site have been identified by NYSDEC as significant habitats (Figure 2.4-3)[19]. One area is the nearshore area of Lake Ontario between the Salmon River and the city of Oswego, including the area immediately offshore from the plant. This stretch of coastline is an important non-breeding waterfowl winter concentration area, as discussed in Section 2.4.1.1.3.2. The second significant habitat is a deer yard (concentration area) northwest of Seneca Hill about 11 km (7 mi) southwest of the site (Figure 2.4-3). It has been estimated that approximately 50 deer use this area between December and March[2].

2.4.1.1.5 Environmental Stresses

There are two major types of vegetation stresses, natural and man-induced, which can affect species composition of a community. Natural environmental stresses to vegetation can result from diseases of numerous origins, insects, wind, fire, drought, ice, and snow. Man-induced stresses, such as farming, logging, quarrying, application of pesticides, and recreational activities, generally alter habitat and thus may significantly affect floral and faunal communities.

No naturally occurring environmental stresses were noted during the 1979 site survey, nor did stereoscopic infrared aerial photographs taken in August 1979 reveal any major natural environmental stresses within the 1.6-km (1-mi) radius of Unit 2.

Discussion with the NYSDEC staff (Cortland Regional Office) revealed that there is no indication of stress to forest vegetation or wildlife in the area of Unit 2 that could be attributed to pest or disease vectors (personal communication with NYSDEC).

With respect to man-induced environmental stresses, the clearing of land in the past for agricultural uses has appreciably altered the structure of the vegetational communities within the region. Presently, much of the area is in varying stages of secondary succession following land use as cropland, pastureland, or orchards. Pioneer stages of succession (old field communities) are present, along with intermediate stages (early second-growth hardwood forests) and those seres approaching mature climax communities (beech-maple forests).

Management of the transmission line ROWs and grassed areas adjacent to the power plant complex will maintain them in early, suppressed stages of secondary succession. These managed areas are useful habitats for several wildlife species including deer, raptors and field-dwelling birds, small mammals, and herpetofauna.

2.4.1.1.6 Summary

Several distinct biotic communities are present within the 1.6-km (1-mi) radius of Unit 2. These communities vary in successional stage, diversity, and role in the ecological relationships of the site.

In general, the forest communities in the area are productive, stable ecosystems characterized by complex food webs. The stability of forest ecosystems is attributed to the diversity of organisms, the relatively long life cycles of the dominant organisms, and tight nutrient cycles[20]. In the vicinity of Unit 2, several forest communities are present, each representing different stages in secondary succession (early second-growth forest, intermediate second-growth forest, and mixed hardwood forest, each approaching the mature climax community of the region).

The open field communities are typical examples of the annual weed stage in old field succession. Food chains in the open field community are generally simple, with most energy flow occurring through the herbivores[20]. Most of the dominant plants have short life cycles and produce abundant seed crops in the fall, making these communities valuable to wildlife.

Open field/shrub communities are more stratified than open fields and contain more plant forms (perennial herbs, vines, shrubs, and young trees). More specialized ecological niches are therefore available for wildlife. The open field/shrub communities, because of their more complex food webs, less pronounced seasonal fluctuations in community function, and the longer life cycles of the dominant organisms, are considered to be more ecologically stable[20].

There are numerous ecotones in the vicinity of Unit 2 because of the patchy distribution of vegetation. Often, the diversity of species is greater in ecotones than in surrounding communities[20]. Thus, ecotones such as those found in this area are valuable to wildlife as habitat and food sources.

2.4.1.2 Transmission Corridors and Offsite Areas

Descriptions of the terrestrial ecosystem within the Unit 2-to-Volney transmission corridor are based on the Article VII application, a literature review, aerial photographs, consultation with local specialists, a field survey in September 1979, and a site visit in October 1981[21,22]. A description of the methodologies used during the September 1979 site visit is included in Section 6.5.1.

2.4.1.2.1 General Corridor Characteristics

The new 345-kV transmission line will extend from Unit 2 to the existing Volney substation, 15 km (9.4 mi) south-southeast of Unit 2 (Figures 3.7-1 and 3.7-4)[1]. The new transmission line will parallel the existing Nine Mile 1-Volney 345-kV transmission line, passing through the towns of Scriba and Volney, NY. The existing transmission ROW, south of Lake Road, is 152 m (500 ft) wide. The centerline of the new transmission line will be located 30 m (100 ft) east of the easternmost 345-kV line and will require clearing of an additional 23 m (75 ft) within the existing ROW.

2.4.1.2.2 Terrestrial Communities and Species Interactions

Hardwood cover types dominate the areas to be cleared for the new line, interrupted with small areas of hardwood-conifer and conifer trees. The age class of these forested areas is principally sapling and pole timber, with isolated areas of mature merchantable timber. Other forested uplands include small portions of conifer plantations and abandoned apple and pear orchards. Scattered wooded and shrub wetlands and actively farmed bottomlands also occur along the proposed route.

Table 2.2-6 and Figure 2.4-4 present the results of the ROW vegetation analysis survey conducted prior to the proposed clearing. Tables 2.4-14 and 2.4-15 present the vegetative species traversed by the existing ROW.

The existing transmission corridor is in a successional process which is similar to that in the adjacent forest brushland, except that it has been maintained at an earlier stage. Immediately following clearing of the ROW, the vegetation present within the corridor would have been dependent on the original ecosystem. Forested stretches would have resembled areas clear-cut during a logging operation, whereas agricultural areas would be essentially unchanged. Since that time, maintenance procedures have

tended to create and hold all areas, except those actively farmed, at an advanced old field stage of succession.

The history of the transmission corridor is, in many respects, similar to that of the large stretches of surrounding vegetation presently in forest brushland that also have been previously cleared. Species composition is similar in many cases, with the greatest differences being the greater dominance of grasses and forbs in the transmission corridor versus tall-growing woody species (shrubs and trees) in the forest brushland.

Forested Communities

The forest communities in the region crossed by the new 345-kV line include four major vegetation types (Table 2.2-6). The predominant vegetation is forest brushland, which is defined as areas with brush cover up to fully stocked poles less than 9.1 m (30 ft) high. This vegetation type includes approximately 13,866 ha (34,262.9 acres) in the vicinity of the ROW and covers approximately 26.4 ha (64.2 acres), or 80.6 percent of the new corridor. This vegetation type results from a variety of natural and manmade perturbations of what was originally a typical northeastern climax deciduous forest. The greatest source of disturbance has been clearing for agricultural purposes, including orchards, pasture, and cropland. Other disturbances typical of this area include logging, clearing for residential use, fire, blowdown, and natural disease. All of these areas have succeeded, following their disturbance, to ecosystems partway between forest and old field and would be expected to continue until they reach a climax forest.

A second type of forested land, mature forest, is defined as containing natural stands where at least 50 percent of the trees are over 50 yr old and over 9.1 m (30 ft) high. The largest area of mature forest along the corridor is located north of Miner Road and is known as Scriba Woods[1]. The area east of the corridor has been described by Bieber, et al, and is representative of a typical climax community for this area[1]. Canopy cover is 80 to 90 percent and the trees reach 23 m (75 ft) in height. Dominant canopy species include American beech and sugar maple. Codominant species include hemlock, red maple, white ash, and yellow birch. Approximately 9 percent of the ROW crosses mature forest.

The third vegetation type is forest wetland. Wetlands (forested and otherwise) in Oswego County have been surveyed by NYSDEC in accordance with the New York State Wetlands

Act[23,24]. An update of this survey with particular attention paid to the transmission corridor has been performed by the Oswego County Environmental Management Council[24]. In the vicinity of the corridor, 1.6 km (1 mi) on each side, are 26 wetlands, each having a size of 5 ha (12.4 acres), the minimum size recorded. A total of 1.0 ha (2.4 acres), or 3 percent of the area to be cleared along the ROW, will cross this vegetation type.

The largest area of unmanaged (not farmed) wetlands that will be crossed by the new transmission line is located on stream Ont-62, approximately 1.6 km (1 mi) south of Lake Road. This area has apparently experienced a recent increase in water levels, causing considerable mortality in trees and other vegetative cover over several acres. As a result, the next successional stage for many parts of this area will probably be a shallow pond or a shrub swamp. Of this wetland, about 0.2 ha (0.4 acres) will be crossed by the new transmission line.

The fourth forest category is plantation, a forest area that is artificially stocked. Only 1.6 percent of the corridor crosses forest plantations.

Nonforested Communities

The new 345-kV line will also cross two small sectors of cultivated land. The first area, which lies south of County Route 4, is an 11-ha (26-acre) field generally used for growing lettuce or onions. The remaining area, immediately north of State Highway 104, is a 4-ha (11-acre) hayfield. The portions of these fields crossed by the new line total 2.0 ha (4.8 acres) and represent about 6 percent of the area to be cleared.

Endangered or Threatened Species

No federally listed endangered or threatened floral species are known to exist in Oswego County. Information concerning species listed as protected by NYSDEC is discussed in Section 2.4.1.1.

2.4.1.2.3 Fauna

Vertebrate fauna that may be found in and along the transmission corridor are similar to those found onsite (Section 2.4.1.1.3). Natural history information on vertebrate fauna has been presented previously (Section 2.4.1.1.3 and Tables 2.4-6 through 2.4-13). Approximately 26 mammals, including 1 marsupial, 6 insectivores (shrews and moles), 1

lagomorph, 8 rodents (including 6 small mammals), 9 carnivores, and 1 even-toed ungulate, have ranges and habitat requirements that are met by new and shrubby fields and thus may be found in the vegetative habitats provided by the ROW (Table 2.4-6). Many of these animals may also be found in the forest and forest shrub communities along the ROW. In addition, there are about 18 more mammals that are primarily woods dwellers. Similarly, there are many birds (Tables 2.4-9 and 2.4-10) and reptiles (Table 2.4-13) found near the site that may also occur in or along the transmission corridor.

The recent history of the ROW and the nearby environs (Section 2.4.1.1.2), and the many ecotonal areas along the ROW, the roadside, residences, and farmlands in the general vicinity of the ROW, results in a general ecosystem with diverse animal species. There is only limited representation by species requiring larger tracts of mature forest, whereas those found in old fields, old field and forest shrub, and woodlots are common.

Important Vertebrate Fauna

Vertebrate fauna can be considered important because of their status as endangered or threatened, because of their commercial or recreational value, or because they support either of the preceding groups.

Endangered or Threatened Species

Except for occasional transient species, no federally listed endangered or threatened wildlife species are known to exist within the transmission ROW[6]. Information concerning possible transients is presented in Section 2.4.1.1.3.

Commercially or Recreationally Significant Species

Small game species that are likely to be found in the area of the 345-kV transmission corridor are similar to those using the site (Section 2.4.1.1.3). Important species include the gray squirrel, cottontail rabbit, waterfowl, and possibly snowshoe hare. Ruffed grouse and woodcock use of the area is generally seasonal. Table 2.4-7 provides a list of important game and furbearer species occurring in Oswego County and an estimate of the numbers taken in the area each year[2,25]. The possible distribution of species by habitat is presented in Table 2.4-6.

Larger game species are also found along the ROW. Beaver use is prevalent in the Black Creek area, located about

9.4 km (5.9 mi) south of the site. Signs of deer are also present. This species is the only large game species found in the area, but their concentration is considered to be low. The estimated density is 1 buck/sq mi[2]. Additional life history and habitat utilization information for important vertebrate species in the area is found in Sections 2.4.1.1.3.1 and 2.4.1.1.3.2.

Important Invertebrate Fauna

NYSDEC at Cortland, NY, indicates that there are no known occurrences of important invertebrate fauna along the 345-kV ROW from Unit 2 to the Volney substation[26]. This includes major endangered or threatened species, commercially or recreationally important species, and potentially limiting components of the food chain. There are also no pest or disease vectors affecting wildlife or vegetation that would classify as invertebrates of concern.

2.4.1.2.4 Special Habitats

According to NYSDEC, no wildlife refuges or concentration areas are traversed by the ROW[21]. The nearest significant terrestrial habitat is a deer concentration area located approximately 11 km (7 mi) west of the ROW (Figure 2.4-3)[1]. There are no other significant or irreplaceable terrestrial resources in the vicinity of the transmission corridor.

2.4.1.2.5 Stressed Areas

There are no indications of environmental stresses to forest vegetation or wildlife along the ROW that could be attributed to pest or disease vectors, i.e., naturally induced stresses[26]. However, there are areas along the ROW that are currently managed for agricultural use and maintenance of the existing 345-kV ROW. Continued management of the existing ROW will maintain it in the early stages of secondary succession (e.g., old field and low-growing shrub communities) and will provide useful habitat for several forms of wildlife, including raptors, field-dwelling birds, small mammals, deer, and herpetofauna.

2.4.2 Aquatic Ecology

2.4.2.1 The Site and Vicinity

Niagara Mohawk Power Corporation (NMPC) has conducted yearly biological studies in the vicinity of Unit 1 since 1969. A comprehensive ecological survey of Lake Ontario was conducted in the Nine Mile Point vicinity during the years 1973

through 1978. A reduced program, reflecting modifications made in the Unit 1 technical specifications in 1978, was conducted from 1979 through 1981. During the 6-yr intensive study, the major trophic levels of the aquatic ecosystem were sampled extensively to determine any impacts of the operation of Unit 1 and the James A. Fitzpatrick (JAF) plant, and to conduct preoperational studies for Unit 2.

Each trophic level (phytoplankton, microzooplankton, macrozooplankton, ichthyoplankton, benthos, and nekton) was examined for spatial and temporal trends in distribution and abundance. Populations in nature vary according to inherent life history characteristics and interaction with other trophic levels, and with density-dependent and density-independent factors. In Lake Ontario, overfishing and the introduction of exotic species have further disrupted the stability of the fish community. Therefore, to explain variations in population distribution and abundance, it is necessary to consider the natural factors as well as the effect of power plant operations.

The sampling programs designed to evaluate the population distribution and abundance relative to plant operation are summarized in Section 6.5.2.1 and provided in detail in the annual interpretive reports for each of the sampling years[27-35].

The following sections present summaries of study results by trophic category.

2.4.2.1.1 Phytoplankton

The data collected between 1973 and 1978 have been examined for abundance, distribution, and productivity of the phytoplankton community in the Nine Mile Point vicinity. A total of 187 genera from seven divisions were identified during this period. The species assemblage remained consistent throughout the study period and was similar to that described in previous studies[36-39]. The following are the most abundant taxa identified during the study:

Blue-Green Algae	Diatoms
Anacystis sp.	Cyclotella sp.
Chroococcus sp.	Melosira sp.
Coelosphaerium sp.	Stephanodiscus sp.
Gomphosphaeria sp.	Asterionella sp.
Oscillatoria sp.	Diatoma sp.
Anabaena sp.	Fragilaria sp.
Aphanizomenon sp.	Tabellaria sp.

Green Algae

- Eudorina sp.
- Mougeotia sp.
- Coelastrum sp.
- Oocystis sp.
- Scenedesmus sp.

Others

- Ochromonas sp.
- Rhodomonas sp.

Phytoplankton abundance generally cycled two to four times each year, with the maximum abundances generally occurring during the summer[39]. These seasonal patterns reflect similar patterns previously reported in Lake Ontario[36-38]. Bacillariophyta (diatoms) bloomed in the spring, then declined until late fall when they again became abundant. Green algae were generally most abundant during the summer; blue-green algae, during late summer and early fall.

Analysis of spatial distribution showed that abundances were generally lower offshore than onshore[26-31], an observation supported by the results of other researchers on Lake Ontario[40]. Longshore trends indicated a generally higher phytoplankton standing crop west of Unit 1 compared to other transects, and this was attributed to the influence of the Oswego River, which affects this area more than the other stations[41,42].

Since chlorophyll a is common to all phytoplankton taxa, it is regularly used as an indicator of phytoplankton standing crop[43]. Generally, values in the Nine Mile Point vicinity were higher during the spring and summer than during the fall, but within each year the number of peaks varied[39]. Chlorophyll a was chosen for examination of long-term trends because the techniques used to collect and analyze the data did not change significantly over the 6-yr duration of the program; consequently, the trends exhibited should be related to changes in the community standing crop rather than to methodology.

The long-term trends, as indicated by chlorophyll a concentrations, denoted a cyclic pattern, with low values occurring during 1975 and 1978 and highest values during 1974[39]. The remaining 3 yr (1973, 1976, and 1977) demonstrated intermediate values. Annual temperature cycles, in combination with annual light cycles, have been reported as being responsible for the gross seasonal changes in phytoplankton communities[44]. No definite relationship between water temperature and chlorophyll a concentrations was found for the Nine Mile Point vicinity[39]. Similar species and seasonal patterns were observed each year, and

no apparent changes in abundance or population structure were attributed to plant operations.

2.4.2.1.2 Microzooplankton

Lake zooplankton are separated into two groups based on size, with microzooplankton ranging from 76 to 571 um and macrozooplankton larger than 571 um. A total of 51 genera were identified from the microzooplankton sampling program conducted from 1973 through 1978. Rotifers were the most numerous taxa. Many of the same species occurred each year, and the common genera reported near Nine Mile Point were also reported to be common in Lake Ontario and the Great Lakes in general[26-31]. This section discusses the three major taxa present in the Nine Mile Point vicinity: rotifers, cladocerans, and copepods. The dominant genera of each group are as follows:

Rotifers

- Keratella sp.
- Brachionus sp.
- Trichocerca sp.
- Pleosoma sp.
- Polyarthra sp.
- Synchaeta sp.

Cladocerans

- Ceriodaphnia sp.
- Daphnia sp.
- Bosmina sp.
- Chydorus sp.

Copepods

- Diaptomus sp.
- Diacyclops sp.
- Tropocyclops sp.

Strong seasonal trends were evident in all studies, with the maximum microzooplankton total abundance occurring in June or July and secondary peaks either in the spring or fall[39]. Rotifers and, more specifically, Keratella sp. were typically the dominant group, except during the fall when crustaceans (cladocerans and copepods) sometimes dominated.

Microzooplankton abundances were lower at offshore stations than at nearshore stations[26-31]. Watson[45] and Patalas[46] described similar results in their studies. No consistent longshore trends were evident for the major groups; that is, over several years, no one transect showed either higher or lower abundance than any other.

The microzooplankton community observed each year was similar, with variations between years caused by a general reduction of all components of the community rather than a reduction of a specific component[39]. The mean mi-

crozooplankton abundance (indicative of the standing crop) increased throughout the first four study years (1973-1976), but dropped significantly in 1977 and 1978. This decrease corresponds to a general reduction in water temperature (increased cloud cover, less solar input). The reduced temperature during this period may have affected the microzooplankton standing crop either directly, by causing a reduction in their reproduction and/or growth, or indirectly, by reducing their primary food source, the phytoplankton. No effect of operation of the generating stations was observed in microzooplankton abundance or community structure.

2.4.2.1.3 Macrozooplankton

Macrozooplankton, defined as invertebrate animal plankton larger than 571 um, community structure, and temporal/spatial distribution in the Nine Mile Point vicinity were investigated during the 1973 through 1978 study period.

A total of 26 genera from the phyla Coelenterata, Platyhelminthes, Aschehelminthes, Mollusca, Annelida, and Arthropoda were represented, with the arthropod classes Insecta and Crustacea contributing the greatest number of genera[39]. The dominant taxa are listed as follows:

Hydrozoa

- Cordylophora sp.

Insecta (Diptera)

- Chaoborus sp.
- Chironomidae

Crustacea

- Daphnia sp.
- Leptodora sp.
- Diaptomus sp.
- Eurytemura sp.
- Limnocalanus sp.
- Cyclops sp.
- Gammarus sp.
- Pontoporeia sp.
- Mysis sp.

Quantitative evaluation of the macrozooplankton community is extremely difficult because of the behavior of the species involved and their normal temporal and spatial cycles[39]. Quantitative estimates are further affected by retention of specific organisms by the sampling gear and loss of many of the young through the collection net. Therefore, to evaluate the trends over the 6-yr period, three dominant taxa (Leptodora sp., Amphipoda [primarily Gammarus sp.], and Diptera) are discussed.

The seasonal pattern of the cladoceran Leptodora (the primary constituent of the macrozooplankton) was basically

unimodal, with peak numbers occurring in late summer[39]. Temporal variability was caused by diel trends and local hydrographic events[41,42]. Leptodora were dominant for most of the year, with copepods and amphipods contributing substantial numbers during early spring and late summer/fall, respectively.

Concentrations of the selected taxa typically increased with depth and were more abundant in the nearshore stations than at the offshore locations. Gammarus, Leptodora, and dipterans were more abundant at night than during the day[41,42].

Although spatial distribution was variable, Gammarus abundance tended to increase from west to east in the study area, reflecting the substrate preferences of this epibenthic species. Leptodora tended to be more abundant toward the western end of the study area, but high concentrations were also noted immediately to the east of Unit 1. Dipterans, like Gammarus, tended to be more abundant at eastern than western transects.

On a long-term basis (1973 through 1978), Gammarus and dipteran concentrations in the water column consistently decreased from year to year at all depth contours; by 1977 Gammarus had essentially disappeared from the water column during the day[39]. However, Gammarus abundance in benthic collections showed no consistent changes during the same time period (Section 2.4.2.1.5). Concentrations of Leptodora consistently increased as Gammarus declined.

The increase in Leptodora concentrations possibly reflects a reduction in grazing pressure due to locally reduced fish stocks (Section 2.4.2.1.6). It is possible that local environmental changes were selective against Gammarus, but benthic data showed no consistent reductions in their abundance. With reference to overall abundance of macrozooplankton, these data do not support any consistent long-term changes attributable to power plant operation.

2.4.2.1.4 Ichthyoplankton

Ichthyoplankton represent the vertebrate portion of the macrozooplankton collection and include eggs, larvae, and juvenile fish. The species composition and spatial/temporal distribution of ichthyoplankton in the Nine Mile Point area were investigated from 1973 through 1978. A total of 31 species of ichthyoplankton (eggs and/or larvae) were identified, of which 11, including the bluegill, smallmouth bass, white bass, and walleye, were rare[39]. The dominant

species in the area throughout the study period were alewife, rainbow smelt, and to a lesser degree threespine stickleback and yellow perch.

Alewife spawning takes place along gravelly or sandy shallow areas in Lake Ontario between April and June[47]. Broadcast at random, the eggs are demersal and essentially non-adhesive. The rainbow smelt migrate inshore to spawn in streams or near the lake's shore during April or May. Eggs are demersal, adhesive, and hatch in 2 to 3 weeks, after which growth is fairly rapid[41]. Both the threespine stickleback and yellow perch prefer shallow waters. The yellow perch spawns during spring, usually near rooted aquatic vegetation to which the egg masses can adhere. The stickleback spawns later in shallow water, preferably over a sandy bottom[47].

The seasonal pattern of ichthyoplankton involved the succession of three groups of species: the early spring group composed of burbot (Lota lota) and Coregonus sp.; the spring group dominated by rainbow smelt (Osmerus mordax); and the late spring/summer group dominated by alewife. Peak concentrations of eggs and larvae coincided with the occurrence of the late spring/summer group and consisted primarily of alewife larvae[26-31].

Analyses of selected dominant taxa (alewife and rainbow smelt) indicated that alewife eggs were most abundant in bottom samples collected from nearshore waters at night. Rainbow smelt eggs were rare in the study area and occurred primarily in surface waters. Since smelt spawning typically occurs at the bottom of streams or along the shoreline, the eggs collected within the area, particularly at the surface, most likely were dislodged from their natural habitat by strong currents or storms. Fertility of these eggs was not determined.

The larvae of rainbow smelt and alewife, predominantly post-yolk-sac phase, were more abundant at night than during the day. While alewife larvae were more abundant in surface waters, rainbow smelt larvae were more abundant in mid-depth and bottom waters. There was no consistent east/west pattern in the distribution of alewife or rainbow smelt larvae[26-31].

Spatial variability for both the alewife and the rainbow smelt was minimal between the 6-m (20-ft), 12-m (40-ft), and offshore contours[39]. Seasonal distribution of alewife and smelt remained similar in each of the 6 yr, with peak abundances in June and July, respectively.

The yearly mean larval concentration reported in the Nine Mile Point vicinity from May through November increased throughout the study period[39]. Except for a slight decrease in smelt larval abundance in 1975, both the alewife and smelt larvae showed increasing abundances from 1974 through 1978. Thus, based on the maintenance of a diverse species inventory and an increasing stock of the two dominant larval species, the operation of the generating stations has no observable impact on the ichthyoplankton community.

2.4.2.1.5 Benthic Organisms

Periphyton and invertebrate populations inhabit the Lake Ontario bottom, residing either on (epifaunal/epifloral) or within (infaunal) the substratum. In Lake Ontario, seasonal environmental changes influence the deposition of bottom sediments which, in turn, affects the spatial distribution of the organisms that have specific substrate requirements for burrowing or feeding activities. The bottom in the study area is characteristically bedrock, with varying amounts of rubble, sand, and silt. Sand and silt typically represented less than 10 percent of the bottom substrate of the NMPW and NMPP transects, while it often represented 80 to 90 percent of the substrate at the NMPE and FITZ transects (See Section 6.5.2.1 for station locations).

A cumulative macroinvertebrate species inventory for the period 1973 through 1978 showed a large diversity of benthic invertebrates, including 124 genera from 11 phyla[39]. Oligochaete worms and dipteran larvae were the dominant forms. The studies show no changes in benthic taxa over the 6 yr period[39].

Spatial variability between transects differed by taxon. Amphipoda and Platyhelminthes abundances were similar for each transect each year, while Nematoda, Gastropoda, and Pelecypoda abundances were consistently highest and lowest at the NMPE and NMPP transects, respectively. Diptera, Polychaeta, and Oligochaeta showed variable spatial distribution over the 6-yr study. The increased abundances, particularly of the Nematoda, Gastropoda, and Pelecypoda, at the easternmost transect (NMPE) probably relate to the predominantly soft substrate, which is more suitable for supporting the infaunal forms than is the hard substrate, which is more characteristic of the NMPP transect[39].

Taxon-specific, long-term (1973 through 1978) trends were demonstrated. Except for an increased abundance in 1974, Oligochaeta abundances remained similar throughout the study

period. Amphipoda abundances also remained constant. Gastropoda, Nematoda, Diptera, and Platyhelminthes varied, but demonstrated no singular trend or population shift. Mean Pelecypoda abundance decreased throughout the study with the lowest abundances occurring at the NMPP transect; most likely attributable to the loss of suitable habitat for this infaunal taxon. The bottom substrate (predominantly bedrock) at the NMPP transect was not capable of supporting the burrowing Pelecypoda. These benthic dynamics indicate viable and persistent communities, with no trend toward anomalous declines or increases in densities.

Sampling of the periphyton community was conducted from 1973 through 1978. Species assemblages attached to glass or Plexiglas substrates located near the surface and at the bottom were identified and enumerated.

The periphyton species inventory is extensive, indicating a diverse and viable assemblage of periphytic algae in the Nine Mile Point vicinity(39). The periphyton community was composed primarily of diatoms in the spring, green and/or blue-green algae during the summer months, and diatoms again in the fall. While not identified and enumerated, protozoa, primarily ciliates and suctorians, were common components of the periphyton community, particularly at the greater depths where light intensity was lower.

The pattern of algal succession was similar for both the phytoperiphyton and the phytoplankton communities and typical of conditions in temperate water bodies(44). The presence of a relatively large blue-green algal component is consistent with reports of increasing eutrophication of Lake Ontario, particularly in the nearshore waters(48). Seasonal growth patterns of the bottom periphyton community indicated peak biomass during July or August, depending on water temperature and depth. Bottom periphyton biomass and chlorophyll a values decreased as the depth contours increased, but no consistent pattern was discernible among the four transects tested(44). Increased biomass on artificial surface substrates at the NMPP and FITZ transects is most likely a result of a stimulatory effect of the Cooling water system discharge mixing zone(39).

The species composition and standing crop (biomass and chlorophyll a) of the periphyton community have remained relatively constant over the 6-yr study period. The various groups of periphyton showed some spatial variability among the transects; however, the seasonal fluctuations far exceeded the spatial variability and were typical of those described in other long-term studies(49). Thus, the peri-

phyton community was composed of a diverse assemblage of organisms with a dynamic seasonal variability that was much more extensive than the spatial or long-term temporal variability observed.

2.4.2.1.6 Fish

The fish community of Lake Ontario has undergone major changes, beginning before 1850 and continuing to the present. The community can be described as unstable and dominated by exotic species that were either accidentally or purposely introduced. The commercially important deep-water assemblage of salmonids has been lost, and many other species are greatly reduced in abundance. Pesticides have entered the lake and produced unacceptably high concentrations in a number of commercially and recreationally important species. In recent years, large numbers of salmonids have been stocked in the lake to prey upon the abundant alewives and produce a sport fishery.

A total of 82 species were collected from Lake Ontario during aquatic surveillance programs conducted from 1972 through 1981[39]. The following information represents a summary of the results of fish sampling conducted during this period on eight of these species identified as representative and important by the EPA: alewife, rainbow smelt, yellow perch, white perch, smallmouth bass, coho salmon, brown trout, and threespine stickleback. Limited data were obtained on threespine stickleback, brown trout, and coho salmon because few specimens of these species were collected. This summary concentrates on the relative abundance and temporal and spatial distribution of the aforementioned species in the vicinity of Nine Mile Point. Site-specific life history information, including age and growth studies, fecundity, coefficient of maturity, and food habits, is available in the annual reports[26-34].

<u>Alewife</u> (<u>Alosa pseudoharengus</u>)

Alewife in the Nine Mile Point area exhibited seasonal as well as diel variations in distribution and abundance. Alewife were more abundant during spring and summer than during the fall or winter. The bottom gill nets indicate that alewife remains inshore of this depth during its spring/early summer spawning period[39]. Longshore distribution indicates that alewife utilize the entire shoreline during their spawning period and show no preference or dependence on any given area.

Gill net sampling at four transects in the vicinity of Nine Mile Point provides a basis for examining the trend in relative abundance of alewife from 1973 through 1981[26-34]. There was a decline in alewife abundance at Nine Mile Point after a peak in 1974. This decrease is reported to be a lakewide phenomenon as a result of heavy alewife mortality during the winter of 1974-1975. Gill net catches from 1980 and 1981 indicate that the population has recovered.

Rainbow Smelt (*Osmerus mordax*)

The vast majority of adult rainbow smelt from the Nine Mile Point area were collected by surface and bottom gill nets[26-34]. Trawl and seine collections caught few rainbow smelt. The very low abundance of this species in seine collections suggests that spawning is not occurring in the littoral area near Nine Mile Point. Scott and Crossman reported that rainbow smelt in the Great Lakes spawn in streams or, under adverse weather conditions, in the offshore areas on gravel shoals[47]. The predominance of bedrock and large cobble bottom substrate within the Nine Mile Point vicinity limit this area for smelt spawning. There is no consistent pattern in the catch rate between depth contours or transects, indicating that the rainbow smelt move freely within the Nine Mile Point area.

The bottom gill nets fished consistently from 1973 through 1981 indicate peaks in abundance in 1974 and 1981, with low abundances in 1975 and 1980[39]. The peaks in 1974 and 1981 coincide with the peaks in alewife abundance during this 9-yr period.

Yellow perch (*Perca flavescens*)

Yellow perch are able to tolerate a wide variety of environmental conditions and are a commercially valuable species in the Great Lakes and elsewhere. They are generally found in water less than 9.2 m (30 ft) deep and aggregate in schools of 50-200 individuals of approximately the same size[41].

Gill net sampling in the Nine Mile Point vicinity indicated peaks in abundance of yellow perch in 1974 and 1981 and low abundance in 1977, except for the 5-m (16-ft) depth contour[39]. The 5- and 9-m (16- and 30- ft) depth stations showed the greatest abundance of yellow perch, reflecting their preference for shallow water. There was no consistent pattern in the abundance of yellow perch among transects.

The vast majority of yellow perch collected in the vicinity of Nine Mile Point was obtained in bottom gill nets[27-29].

Yellow perch were obtained in July through September, not coincident with the timing of their reproductive behavior (April). This suggests that spawning does not take place in the area.

Between 1972 and 1976, 4,107 yellow perch were tagged in the vicinity of Nine Mile Point to determine their distribution and movements[50]. Returns showed regular seasonal movements between the Nine Mile Point area and the eastern end of Lake Ontario. During fall, yellow perch moved eastward from Nine Mile Point and concentrated in the area of Sandy Pond, where they overwintered and probably spawned the following spring. In spring, they moved westward along the south shore of the lake and were recaptured in the Nine Mile Point area in greatest numbers from June through October.

White Perch (*Morone americana*)

White perch are a common brackish-water species in the northeastern coastal area of North America. Not a native of the Great Lakes, this species presumably gained access to Lake Ontario via the Oswego River, resulting from Hudson River populations moving northward and westward through the Mohawk River and Erie Barge Canal[47,51].

White perch were generally more abundant at the 5- and 9-m (16- and 30-ft) stations than at the deeper stations. They were abundant in the east side of the study area, particularly in 1973 and 1974 when overall abundance was high. White perch were more abundant near the bottom than at the surface throughout a diel cycle. Although seasonal distribution was exhibited in the day collections, summer night collections were larger than either spring or fall night collections. Gill net sampling from 1973 through 1981 showed a peak in abundance in 1974, with lower but stable abundance for the remaining 7 yr[39].

Smallmouth Bass (*Micropterus dolomieui*)

Smallmouth bass are distributed in North America from southern Canada to Alabama and west to Oklahoma[52]. It is an important sport fish and piscivore in the nearshore waters of Lake Ontario.

In the Nine Mile Point area, smallmouth bass were collected almost exclusively with bottom gill nets. Compared to other abundant species, the catch rate of smallmouth bass has always been quite low, although they were found in the nearshore area and in impingement collections. Catches at the 5-, 9-, and 12-m (16-, 30-, and 39-ft) contours were con-

sistently greater than at the 18-m (59-ft) contour, reflecting the nearshore distribution of this species. There was no consistent pattern in the catch rate when transects were compared. Gill net catches were consistently higher during the summer than during spring and fall[39]. The sampling from 1973 through 1981 indicates a trend of decreasing abundance through 1979, with increasing abundances recorded for 1980 and 1981[39].

Threespine stickleback (Gasterosteus aculeatus)

The threespine stickleback is widely distributed in fresh and marine waters of North America, ranging from Chesapeake Bay north to the Hudson Bay region. Although threespine stickleback are relatively abundant in impingement samples, they are not collected in large numbers with the fishing gear employed at Nine Mile Point; therefore, there are very limited data available for the Nine Mile Point vicinity.

The total numbers of threespine stickleback collected by various fishery gear at Nine Mile Point from 1973 through 1978 (sampling in 1979 through 1981 used only the bottom gill net which does not effectively collect this species) were highest during 1976 and 1978; however, there was no discernible trend in abundance over the years of sampling[39].

Coho Salmon (Oncorhyncus kisutch)

The coho salmon is an anadromous species occurring naturally in the Pacific Ocean and in rivers that drain northwestern North America. Attempts to establish this species in the Great Lakes were unsuccessful until the 1960s[47]. NYSDEC annually stocks coho salmon in New York State tributary streams of Lake Ontario.

Only 223 coho salmon were collected at Nine Mile Point with various fishery gear from 1973 through 1981[39]. They were most abundant in 1975 and were not collected at all in 1977 through 1981. This is attributed to a reduction in the sampling effort starting in 1979 and a reduction in coho stocking by NYSDEC subsequent to 1975. Because of the small number collected, no distributional or seasonal trends were determined.

Brown Trout (Salmo trutta)

The total number of brown trout collected at Nine Mile Point by various fishery gear from 1973 through 1981 was 587. Brown trout were most abundant in 1975, reflecting the

stocking rate. There is no obvious trend in the abundance of brown trout over the years of study. The low catch in 1977 and 1979 through 1980 is the result of reduced sampling effort. Because of the low numbers collected, no distributional trends were demonstrated; however, they were typically present within the study area throughout the year[39].

Existing and Planned Man-Induced Manipulations Affecting Fish Population

There are a number of factors that may significantly affect the aquatic biota of Lake Ontario through trophic interactions. Past species composition changes are attributed to the destabilizing influence of overfishing. Commercial fishing is now greatly reduced from past levels, but in conjunction with other factors it apparently has produced some effects. Although these changes have been occurring over a long period of time, there is no indication that the fish community has stabilized. A number of exotic species have been so successful that they now dominate the fish community.

The reintroduction of salmonids has produced a highly successful sport fishery and should help control alewife abundance, which has sometimes been a nuisance problem. Ecological succession in the fish community of Lake Ontario has been altered by man. The water quality of Lake Ontario is generally good and apparently would be adequate to support the original fish stocks if they were still abundant. There are, however, localized areas of pollution; the discovery of unacceptably high levels of mirex in fish indicates that water quality may be influencing the fish community in unknown ways.

Based on the long-term trends established over the 9 yr of study presented in the preceding sections, power plants represent a minor influence on the lake aquatic community. Thermal discharges are a highly localized effect that may affect localized seasonal fish distribution, but no consistent species-specific distribution was identified with the thermal discharges. Direct mortality as a result of impingement and entrainment has had no appreciable effect on the fish populations as demonstrated by long-term abundances. Naturally occurring seasonal and yearly cycles account for most of the variability observed in the monitored aquatic communities.

Endangered Species

Christie[53] listed 10 species of Lake Ontario fish believed to be extinct or greatly reduced in abundance:

Lake sturgeon	Acipenser fulvescens
Atlantic salmon	Salmo salar
Blackfin cisco (Ontario bloater)	Coregonus nigripinnis
Lake trout	Salvelinus namaycush
Shortnose cisco	Coregonus reighardi
Bloater	Coregonus hovi
Kiyi	Coregonus kivi
Burbot	Lota lota
Blue pike	Stizostedion vitreum glaucum
Fourhorn sculpin	Myoxocephalus quadricornis

The blue pike is the only species from Lake Ontario on the U.S. Fish and Wildlife Service's list of endangered and threatened wildlife[54]. The Atlantic salmon and blackfin cisco were extinct here before 1900 and the fourhorn sculpin has not been reported since 1953[53]. The lake trout population has been bolstered by stocking, but the present condition of the stock is not known.

The remaining species, while in low abundance in Lake Ontario, persist in abundance in other waters and therefore are not considered threatened or endangered species by the U.S. Fish and Wildlife Service. At one time, these species were important constituents of the lake's fish community.

Burbot and lake trout are the only species on Christie's list that have been collected in lake and plant sampling in the vicinity of Nine Mile Point. The estimated total number impinged annually has been less than 100 for each species at each plant. In addition, burbot were taken in low numbers in entrainment sampling. This low level of mortality is not believed to be a threat to these species and, in fact, the occurrence of these species in plant sampling at Unit 1 and the JAF plant may indicate an increase in abundance of these species in the lake.

Literature on the general biology of the endangered species in Lake Ontario and the fishery sampling at Nine Mile Point indicate that this area is not of unique importance to these species. A recovery of the populations now in low abundance may be possible in the future for some species. The biological requirements of these species are such that the effects of power plant operation at Nine Mile Point would

not prevent the recovery of these species if other conditions were favorable.

Commercial and Sport Fisheries of Lake Ontario

Commercial fishery and sportfishing in Lake Ontario have undergone major changes with the reduction in abundance (and, in some cases, extinction) of many important species and the introduction of exotic game species[53]. Species composition changes have shifted the emphasis of the commercial fishery from one that relied on relatively small numbers of large, valuable fish to a fishery that captures large numbers of small, lower value fish.

A wide variety of species are taken in sportfishing at various times and locations around the lake. Centrarchids, especially the smallmouth bass, as well as yellow perch, catfish, bullheads, and white perch are probably taken by sportfishermen over a broad area. Rainbow trout, northern pike, and muskellunge are important in restricted areas. The walleye was once an abundant and popular sport fish, especially in the 1950s; however, it decreased in abundance after 1959 and is just recently returning to its previous levels.

Recently, large numbers of salmonids, including lake trout, splake, coho salmon, chinook salmon, Atlantic salmon, steelhead trout, and brown trout have been stocked in the lake to take advantage of the food base provided by the alewife and to create recreational fisheries. The coho, chinook, and brown trout, have survived well, and an important sport fishery on these species has developed. New York State has recently constructed a large hatchery for salmon production on the Salmon River, and large numbers of coho, chinook, and steelhead trout will be stocked in the future.

2.4.2.2 Transmission Corridors and Offsite Areas

The following description of the aquatic ecology of the transmission corridor is based on the Article VII Application filed with the New York State Public Service Commission in 1982[21] and on a field reconnaissance survey conducted in October 1981. The only aquatic habitats potentially affected are those that abut or are crossed by the existing transmission corridor which will be utilized for the new transmission line from Unit 2 to the Volney Substation site (Section 3.7)[21].

While the transmission corridor crosses several wetland habitats, drainage ditches, and intermittent streams, there

are only two prominent aquatic habitats encountered: an unnamed stream (and tributaries) designated Ontario 62 by NYSDEC, and tributaries of Black Creek (Ontario 66). Figure 2.4-4 shows the locations of these streams in relation to the transmission corridor. All streams encountered have been designated Class D by NYSDEC. Class D waters are not considered to be conducive to the propagation of fish; however, the waters must be suitable for fish survival[55].

Moving southward from Units 1 and 2 along the transmission route, the first stream encountered is the main channel of the unnamed stream designated Ontario 62 (Figure 2.4-4). This stream, with several small branches originating near Hammond's Corner, drains the farm and pastureland to the south and flows into Lake Ontario at the end of Lakeview Road. The transmission route crosses the stream about 0.5 km (0.3 mi) north of Miner Road. At this location, the stream flows through existing double 1.2-m (48-in) culverts. During the 1981 field reconnaissance performed by Stone & Webster Engineering Corporation, it was noted that several acres were flooded upstream of the culverts. In April 1977, rainbow trout (<u>Salmo gairdneri</u>) were observed swimming upstream through the culverts. NYSDEC has noted that any small stream in this area may have rainbow trout in the spring and brown trout (<u>S. trutta</u>) in the fall[21]. A very small branch of the stream (Ontario 62-3) is crossed twice by the transmission line farther to the south, once about 0.7 km (0.4 mi) south of Miner Road where it flows through a culvert. In October 1981, this stream was very shallow (about 5 cm [2 in] deep) and less than 1 m (3 ft) across. It is crossed again about 0.1 km (0.06 mi) north of Middle Road, at which point no flows are likely during dry periods. No information is available about the biota of this branch of the stream.

The second area of aquatic habitat along the transmission route is one of the main tributaries of Black Creek (Ontario 66-2). Black Creek, originating in Volney and South Scriba, flows into the Oswego River north of Fulton. At the point where it is crossed by the existing and future transmission lines (about 0.1 km [0.06 mi] north of O'Conner Road), the tributary flows through a dredged channel. When viewed in October 1981 (following a period of rain), the stream was about 2.4 m (8 ft) wide, 15 cm (6 in) deep, and flowed at a rate of about 30 to 60 cm/sec (1 to 2 fps). The bottom consisted of gravel and silt. Trout have been reported to occur in this section of Black Creek[21].

South of O'Conner Road and north of Hall Road, another tributary of Black Creek (Ontario 66-2-6) flows through a ditch along the center of the existing transmission line corridor, providing drainage for surrounding farm and pastureland. In October 1981, this ditch (about 1.8 m [6 ft] deep) contained a stream about 1.2 m (4 ft) wide and 13 cm (5 in) deep. No information is available on the biota of this tributary of Black Creek.

There are no other prominent aquatic habitats along the transmission route from Unit 2 to the Volney Substation. All other areas that were observed to contain water were small intermittent wetlands, streams, and drainage ditches. None of these are likely to support an extensive fish community, but probably provide breeding and nursery areas for some amphibians and insects. No aquatic species on the federal list of endangered and threatened species(5) are known to inhabit the aquatic habitats crossed by the transmission route(21).

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TABLE 2.4-1

PHYLOGENETIC SPECIES LIST OF PLANTS
RECORDED DURING 1979 FIELD SURVEY
UNIT 2 SITE AND ENVIRONS[1]

Lycopodiaceae

Lycopodium complanatum - Running pine[2]

Polypodiaceae

Pteridium aquilinum - Bracken fern
Onoclea sensibilis - Sensitive fern
Polystichum acrostichoides - Christmas fern[2]
Thelypteris noveboracensis - New York fern[2]
Dennstaedtia punctilobula - Hay-scented fern

Pinaceae

Tsuga canadensis - Canadian hemlock

Gramineae

- Grasses

Cyperaceae

Carex spp. - Sedges

Araceae

Arisaema triphyllum - Jack-in-the-pulpit

Juncaceae

Scirpus spp. - Rushes

Liliaceae

Polygonatum biflorum - Solomon's seal
Smilacinca racemosa - False Solomon's seal
Trillium sp. - Trillium[2]

Salicaceae

Populus stremuloides - Quaking aspen
Salix nigra - Black willow

TABLE 2.4-1 (Cont)

Juglandaceae

Carya spp. - Hickory

Corylaceae

Alnus sp. - Alder
Betula allegheniensis - Yellow birch
Betula populifolia - Gray birch
Carpinus caroliniana - Ironwood (American hornbeam)
Ostrya virginiana - Eastern hophornbeam

Fagaceae

Fagus grandifolia - American beech
Quercus velutina - Black oak

Ulmaceae

Celtis occidentalis - Hackberry

Polygonaceae

Polygonum pennsylvanicum - Pennsylvania smartweed
Rumex acetosella - Sheep sorrel

Hamamelidaceae

Hamamelis virginiana - Witch hazel

Rosaceae

Amelanchier sp. - Shadbush
Fragaria virginiana - Strawberry
Potentilla canadensis - Dwarf cinquefoil
Prunus serotina - Black cherry
Malus sp. - Apple
Rubus spp. - Blackberry
Crataegus spp. - Hawthorne

Oxalidaceae

Oxalis sp. - Wood sorrel

TABLE 2.4-1 (Cont)

Anacardiaceae

<u>Rhus</u> <u>radicans</u> - Poison ivy
<u>Rhus</u> <u>typhina</u> - Staghorn sumac

Aceraceae

<u>Acer</u> <u>saccharum</u> - Sugar maple
<u>Acer</u> <u>pennsylvanicum</u> - Striped maple
<u>Acer</u> <u>rubrum</u> - Red maple
<u>Acer</u> <u>saccharinum</u> - Silver maple

Balsaminaceae

<u>Impatiens</u> <u>capensis</u> - Jewelweed

Vitaceae

<u>Vitis</u> sp. - Grape

Umbelliferae

<u>Daugus</u> <u>carota</u> - Wild carrot (Queen Anne's lace)

Cornaceae

<u>Cornus</u> <u>amomum</u> - Silky dogwood
<u>Nyssa</u> <u>sylvatica</u> - Black gum

Oleaceae

<u>Fraxinus</u> <u>americana</u> - White ash

Verbenaceae

<u>Verbena</u> sp. - Vervain

Scrophulariaceae

<u>Linaria</u> <u>vulgaris</u> - Toadflax (butter-and-eggs)
<u>Verbascum</u> <u>thapsus</u> - Common mullein
<u>Veronica</u> <u>officinalis</u> - Common speedwell

Rubiaceae

<u>Mitchella</u> <u>repens</u> - Partridgeberry

TABLE 2.4-1 (Cont)

Caprifoliaceae

- Viburnum acerifolium - Maple-leaved viburnum
- Viburnum dentatum - Arrowood

Compositae

- Ambrosia artemisiifolia - Ragweed
- Aster spp. - Aster
- Eupatorium perfoliatum - Boneset
- Erechtites hieracifolia - Pilewort
- Chrysanthemum leucanthemum - Ox-eye daisy
- Solidago altissima - Tall goldenrod
- Solidago graminifolia - Lance-leaved goldenrod

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(1) See also Reference 1, Table 2.
(2) Plant protected by New York State Environmental Conservation Law, Section 9-1503. These plants may not be picked, plucked, severed, removed, or carried away without consent of the property owner (NMPC).

TABLE 2.4-2

SUMMARY OF OVERSTORY VEGETATION
EARLY SECOND-GROWTH FOREST COVER TYPE - TRANSECT 1

Tree Species: Scientific Name	Tree Species: Common Name	Relative Density (%)	Density (stems/ha)	Frequency	Relative Frequency (%)	Dominance (Basal Area) (m^2/ha)	Relative Dominance (%)	Importance Value	Mean dbh (cm)
Fraxinus americana	White ash	58.1	224.26	90.9	50.0	5.49	63.1	171.2	17.66
Malus sp.	Apple	18.6	71.79	45.4	24.9	1.68	19.3	62.8	17.31
Populus tremuloides	Quaking aspen	16.2	62.53	27.2	14.9	1.26	14.4	45.5	16.05
Crataegus sp.	Hawthorn	6.9	26.63	18.1	9.9	0.27	3.1	19.9	11.43
Total		99.8			99.7	8.7	99.9	299.4	

TABLE 2.4-3

SUMMARY OF OVERSTORY VEGETATION
MIXED FOREST AND SHRUBLANDS COVER TYPE - TRANSECT 2

Tree Species: Scientific Name	Tree Species: Common Name	Relative Density (%)	Density (stems/ha)	Frequency	Relative Frequency (%)	Dominance (Basal Area) (m^2/ha)	Relative Dominance (%)	Importance Value	Mean dbh (cm)
Fraxinus americana	White ash	35.0	155.0	40	20	2.2	21.2	76.2	13.58
Prunus serotina	Black cherry	22.5	99.7	50	25	1.92	18.5	66.0	15.65
Acer saccharum	Sugar maple	10.0	44.3	30	15	3.57	34.4	59.4	32.03
Malus sp.	Apple	12.5	55.4	20	10	0.62	5.9	28.4	11.99
Populus tremuloides	Quaking aspen	10.0	44.3	20	10	0.72	6.9	26.9	14.34
Tsuga canadensis	Eastern hemlock	2.5	11.08	10	5	0.66	6.3	13.8	27.68
Quercus velutina	Black oak	2.5	11.08	10	5	0.44	4.2	11.7	22.60
Betula populifolia	Gray birch	2.5	11.08	10	5	0.13	1.2	8.7	12.19
Unknown	-	2.5	11.08	10	5	0.10	0.9	8.4	10.92
Total		100.0			100	10.36	99.5	299.5	

TABLE 2.4-4

SUMMARY OF OVERSTORY VEGETATION
MIXED HARDWOOD FOREST COVER TYPE - TRANSECT 3

Tree Species: Scientific Name	Tree Species: Common Name	Relative Density (%)	Density (stems/ha)	Frequency	Relative Frequency (%)	Dominance (Basal Area) (m^2/ha)	Relative Dominance (%)	Importance Value	Mean dbh (cm)
Acer saccharum	Sugar maple	47.7	373.0	90.9	34.5	6.74	24.5	106.7	37.07
Populus tremuloides	Quaking aspen	15.9	124.3	54.5	20.7	8.20	29.8	66.4	29.04
Fraxinus americana	White ash	13.6	106.0	27.2	10.3	3.29	11.9	35.8	19.91
Betula alleghanensis	Yellow birch	6.8	53.1	27.2	10.3	2.80	10.1	27.2	26.03
Fagus grandifolia	Beech	4.5	35.2	18.2	6.9	3.98	14.4	25.8	35.94
Betula populifolia	Gray birch	6.8	53.1	27.2	10.3	1.80	6.5	23.6	20.91
Salix nigra	Black willow	2.2	17.2	9.0	3.4	0.45	1.6	7.2	18.28
Acer rubrum	Red maple	2.2	17.2	9.0	3.4	0.20	0.7	6.3	12.19
Total		99.7			99.8	27.46	99.5	299.0	

TABLE 2.4-5

SMALL-MAMMAL TRAPPING RESULTS

Mammal	Transect 1 No.	Transect 1 No./100 Trapnights	Transect 2 No.	Transect 2 No./100 Trapnights	Transect 3 No.	Transect 3 No./100 Trapnights	Transect 4 No.	Transect 4 No./100 Trapnights	Percent Composition
Peromyscus leucopus (White-footed mouse)	2	0.83	-	-	4	1.66	-	-	30
Peromyscus manculatus (Deer mouse)	2	0.83	-	-	6	2.50	-	-	40
Zapus hudsonicus (Meadow jumping-mouse)	-	-	3	1.25	-	-	-	-	15
Microtus pennsylvanicus (Meadow vole)	-	-	-	-	-	-	2	0.83	10
Tamiasciurus hudsonicus (Red squirrel)	1	0.41	-	-	-	-	-	-	5

KEY TO TRANSECTS:

1 = Early second-growth forest (24.9%)
2 = Transmission line (15.0%)
3 = Mixed hardwood forest (50.0%)
4 = Open field (9.9%)

TABLE 2.4-6

MAMMALIAN SPECIES AND MAJOR HABITAT ASSOCIATIONS
IN OSWEGO COUNTY COASTAL ZONE, 1976[1]

Species	Mature Woods	Intermediate Woods	Shrub-lands	New Field	Aquatic (Wetlands)
Moles					
Hairytail mole[1,2]	X	X	X	X	
Starnose mole[1,2]	X	X	X	X	X
Shrews					
Masked shrew[1,2]	X	X	X	X	
Smoky shrew	X				
N. water shrew	X				
Thompson's pygmy shrew	X	X	X	X	
Least shrew				X	
Shorttail shrew[1,2]	X	X	X	X	
Bats					
Silver-haired bat[1,2]	X	X			X
Keen's myotis[1]	X	X			X
Small-footed myotis	X	X			
E. Pipistrelle[1]	X	X			X
Red bat[1]	X	X			X
Little brown myotis[1,2]	X	X			X
Big brown bat[1]	X	X			
Hoary bat [1]	X	X			
Indiana myotis	X	X			
Carnivores					
Shorttail weasel[1,2]	X	X	X	X	
Longtail weasel[1,2]	X	X	X	X	
Mink[1]	X	X	X	X	X
Red fox[1,2]		X	X	X	
Gray fox[2]	X	X	X		
Bobcat	X	X	X		X
Coyote	X		X		
River otter					X

TABLE 2.4-6 (Cont)

Species	Mature Woods	Intermediate Woods	Shrub-lands	New Field	Aquatic (Wetlands)
Squirrels and Relatives					
Red squirrel[1,2]	X	X			
E. gray squirrel[1,2]	X	X			
E. chipmunk[1,2]	X	X	X		
S. flying squirrel[1]	X	X			
N. flying squirrel[1]	X	X			
Mice, Voles, and Rats					
Woodland deermouse[1]	X	X			
Prairie deermouse[1]			X	X	
White-footed mouse[1,2]	X	X	X	X	
Woodland jumping mouse[1,2]		X	X	X	
Meadow jumping mouse[1,2]	X	X	X	X	
Meadow vole[1,2]			X	X	
Boreal redback vole[1,2]	X	X			
Pine vole[1]	X	X		X	
House mouse and Norway rat[1]	Associated with human habitats				
Miscellaneous					
E. cottontail[1,2]	X	X	X		
Snowshoe hare	X	X			
Striped skunk[1,2]	X	X	X	X	
Porcupine[1,2]	X	X			
Muskrat[1,2]					X
Virginia opossum[1,2]	X	X		X	
Woodchuck[1,2]			X	X	
Beaver[1]					X
Whitetail deer[1,2]	X	X	X		
Raccoon[1,2]	X	X	X		

[1]Species likely to occur in 1.6-km (1-mi) radius of Unit 2.
[2]Designates species that were captured or observed during Oswego inventory.

SOURCE: Reference 1

TABLE 2.4-7

GAME AND FURBEARER SPECIES OF IMPORTANCE IN OSWEGO COUNTY

Common Name	Scientific Name	Estimated Harvest 1980-81[1]
Game Species		
Eastern cottontail	Sylvilagus floridanus	69,642
Ruffed grouse	Bonasa umbellus	57,970
Woodcock	Scolopax minor	11,283
Gray squirrel	Sciurus carolinensis	72,365
Varying hare	Lepus americanus	20,620
Ring-necked pheasant	Phasianus colchicus	14,395
Raccoon	Procyon lotor	39,684
Red fox	Vulpes fulva	2,334
Gray fox	Urocyon cinereoargenteus	2,334
Coyote	Canis latrans, sp.	389
Common snipe	Capella gallinago	} 2,723
Virginia rail	Rallus limicola	}
Sora rail	Porzana carolina	}
Gallinule	Gallinula chloropus	0
Crow	Corvus brachyrhynchos	0
White-tailed deer	Odocoileus virginianus	(380)[2]
Canada goose	Branta canadensis	31,903 (2,575)[3]
Approximately 28 species of waterfowl		90,262 (15,141)[3]
Furbearer Species		
Mink	Mustela vison	2,897
Muskrat	Ondatra zibethica	111,435
Beaver	Castor canadensis	(322)[2]
River otter	Lutra canadensis	(8)[2]
Raccoon	Procyon lotor	23,416
Striped skunk	Mephitis mephitis	3,530
Red fox	Vulpes fulva	4,307
Gray fox	Urocyon cinereoargenteus	3,371

TABLE 2.4-7 (Cont)

Common Name	Scientific Name	Estimated Harvest 1980-81[1]
Coyote	*Canis latrans*, sp.	(26)[2]
Fisher	*Martes pennanti*	(19)[2]
Bobcat	*Lynx rufus*	(0)[2]
Opossum	*Didelphis marsupialis*	5,703

[1] Game species survey area includes the Lake Plain physiographic region within Region 7 of NYSDEC. Furbearer species survey area includes all of Region 7.

[2] Survey area includes licensed trappers in Oswego County only.

[3] Waterfowl harvested in Oswego County.

NOTE: Importance defined by protection through regulated hunting and trapping seasons established by NYSDEC.

SOURCES: References 2 and 25

TABLE 2.4-8

CHECKLIST OF AVIAN SPECIES AND THEIR
OCCURRENCE IN OSWEGO COUNTY COASTAL ZONE

Species	Common Name	Seasonal Status				
Gavia immer	Common loon		W	M		
Gavia stellata	Red-throated loon			M		
Podiceps grisegena	Red-necked grebe			M		
Podiceps auritus	Horned grebe		W	M		
Podilymbus podiceps	Pied-billed grebe	B	W	M		
Fulmarus glacialis	Northfulmar fulmar				V	
Pelecanus occidentalis	Brown pelican				V	
Phalacrocorax carbo	Great cormorant				V	
Phalacrocorax auritus	Double-crested cormorant		W	M		S
Ardea herodias	Great blue heron			M		S
Butorides striatus	Green heron	B		M		
Florida caerulea	Little blue heron				V	
Bubulcus ibis	Cattle egret			M		
Casmerodius albus	Great egret			M		S
Egretta thula	Snowy egret				V	
Hydramassa tricolor	Louisiana heron				V	
Nycticorax nycticorax	Black-crowned night heron			M		S
Ixobrycus exilis	Least bittern	B		M		
Botaurus lentiginosus	American bittern	B		M		
Plegadis falcinellus	Glossy ibis				V	
Cygnus olor	Mute swan				V	
Olor columbianus	Whistling swan			M		
Branta canadensis	Canada goose	B	W	M		
Branta bernicla	Brant			M		
Chen caerulescens	Snow goose			M		
Anas platyrhynchos	Mallard	B	W	M		
Anas rubripes	Black duck	B	W	M		
Anas strepera	Gadwall		W	M		
Anas acuta	Pintail		W	M		
Anas crecca	Green-winged teal			M		
Anas discors	Blue-winged teal	B		M		
Anas americana	American widgeon			M		
Anas clypeata	Northern shoveler			M		
Aix sponsa	Wood duck	B		M		
Aythya americana	Redhead		W	M		
Aythya collaris	Ring-necked duck			M		
Aythya valisineria	Canvasback		W	M		
Aythya marila	Greater scaup		W	M		
Aythya affinis	Lesser scaup		W	M		
Aythya fuligula	Tufted duck				V	
Bucephala clangula	Common grackle		W	M		
Bucephala islandica	Barrow's goldeneye		W	M		

TABLE 2.4-8 (Cont)

Species	Common Name	Seasonal Status					
Bucephala albeola	Bufflehead			W	M		
Clangula hyemalis	Oldsquaw			W	M		
Histrionicus histrionicus	Harlequin duck					V	
Somateria mollissima	Common eider					V	
Somateria spectabilis	King eider			W			
Melanitta deglandi	White-winged scoter			W	M		
Melanitta perspicillata	Surf scoter			W	M		
Melanitta nigra	Black scoter			W	M		
Oxyura jamaicensis	Ruddy duck			W	M		
Lophodytes cucullatus	Hooded merganser			W	M		
Mergus merganser	Common merganser			W	M		
Mergus serrator	Red-breasted merganser			W	M		
Cathartes aura	Turkey vulture		B		M		
Coragyps atratus	Black vulture					V	
Elanoides forficatus	Swallow-tailed kite					V	
Accipiter gentilis	Goshawk			W	M		
Accipiter striatus	Sharp-shinned hawk		B	W	M		
Accipiter cooperii	Cooper's hawk		B	W	M		
Buteo jamaicensis	Red-tailed hawk		B	W	M		
Buteo lineatus	Red-shouldered hawk				M		
Buteo platypterus	Broad-winged hawk		B		M		
Buteo swainsoni	Swainson's hawk					V	
Buteo lagopus	Rough-legged hawk			W	M		
Aquila chrysaetos	Golden eagle				M		
Haliaeetus leucocephalus	Bald eagle			W	M		S
Circus cyaneus	Marsh hawk		B		M		
Pandion haliaetus	Osprey				M		S
Falco rusticolus	Gyrfalcon					V	
Falco peregrinus	Peregrine falcon				M		
Falco columbarius	Merlin				M		
Falco sparverius	American kestrel		B	W	M		
Bonasa umbellus	Ruffed grouse	R					
Phasianus colchicus	Ring-necked pheasant	R					
Grus canadensis	Sandhill crane					V	
Rallus limicola	Virginia rail		B		M		
Porzana carolina	Sora		B		M		
Gallinula chloropus	Common gallinule		B		M		
Fulica americana	American coot			W	M		
Charadrius semipalmatus	Semipalmated plover				M		
Charadrius melodus	Piping plover				M		
Charadrius vociferus	Killdeer		B		M		
Pulvialis dominica	American golden plover				M		
Pulvialis squatarola	Black-bellied plover				M		
Arenaria interpres	Ruddy turnstone				M		
Philohela minor	American woodcock		B		M		

TABLE 2.4-8 (Cont)

Species	Common Name	Seasonal Status				
Capella gallinago	Common snipe	B		M		
Numenius phaeopus	Whimbrel			M		
Bartramia longicauda	Upland sandpiper	B		M		
Actitis macularia	Spotted sandpiper	B		M		
Tringa solitaria	Solitary sandpiper			M		
Tringa melanoleuca	Greater yellowlegs			M		
Tringa flavipes	Lesser yellowlegs			M		
Catoptrophorus semipalmatus	Willet				V	
Caladris canutus	Red knot			M		
Caladris maritima	Purple sandpiper			M		
Caladris melanotos	Pectoral sandpiper			M		
Caladris fuscicollis	White-rumped sandpiper			M		
Caladris bairdii	Baird's sandpiper			M		
Caladris minutilla	Least sandpiper			M		
Caladris alpina	Dunlin			M		
Caladris pusilla	Semipalmated sandpiper			M		
Caladris mauri	Western sandpiper			M		
Caladris alba	Sanderling			M		
Limnodromus griseus	Short-billed dowitcher			M		
Limnodromus scolopaceus	Long-billed dowitcher			M		
Micropalama himantopus	Stilt sandpiper			M		
Tryngites subruficollis	Buff-breasted sandpiper			M		
Limosa fedoa	Marbled godwit				V	
Limosa haemastica	Hudsonian godwit			M		
Phalaropus fulicarius	Red phalarope			M		
Steganopus tricolor	Wilson's phalarope			M		
Lobipes lobatus	Northern phalarope			M		
Stercorarius pomarinus	Pomarine jaeger			M		
Stercorarius parasiticus	Parasitic jaeger			M		
Stercorarius longicaudus	Long-tailed jaeger				V	
Larus hyperboreus	Glaucous gull		W	M		
Larus glaucoides	Iceland gull		W	M		
Larus marinus	Great black-backed gull		W	M		S
Larus argentatus	Herring gull		W	M		S
Larus thayeri	Thayer's gull		W			
Larus delawarensis	Ring-billed gull		W	M		S
Larus ridibundus	Black-headed gull				V	
Larus atricilla	Laughing gull				V	
Larus pipixcan	Franklin's gull			M		S
Larus philadelphia	Bonapartes gull			M		S
Larus minutus	Little gull			M		
Rissa tridactyla	Black-legged kittiwake			M		
Sterna forsteri	Forster's tern			M		
Sterna hirundo	Common tern	B		M		
Sterna caspia	Caspian tern			M		S

TABLE 2.4-8 (Cont)

Species	Common Name	Seasonal Status					
Chlidonias niger	Black tern		B		M		
Columba livia	Rock dove	R					
Zenaida macroura	Mourning dove		B	W	M		
Coccyzus americanus	Yellow-billed cuckoo		B		M		
Coccyzus erythropthalmus	Black-billed cuckoo		B		M		
Otus asio	Screech owl	R					
Bubo virginianus	Great horned owl	R					
Nyctea scandiaca	Snowy owl			W	M		
Strix varia	Barred owl		B	W	M		
Asio otus	Long-eared owl			W	M		S
Asio flammeus	Short-eared owl				M		
Aegolius funereus	Boreal owl					V	
Aegolius acadicus	Saw-whet owl			W	M		
Caprimulgus vociferus	Whippoorwill				M		
Chordeiles minor	Common nighthawk		B		M		
Chaetura pelagica	Chimney swift		B		M		
Archilochus colubris	Ruby-throated hummingbird		B		M		
Megaceryle alcyon	Belted kingfisher		B	W	M		
Colaptes auratus	Common flicker		B		M		
Dryocopus pileatus	Pileated woodpecker	R					
Melanerpes carolinus	Red-bellied woodpecker	R					
Melanerpes erythrocephalus	Red-headed woodpecker		B		M		
Sphyrapicus varius	Yellow-bellied sapsucker				M		
Picoides villosus	Hairy woodpecker		B	W	M		
Picoides pubescens	Downy woodpecker		B	W	M		
Picoides arcticus	Black-backed three-toed woodpecker					V	
Tyrannus tyrannus	Eastern kingbird		B		M		
Myiarchus crinitus	Great crested flycatcher		B		M		
Sayornis phoebe	Eastern phoebe		B		M		
Empidonax flaviventris	Yellow-bellied flycatcher				M		
Empidonax virescens	Acadian flycatcher					V	
Empidonax traillii	Willow flycatcher		B		M		
Empidonax alnorum	Alder flycatcher		B		M		
Empidonax minimus	Least flycatcher		B		M		
Contopus virens	Eastern wood pewee		B		M		
Nuttallornis borealis	Olive-sided flycatcher				M		
Eremophila alpestris	Horned lark		B	W	M		
Tridoprocne bicolor	Tree swallow		B		M		
Riparia riparia	Bank swallow		B		M		
Stelgidopteryx ruficollis	Rough-winged swallow		B		M		
Hirundo rustica	Barn swallow		B		M		
Petrochelidon pyrrhonota	Cliff swallow				M		
Progne subis	Purple martin		B		M		
Cyanocitta cristata	Blue jay		B	W	M		

TABLE 2.4-8 (Cont)

Species	Common Name	Seasonal Status					
Corvus corax	Common raven					V	
Corvus brachyrhynchos	Common crow		B	W	M		
Parus atricapillus	Black-capped chickadee		B	W	M		
Parus hudsonicus	Boreal chickadee			W	M		
Parus bicolor	Tufted titmouse		B	W	M		
Sitta carolinensis	White-breasted nuthatch		B	W	M		
Sitta canadensis	Red-breasted nuthatch		B	W	M		
Certhia familiaris	Brown creeper		B	W	M		
Troglodytes aedon	House wren		B		M		
Troglodytes troglodytes	Winter wren		B		M		
Thryothorus ludovicianus	Carolina wren		B	W	M		
Cistothorus palustris	Long-billed marsh wren		B		M		
Mimus polyglottus	Mockingbird				M		S
Dumetella carolinensis	Gray catbird		B		M		
Toxostoma rufum	Brown thrasher		B		M		
Turdus migratorius	American robin		B	W	M		
Hylocichla mustelina	Wood thrush		B		M		
Catharus guttatus	Hermit thrush				M		
Catharus ustulatus	Swainson's thrush				M		
Catharus minimus	Gray-cheeked thrush				M		
Catharus fuscescens	Veery		B		M		
Sialia sialis	Eastern bluebird		B		M		
Polioptila caerulea	Blue-gray gnatcatcher		B		M		
Regulus satrapa	Golden-crowned kinglet		B	W	M		
Regulus calendula	Ruby-crowned kinglet				M		
Anthus spinoletta	Water pipit				M		
Bombycilla garrulus	Bohemian waxwing			W	M		
Bombycilla cedrorum	Cedar waxwing		B	W	M		
Lanius excubitor	Northern shrike			W	M		
Lanius ludovicianus	Loggerhead shrike				M		S
Sturnus vulgaris	Starling	R			M		
Vireo flavifrons	Yellow-throated vireo		B		M		
Vireo solitarius	Solitary vireo				M		
Vireo olivaceus	Red-eyed vireo		B		M		
Vireo philadelphicus	Philadelphia vireo				M		
Vireo gilvus	Warbling vireo		B		M		
Mniotillta varia	Black-and-white warbler		B		M		
Protonotaria citrea	Prothonotary warbler					V	
Helmitheros vermivorus	Worm-eating warbler					V	
Vermivora chrysoptera	Golden-winged warbler		B		M		
Vermivora pinus	Blue-winged warbler		B		M		
Vermivora peregrina	Tennessee warbler				M		
Vermivora celata	Orange-crowned warbler				M		
Vermivora ruficapilla	Nashville warbler				M		
Parula americana	Northern parula				M		

TABLE 2.4-8 (Cont)

Species	Common Name	Seasonal Status				
		R	B	W	M	V
Dendroica petechia	Yellow warbler		B		M	
Dendroica magnolia	Magnolia warbler				M	
Dendroica tigrina	Cape May warbler				M	
Dendroica caerulescens	Black-throated blue warbler				M	
Dendroica coronata	Yellow-rumped warbler			W	M	
Dendroica virens	Black-throated green warbler		B		M	
Dendroica cerulea	Cerulean warbler		B		M	
Dendroica fusca	Blackburnian warbler		B		M	
Dendroica dominica	Yellow-throated warbler					V
Dendroica pensylvanica	Chestnut-sided warbler		B		M	
Dendroica castanea	Bay-breasted warbler				M	
Dendroica striata	Blackpoll warbler				M	
Dendroica pinus	Pine warbler		B		M	
Dendroica discolor	Prairie warbler					V
Dendroica palmarum	Palm warbler				M	
Seiurus aurocapillus	Ovenbird		B		M	
Seiurus noveboracensis	Northern waterthrush		B		M	
Seiurus motacilla	Louisiana waterthrush					V
Oporonis agilis	Connecticut warbler				M	
Oporonis philadelphia	Mourning warbler		B		M	
Geothlypis trichas	Common yellowthroat		B		M	
Wilsonia citrina	Hooded warbler		B		M	
Wilsonia pusilla	Wilson's warbler				M	
Wilsonia canadensis	Canada warbler		B		M	
Septophaga ruticilla	American redstart		B		M	
Passer domesticus	House sparrow	R				
Policyonyx oryzivorus	Bobolink		B		M	
Sturnella magna	Eastern meadowlark		B	W	M	
Sturnella neglecta	Western meadowlark		B			V
Agelaius phaeniceus	Red-winged blackbird		B	W	M	
Icterus spurius	Orchard oriole					V
Icterus galbula	Northern oriole		B		M	
Euphagus carolinus	Rusty blackbird				M	
Quiscalus quiscula	Common grackle		B	W	M	
Molothrus ater	Brown-headed cowbird		B	W	M	
Piranga olivacea	Scarlet tanager		B		M	
Cardinalis cardinalis	Cardinal	R				
Pheucticus lidovicianus	Rose-breasted grosbeak		B		M	
Passerina cyanea	Indigo bunting		B		M	
Spiza americana	Dickcissel					V
Hesperiphona vespertina	Evening grosbeak			W	M	
Carpodacus purpureus	Purple finch		B	W	M	
Carpodacus mexicanus	House finch					V

TABLE 2.4-8 (Cont)

Species	Common Name	Seasonal Status			
Pinicola enucleator	Pine grosbeak		W	M	
Carduelis hornemannii	Hoary redpoll				V
Carduelis flammea	Common redpoll		W	M	
Carduelis pinus	Pine siskin		W	M	
Carduelis tristis	American goldfinch	B	W	M	
Loxia curvirostra	Red crossbill		W	M	
Loxia leucoptera	White-winged crossbill		W	M	
Pipilo erythrophthalmus	Rufous-sided towhee	B		M	
Passerculus sandwichensis	Savannah sparrow	B		M	
Ammodramus savannarum	Grasshopper sparrow	B		M	
Ammodramus henslowii	Henslow's sparrow	B		M	
Ammospiza caudacuta	Sharp-tailed sparrow				V
Pooecetesgramineus	Vesper sparrow	B		M	
Junco hyemalis	Dark-eyed junco	B	W	M	
Spizella arborea	Tree sparrow		W	M	
Spizella passerina	Chipping sparrow	B		M	
Spizella pallida	Clay-colored sparrow				V
Spizella pusilla	Field sparrow	B		M	
Zonotrichia querula	Harris's sparrow			M	
Zonotrichia leucophrys	White-crowned sparrow			M	
Zonotrichia albicollis	White-throated sparrow	B	W	M	
Passerella iliaca	Fox sparrow			M	
Melospiza lincolnii	Lincoln's sparrow			M	
Melospiza georgiana	Swamp sparrow	B		M	
Melospiza melodia	Song sparrow	B	W	M	
Calcarius lapponicus	Lapland longspur		W	M	
Plectrophenax nivalis	Snow bunting		W		

KEY: R = Resident, B = Breeder, W = Winterer, M = Migrant, V = Vagrant, S = Summering nonbreeder

SOURCE: Reference 1

TABLE 2.4-9

GENERALIZED HABITAT ASSOCIATIONS OF MAJOR BREEDING SPECIES IN THE VICINITY OF UNIT 2

Lake Ontario Littoral and Shore

Killdeer	Belted kingfisher	Rough-winged swallow
Spotted sandpiper	Bank swallow	Barn swallow

Marshes

Pied-billed grebe	Blue-winged teal	Black tern
Least bittern	Marsh hawk	Long-billed marsh wren
American bittern	Virginia rail	Common yellowthroat
Canada goose	Sora	Red-winged blackbird
Mallard	Common gallinule	Swamp sparrow
Black duck	Common snipe	

Other Wetlands

Pied-billed grebe	Blue-winged teal	American woodcock
Green heron	Wood duck	Common snipe
American bittern	Turkey vulture	Belted kingfisher
Canada goose	Marsh hawk	Alder flycatcher
Mallard	Virginia rail	Red-winged blackbird
Black duck	Common gallinule	Swamp sparrow

Swamp Woodlands and Very Wet Woods

Wood duck	Barred owl	Northern waterthrust
Screech owl		

Other Woodlands

Sharp-shinned hawk[1]	Least flycatcher	Red-eyed vireo
Cooper's hawk	Eastern wood peewee	Black-and-white warbler
Red-tailed hawk	Blue jay	Black-throated green warbler[1]
Broad-winged hawk	Black-capped chickadee	Cerulean warbler
Ruffed grouse	White-breasted nuthatch	Blackburnian warbler[2]
Screech owl	Red-breasted nuthatch[1]	Pine warbler
Great horned owl	Brown creeper	Ovenbird
Ruby-throated hummingbird	Winter wren[1]	Hooded warbler
Pileated woodpecker	Wood thrush	Canada warbler
Red-bellied woodpecker	Veery	American redstart
Red-headed woodpecker	Blue-gray gnatcatcher	Northern oriole
Hairy woodpecker	Golden-crowned kinglet[2]	Scarlet tanager
Downy woodpecker	Yellow-throated vireo	Rose-breasted grosbeak
Great crested flycatcher		

TABLE 2.4-9 (Cont)

Shrublands

Red-tailed hawk	Willow flycatcher	Chestnut-sided warbler
American kestrel	Blue jay	Common yellowthroat
Ring-necked pheasant	House wren	Cardinal
American woodcock	Gray catbird	Indigo bunting
Mourning dove	Brown thrasher	Rufous-sided towhee
Yellow-billed cuckoo	American robin	Dark-eyed junco
Black-billed cuckoo	Cedar waxwing	Chipping sparrow
Ruby-throated hummingbird	Golden-winged warbler	White-throated sparrow
Common flicker	Blue-winged warbler	Song sparrow
Downy woodpecker	Yellow warbler	

Active Farmlands and Associated Areas

Red-tailed hawk	Barn swallow	Eastern meadowlark
American kestrel	Purple martin(3)	Red-winged blackbird
Ring-necked pheasant	Common crow	Common grackle
Killdeer	House wren	Brown-headed cowbird
Upland sandpiper	American robin	American goldfinch
Mourning dove	Eastern bluebird	Savannah sparrow
Common flicker	Starling	Grasshopper sparrow
Eastern kingbird	Warbling vireo	Henslow's sparrow
Eastern phoebe	Yellow warbler	Vesper sparrow
Horned lark	Common yellowthroat	Chipping sparrow
Tree swallow	House sparrow	Field sparrow

Residential and Developed Areas

Rock dove	Eastern phoebe	House sparrow
Common nighthawk	American robin	Red-winged blackbird
Chimney swift	Starling	Common grackle

(1)Present only in mixed areas with hemlock and/or other conifers present.
(2)Present only in mixed areas with pine present.
(3)Breeds only adjacent to water.

SOURCE: Reference 1

TABLE 2.4-10

HABITAT ASSOCIATIONS FOR AVIAN SPECIES OCCURRING DURING NONBREEDING SEASONS IN THE VICINITY OF UNIT 2

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Common loon	X					
Red-throated loon	X					
Red-necked grebe	X					
Horned grebe	X					
Pied-billed grebe	X	X				
Double-crested comorant	X					
Great blue heron	X	X				
Green heron	X	X				
Cattle egret	X	X			X	
Great egret		X				
Black-crowned night heron	X	X				
Least bittern	X					
American bittern		X				
Whistling swan	X	X				
Canada goose	X	X			X	
Brant	X					
Snow goose	X	X				
Mallard	X	X				
Black duck	X	X				
Gadwall	X	X				
Pintail	X	X				
Green-winged teal	X	X				
Blue-winged teal	X	X				
American widgeon	X	X				
Northern shoveler	X	X				
Wood duck	X	X				
Redhead	X	X				

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Devèloped Areas
Ring-necked duck	X	X				
Canvasback	X	X				
Greater scaup	X					
Lesser scaup	X					
Common goldeneye	X					
Barrow's goldeneye	X					
Bufflehead	X					
Oldsquaw	X					
King eider	X					
White-winged scoter	X					
Surf scoter	X					
Black scoter	X					
Ruddy scoter	X	X				
Hooded merganser	X	X				
Common merganser	X	X				
Red-breasted merganser	X					
Turkey vulture		X		X	X	
Goshawk			X	X	X	
Sharp-shinned hawk			X	X	X	
Cooper's hawk			X	X	X	
Red-tailed hawk			X	X	X	X
Red-shouldered hawk		X	X			
Broad-winged hawk		X	X		X	
Rough-legged hawk	X			X	X	
Golden eagle	X			X	X	
Bald eagle	X	X				
Marsh hawk		X		X	X	
Osprey	X	X				
Peregrine falcon	X	X				
Merlin	X	X				

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
American kestrel	X	X		X	X	X
Ruffed grouse			X	X		
Ring-necked pheasant				X	X	
Virginia rail		X				
Sora		X				
Common gallinule		X				
American coot	X	X				
Semipalmated plover	X					
Piping plover	X					
Killdeer	X	X			X	X
American golden plover	X	X			X	
Black-bellied plover	X	X			X	
Ruddy turnstone	X					
American woodcock		X		X		
Common snipe		X		X		
Whimbrel	X					
Upland sandpiper	X				X	
Spotted sandpiper	X	X				
Solitary sandpiper	X	X				
Greater yellowlegs	X	X				
Lesser yellowlegs	X	X				
Redknot	X					
Purple sandpiper	X					
Pectoral sandpiper	X	X				
White-rumped sandpiper	X					
Baird's sandpiper	X					

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Least sandpiper	X	X				
Dunlin	X					
Semipalmated sandpiper	X					
Western sandpiper	X					
Sanderling	X					
Short-billed dowitcher	X	X				
Stilt sandpiper	X					
Buff-breasted sandpiper	X					
Hudsonian godwit	X					
Red phalarope	X					
Wilson's phalarope	X	X				
Northern phalarope	X	X				
Pomarine jaeger	X					
Parasitic jaeger	X					
Glaucous gull	X					X
Iceland gull	X					X
Great black-backed gull	X					X
Herring gull	X				X	X
Ringed-billed gull	X				X	X
Franklin's gull	X					
Bonaparte's gull	X					
Little gull	X					
Black-legged kittiwake	X					
Forster's tern	X					
Common tern	X	X				
Caspian tern	X	X				
Black tern	X	X				

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Rock dove	X			X	X	X
Mourning dove				X	X	X
Yellow-billed cuckoo				X		
Black-billed cuckoo				X		
Screech owl		X	X			
Great horned owl		X	X	X		
Snowy owl	X				X	
Barred owl		X	X			
Long-eared owl			X		X(1)	
Short-eared owl		X		X	X	
Saw-whet owl				X	X	
Whippoorwill		X	X	X		
Common nighthawk		X				X
Chimney swift	X	X			X	X
Ruby-throated hummingbird		X	X	X	X	
Belted kingfish	X	X				
Common flicker	X	X	X	X	X	X
Pileated woodpecker			X			
Red-bellied woodpecker		X	X			X
Red-headed woodpecker			X	X	X	
Yellow-bellied sapsucker		X	X	X		
Hairy woodpecker		X	X	X		
Downy woodpecker		X	X	X	X	X
Eastern kingbird	X	X		X	X	

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Great crested flycatcher			X	X		
Eastern phoebe			X	X	X	X
Yellow-bellied flycatcher			X	X		
Trail's (type) flycatcher[2]			X	X	X	
Least flycatcher		X	X	X		
Eastern wood peewee			X	X		
Olive-sided flycatcher			X	X		
Horned lark	X				X	X
Tree swallow	X	X		X	X	X
Bank swallow	X	X		X	X	X
Rough-winged swallow	X	X			X	X
Barn swallow	X	X		X	X	X
Cliff swallow	X	X			X	
Purple martin	X	X			X	X
Blue jay	X	X	X	X	X	X
Common crow			X	X	X	X
Black-capped chickadee			X	X	X	X
Boreal chickadee			X	X		
Tufted titmouse			X	X	X	X
White-breasted nuthatch		X	X	X	X	X
Red-breasted nuthatch		X	X	X		
Brown creeper		X	X	X		
House wren		X	X	X	X	X
Winter wren		X	X	X		
Carolina wren			X	X	X	X
Long-billed marsh wren		X				

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Short-billed marsh wren					X	
Mockingbird				X	X	X
Gray catbird		X		X	X	
Brown thrasher		X		X	X	
American robin		X	X	X	X	X
Wood thrush			X	X		
Hermit thrush			X	X		
Swainson's thrush			X	X		
Gray-cheeked thrush			X	X		
Veery	X		X	X		
Eastern bluebird				X	X	
Blue-gray gnatcatcher			X	X		
Golden-crowned kinglet			X	X		
Ruby-crowned kinglet			X	X		
Water pipit	X				X	
Cedar waxwing				X	X	X
Northern shrike	X	X		X	X	X
Loggerhead shrike		X		X	X	
Starling	X	X	X	X	X	X
Yellow-throated vireo			X	X		
Solitary vireo			X	X		
Red-eyed vireo			X	X		
Philadelphia vireo			X	X		
Warbling vireo			X	X		
Black-and-white warbler				X	X	

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Golden-winged warbler				X		
Blue-winged warbler				X		
Tennessee warbler			X	X		
Orange-crowned warbler			X	X		
Nashville warbler			X	X		
Northern parula			X	X		
Yellow warbler			X	X	X	
Magnolia warbler			X	X		
Cape May warbler			X	X		
Black-throated blue warbler			X	X		
Yellow-rumped warbler			X	X		
Black-throated green warbler				X	X	
Cerulean warbler			X	X		
Blackburnian warbler			X	X		
Chestnut-sided warbler				X	X	
Bay-breasted warbler			X	X		
Blackpoll warbler			X	X		
Pine warbler			X	X		
Palm warbler			X	X		
Ovenbird		X	X	X		
Northern waterthrush		X	X	X		
Connecticut warbler			X	X		

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
Mourning warbler			X	X		
Common yellowthroat		X	X	X	X	
Hooded warbler			X	X		
Wilson's warbler			X	X		
Canada warbler			X	X		
American redstart			X	X		
House sparrow					X	X
Bobolink				X	X	
Eastern meadowlark					X	
Red-winged blackbird	X	X		X	X	X
Northern oriole			X	X	X	
Rusty blackbird		X	X	X		
Common grackle		X	X	X	X	X
Brown-headed cowbird		X	X	X	X	X
Scarlet tanager			X	X		
Cardinal			X	X	X	X
Rose-breasted grosbeak			X	X		
Indigo bunting				X	X	
Evening grosbeak			X	X	X	X
Purple finch			X	X		X
Pine grosbeak			X	X		
Common redpoll				X	X	
Pine siskin			X	X		

TABLE 2.4-10 (Cont)

Species	Lake Ontario Shore	Wet-Lands	Wood-Lands	Shrub-Lands	Farm-Lands	Developed Areas
American goldfinch				X	X	X
Red crossbill			X	X		
White-winged crossbill			X	X		
Rufous-sided towhee				X	X	
Savannah sparrow					X	
Grasshopper sparrow					X	
Henslow's sparrow					X	
Vesper sparrow					X	
Dark-eyed junco			X	X	X	
Tree sparrow				X	X	
Chipping sparrow					X	X
Field sparrow				X	X	
White-crowned sparrow			X	X		
White-throated sparrow			X	X		
Fox sparrow			X	X		
Lincoln's sparrow			X	X		
Swamp sparrow		X		X		
Song sparrow		X	X	X	X	X
Lapland longspur					X	
Snow bunting	X				X	

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(1) Pine plantations.
(2) Includes willow and alder flycatcher.

SOURCE: Reference 1

TABLE 2.4-11

ROADSIDE COUNT AND BREEDING BIRD CENSUS FOR AREAS ADJACENT TO UNIT 2 SITE, 1976

Species	Roadside Count Town of Scriba (Individuals Observed)	Breeding Bird Strip Census (Individuals/hr) Walker Railroad	West Nine Mile	Bayshore Beach Shrub	Scriba Woods
Green heron	2	0.8	0.2	-	-
Mallard	-	0.3	0.2	-	2.0
Wood duck	-	0.3	-	-	-
Red-tailed hawk	-	0.3	-	-	-
Broad-winged hawk	-	0.3	-	-	-
Marsh hawk	-	0.3	-	-	-
Ruffed grouse	-	0.5	-	-	-
Killdeer	1	0.3	-	2.0	-
Rock dove	-	0.2	-	-	1.0
Mourning dove	3	0.5	-	-	1.0
Common flicker	4	0.8	1.0	1.0	-
Hairy woodpecker	1	0.5	-	-	1.0
Downy woodpecker	1	0.5	0.3	-	1.0
Great-crested flycatcher	12	0.3	2.0	1.0	2.0
Eastern phoebe	2	0.5	1.0	-	1.0
Willow flycatcher	5	0.3	1.2	3.0	2.0
Least flycatcher	2	0.6	2.0	-	3.0
Eastern wood peewee	10	0.6	2.7	-	3.0
Tree swallow	-	0.5	-	-	-
Barn swallow	31	0.5	-	-	-
Purple martin	-	0.5	-	-	-
Blue jay	12	0.5	0.8	1.0	2.0
Common crow	11	0.5	0.6	-	1.0
Black-capped chickadee	2	0.6	0.6	-	1.0
House wren	26	3.6	5.6	2.0	5.0
Gray catbird	24	3.6	2.4	2.0	5.0
American robin	40	1.5	9.6	2.0	-
Wood thrush	31	2.1	2.6	1.0	2.0
Swainson's thrush	-	0.1	-	-	-
Veery	16	2.7	4.4	-	4.0
Cedar waxwing	14	0.4	2.0	1.0	2.0
Starling	17	0.9	1.0	4.0	1.0
Yellow-throated vireo	-	-	0.5	-	-
Red-eyed vireo	18	2.1	7.4	1.0	3.0
Warbling vireo	6	0.3	1.0	1.0	-
Black and white warbler	-	1.4	-	-	-
Golden-winged warbler	3	0.3	1.0	-	2.0
Yellow warbler	46	6.0	3.8	6.0	6.0

TABLE 2.4-11 (Cont)

Species	Roadside Count Town of Scriba (Individuals Observed)	Breeding Bird Strip Census (Individuals/hr) Walker Railroad	West Nine Mile	Bayshore Beach Shrub	Scriba Woods
Black-throated green warbler	-	0.3	-	-	-
Cerulean warbler	-	-	0.8	-	-
Ruby-throated hummingbird	4	-	-	-	-
Eastern kingbird	6	-	-	-	-
White-breasted nuthatch	2	-	-	-	-
Brown thrasher	1	-	-	-	-
Ovenbird	2	0.5	1.8	-	2.0
Common yellow throat	22	1.3	2.0	2.0	5.0
Hooded warbler	-	-	0.3	-	2.0
American redstart	10	2.3	10.4	1.0	9.0
Bobolink	13	0.3	-	1.0	-
Eastern meadow lark	10	0.3	-	2.0	-
House sparrow	9	-	-	-	-
Red-winged blackbird	45	1.1	-	8.0	4.0
Northern oriole	15	2.3	1.0	-	2.0
Common grackle	7	0.5	-	2.0	1.0
Brown-headed cowbird	8	0.3	2.0	1.0	-
Scarlet tanager	1	-	1.0	-	2.0
Cardinal	-	0.5	-	-	1.0
Rose-breasted grosbeak	2	0.5	-	-	2.0
Indigo bunting	-	-	-	2.0	3.0
Purple finch	-	0.5	-	-	-
American goldfinch	22	1.0	3.0	2.0	3.0
Rufous-sided towhee	12	0.5	0.8	1.0	1.0
Savannah sparrow	-	-	-	-	1.0
Dark-eyed junco	-	0.3	-	-	-
Chipping sparrow	5	0.3	-	-	1.0
Field sparrow	-	0.5	-	1.0	1.0
White-crowned sparrow	-	-	1.0	-	-
Swamp sparrow	-	2.1	-	-	-
Song sparrow	-	1.0	-	3.0	3.0

SOURCE: Reference 1

TABLE 2.4-12

BIRD OF PREY NESTING LOCATIONS

Species	Location and Comment
Turkey vulture	1. Butterfly Swamp - Pair present 2. Deer Creek Marsh - Pair present
Sharp-shinned hawk	1. Milea Beach Woods, north of Alcan - Pair present, defense behavior against intruders 2. Noyes Woods - Pair present 3. Kelley Road Woods - Pair present
Cooper's hawk	1. Milea Beach Woods - Adult female present 2. Butterfly Swamp - Two adults at nest containing two well-grown young. Located in a hemlock on old dunes in northern section, at least one fledged.
Red-tailed hawk	1. Snake Swamp Woods - Pair present, nest found 2. Milea Beach Woods, near Central Teal Marsh - Pair present 3. Walker Woods - Pair present* 4. Scriba Woods - Pair at nest containing two well-grown young* 5. Shore Oaks Woods - Pair present 6. Butterfly Swamp Wood Fringe - Pair present 7. Sage Creek Woods - Pair present 8. Deer Creek Area - Two pairs present
Broad-winged hawk	1. South Blind Creek Cove Woods - Pair present
Marsh hawk	1. Deer Creek Marsh - Adult female present 2. South Pond Wetlands - Pair present at nest with three large young; All young fledged
American kestrel	1. Camp Hollis Area - Pair present at nest 2. West Campus Brushlands - Pair present

TABLE 2.4-12 (Cont)

Species	Location and Comment
American kestrel (Cont)	3. East Oswego Shrublands - Pair present
	4. Central Teal Marsh Fringe - Pair present
	5. Bayshore Shrublands - Pair present*
	6. Power Line Corridor - Pair present*
	7. South Miner Farm Area - Pair present at nest
	8. North New Haven Farmlands at Demster Beach - Pair present
	9. Central Butterfly Swamp - Pair present
	10. Rose's Farmlands - Pair present
	11. East Sandy Pond Farmlands - Pair present
Screech owl	1. Snake Swamp - Two birds present
	2. Teal Marsh - One bird present
	3. Nine Mile Point Woods - Two birds present*
Great horned owl	1. Snake Swamp - Two birds present
	2. Milea Beach Woods - Two adults, one fledged young
	3. Parkhurst Woods - Two birds present*
	4. Shore Oaks Woods - Two birds present
	5. Sage Creek Woods - Two birds present
Barred owl	1. Health Camp Marsh - Pair present
	2. Butterfly Swamp - Pair present
	3. Deer Creek Marsh - Pair present

*Proximal to Unit 2 site.

NOTE: Nesting definite only where nest found; other breeding is assumed by adult presence.

SOURCE: Reference 1

TABLE 2.4-13

HERPETOFAUNA COMMONLY OCCURRING
IN THE OSWEGO COUNTY COASTAL ZONE

Common Name	Scientific Name	Occurrence on Unit 2 Site or in Adjacent Environs
Reptiles		
Snapping turtle	Chelydra serpentina	Likely
Bog turtle	Clemmys muhlenbergi	Unlikely
Wood turtle	Clemmys insculpta	Likely
Spotted turtle	Clemmys guttata	Likely
Map turtle	Graptemys geographica	Unlikely
Midland painted turtle	Chrysemys picta marginata	Most likely
Easter spiny softshell turtle	Trionyx spiniferus spiniferus	Unlikely
Red-bellied snake	Storeria occipitomaculata	Likely
Northern brown snake	Storeria dekayi	Most likely
Northern water snake	Natrix sipedox	Most likely
Eastern garter snake	Thamnophis sertalis	Most likely
Eastern ribbon snake	Thamnophis sauritus	Most likely
Eastern hognose snake	Heterodon platyrhinos	Unlikely
Northern ringneck snake	Diadophis punctatus	Likely
Northern black racer	Coluber constrictor	Unlikely
Smooth green snake	Opheodrys vernalis	Most likely
Black rat snake	Elaphe obsoleta	Unlikely
Eastern milk snake	Lampropeltis doliata	Most likely
Timber rattlesnake	Crotalus horridus	Likely
Amphibians		
Mudpuppy	Nectionus maculosus	Likely
Red-spotted newt	Diemictylus viridescens	Most likely
Blue-spotted salamander	Ambystoma laterale	Likely
Jefferson salamander	Ambystoma jeffersonianum	Likely
Dusky salamander	Desmognathus fuscus	Likely
Allegheny mountain salamander	Desmognathus ochrophaeus	Likely
Red-backed salamander	Plethodon cinereus	Most likely
Slimy salamander	Plethodon glutinosus	Likely
Northern spring salamander	Gyrinophilus porphriticus	Likely
Four-toed salamander	Hemidactyliun scutatum	Likely
Spotted salamander	Ambystoma maculatum	Likely
Northern two-lined salamander	Eurycea bislineata	Most likely
American toad	Bufo americanus	Most likely

TABLE 2.4-13 (Cont)

Common Name	Scientific Name	Occurrence on Unit 2 Site or in Adjacent Environs
Amphibians (Cont)		
Northern spring peeper	*Hyla crucifer*	Most likely
Gray tree frog	*Hyla versicolor*	Likely
Western chorus frog	*Pseudacris triseata*	Likely
Pickerel frog	*Rana palustris*	Likely
Northern leopard frog	*Rana pipiens*	Most likely
Bullfrog	*Rana catesbeiana*	Most likely
Green frog	*Rana clamitans*	Most likely
Wood frog	*Rana sylvatica*	Most likely

KEY TO OCCURRENCE:

Most likely = Record of species on Unit 2 site or surrounding environs.

Likely = Geographic range includes Oswego County, and suitable habitat is available.

Unlikely = Geographic range includes Oswego County, but suitable habitat is unavailable or no record of species from the county.

SOURCES: References 1 and 16

TABLE 2.4-14

COMMON VEGETATION SPECIES LIKELY TO OCCUR WITHIN
THE UNIT 2-VOLNEY 345-KV RIGHT-OF-WAY

Scientific Name	Common Name
Alnus spp.	Alder
Pyrus malus	Apple
Malus pumila	Apple
Ulmus americana	American elm
Viburnum recognitum	Arrowwood
Fagus grandifolia	Beech
Rubus spp.	Blackberry
Carya cordiformis	Bitternut hickory
Prunus serotina	Black cherry
Prunus virginiana	Choke cherry
Aronia spp.	Chokeberry
Sambucus canadensis	Elderberry
Cornus racemosa	Gray dogwood
Tsuga canadensis	Hemlock
Crataequs spp.	Hawthorn
Vaccinium corymbosum	Highbush blueberry
Viburnum trilobum	Highbush cranberry
Viburnum alnifolium	Hobblebush
Juniperus horizontalis	Creeping juniper
Populus grandidentata	Large-toothed aspen
Viburnum acerifolium	Maple-leaved viburnum
Viburnum lentago	Nannyberry
Prunus pensylvanica	Pin cherry
Pyrus communis	Pear
Ribes spp.	Ribes
Cornus stolonifera	Red osier dogwood
Juniperus virginiana	Red cedar
Quercus rubra	Red oak
Pinus resinosa	Red pine
Acer rubrum	Red maple
Picea rubens	Red spruce
Acer saccharinum	Silver maple
Acer saccharum	Sugar maple
Amelanchier spp.	Serviceberry
Cornus spp.	Silky dogwood
Lindera benzoin	Spicebush
Spiraea spp.	Spiraea
Acer pensylvanicum	Striped maple
Rhus typhina	Staghorn sumac
Hamamelis virginiana	Witch hazel
Salix spp.	Willow
Fraxinus americana	White ash

TABLE 2.4-14 (Cont)

Scientific Name	Common Name
Thuja occidentalis	White cedar
Pinus strobus	White pine
Betula lutea	Yellow birch

SOURCES: References 21 and 22

TABLE 2.4-15

PRELIMINARY VEGETATION ANALYSIS SURVEY OF THE RIGHT-OF-WAY OF THE UNIT 2-VOLNEY 345-KV TRANSMISSION FACILITY

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
1- 1 3/4	A	4.13	-	-	-	-	-	-	-
1 3/4	B	0.10	H	S,P	White ash Red maple	M	Nannyberry Elderberry Hawthorn	D	NM
1 3/4- 2	B	1.05	H	S	Large-toothed aspen	L	Alder Silky dogwood	L-M	NM
2- 2 1/2	B	1.07	H	P	White ash Large-toothed aspen Red maple		Arrowwood Silky dogwood Hawthorn	L-M	NM
2 1/2	B	1.72	H	S	White ash Large-toothed aspen	L	Serviceberry Arrowwood Hawthorn	M	NM
2 1/2- 3	B	1.64	H,C	P	Beech Hemlock	M	Hawthorn Apple	L	NM
2 1/2- 3 1/4	B	2.24	H	S	White ash Red maple Large-toothed aspen	L	Arrowwood Hawthorn Apple	M	NM
3 1/4- 3 3/4	C	3.39	H,C	P,M	Hemlock Red maple White ash	D	Hawthorn	L	NM
3 3/4	C	0.83	H	P,M	White ash Red maple	M	Willow Witch hazel Arrowwood	L-M	NM
3 3/4- 4 3/4	C	5.51	H	P,M	Sugar maple Red maple Red oak	D	Arrowwood Witch hazel Hawthorn	L	M
4 3/4- 5 3/4	D	5.32	H	P	White ash Red maple Large-toothed aspen	L	Arrowwood Apple Nannyberry	M	NM

TABLE 2.4-15 (Cont)

Location(1)	Section(2)	Estimated Acreage	Cover Type(3)	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
5 1/4- 5 1/2	D	0.37	H,C	P,M	Sugar maple Hemlock	D	Striped maple	L	M
5 3/4	D	1.32	H,C	S,P	Hemlock White ash Red maple	M	Arrowwood Silky dogwood Willow	L	NM
5 3/4	E	0.23	H	S,P	Large-toothed aspen Sugar maple Pin cherry	L-M	Arrowwood Alder Staghorn sumac	M	NM
6	E	0.32	H	P	Red maple White ash Black cherry	M	Willow Sugar maple Arrowwood	M	NM
6- 6 1/4	E	0.92	H	S	White ash Red maple American elm	L	Willow Redosier dogwood Alder	M	NM
6 1/4	E	1.01	H	S,P	White ash Red maple Black cherry	L-M	Arrowwood Apple Juniper	L	NM
6 1/4	E	0.32	H	S	Large-toothed aspen	L	Willow Apple Arrowwood	D	NM
6 1/4- 7 1/4	F	4.42	C,H	P,M	Red maple Black cherry Sugar maple	D	Willow Hawthorn Arrowwood	L	NM
7 1/4	F	0.55	H,C	P	Hemlock White ash Yellow birch	M-D	Willow Arrowwood	L	NM
7 1/4- 7 1/2	F	2.98	H	P,M	Sugar maple Red maple Large-toothed aspen	D	Witch hazel Apple	L	M
7 1/2- 8	G	3.21	H	P,S	Sugar maple Red maple White ash	M-D	Arrowwood Witch hazel Silky dogwood	L	NM

TABLE 2.4-15 (Cont)

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
8- 8 1/4	G	1.24	H	S	Large-toothed aspen White ash	L	Willow Arrowwood Highbush blueberry	M-D	NM
8 1/4- 8 1/2	G	2.29	H	P	Large-toothed aspen White ash Sugar maple	M-D	Arrowwood Hawthorn Elderberry	L	NM
8 1/2	G	0.55	H	P	Sugar maple Black cherry	M	Sugar maple Highbush blueberry	L	NM
8 1/2- 9 1/4	G	1.65	H	S	White ash Bitternut hickory	L	Redosier dogwood Sugar maple Arrowwood	D	NM
8 1/2- 9 3/4	G	7.40	H	S,P	White ash Large-toothed aspen Sugar maple	M	Arrowwood Chokeberry Apple	L	NM
9 3/4- 10 1/2	H	7.57	H	M	Sugar maple White ash Bitternut hickory	D	Arrowwood Chokeberry	L	M
10 1/2	H	0.57	C	P,M	Red spruce	D	Highbush cranberry	L	M
10 3/4	I	0.46	H	P	Black cherry Red maple	M	Sugar maple Blackberry	L	NM
10 3/4- 11	I	3.13	H	S,P	Black cherry Large-toothed aspen	M	Apple Willow Alder	L-M	NM
11- 11 3/4	I	4.90	H	P	White ash Sugar maple Beech	D	Arrowwood Willow Juniper	L	NM
11 3/4	I	0.96	C,H	S,P	Hemlock Large-toothed aspen White Ash	M-D	Witch hazel Maple-leaved viburnum Alder	L	NM
11 3/4- 12 1/2	I	3.99	H	S	Large-toothed aspen White ash Bitternut hickory	M	Witch hazel Silky dogwood Juniper	L	NM

TABLE 2.4-15 (Cont)

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
12 1/2-13	I	5.05	H	S	Red maple American elm White ash	L	Arrowwood Silky dogwood Redosier dogwood	M	NM
13 1/4	I	0.45	H	S	White ash Black cherry American elm	L	Arrowwood Silky dogwood Elderberry	L-M	NM
13 1/4	I	0.34	-	-	-	-	-	-	-
13 1/4-13 3/4	I	1.61	H	S,P	Large-toothed aspen White ash	M	Silky dogwood Willow Spiraea	L-M	NM
13 1/4	I	0.64	H	S	Large-toothed aspen	L	Willow Alder Silky dogwood	D	NM
13 3/4	I	1.04	H	S,P	Red maple Silver maple White ash	L	Willow Silky dogwood Arrowwood	D	NM
13 3/4	I	0.60	H	S	Silver maple Large-toothed aspen Red maple	M-D	Arrowwood Spiraea Willow	L-M	NM
13 3/4-14 3/4	I	5.85	H	S	Black cherry Red maple White ash	L	Sugar maple Arrowwood Redosier dogwood	M-D	NM
14 3/4-15 1/4	I	2.57	H	S,P,M	White ash Red maple Black cherry	M-D	Arrowwood Gray dogwood Sugar maple	L	NM
15 1/4	I	0.56	H	S	Red maple	L	Willow Redosier dogwood Arrowwood	M	NM
15 1/4-16 1/4	I	5.17	H	S,P	Large-toothed aspen White ash Sugar maple	M	Apple Arrowwood Sugar maple	L-M	NM

TABLE 2.4-15 (Cont)

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
16 1/4- 17	J	3.61	C,H	P,M	Hemlock Yellow birch Sugar maple	D	Chokecherry Arrowwood	L	M
17	K	0.23	H	P,M	Yellow birch Sugar maple White ash	M	Witch hazel Arrowwood	L	NM
17- 18 1/2	K	7.23	H	S,P	Sugar maple White ash Black cherry	M-D	Witch hazel Arrowwood Apple	L	NM
18 1/2	K	1.89	H	S	Large-toothed aspen American elm Hemlock	L	Alder Arrowwood Apple	M-D	NM
18 3/4	K	0.46	H	S	Red maple	L	Apple	L	NM
19	K	0.23	H	S	Black cherry	L	Apple Arrowwood Pear	L	NM
19- 19 1/4	K	2.24	H	S	Red maple Large-toothed aspen	L	Willow Arrowwood Alder	D	NM
19 1/4- 19 1/2	K	1.09	C,H	S,P	Large-toothed aspen Yellow birch White cedar	M-D	Witch hazel Apple Juniper	L	NM
19 1/2- 20	K	2.73	H	S,P	Large-toothed aspen Red maple White cedar	M-D	Arrowwood Witch hazel Chokecherry	L	NM
20	L	1.38	C,H	P,M	White pine Black cherry Large-toothed aspen	D	Arrowwood Witch hazel Chokecherry	L	M
20- 20 1/2	L	3.12	H,C	P,M	Red maple Black cherry White ash	L-M	Arrowwood Witch hazel Spiraea	L-M	M

TABLE 2.4-15 (Cont)

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
20 1/2	M	0.31	H	S,P	Red maple Silver maple	M	Gray dogwood Highbush cranberry Elderberry	L	NM
20 3/4	M	1.03	H	M	Black cherry White ash Silver maple	M-D	Arrowwood Chokecherry	L	M
20 3/4	M	0.01	H	P	Silver maple Red maple Willow	M	Arrowwood	L	NM
20 3/4	M	0.62	H	S,P	Red maple	M	Highbush cranberry	L-M	NM
20 3/4- 21 1/4	M	0.69	H	S,P,M	Black cherry White ash Red maple	L-M	Arrowwood Redosier dogwood Silky dogwood	M	NM
20 3/4	M	0.41	H	P	Silver maple Red maple White ash	M-D	Arrowwood	L	NM
20 3/4	M	0.24	H	P	Red maple White ash	M-D	Arrowwood	L	NM
21 1/2	M	1.24	H	S,P	Large-toothed aspen Red maple Red pine	L	Arrowwood Willow Juniper	M-D	NM
21 1/2	M	0.57	H	S	Black cherry Hemlock	L	Alder Ribes	D	NM
21 1/2- 22 1/4	M	2.52	H	S	Red maple Large-toothed aspen White ash	L	Alder Arrowwood Hawthorn	M-D	NM
22 1/4- 22 3/4	M	3.51	H	S,P	Large-toothed aspen White ash Red maple	M	Arrowwood Silky dogwood Willow	L-M	NM
22 3/4	M	1.40	H	S,P	American elm White ash	L	Alder Arrowwood Willow	M	NM

TABLE 2.4-15 (Cont)

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
22 3/4	M	0.62	H	S,P	Large-toothed aspen White ash	M	Arrowwood Apple Redosier dogwood	L	NM
22 3/4 24 1/4	M	5.51	H	S	Large-toothed aspen White ash Red cedar	L	Alder Willow Gray dogwood	M-D	NM
24 1/4 24 1/2	M	1.55	H	S	White ash American elm	L	Alder Sugar maple	M	NM
24 1/2- 24 3/4	M	1.38	-	-	-	-	-	-	-
24 3/4	M	0.34	H	S	Red maple White ash American elm	L	Alder Willow	M	NM
25	M	2.39	H	S	Red maple Black cherry	L	Alder Willow Apple	L	NM
25 1/4	M	1.05	H	S	White ash American elm Sugar maple	M	Arrowwood	L	NM
25 1/4- 26 1/2	N	7.23	A	-	-	-	Onions Lettuce	-	-
26 1/2- 27 3/4	O	5.88	H	S,P	White ash Red maple Black cherry	M	Elderberry Arrowwood Willow	L	NM
27 1/2- 28 1/2	O	2.62	H	S	Red maple Large-toothed aspen White ash	L-M	Willow Elderberry	L-M	NM
27 1/4- 28 1/2	P	2.75	H,C	P,M	Hemlock Sugar maple Yellow birch	M-D	Striped maple Spicebush	L	M

TABLE 2.4-15 (Cont)

Location[1]	Section[2]	Estimated Acreage	Cover Type[3]	Age Class	Undesirable Species	Density	Desirable Species	Density	Merchant-ability
28 1/2-29	P	2.98	H,C	P,M	White ash Hemlock Yellow birch	M-D	Witch hazel Hobblebush Striped maple	L	M
28 1/2	P	2.02	H	S,P	White ash	M	Witch hazel	L-M	NM
29 1/4-29 3/4	P	3.10	H,C	S,P	Large-toothed aspen White ash White cedar	M-D	Serviceberry Witch hazel Arrowwood	L	NM
29 3/4-30 1/4	Q	2.83	H	S,P	Large-toothed aspen White ash Sugar maple	M-D	Serviceberry Spicebush Witch hazel	L-M	NM
30 1/4-31	Q	3.51	H	S	Red maple White ash Large-toothed aspen	M	Apple Arrowwood Willow	M	NM
31 1/4	Q	0.86	H	S	Red maple White ash Pin cherry	M	Witch hazel Willow Arrowwood	L-M	NM
	Q	4.0	H	S	Sugar maple Large-toothed aspen American elm	M	Hawthorn Arrowwood Willow	M	NM

[1]Location is keyed to transmission tower numbers associated with original 765-kV Article VII filing.
[2]Sections refer to general vegetation groupings shown on Figure 2.4-4.
[3]Wetlands information provided on Figure 2.4-4 from the Oswego County Environmental Management Council (OCEMC).

KEY TO COVER TYPE:

A = Agricultural
H = Hardwoods
C = Coniferous

KEY TO AGE CLASS:

S = Sapling
P = Pole Size
M = Mature Sawlog

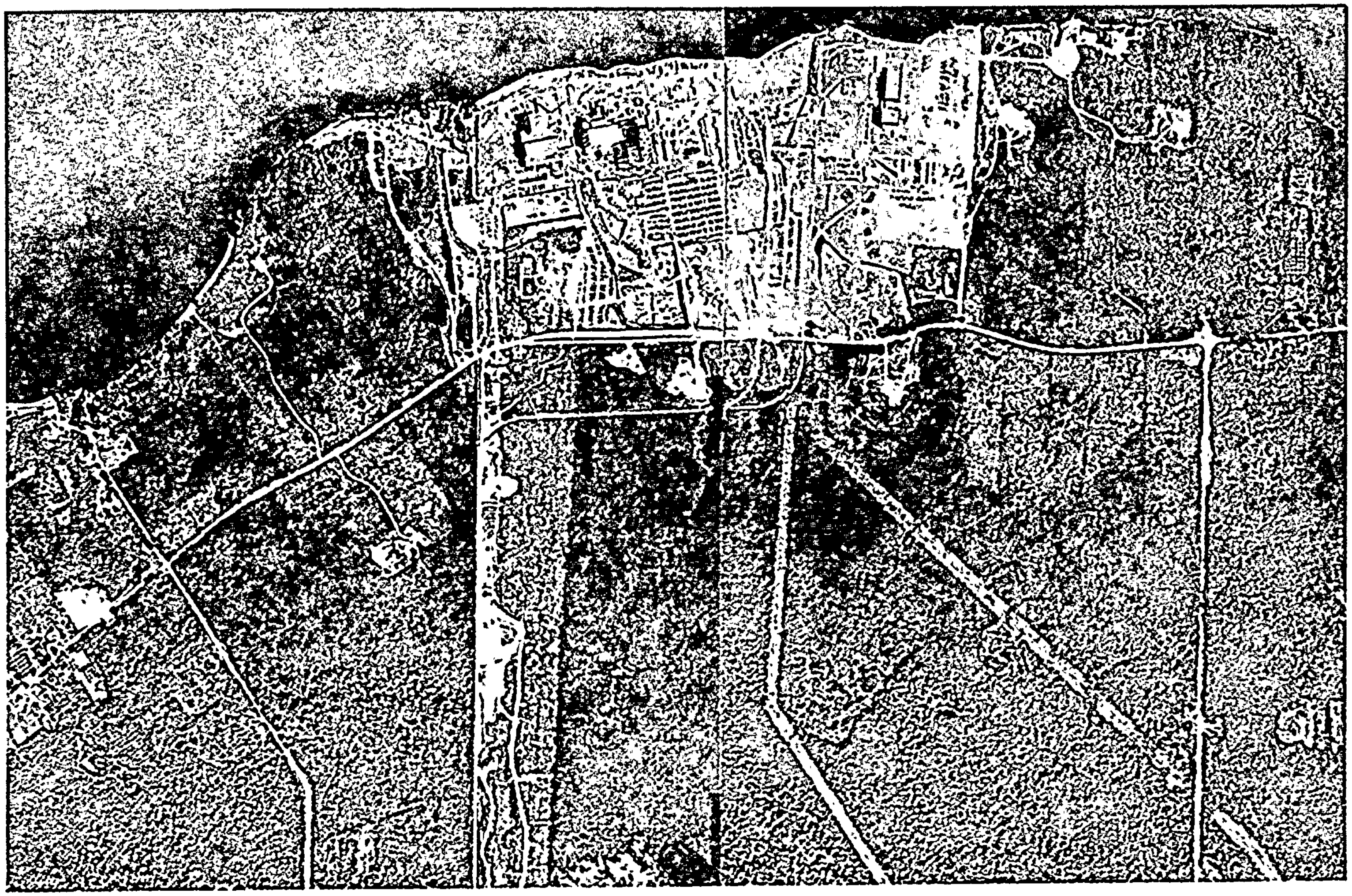
KEY TO DENSITY:

L = Light
M = Moderate
D = Dense

KEY TO MERCHANTABILITY:

M = Merchantable
NM = Nonmerchantable

SOURCE: Reference 21



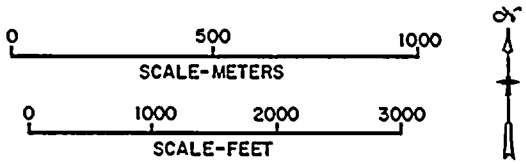


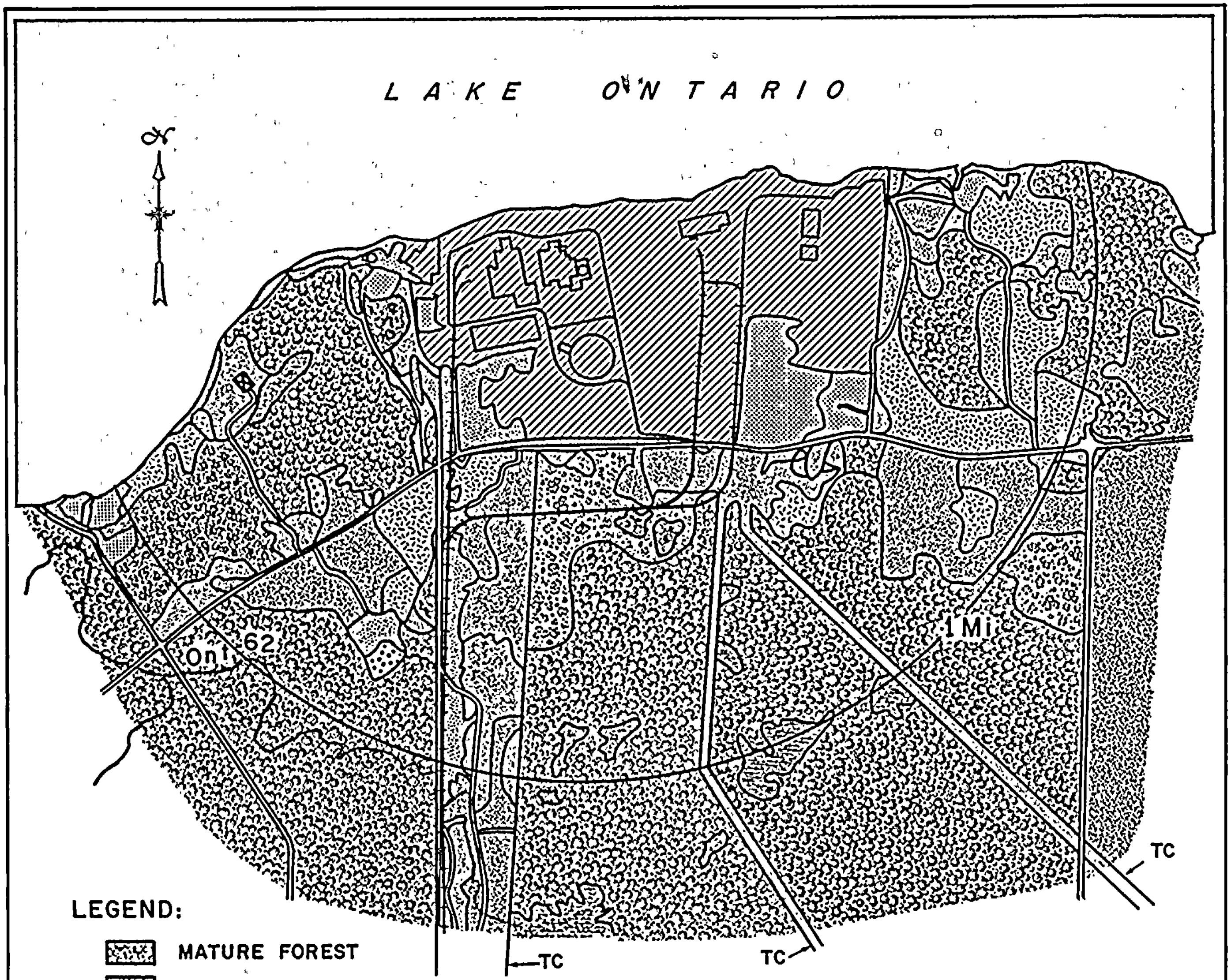
FIGURE 2.4-1

AERIAL PHOTOGRAPH

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT-UNIT 2

ENVIRONMENTAL REPORT-OLS



LEGEND:

- MATURE FOREST
- FOREST SHRUB
- SHRUB
- OLD FIELD SHRUB
- ORCHARD
- SHRUB ORCHARD
- OLD FIELD
- WOODED SWAMP
- GRASS
- INDUSTRIAL
- RESIDENTIAL
- BARE
- WATER
- TC TRANSMISSION CORRIDOR
- X METEOROLOGICAL TOWER

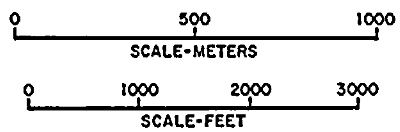


FIGURE 2.4-2

VEGETATION TYPES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT - OLS

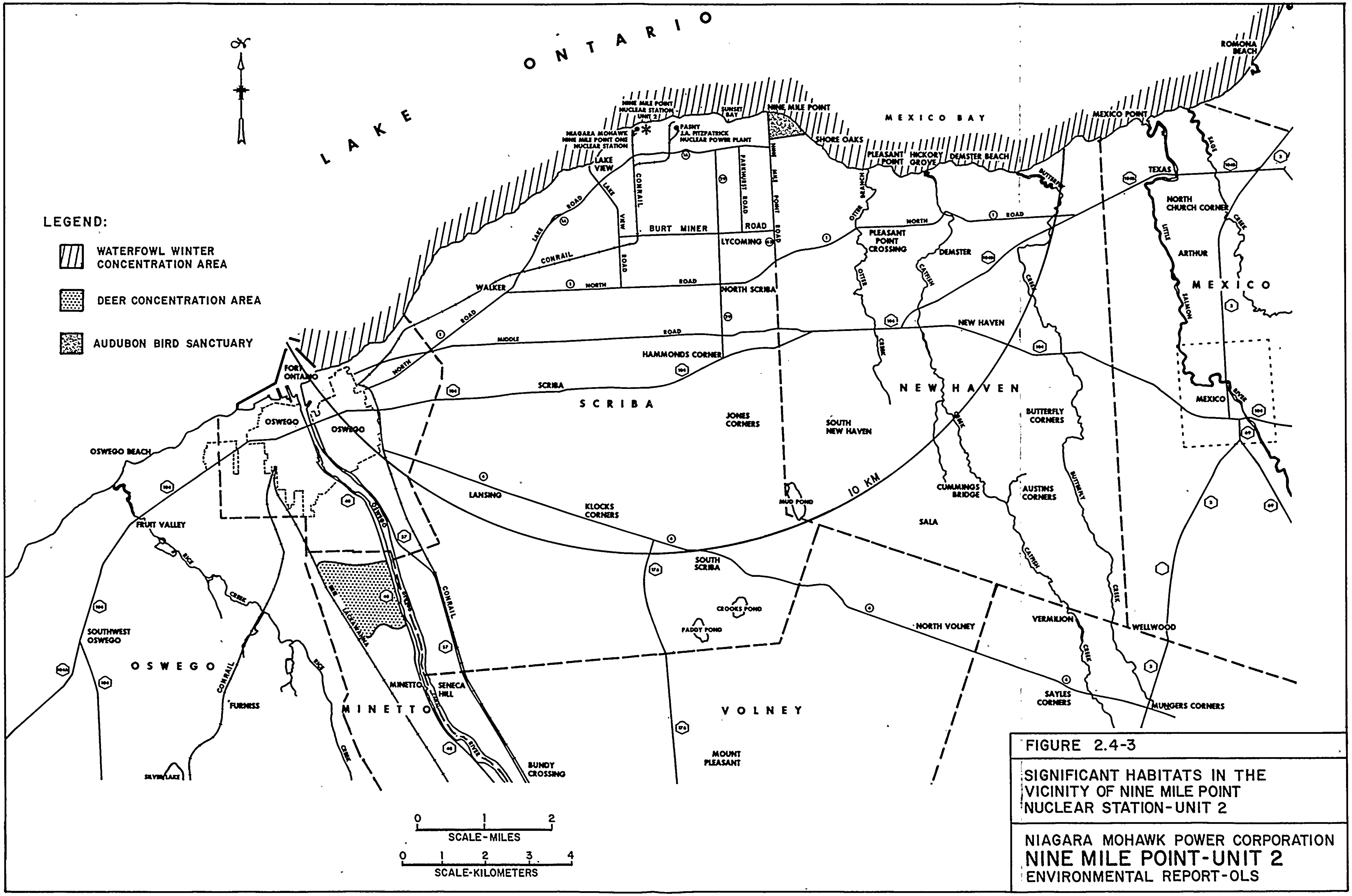


FIGURE 2.4-3

SIGNIFICANT HABITATS IN THE VICINITY OF NINE MILE POINT NUCLEAR STATION-UNIT 2

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

2.5 SOCIOECONOMICS

2.5.1 Demography

Unit 2 is located on Lake Ontario in the town of Scriba, in the north central portion of Oswego County, approximately 10 km (6.2 mi) northeast of the city of Oswego. In 1980, Oswego County had an estimated population of 113,901, at an average density of 43.0 people/sq km (111 people/sq mi)[1]. This population density is considerably lower than the state average of 137 people/sq km (356 people/sq mi). The 1980 population and the population density for the 10 towns and 1 city within 20 km (12.4 mi) of Unit 2 are listed in Table 2.5-1. Town and city boundaries are shown on Figure 2.5-1.

The 80-km (50-mi) area surrounding the station contains all or portions of 10 New York State counties and portions of Canada. Also within 80 km (50 mi) is the Syracuse Standard Metropolitan Statistical Area (SMSA). Political boundaries of counties and population centers within 80 km (50 mi) are shown on Figure 2.5-2.

For population projection purposes, 1985 is used as the year of initial plant operation. The difference between the population of 1985 and 1986, the year of actual commercial operation, should not differ to any significant extent. Therefore, since projections are calculated at 5-yr intervals based on the decennial census, 1985 provides the best estimate of population distribution at the start of commercial operation.

2.5.1.1 Population Within 20 Km (12.4 Mi)

The total 1980 population within 20 km (12.4 mi) of Unit 2 is estimated to be 46,349, a 1.1-percent increase over the 1970 total. This population is projected to increase to approximately 64,970 by the year 2000 and to approximately 106,509 by 2030[1]. The 20-km (12.4-mi) area contains all or portions of 1 city and 10 towns: the city of Oswego and the towns of Minetto, Scriba, New Haven, Oswego, Mexico, Palermo, Richland, Volney, Granby, and Hannibal. City and town boundaries are shown on Figure 2.5-1.

Of the 10 towns and 1 city in the 20-km (12.4-mi) area, the city of Oswego is the largest in population size, containing approximately 19,793 people in 1980. Next, in order of population, are Granby, Richland, Scriba, and Volney, with estimated 1980 populations of 6,341, 5,594, 5,455, and 5,358, respectively[1]. Population growth and the

1970-1980 percent change in population for the towns and city within the 20-km (12.4-mi) area are listed in Table 2.5-2.

It is expected that a large portion of the population growth in the 20-km (12.4-mi) area will occur around the southeastern fringes of the city of Oswego, with the surrounding towns of Scriba, Palermo, New Haven, and Volney absorbing much of the city's satellite growth[2].

Population distribution within 8 km (5 mi) of the station is based on a field house count conducted in October 1981 and town-specific people per household factors. Between 8 and 10 km (5 and 6.2 mi), population distribution is based on a house count taken from U.S. Geological Survey maps (photorevised 1978) on which houses have been symbolically identified[3]. Houses were used to estimate the area population by applying a factor of 2.65 persons/household for each house in the town of Scriba and 2.43 persons/household for each house in the town of New Haven[1]. Population figures within 10 km (6.2 mi) of the site were then projected by multiplying the base-year population by the Oswego County growth factor, supplied by the New York State Department of Commerce, Economic Development Board, which used the cohort-component method to obtain projections[4].

Polar-grid sector populations between 10 and 20 km (6.2 and 12.4 mi) are based on 1980 U.S. Census data and New York State population projections. Sector populations were determined by assuming that the population of a minor civil division (i.e., a town) is evenly distributed over its land area. The proportion of each civil division's area in each grid sector was then determined and applied to each civil division's total population, yielding the population in each grid sector. Population projections, based on 1978 projections supplied by the New York State Department of Commerce, Economic Development Board, were applied to each civil division, assuming that each portion would maintain its relative share of any population change. Population density was calculated by dividing the population in each sector by its land area[5]. Population distribution within a 20-km (12.4-mi) radius of the plant for 1980 through 2030 is shown on Figures 2.5-3 through 2.5-9 and listed in Tables 2.5-3 through 2.5-9.

Transient population within 20 km (12.4 mi) of Unit 2 is limited due to the rural, undeveloped character of the area. There are, however, a number of school, industrial, and recreational facilities in the area that create small, daily

and seasonal changes in sector populations. Facilities attracting transient population associated with educational and industrial institutions, as well as marinas and commercial campgrounds, are discussed in Section 2.5.2; those associated with other recreational areas are discussed in Section 2.2.3 (Table 2.2-12). Data on distribution of transient population associated with marinas are not available.

Age distribution of the populations in the towns and city within 20 km (12.4 mi) of the station are in general conformance with the proportional population distributions of the state of New York and the United States[2,6].

2.5.1.2 Population Between 20 and 80 Km (12.4 and 50 Mi)

The total population for the area between 20 and 80 km (12.4 and 50 mi) of Unit 2, which was approximately 930,848 in 1980, is expected to grow to approximately 1,095,741 in the year 2000, reaching a total of approximately 1,572,006 by 2030[1,7]. Population distribution in the 80-km (50-mi) area for 1980, 1985, 1990, 2000, 2010, 2020, and 2030 is shown on Figures 2.5-10 through 2.5-16 and listed in Tables 2.5-10 through 2.5-16.

The 80-km (50-mi) area contains portions of three Canadian census divisions located in the Province of Ontario: Prince Edward, Frontenac, and Addington and Lenox. The 1981 population statistics for these census divisions are included.

The 80-km (50-mi) region is moderately populated. In 1980, only the population in the city of Syracuse and its satellite towns exceeded 100,000, and only seven other population centers contained more than 10,000 people[1]. Table 2.5-17 lists civil divisions with over 10,000 people.

Three SMSAs are partially located within an 80-km (50-mi) radius of the station: the Syracuse SMSA, the Rochester SMSA, and the Utica-Rome SMSA. The Syracuse SMSA, including the counties of Onondaga, Oswego, and Madison, contained a total of 647,500 people in 1977, at an average density of 105 people/sq km (273 people/sq mi). This SMSA is expected to reach a total population of approximately 686,000 by 1985 and approximately 782,000 by the year 2000[4]. The Rochester SMSA includes five counties; only one, Wayne County, falls within the 80-km (50-mi) region. In 1975, 971,465 people lived in the Rochester SMSA, at an average density of 127 people/sq km (328 people/sq mi)[6]. By 1985 and 2000, the Rochester SMSA is expected to support approximate populations of 1,022,000 and 1,194,000,

respectively[4]. Finally, the Utica-Rome SMSA contains only two counties, Oneida and Herkimer, and only part of Oneida County is located within the 80-km (50-mi) region. In 1975, 334,046 people resided in the Utica-Rome SMSA, at an average density of 49 people/sq km (126 people/sq mi)[6].

Population distributions and projections for areas between 20 and 80 km (12.4 and 50 mi) were calculated in the same manner used for the area between 10 and 20 km (6.2 and 12.4 mi) (Section 2.5.1.1).

2.5.2 Community Characteristics of Region

This section describes the employment, economic base, taxation, and other pertinent characteristics of the town of Scriba and the surrounding cities and towns within 15 km (9.3 mi) of Unit 2, including: New Haven, Volney, Mexico, Richland, Palermo, Oswego Town, Oswego City, and Minetto. Where a broader context is relevant, data on Oswego County, the Syracuse SMSA, and New York State are included. Figure 2.5-17 shows the location of these cities and towns relative to Unit 2.

2.5.2.1 Employment and Economic Base

Table 2.5-18 shows employment by industry for Oswego County[2]. Employment by occupation for the county in 1970 is shown in Table 2.5-19.

In 1980, the civilian labor force in Oswego County totaled 53,400. Of this labor force, 5,300 were unemployed, thus accounting for a 10-percent unemployment rate[8]. Oswego County had a higher unemployment rate than both the regional Syracuse SMSA and the New York State unemployment rates[9]. Table 2.5-20 lists county versus regional and state employment statistics.

The major industries within 15 km (9.3 mi) of Unit 2 are industrial manufacturers, paper product manufacturers and printers, food distributors, and electric utilities. The major employers in the vicinity are: Alcan Aluminum Corporation, with approximately 1,000 employees; Cyclotherm, with between 100 and 199; Copperweld Corporation, with 142; Oswego Castings Corporation, with between 100 and 199; Power Authority of the State of New York, with between 150 and 200; and Niagara Mohawk Power Corporation (NMPC), with approximately 400 to 450 employees[10].

Median income for Oswego County residents equaled $9,254 in 1970. The average annual income for Scriba residents,

$8,966, was below the county average, while for Oswego City residents it was approximately average at $9,255. Table 2.5-21 lists median income data for communities in the vicinity of Unit 2.

2.5.2.2 Taxation

The county levies a school tax by municipality and school districts. Such taxes for the towns, villages, and cities within the vicinity of Unit 2 are shown in Table 2.5-22.

Major sources of county revenues include: property taxes, school taxes, state aid, federal aid, federal transfer payments, and federal revenue sharing. Table 2.5-23 lists revenue and expenditure categories for Oswego County for 1976.

All property in the county is assessed based on county, town, and village rates on the value of buildings, equipment, and land. The property taxes for Unit 2 are paid to Oswego County and the town of Scriba. Table 2.5-24 lists property tax bases, rates, and revenues for cities and towns within the vicinity of Unit 2.

2.5.2.3 Zoning

Fifteen of the 32 villages and towns and both cities of Oswego and Fulton in Oswego County have adopted zoning ordinances. The town of Scriba has not adopted zoning ordinances. Since the boundaries for NMPC property at Nine Mile Point Station fall within Scriba, no zoning restrictions apply[2].

2.5.2.4 Social Services and Public Facilities

Many public water systems supplement independent means of providing drinking water in Oswego County. The service area within 10 km (6.2 mi) of Unit 2 includes the town of Scriba and the city of Oswego. The city of Oswego and portions of the towns of Oswego, Minetto, Scriba, and Volney are served by the city's public water facilities. The water is drawn from Lake Ontario, treated, and distributed by the city to its customers and the outlying water districts. The city's intake and pumping facilities are more than adequate for current demands[11].

The town of Scriba is served by the Hall Road, Middle Road, North Road, and Seneca Hill Water Districts. Approximately 40 percent of the population in the town of Scriba is served by these districts. The Seneca Hill District is a joint

district, serving portions of the towns of Scriba and Volney. The water is provided to these districts by the city of Oswego and resold by the town of Scriba to its customers[11]. The two major users in Scriba, the Alcan Aluminum plant and Unit 2, purchase water directly from the city of Oswego. The 1979 average daily demand in the town of Scriba was 908,400 l/d (240,000 gpd)[2,11]. Additional storage and system strengthening will probably be required to meet the town's future water supply requirements[11].

The city of Oswego operates a secondary sewage treatment plant, the East Side Sewage Treatment Plant, that serves residents and industry located on the east side of the Oswego River and portions of the town of Scriba. The majority of solid waste in the county is disposed of through county-operated facilities.

Police protection in Oswego County is provided by three sources: the Oswego Police Department, the Oswego County Sheriff, and the New York State Police.

Fire protection for Oswego County is provided by several volunteer departments as well as by two professional departments.

Oswego County is well served with medical facilities[12]. The Oswego Hospital is located in the city of Oswego and operates 132 certified beds. The Albert Lindley Lee Memorial Hospital in Fulton is licensed to operate 67 beds. The Oswego County Community Mental Health Services facility is located in the city of Oswego.

2.5.2.5 Transportation

Transportation facilities are discussed in Sections 2.2.1 and 2.2.3. There are no modifications planned due to Unit 2 operation that would affect traffic flow.

2.5.2.6 Demography

Population forecasts for the site vicinity are provided in Section 2.5.1, which also includes a discussion of social structure elements, such as age, and institutional and transient populations.

2.5.2.7 Housing

Housing characteristics for cities, villages, and towns in the vicinity of Nine Mile Point Station are listed in Table 2.5-25. Although many communities in Oswego County

border Lake Ontario, only approximately 7 percent of the housing units are seasonal units. Lakeshore developments in the town of Scriba are located at Shore Oaks, Lakeview, and Nine Mile Point and are occupied primarily as year-round residences[2,13]. Based on a review of new-housing permits and their composition, local housing appears to be adequate.

2.5.2.8 Education

Oswego County comprises nine school districts. Table 2.5-26 lists public and nonpublic schools and district enrollments. Considering present enrollments and capacities, school resources will provide adequate capacity to accommodate growth. Table 2.5-27 identifies the jurisdiction of the nine districts relative to the cities and towns within the vicinity of Unit 2. The enrollment for public schools in 1979 and parochial schools in 1976 in the county totaled 25,893 and 1,660, respectively[14,15].

The State University of New York operates the College of Arts and Science at Oswego. The campus is located in the western part of the city of Oswego and borders Lake Ontario. Enrollment in January 1977 totaled 8,850 students, including 7,247 full-time undergraduates and 1,425 full- and part-time graduate students[2,16].

There are 9 public libraries and 1 private library in Oswego County.

2.5.2.9 Recreation

Principal recreational facilities within the vicinity of Unit 2 are listed in Table 2.5-28. These facilities include publicly and privately operated parks and recreation areas, including those associated with schools. Table 2.5-29 lists major civic clubs within the area. In addition to these civic clubs, there are numerous fish and game clubs in the county. The majority of these sporting clubs belong to the Oswego County Federation of Sportsmen's Club. Membership ranges from 10 to over 900 in some clubs. There are also approximately 100 landowner associations in the eastern portion of the county. These associations open land to members for hunting and fishing[2,17,18]. Table 2.5-30 provides a summary of state, county, and semipublic outdoor recreation areas and open space in Oswego County[16]. Table 2.5-31 provides a list of marinas within Oswego County.

Commercial and private outdoor recreation and open space exist in Oswego County. There are nine public and two

private golf courses in the county. Table 2.5-32 lists the names, locations, and areas of these golf courses.

Private campgrounds in Oswego County range from modest facilities to elaborate layouts that include commercial facilities such as indoor recreation buildings. The majority of this type of commercial recreation is found on Lake Ontario in the northern part of the county. Campground locations are listed in Table 2.5-33. In addition to the trailer and camp sites listed in this table, a private enterprise at Kasoag Lakes in the town of Williamstown has approximately 40.5 ha (100 acres) open to the public for picnicking and swimming.

State University at Oswego operates recreational facilities that are open to the public. Fallbrook and the Rice Creek Biological Field Station are the campus' two major recreational facilities with public access. Fallbrook, owned by the College Foundation, is located 3.2 km (2 mi) southwest of the college's main campus in the town of Oswego. The site includes a riding stable and paddock, and ski trails, slopes, and a tow. The Rice Creek Biological Field Station, located off Thompson Road near Fallbrook, serves as an outdoor classroom. The Field Station property has specially marked trails that provide hikers a close view of field, forest, and wetland environments(18).

Two general types of recreational development are being studied and pursued at the county and local levels: riverbank access and lakefront access. Figure 2.5-18 shows lakes and rivers in Oswego County. The Oswego, Oneida, Salmon, and Little Salmon Rivers provide a variety of recreational activities, including boating, canoeing, and fishing. The Oswego County Planning Board recommends that both the Oneida and Oswego Rivers be further developed as recreational waterways(18).

The Little Salmon River is well suited for a variety of recreational activities, including boating and canoeing. There are neither public nor large individual blocks of privately owned lands along the river. The county is pursuing the development of public access to the Little Salmon River.

Further access to Lake Ontario and Oneida Lake is the second type of recreational development being pursued by the county. The county recommends that access to Lake Ontario be provided through two means: acquisition of new lands, and further use and development of existing port and boat-

launching facilities along the lake[18].

2.5.3 Historical and Archeological Sites and Natural Landmarks

Based on a literature search of National Registers of Historic Places and Natural Landmarks, and discussions with state and local historic commissions, 13 historical sites have been identified within 15 km (9.4 mi) of Unit 2. Fort Ontario, the nearest historical site, is located in the city of Oswego, NY, 10 km (6.2 mi) southwest of the power station and is listed in the National Register of Historic Places. Fort Ontario was built in 1755 and was the first English foothold in the Great Lakes region. Seven additional National Register properties are located in the city of Oswego[19]. These sites are located between 10 and 13 km (6.2 and 8.1 mi) southwest of the power station. Presently, no additional properties within 15 km (9.4 mi) are considered eligible for National Register status[19,20].

According to the National Registry of Natural Landmarks, no national natural landmarks exist in the vicinity of the power station[21]. The only significant natural area within 15 km (9.4 mi) of Unit 2 is Derby Hill, located 15 km (9.4 mi) east of the site. Derby Hill is a drumlin, partially eroded by Lake Ontario. Because of its location on the southeast corner of the lake, it is a main funneling point for migrating birds. Derby Hill is owned and managed by the Onondaga Audubon Society[11].

According to the New York State Historic Preservation Field Services, the state inventory has no historic sites or landmarks in the towns of Scriba, Volney, Minetto, Palermo, or Mexico, NY[20]. Table 2.5-34 and Figure 2.5-19 identify the historical sites within 15 km (9.4 mi) of the power station.

In 1977, Pratt and Pratt Archeological Consultants conducted a survey of past archeological and cultural resources within 5 km (3.1 mi) of the Unit 2-Volney transmission corridor. Based on the results of this study, the Unit 2 site contains no known resources of archeological interest. The nearest relics identified are those of prehistoric Indian-marked fishing villages located 8 km (5 mi) from Unit 2. No state-verified archeological sites are located within the survey study area of 15 km (9.4 mi). According to the Pratt study, a low to moderate potential exists for prehistoric, protohistoric, and historic Indian sites within the study area[22]. Before the transmission line is constructed, a field survey involving test pits will be conducted.

The Pratt study identified 76 cultural resource sites within the survey study area, 15 km (9.4 mi). No standing structures exist representing these past cultural resources. The cultural resource sites nearest to Unit 2 are the locations of a past schoolhouse and sawmill located 1.2 km (0.8 mi) southwest of the plant site. Table 2.5-35 and Figure 2.5-19 identify the sites of past cultural resources within 15 km (9.4 mi) of Unit 2.

2.5.4 References

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4. 1978 Official Population Projections for New York State Counties. New York State Department of Commerce, Economic Development Board.

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7. Population: Geographic Distributions, Census Divisions, and Subdivisions of Ontario, Table 3, 1981 Population and Dwellings, Statistics, Canada, 1981.

8. State of New York Department of Commerce. Annual Report 1979-1980, Economic Development, Trade and Tourism, Albany, NY.

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10. Oswego Chamber of Commerce. Major Industries in Oswego County. Oswego, NY, 1980.

11. Central New York Regional Planning and Development Board. Central New York Water Quality Management Program: Final Oswego County Subplan, 1979. Syracuse, NY.

12. State of New York, Office of Health Systems Management. Health Facilities Directory, 1980. Albany, NY.

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14. Information Center on Education. Public School Enrollment and Staff, New York State 1979-1980. Albany, NY.

15. Information Center on Education. Directory of Public Schools and Administrators, New York State 1980-1981. The State Education Department, Albany, NY.

16. Oswego County Planning Board. Preliminary Land Use Plan, 1976. Oswego, NY.

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18. Oswego County Planning Board. Preliminary Outdoor Recreation Plan, 1979. Oswego, NY.

19. Heritage Conservation and Recreation Service. National Register of Historic Places. U.S. Department of the Interior, Washington, DC, April 14, 1981.

20. Transmittal from Ms. Carol Kingsbury, Project Review Assistant. Historic Preservation Field Services, New York State Parks and Recreation, Albany, NY, December 12, 1978.

21. National Park Service. National Registry of Natural Landmarks, Federal Registry of Natural Landmarks, 46FR17891, U.S. Department of the Interior, Washington, DC, March 20, 1981.

22. Pratt & Pratt Archeological Consultants. Background and Literature Search for the Cultural Resources Survey of the Proposed Nine Mile 2-Volney 765 kV Electric Transmission Project, 1977.

23. New York State Department of Recreation. New York State Outdoor Recreation Facilities Inventory, 1978.

24. New York State Department of Recreation. Parks Capacities for Oswego County, 1977.

25. Niagara Mohawk Power Corporation. Nine Mile Point Nuclear Station - Unit 2 Environmental Report - Construction Permit State, Appendix C, 1972.

TABLE 2.5-1

1980 POPULATION AND POPULATION DENSITIES
FOR TOWNS AND CITIES WITHIN 20 KM (12.4 MI) OF UNIT 2

	1980 Population	Population Density (people/sq km)
City of Oswego	19,793	1,029.0
Oswego (town)	7,865	116.9
Granby	6,341	55.2
Richland	5,594	40.9
Scriba	5,455	52.9
Volney	5,358	46.0
Mexico	4,790	41.8
Hannibal	4,027	38.5
Palermo	3,253	31.6
New Haven	2,421	31.7
Minetto	1,905	125.5

SOURCE: Reference 1

TABLE 2.5-2

1970-1980 POPULATION GROWTH FOR TOWNS AND CITIES WITHIN 20 KM (12.4 MI) OF UNIT 2

	1970	1980	1970-1980 Percent Change
City of Oswego	20,913	19,793	-5.4
Oswego (town)	6,514	7,865	20.7
Granby	4,718	6,341	34.4
Richland	5,324	5,594	5.1
Scriba	3,619	5,455	50.7
Volney	4,520	5,358	18.5
Mexico	4,174	4,790	14.8
Hannibal	3,165	4,027	27.2
Palermo	2,321	3,253	40.2
New Haven	1,845	2,421	31.2
Minetto	1,688	1,905	12.9

SOURCE: Reference 1

TABLE 2.5-3

1980 POPULATION DISTRIBUTION (20 KM/12.4 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	21	0	0	0	0	584	605
E	0	119	119	107	61	1,842	2,248
ESE	13	59	63	156	241	2,405	2,937
SE	0	122	93	56	134	2,137	2,542
SSE	0	111	130	233	115	2,247	2,836
S	0	74	159	215	135	2,815	3,398
SSW	11	77	273	358	302	4,429	5,450
SW	19	127	366	329	4,624	19,205	24,670
WSW	0	34	21	3	0	1,605	1,663
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	64	723	1,224	1,457	5,612	37,269	46,349

TABLE 2.5-4

1985 POPULATION DISTRIBUTION (20 KM/12.4 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	23	0	0	0	0	646	669
E	0	132	132	118	68	2,037	2,487
ESE	14	65	70	173	267	2,661	3,250
SE	0	135	103	62	148	2,365	2,813
SSE	0	123	144	258	127	2,485	3,137
S	0	82	176	238	149	3,113	3,758
SSW	12	85	302	396	334	4,899	6,028
SW	21	141	405	364	5,115	21,243	27,289
WSW	0	38	23	3	0	1,775	1,839
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	70	801	1,355	1,612	6,208	41,224	51,270

TABLE 2.5-5

1990 POPULATION DISTRIBUTION (20 KM/12.4 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	33	0	0	0	0	761	794
E	0	183	171	154	88	2,468	3,064
ESE	20	88	91	225	347	3,107	3,878
SE	0	187	137	80	193	2,656	3,253
SSE	0	173	201	357	171	2,741	3,643
S	0	115	246	333	210	3,189	4,093
SSW	16	119	423	555	468	4,992	6,573
SW	29	197	567	510	6,749	22,810	30,862
WSW	0	54	33	4	0	1,522	1,613
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	98	1,116	1,869	2,218	8,226	44,246	57,773

TABLE 2.5-6

2000 POPULATION DISTRIBUTION (20 KM/12.4 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	38	0	0	0	0	897	935
E	0	211	197	177	101	2,939	3,625
ESE	23	101	105	258	398	3,728	4,613
SE	0	215	157	92	221	3,206	3,891
SSE	0	198	230	410	197	3,277	4,312
S	0	132	283	383	241	3,635	4,674
SSW	18	137	485	638	538	5,734	7,550
SW	34	226	651	585	7,749	24,366	33,611
WSW	0	61	38	5	0	1,655	1,759
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	113	1,281	2,146	2,548	9,445	49,437	64,970

TABLE 2.5-7

2010 POPULATION DISTRIBUTION (20 KM/12.4 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	45	0	0	0	0	976	1,021
E	0	245	229	317	118	3,094	4,003
ESE	27	118	122	301	464	3,775	4,807
SE	0	251	183	108	258	3,107	3,907
SSE	0	231	269	478	229	3,140	4,347
S	0	154	330	446	281	4,015	5,226
SSW	22	160	566	744	627	6,455	8,574
SW	39	263	760	683	9,038	34,249	45,032
WSW	0	72	45	5	0	2,656	2,778
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	133	1,494	2,504	3,082	11,015	61,467	79,695

TABLE 2.5-8

2020 POPULATION DISTRIBUTION (20 KM/12.4 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	52	0	0	0	0	1,131	1,183
E	0	285	266	239	137	3,586	4,513
ESE	31	137	141	349	538	4,377	5,573
SE	0	291	212	98	299	3,603	4,503
SSE	0	268	312	555	266	3,642	5,043
S	0	179	382	517	326	4,655	6,059
SSW	25	185	657	862	727	7,483	9,939
SW	46	305	881	792	10,480	39,711	52,215
WSW	0	83	52	6	0	3,080	3,221
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	154	1,733	2,903	3,418	12,773	71,268	92,249

TABLE 2.5-9

2030 POPULATION DISTRIBUTION (20 KM/12.4 MI)

	Distance (km/mi)						
Direction	0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	Total
N	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0
ENE	60	0	0	0	0	1,306	1,366
E	0	329	307	276	158	4,140	5,210
ESE	36	158	163	403	621	5,053	6,434
SE	0	336	245	144	345	4,158	5,228
SSE	0	309	360	640	307	4,203	5,819
S	0	206	441	597	377	5,374	6,995
SSW	29	213	758	995	839	8,637	11,471
SW	53	353	1,017	914	12,096	45,836	60,269
WSW	0	96	60	7	0	3,554	3,717
W	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0
Total	178	2,000	3,351	3,976	14,743	82,261	106,509

Nine Mile Point Unit 2 ER-OLS

TABLE 2.5-10

1980 POPULATION DISTRIBUTION (80 KM/50 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	108	6,732*	6,840*
NNE	0	0	0	0	0	0	937	3,489	9,495	13,921
NE	0	0	0	0	0	0	3,265	13,196	41,842	58,303
ENE	21	0	0	0	0	584	4,203	949	7,409	13,166
E	0	119	119	107	61	1,842	4,481	807	4,340	11,876
ESE	13	59	63	156	241	2,405	4,405	7,458	37,291	52,091
SE	0	122	93	56	134	2,137	9,762	14,451	39,934	66,689
SSE	0	111	130	233	115	2,247	31,909	272,279	63,365	370,389
S	0	74	159	215	135	2,815	32,901	67,605	26,595	130,499
SSW	11	77	273	358	302	4,429	8,041	13,680	60,768	87,939
SW	19	127	366	329	4,624	19,205	8,392	9,783	34,095	76,940
WSW	0	34	21	3	0	1,605	318	4,383	25,424	31,788
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	645*	645*
NW	0	0	0	0	0	0	0	265*	6,944*	7,209*
NNW	0	0	0	0	0	0	0	0	2,553*	2,553*
Total	64	723	1,224	1,457	5,612	37,269	108,614	408,453*	367,432*	930,848*

*Sectors contain portions of Canada, for which 1981 population data were used.

TABLE 2.5-11

1985 POPULATION DISTRIBUTION (80 KM/50 MI)

	Distance (km/mi)									
Direction	0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	114	7,269	7,383
NNE	0	0	0	0	0	0	989	3,683	10,022	14,694
NE	0	0	0	0	0	0	3,463	13,929	44,167	61,559
ENE	23	0	0	0	0	646	4,616	1,017	8,005	14,307
E	0	132	132	118	68	2,037	4,955	882	4,679	13,003
ESE	14	65	70	173	267	2,661	4,873	7,695	38,009	53,827
SE	0	135	103	62	148	2,365	10,800	15,510	43,396	72,519
SSE	0	123	144	258	127	2,485	34,165	287,067	66,240	390,609
S	0	82	176	238	149	3,113	35,733	71,245	27,754	138,490
SSW	12	85	302	396	334	4,899	8,599	13,701	60,138	88,466
SW	21	141	405	364	5,115	21,243	8,747	10,089	35,248	81,373
WSW	0	38	23	3	0	1,775	331	4,525	26,244	32,939
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	676	676
NW	0	0	0	0	0	0	0	278	7,268	7,546
NNW	0	0	0	0	0	0	0	0	2,653	2,653
Total	70	801	1,355	1,612	6,208	41,224	117,271	429,735	381,768	980,044

TABLE 2.5-12

1990 POPULATION DISTRIBUTION (80 KM/50 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	110	7,647	7,757
NNE	0	0	0	0	0	0	1,020	3,447	9,433	13,900
NE	0	0	0	0	0	0	3,504	14,353	45,826	63,683
ENE	33	0	0	0	0	761	4,373	1,050	9,082	15,299
E	0	183	171	154	88	2,468	5,657	826	4,758	14,305
ESE	20	88	91	225	347	3,107	5,679	6,973	36,826	53,356
SE	0	187	137	80	193	2,656	13,383	15,363	44,611	76,610
SSE	0	173	201	357	171	2,741	31,739	308,253	68,733	412,368
S	0	115	246	333	210	3,189	34,467	75,781	26,251	140,592
SSW	16	119	423	555	468	4,992	8,218	13,216	64,270	92,277
SW	29	197	567	510	6,749	22,810	7,454	10,289	38,990	87,595
WSW	0	54	33	4	0	1,522	276	4,721	26,309	32,919
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	695	695
NW	0	0	0	0	0	0	0	285	7,465	7,750
NNW	0	0	0	0	0	0	0	0	2,685	2,685
Total	98	1,116	1,869	2,218	8,226	44,246	115,770	454,667	393,581	1,021,791

TABLE 2.5-13

2000 POPULATION DISTRIBUTION (80 KM/50 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	109	7,835	7,944
NNE	0	0	0	0	0	0	1,009	3,411	9,333	13,753
NE	0	0	0	0	0	0	3,506	14,201	45,346	63,053
ENE	38	0	0	0	0	897	4,810	1,077	9,402	16,224
E	0	211	197	177	101	2,939	6,862	899	4,921	16,307
ESE	23	101	105	258	398	3,728	7,068	7,081	36,543	55,305
SE	0	215	157	92	221	3,206	15,962	17,060	48,004	84,917
SSE	0	198	230	410	197	3,277	35,642	332,731	74,269	446,954
S	0	132	283	383	241	3,635	36,669	81,771	28,113	151,227
SSW	18	137	485	638	538	5,734	9,039	13,781	66,018	96,388
SW	34	226	651	585	7,749	24,366	8,080	11,388	42,947	96,026
WSW	0	61	38	5	0	1,655	300	5,234	29,170	36,463
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	698	698
NW	0	0	0	0	0	0	0	287	7,500	7,787
NNW	0	0	0	0	0	0	0	0	2,695	2,695
Total	113	1,281	2,146	2,548	9,445	49,437	128,947	489,030	412,794	1,095,741

TABLE 2.5-14

2010 POPULATION DISTRIBUTION (80 KM/50 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	111	8,323	8,434
NNE	0	0	0	0	0	0	1,030	3,482	9,527	14,039
NE	0	0	0	0	0	0	3,685	14,498	46,303	64,486
ENE	45	0	0	0	0	976	5,914	1,139	9,943	18,017
E	0	245	229	317	118	3,094	7,173	1,039	5,206	17,421
ESE	27	118	122	301	464	3,775	6,601	7,530	38,543	57,481
SE	0	251	183	108	258	3,107	14,073	18,094	54,536	90,610
SSE	0	231	269	478	229	3,140	34,071	380,085	84,897	503,400
S	0	154	330	446	281	4,015	50,088	93,351	31,538	180,203
SSW	22	160	566	744	627	6,455	10,025	14,385	68,072	101,056
SW	39	263	760	683	9,038	34,249	9,965	12,651	47,686	115,334
WSW	0	72	45	5	0	2,656	386	5,824	32,464	41,452
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	695	695
NW	0	0	0	0	0	0	0	286	7,436	7,722
NNW	0	0	0	0	0	0	0	0	2,534	2,534
Total	133	1,494	2,504	3,082	11,015	61,467	143,011	552,475	447,703	1,222,884

TABLE 2.5-15

2020 POPULATION DISTRIBUTION (80 KM/50 MI)

Direction	Distance (km/mi) 0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	112	8,691	8,803
NNE	0	0	0	0	0	0	1,041	3,518	9,625	14,184
NE	0	0	0	0	0	0	3,792	14,650	46,784	65,226
ENE	52	0	0	0	0	1,131	6,756	1,204	10,365	19,508
E	0	285	266	239	137	3,586	8,318	1,180	5,437	19,448
ESE	31	137	141	349	538	4,377	7,654	8,247	41,599	63,073
SE	0	291	212	98	299	3,603	16,317	20,814	62,140	103,774
SSE	0	268	312	555	266	3,642	39,521	441,045	98,421	584,030
S	0	179	382	517	326	4,655	58,091	108,249	35,914	208,313
SSW	25	185	657	862	727	7,483	11,309	15,075	70,665	106,988
SW	46	305	881	792	10,480	39,711	11,059	14,156	53,264	130,694
WSW	0	83	52	6	0	3,080	428	6,528	36,386	46,563
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	671	671
NW	0	0	0	0	0	0	0	275	7,120	7,395
NNW	0	0	0	0	0	0	0	0	2,223	2,223
Total	154	1,733	2,903	3,418	12,773	71,268	164,286	635,053	489,305	1,380,893

TABLE 2.5-16

2030 POPULATION DISTRIBUTION (80 KM/50 MI)

	Distance (km/mi)									
Direction	0-2/ 0-1.2	2-4/ 1.2-2.5	4-6/ 2.5-3.7	6-8/ 3.7-5.0	8-10/ 5.0-6.2	10-20/ 6.2-12.4	20-40/ 12.4-24.8	40-60/ 24.8-37.3	60-80/ 37.3-50.0	Total
N	0	0	0	0	0	0	0	113	9,009	9,122
NNE	0	0	0	0	0	0	1,048	3,542	9,690	14,280
NE	0	0	0	0	0	0	3,898	14,750	47,105	65,753
ENE	60	0	0	0	0	1,306	7,699	1,268	10,723	21,056
E	0	329	307	276	158	4,140	9,601	1,339	5,640	21,790
ESE	36	158	163	403	621	5,053	8,836	9,191	45,913	70,374
SE	0	336	245	144	345	4,158	18,832	24,063	71,167	119,290
SSE	0	309	360	640	307	4,203	46,018	517,144	115,209	684,190
S	0	206	441	597	377	5,374	67,366	126,839	41,340	242,540
SSW	29	213	758	995	839	8,637	12,754	15,847	73,762	113,834
SW	53	353	1,017	914	12,096	45,836	12,291	15,890	59,674	148,124
WSW	0	96	60	7	0	3,554	477	7,339	40,904	52,437
W	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	626	626
NW	0	0	0	0	0	0	0	257	6,576	6,833
NNW	0	0	0	0	0	0	0	0	1,757	1,757
Total	178	2,000	3,351	3,976	14,743	82,261	188,820	737,582	539,095	1,572,006

TABLE 2.5-17

CIVIL DIVISIONS WITH OVER 10,000 PEOPLE IN 1980
WITHIN 80 KM (50 MI) OF UNIT 2

Civil Divisions	County	Population
Newark Village	Wayne	10,017
Auburn	Cayuga	32,548
Clay	Onondaga	46,963
Cicero	Onondaga	21,594
Manlius	Onondaga	18,539
De Witt	Onondaga	23,456
Syracuse	Onondaga	170,105
Geddes	Onondaga	11,388
Camillus	Onondaga	24,333
Onondaga	Onondaga	17,824
Van Buren	Onondaga	10,071
Salina	Onondaga	34,551
Fulton	Oswego	13,312
Oswego	Oswego	19,793
Oneida	Madison	10,810
Rome	Oneida	43,826
Watertown	Jefferson	27,861

SOURCE: Reference 1

TABLE 2.5-18

EMPLOYMENT BY INDUSTRY
OSWEGO COUNTY - 1970

Industry	Employees	Percent of Total
Manufacturing	11,308	33.3
Wholesale trade	979	2.8
Retail trade	5,004	14.8
Agriculture	1,011	3.0
Mining	26	0.08
Construction	2,769	8.2
Services	8,487	25.0
Finance, insurance, real estate	930	2.7
Transportation, communication, public utilities	2,198	6.5
Public administration	1,207	3.6
Total	33,919	99.98

SOURCE: Reference 2

TABLE 2.5-19

EMPLOYMENT BY OCCUPATION
OSWEGO COUNTY - 1970

Occupational Group	Number Employed	Percent of Total
Professional, technical, and kindred workers	4,579	13.5
Operatives	7,706	22.7
Craftsmen, foremen, and kindred workers	5,765	17.0
Clerical and kindred workers	5,232	15.4
Service workers	4,179	12.3
Administrative managers, except farm	2,151	6.3
Sales workers	1,907	5.6
Laborers	1,769	5.2
Farmers and farm managers	631	1.9
Total	33,919	99.9

SOURCE: Reference 2

TABLE 2.5-20

LABOR FORCE AND EMPLOYMENT BY AREA - 1970

Labor Force	Oswego County	Syracuse SMSA	New York State
Civilian	53,400	305,900	7,983,000
Employed	48,100	283,400	7,386,000
Nonagricultural	*	260,500	7,169,300
Manufacturing	*	58,800	1,461,900
Unemployed	5,300	22,400	596,000
Rate (percent)	10.0	7.3	7.5

*Data not available.

SOURCE: Reference 8

TABLE 2.5-21

MEDIAN INCOME FOR CITIES AND TOWNS
IN THE VICINITY OF NINE MILE POINT STATION - 1970

	Median Income			Percent of Families		Mean Family Income of Those Below Poverty Level
	Families	Unrelated Individuals	Consumer Units[1]	Below Poverty Level	Receiving Public Assistance	
Scriba	$ 8,966	$ 2,483	$ 8,567	10.0	12.4	$ 1,737
New Haven	8,274	4,864	7,900	12.4	-	2,621
Volney	9,192	1,981	8,366	7.6	17.9	2,824
Mexico	8,839	1,750	7,728	8.8	22.4	2,689
Richland	9,043	1,818	7,575	13.5	32.2	2,115
Palermo	8,013	<1,000	7,159	11.0	3.5	817
Oswego	10,211	1,873	7,999	5.4	-	2,396
Oswego City	9,255	1,224	3,235	10.06	10.04	1,824
Minetto	10,391	[2]	9,862	8.6	-	1,675
Oswego County	9,254	1,593	7,220	8.98	15.83	2,036

[1]Consumer Units: Families and unrelated individuals.
[2]Not calculated, as unrelated individuals total less than 50.

SOURCE: Reference 13

TABLE 2.5-22

SCHOOL DISTRICT TAX RATES FOR CITIES AND TOWNS
IN THE VICINITY OF NINE MILE POINT STATION - 1976-1977

	Altmar-Parish-Williamstown	Mexico Academy	Sandy Creek Central	Central Square	Pulaski Central	Phoenix Central	Hannibal Central	Fulton Consolidated	Enlarged City School
Scriba		66.04						121.468	94.54
New Haven		100.88							
Volney		45.11				72.30		82.788	64.43
Mexico	80.401	57.06		119.93					
Richland	92.182	65.39	116.15		99.226				
Palermo		66.14		138.12		106.30		121.718	
Oswego							70.033	118.474	92.20
Oswego City									71.12
Minetto								153.832	119.72

SOURCE: Reference 2

TABLE 2.5-23

OSWEGO COUNTY REVENUES AND EXPENDITURES - 1976

Revenues

Source	Amount	Percent of Total
Real property taxes	$15,269,265	36
State aid	7,642,822	18
Federal aid	11,110,471	26
Federal revenue sharing	1,332,791	3
Budget notes	998,350	2
Use of money and property (interest and rentals)	1,257,606	3
Other local sources	4,975,939	12
Total	$42,587,244	100

Expenditures

Use	Amount	Percent of Total
Legislative	$ 337,753	0.8
Judicial	809,737	2.0
Finance	289,118	0.7
Staff	692,160	1.7
Shared services	523,761	1.3
Special items	1,367,034	3.4
Education	256,629	0.6
Public safety	1,444,007	3.6
Health	3,893,579	9.7
Transportation	4,231,050	10.5
Economic assistance	20,345,793	50.5
Culture and recreation	425,683	1.1
Home and community services	761,230	1.8
Debt services	3,336,521	8.3
Capital outlay	1,314,013	3.3
Compensation	272,150	0.7
Total	$40,260,210	100.0

SOURCE: Reference 2

TABLE 2.5-24

1976 PROPERTY TAX STATISTICS
RATES AND REVENUES FOR CITIES AND TOWNS
IN THE VICINITY OF NINE MILE POINT STATION

	Tax Base (Full Value)	Equalization Rate	Assessed Value	Tax Rate* Town or City	Tax Rate* County	Town or City Tax Levied	County Tax Levied
Scriba	$ 203,438,340	14.64	$ 29,783,373	12.80	90.80	$ 454,987	$ 2,701,427
New Haven	13,609,301	9.73	1,324,185	71.30	136.80	104,524	181,081
Volney	57,231,052	21.66	12,396,246	12.60	61.20	216,151	759,014
Mexico	29,159,704	16.94	4,939,654	61.30	79.20	267,402	391,358
Richland	39,412,326	15.00	5,911,849	37.32	88.70	202,765	524,346
Palermo	15,702,239	14.78	2,320,791	40.50	89.80	114,130	208,611
Oswego	38,962,611	15.01	5,848,288	27.80	87.60	190,179	518,581
Oswego City	447,931,258	19.46	87,167,423	51.09	68.51	4,453,384	5,971,466
Minetto	19,371,522	11.56	2,239,348	40.60	115.00	115,062	257,702
Oswego County	1,238,079,463	-	214,027,516	-	-	3,422,445	16,500,466

*Per $1,000 assessed value.

SOURCE: Reference 2

TABLE 2.5-25

HOUSING CHARACTERISTICS FOR CITIES AND TOWNS SURROUNDING NINE MILE POINT STATION - 1970

	Scriba	New Haven	Volney	Mexico	Richland	Palermo	Oswego	Oswego City	Minetto	Oswego County
Year-round units	1,164	696	1,245	1,222	1,759	628	1,063	6,866	500	30,848
Single-unit structures	951	632	1,012	965	1,264	491	845	4,614	419	22,227
Structures with two or more units	71	23	107	159	393	27	54	2,233	63	6,287
Total occupied units	1,179	703	1,261	1,392	1,973	628	1,094	6,879	501	32,857
Median value-owner occupied	$10,000-15,000	5,000-10,000	10,000-15,000	10,000-15,000	10,000-15,000	5,000-10,000	25,000-35,000	5,000-10,000	20,000-25,000	10,000-15,000
Median gross rent per month - renter occupied	$100-150	150-200	60-100	100-150	100-150	100-150	100-150	100-150	100-150	100-150
New Private Housing Units Authorized By Building Permits - 1976										
Single-unit structures	*	*	18	1	*	*	*	19	*	196
Structures with five or more units			0	0				21		51
Total			22	1				40		298

*Nonreporting communities.

SOURCE: Reference 2

TABLE 2.5-26

LOCATION AND ENROLLMENT OF PUBLIC SCHOOLS IN OSWEGO COUNTY - SEPTEMBER 1982

District	Schools	Location	Distance in km (mi) and Direction from Station	School Enrollment	District Enrollment
Altmar-Parish-Williamstown	Altmar Elementary	Altmar	33.8 (21) E	263	1,648
	Parish Elementary	Parish	25.7 (16) ESE	305	
	Williamstown Elementary	Williamstown	43.4 (27) ESE	173	
	A.P.W. Middle High	Parish	30.6 (19) ESE	436	
	A.P.W. High School	Parish	30.6 (19) ESE	471	
Central Square	Central Square Elementary	Central Square	33.8 (21) SE	496	4,408
	Hastings-Mallory Elementary	Central Square	30.6 (19) SE	577	
	Brewerton Elementary	Brewerton	37.0 (23) SSE	460	
	Aura A. Cole Elementary	Constantia	51.5 (32) SE	470	
	Cleveland Elementary	Cleveland	53.1 (33) SE	332	
	Millard Hawk Jr. High School	Central Square	33.8 (21) SE	737	
	Paul V. Moore High School	Central Square	32.2 (20) SE	1,336	
Fulton Consolidated	Erie Street School	Fulton	22.5 (14) S	161	4,068
	James R. Fairgrieve School	Fulton	20.9 (13) S	545	
	James E. Lanigan School	Fulton	24.1 (15) S	497	
	Oak Street School	Fulton	22.5 (14) S	165	
	Phillips Street School	Fulton	22.5 (14) S	215	
	State Street School	Fulton	20.9 (13) S	95	
	Volney Elementary School	Fulton	20.9 (13) S	484	
	Fulton Junior High School	Fulton	20.9 (13) S	689	
	G. Ray Bodley High School	Fulton	24.1 (15) S	1,217	
Pulaski Academy and Central	Pulaski Elementary	Pulaski	28.9 (18) ENE	727	1,342
	Pulaski Junior-Senior High School	Pulaski	22.5 (14) ENE	615	
Hannibal Central	Fairley Elementary	Hannibal	25.7 (16) SSW	524	1,703
	Cayuga Street School	Hannibal	25.7 (16) SSW	386	
	Hannibal High School	Hannibal	25.7 (16) SSW	793	
Mexico Academy	Mexico Elementary	Mexico	15.3 (9.5) ESE	377	2,592
	Palermo Elementary	Fulton	20.9 (13) SSE	271	
	New Haven Elementary	New Haven	8.0 (5) SE	300	
	Mexico Academy Junior	Mexico	15.3 (9.5) ESE	841	
	Mexico Academy Senior High School	Mexico	15.3 (9.5) ESE	803	

TABLE 2.5-26 (Cont)

District	Schools	Location	Distance in km (mi) and Direction from Station	School Enrollment	District Enrollment
Enlarged City School District of Oswego	Fitzhugh Park School	Oswego	9.7 (6.0) SW	522	5,062
	Kingsford Park School	Oswego	12.1 (7.5) SW	507	
	Minetto School	Minetto	16.1 (10) SSW	501	
	Charles E. Riley School	Oswego	10.5 (6.5) SW	577	
	Frederick Leighton School	Oswego	12.1 (7.5) SW	403	
	Oswego Middle School	Oswego	12.1 (7.5) SE	849	
	Oswego High School	Oswego	12.1 (7.5) SW	1,703	
Phoenix Central	Emerson J. Dillon School	Phoenix	32.2 (20) SSE	903	2,750
	Elm Street School	Phoenix	33.8 (21) SSE	688	
	Pennellville School	Pennellville	28.9 (18) SSE	175	
	John C. Birdlebough High School	Phoenix	32.2 (20) SSE	984	
Sandy Creek Central	Sandy Creek Elementary	Sandy Creek	46.7 (29) E	429	1,168
	Orwell Elementary	Orwell	33.8 (21) ENE	78	
	Sandy Creek High School	Sandy Creek	30.6 (19) NE	661	
County Total (public)					24,741

TABLE 2.5-26 (Cont)

LOCATION AND ENROLLMENT OF NON-PUBLIC SCHOOLS IN OSWEGO COUNTY - SEPTEMBER 1982

Parochial and Denominational Schools	Location	Distance in km (mi) and Direction from Station	Enrollment
Fulton Catholic School	Fulton	20.9 (13) S	213*
St. Paul's Academy	Oswego	10.5 (6.5) SW	165
St. Mary's Academy	Oswego	11.6 (7.2) SW	171
Oswego Catholic Junior High School	Oswego	10.5 (6.5) SW	58
Seventh Day Adventist School	Dexterville	22.5 (14) SSW	31*
Southwest Christian School	Oswego	12.1 (7.5) SW	58
Bishop Cunningham High School	Oswego	10.2 (6.3) SW	185
Oswego Community Christian School	Oswego	11.2 (7.0) SW	42
Campus School			
SUNY Campus School	Oswego	14.5 (9) SW	321*
County Total (nonpublic)			1,244

*1979 data.

SOURCES: Reference 2

Reference 14

Reference 15

TABLE 2.5-27

SCHOOL DISTRICTS SERVING CITIES AND TOWNS
IN THE VICINITY OF NINE MILE POINT STATION

	Altmar-Parish-Williamstown	Mexico Academy	Sandy Creek Central	Central Square	Pulaski Central	Phoenix Central	Hannibal Central	Fulton Consolidated	Enlarged City School District
Scriba		X						X	X
New Haven		X							
Volney		X				X		X	X
Mexico	X	X		X					
Richland	X	X	X		X				
Palermo		X		X		X		X	
Oswego							X	X	X
Oswego City									X
Minetto								X	X

SOURCE: Reference 2

TABLE 2.5-28

RECREATIONAL FACILITIES WITHIN THE VICINITY OF NINE MILE POINT STATION

Town/City	Facility	Operator	Location	Hectares (acres)	Activity
Scriba	Town Park	Municipality	Hay Fly Road	27.9 (69)*	Tennis courts, basketball, swimming beach and lockers, ice skating rink and lodge, and concession stand
	Nine Mile Point Energy Information Center	NMPC	Off Lake Road	NA	Energy Information Center and picnic area
Oswego Town	Town Park	Municipality	County Route 7	13.3 (32.8)	Observation tower, picnic tables, hiking, and cross-country ski trails
	Camp Hollis Park	County	Off Health Lake Road on Lake Ontario	12.1 (30)	Supervised overnight camping, swimming pool, and playfields
Mexico	Hotchkiss Community Park	Municipality	US Route 104	6.8 (16.8)	Baseball fields, picnic grills and tables, a pedestrian and bicycle trail, and an enclosed swimming pool
	Mexico Point	State	Off US Route 104 on Lake Ontario	8.1 (20.0)	Boat-launching site providing access to Lake Ontario
Oswego City	Fort Ontario Park	City	Off E. 9th and Schuyler St	6.1 (15)	Little league park and stadium, lighted softball field with seating for 1,500, football fields, tennis courts, swimming pool, picnic area, ice skating rink, art guild, and theater.

TABLE 2.5-28 (Cont)

Town/City	Facility	Operator	Location	Hectares (acres)	Activity
Oswego City	Wright's Landing	City	W. 4th Street	3.9 (9.6)	Public boat launch with 3 launching pads which provide access to Oswego Harbor and Lake Ontario
	Oswego Marina	Private	E. 1st Street	NA	Private marina with rental (weekly or seasonal) moorings for approximately 66 boats, restaurant, houseboat, and sailboat charters
	Leighton Field	City	Leighton School Ruth St and Hillside Ave	2.8 (7)	Baseball field, basketball courts, and football field
	Fitzhugh Park	City	Fitzhugh School E. Bridge and E. 10 St	1.2 (3)	Tennis courts, baseball field, and playfield
	Oak Hill Park	City	E. 7th and Lawrence St	0.81 (2)	Playground
	Peglow Park	City	Riley School 4th and Bunner St	0.81 (2)	Baseball field, tennis courts, basketball courts, playfields, football field
	Hamilton Park	City	E. 7th and Church St	0.40 (1)	Playground, playfields, picnicking
	East Park	City	E. 4th and Bridge St	2.8 (7)	Playground, playfields
	Kingsford Park	City	W. 4th and Niagara St	2.0 (5)	Playground, baseball field, ice skating rink
	West Park	City	W. 3rd and Seneca St	2.8 (7)	Playground, playfields
	Crisafulli Park	City	Bronson and Ontario St	1.2 (3)	Baseball field, playground
	Breitbeck Park	City	W. 8th and Lake St	0.81 (2)	Playground, basketball courts, picnic tables, covered pavillion

TABLE 2.5-28 (Cont)

Town/City	Facility	Operator	Location	Hectares (acres)	Activity
Oswego City	Oswego Catholic High School	School	E. 7th and Burdele St	2.0 (5)	Baseball field, playfields
	Oswego High School	City	W. 2nd and W. Utica St	2.4 (6)	Baseball field, tennis courts, indoor pool, gymnasium, football field
	Oswego Beach	City	Washington Blvd	NA	Access to Lake Ontario, swimming
	Rice Creek Biological Center	SUNY at Oswego	Thompson Rd, Oswego Campus	33.6 (83)	Biological information center, marked hiking trails
	Piez Hall Planetarium	SUNY at Oswego	Oswego Campus	NA	Planetarium, science center
	Fallbrook Stables and Ski Lodge	SUNY at Oswego	Thompson Rd, Oswego Campus	58.7 (145)	Riding trails, indoor and outdoor paddock, 20 mi of cross-country ski trails, lodge, ski slope, and tow
	Romney Field House	SUNY at Oswego	Sheldon Ave, Oswego Campus	NA	Skating rink, basketball court, weight room, gymnasium, track

*20 acres in active use.

SOURCES: Reference 10

Reference 18

Reference 19

TABLE 2.5-29

MAJOR CLUBS AND ORGANIZATIONS
IN THE VICINITY OF NINE MILE POINT STATION

American Association of University Women
Benevolent and Protective Order of Elks No. 271
Daughters of the American Revolution
Ancient Order of Hibernians
Fortnightly Club
Heritage Foundation of Oswego
Kiwanis Club of Oswego
Lake City Lodge No. 127
Lavere-Harrington Post 2320, VFW
Leatherstocking Club
Loyal Order of Moose No. 743
William S. Monaghan Post 268
Order of Eastern Star
Oswego Art Guild, Inc.
Oswego Chapter, Business and Professional Woman's Club
Oswego Council No. 227 Knights of Columbus
Oswego Country Club
Oswego County Council on the Arts
Oswego County Historical Society
Oswego County Radio Amateurs Association
Oswego County Republican Committee
Oswego Garden Club
Oswego Jaycees
Oswego Jayncees
Oswego Lions Club
Oswego Players, Inc.
Oswego Polish-American Club
Oswego Senior Citizens Club
Oswego Valley League of Women Voters
Oswego Woman's Civic Council
Quattrini-Dehm Post, 5885 VFW
Retired Senior Volunteer Program
Rotary Club of Oswego
Sons of Italy in America
Winter Club
Women's City Club of Oswego
Zonta Club of Oswego

SOURCE: Reference 10

TABLE 2.5-30

SUMMARY OF OUTDOOR RECREATION AREAS AND OPEN SPACE IN OSWEGO COUNTY

Jurisdiction	Recreation Area	Location	Hectares (acres)	Activity
PARKS				
New York State	Battle Island State Park	Town of Granby, Route 48	95.1 (235)	Golf, fishing, hiking, snowmobiling
	Selkirk Shores State Park	Town of Richland, Route 3	397.4 (982)	Camping, fishing, hiking, swimming, picnicking
	Fort Ontario	City of Oswego US Route 104	6.1 (15)	Historical fort and cemetery
	Barge Canal Land	Towns of Granby, Schroeppel, Volney	74.1 (183)	Picnicking, fishing
	Fish Hatchery	Town of Constantia, Route 49	8.1 (20)	
	Roadside Parks	Town of Hastings, I-81, and Palermo, Route 3	1.6 (4)	Picnicking
MANAGEMENT AREAS				
New York State	Curtiss Game Management Area	Town of Volney, Route 57	18.2 (45)	Fishing
	Happy Valley Game Management Area	Towns of Albion, Amboy, Parish, Williamstown, Route 126	3,490.1 (8,624)	Limited hunting and fishing
	Little John Game Management Area	Towns of Bolyston, Redfield, Old Country Route 17	3,246.1 (8,021)	Hunting, hiking, and fishing
	Three Mile Bay Game Management Area	Towns of Constantia, West Monroe, Route 49	1,214.1 (3,000)	Picnicking, boat launch

TABLE 2.5-30 (Cont)

Jurisdiction	Recreation Area	Location	Hectares (acres)	Activity
REFORESTATION AREAS				
New York State	Reforestation Area	Towns of Albion, Amboy, Bolyston, Orwell, Redfield, and Parish	8,305.3 (20,522)	Hunting, fishing, picnicking, boat launch (in Redfield only)
Oswego County	Reforestation Area	Towns of Albion, Hannibal, Parish, New Haven, Williamstown, Volney, and Scriba	971.3 (2,400)	Hunting and fishing
SEMIPUBLIC RECREATION AREAS				
Boy Scouts of America	Camp 12 Pines	Town of Amboy, Old County Route 26A	80.1 (198)	Camping
	Camp Woodland	Town of Constantia, Old County Route 23	404.7 (1,000)	Camping
Girl Scouts of America	Camp Near Wilderness	Town of Amboy, Old County Route 26	70.0 (173)	Camping
	Camp Aldens Woods	Town of Hastings	14.9 (37)	Camping
	Camp Glengarra	Town of Amboy, Old County Route 17	263.9 (652)	Camping
Campfire Girls	Camp Talooli	Town of Schroeppel, Old County Route 54	47.8 (118)	Camping
Church	Camp Vander	Town of Constantia, NY Route 49	242.8 (600)	Camping
Syracuse Boys Club	Camp Zerbe	Town of Williamstown, Old County Route 126	147.7 (365)	Camping

SOURCE: Reference 16

TABLE 2.5-31

MARINAS IN OSWEGO COUNTY

Marina	Facilities	Boating Capacity (No. of People)
Tanner's Marina	80 pier moorings, boat storage, equipment sales, repairs, service	634
Spruce Grove Marina	50 pier moorings, boat storage, equipment sales, repairs	495
Kenny's Boat Livery	15 anchorage moorings, 2 launch ramps, boat storage, service	607
Jone's Marina	36 pier moorings, 1 launch ramp, service	432
Bartlett's Bait Shop	20 pier moorings, 1 launch ramp, service	NA
Freeman's Marine	22 pier moorings, 1 launch ramp	45
Reiters Marina	28 pier moorings, 1 launch ramp	315
Seber Shores Marina	10 pier moorings, 1 launch ramp	NA
Penoyers Marina	75 pier moorings, boat storage, service	612
Del Bliss Marina	75 pier moorings, boat storage, 1 launch ramp	612
Brabury's Boatel	150 pier moorings, 1 launch ramp	945
Fuller's Grove	Pier moorings	270

TABLE 2.5-31 (Cont)

Marina	Facilities	Boating Capacity (No. of People)
Wright's Landing	3 launch ramps	NA
Oswego Marina	66 pier moorings, boat storage, 2 launch ramps	837
Cleveland Marina	Pier moorings, 1 launch ramp	274
Lock 7 Marina	Pier moorings	279
Small's Boat Livery	Moorings, 1 launch ramp	270
Mexico Point State Marina	4 launch ramps	540
John's Boats & Bait	1 launch ramp, service	270

SOURCES: Reference 23

Reference 24

TABLE 2.5-32

OSWEGO COUNTY GOLF COURSES

Name	Location	Hectares(acres)	
Battle Island	Town of Granby	95.1	(235)
Green Acres	Town of West Monroe	70.8	(175)
Riverview	Town of Hastings	64.8	(160)
Len Mar Greens	Town of Richland	30.6	(76)
Easy Par Country Club	Town of Oswego	30.4	(75)
Emerald Crest	Town of Palermo	24.3	(60)
Brown Trout Lodge	Town of Orwell	121.4	(300)
The Elms	Town of Sandy Creek	23.1	(57)
North Shore Golf Club	Town of Constantia	60.7	(150)
Oswego Country Club (Private)	City of Oswego	64.8	(160)
Beaver Meadows (Private)	Town of Schroeppel	80.9	(200)

SOURCE: Reference 16

TABLE 2.5-33

COMMERCIAL CAMPGROUNDS IN OSWEGO COUNTY

Name	Location	Hectares (acres)		Camp Sites*	Capacity
Flat Rock Campsite	Town of Mexico	16.2	(40)	76 electrified sites	657
Dowie Dale Beach	Town of New Haven, US Route 104B	40.5	(100)	160 electrified sites	1,268
Regan's Silver Lake	Town of Oswego, County Route 7	12.1	(30)	25 electrified sites	918
Lorton Lake Trailer and Camp	Town of Orwell, County Route 30	40.5	(100)	50 electrified sites	544
Brennan Beach	Town of Richland, NY Route 3	24.3	(60)	400 vehicle sites	2,149
Ched-Mardo Farm	Town of Richland, NY Route 3	24.3	(60)	140 electrified sites	1,879
White Sands Beach	Town of Richland	14.2	(35)	200 electrified sites	1,963
Sandy Pond Beach	Town of Sandy Creek, NY Route 3	64.8	(160)	140 electrified sites	736
Rainbow Shores	Town of Sandy Creek, NY Route 3	10.5	(26)	140 electrified sites	1,276
Whispering Pines	Town of Sandy Creek, NY Route 3	20.2	(50)	50 electrified sites	545

*All sites are vacation only.

SOURCES: Reference 16

Reference 23

Reference 24

TABLE 2.5-34

HISTORIC SITES WITHIN 15 KM OF UNIT 2

Map No.*	Landmark	Location	Approximate Distance and Direction From Unit 2 (km)	Description and Present Use
1	Oswego City Library	120 E. Second St. Oswego	10.8 SW	National Register historic site. Notable architecture and one of oldest continually used city libraries in the county. Given to Oswego by Gerrit Smith in 1855.
2	Fort Ontario	E. Seventh St. Oswego	10.0 SW	National Register historic site. Built in 1755, first English foothold in all Great Lakes region. Just to the east is an old military cemetery dating from French and Indian War.
3	Oswego Market House	Water St. Oswego	11.0 SW	National Register historic site. Built in 1835.
4	Richardson-Bates House	135 E. Second St. Oswego	10.8 SW	National Register historic site. Built between 1867 and 1871 by Maxwell Richardson. An example of Tuscan Villa Victorian Architecture. Donated to Oswego County Historical Society as a museum in 1946.
5	U.S. Custom House	W. Oneida St. First and Second St. Oswego	11.2 SW	National Register historic site.
6	Walton & Willett Stone House	1 Seneca St. Oswego	10.5 SW	National Register historic site.
7	Fort Oswego	Corner of W. First and Van Buren St. Oswego	11.0 SW	Locally significant historic site. Built by British in 1727 and destroyed by French in 1756. Site marked with stone marker.
8	Oswego Harbor	E. First St. Oswego	10.8 SW	Locally significant historic site. Most important port on American side of Lake Ontario. Here thrived a tremendous water commerce and an extensive milling industry in the latter half of 19th century.
9	Spy Island	At mouth of Little Salmon River, NYS-104B, Mexico	12.3 E	Locally significant historic site. Location of grave of Silas Towne, Revolutionary war spy for General Washington.

TABLE 2.5-34 (Cont)

Map No.*	Landmark	Location	Approximate Distance and Direction From Unit 2 (km)	Description and Present Use
10	Arthur Tavern	Co. Route 16 Mexico	13.2 ESE	Locally significant historic site. Built circa 1839 by Alex Danby.
11	Fruit Valley Community	US 104 W. Oswego	15.0 SW	Locally significant historic site. Community contains graveyard with burial place of Dr. Mary Walker, noted feminist and winner of Congressional Medal of Honor for serving as a Civil War nurse, and a house reputed to have been a station on the underground railroad aiding the escape of fugitive slaves.
12	Oswego City Hall	W. Oneida St. Oswego	11.2 SW	National Register historic site.
13	Sheldon Hall	Washington St. Oswego	12.8 SW	National Register historic site.

*See Figure 2.5-19.

SOURCE: Reference 25

TABLE 2.5-35

CULTURAL RESOURCE SITES WITHIN 15 KM OF UNIT 2

Map No.(1)	Resource	Site Location	Approximate Distance and Direction from Unit 2 (km)	Approximate Distance from Centerline of Transmission Corridor (km)
1	Sawmill	North Rd, Scriba	1.2 SW	(2)
2	Schoolhouse 12	North Rd, Scriba	1.2 SW	(2)
3	Schoolhouse 15	Lake Rd, Scriba	1.3 SW	(2)
4	Schoolhouse 16	Lake Rd, Scriba	2.1 E	(2)
5	Stave factory	NYS 29, Scriba	1.7 ESE	1.7
6	Store	North Rd, Scriba	4.3 SSW	(2)
7	Cemetery	North Rd, Scriba	4.1 SSW	1.5
8	Schoolhouse 13	North Rd, Scriba	3.9 SSW	1.1
9	Blacksmith shop	North Rd, Scriba	3.9 S	0.7
10	Cemetery	North Rd, Scriba	3.8 SSE	1.2
11	Baptist church	North Rd, Scriba	3.8 SSE	1.2
12	Schoolhouse 14	NYS 29, Scriba	3.9 SSE	1.6
13	Cheese factory	NYS 29, Scriba	3.4 SSE	1.8
14	Blacksmith shop	North Rd, Scriba	4.1 SSE	1.8
15	Grocery and post office	North Rd, Scriba	4.1 SSE	1.7
16	Harness shop and grocery	North Rd, Scriba	4.1 SSE	1.7
17	Blacksmith shop	North Rd, Scriba	4.5 SE	(2)
18	I. Hubble & Co.	Middle Rd, Scriba	5.2 SSW	(2)
19	Schoolhouse 4	US 104, Scriba	7.8 SW	(2)

TABLE 2.5-35 (Cont)

Map No.[1]	Resource	Site Location	Approximate Distance and Direction from Unit 2 (km)	Approximate Distance from Centerline of Transmission Corridor (km)
20	Cooper shop	US 104, Scriba	7.1 SSW	[2]
21	Schoolhouse 10, cooper shops, store, sash factory Methodist-Episcopal church, hotel, shoe shop, store and post office, blacksmith shops, wagon shop	US 104, Scriba	6.5 SSW	[2]
22	Cemetery	Klocks Corners Rd, Scriba	6.9 SSW	[2]
23	Sawmill	Klocks Corners Rd, Scriba	7.2 SSW	[2]
24	Schoolhouse 3	US 104, Scriba	6.0 S	0.5
25	Schoolhouse 7	NYS 51A, Scriba	7.2 SSE	1.0
26	Store	NYS 51A, Scriba	7.2 SSE	1.0
27	Cider mill	NYS 51A, Scriba	7.9 SSE	1.8
28	Cooper shop	NYS 29, Scriba	8.0 SSE	0.6
29	Wagon and blacksmith shop	O'Connor Rd, Scriba	9.6 SSE	0.3
30	Steam sawmill	O'Connor Rd, Scriba	9.8 SSE	0.1
31	Sawmill	O'Connor Rd, Scriba	9.9 SSE	0.1
32	Schoolhouse 6	Hall Rd, Scriba	10.5 S	0.9
33	Blacksmith shop	Hall Rd, Scriba	10.6 SSE	0.7
34	Schoolhouse 21	Mt. Pleasant Rd, Scriba	12.7 SSE	1.4

TABLE 2.5-35 (Cont)

Map No.[1]	Resource	Site Location	Approximate Distance and Direction from Unit 2 (km)	Approximate Distance from Centerline of Transmission Corridor (km)
35	Cemetery	Hall Rd, Scriba	10.2 S	1.5
36	H. Brown Hotel and store	Hall Rd, Scriba	10.0 S	(2)
37	Schoolhouse 5	Myers Rd, Scriba	10.7 S	(2)
38	Cheese factory	Whittemore Rd, Scriba	10.7 S	(2)
39	Sawmill	Myers Rd, Scriba	10.9 S	(2)
40	Schoolhouse 3	Hall Rd, Scriba	9.5 SSW	(2)
41	Harness shop	Hall Rd, Scriba	9.5 SSW	(2)
42	Cooper shop	NYS 53, Scriba	8.7 SSW	(2)
43	Cooper shop	NYS 53, Scriba	8.8 SSW	(2)
44	Schoolhouse 17	O'Connor Rd, Scriba	8.5 S	1.5
45	Schoolhouse 18	North Rd, New Haven	4.4 SE	(2)
46	Schoolhouse 8	Middle Rd, New Haven	6.1 SE	(2)
47	Stave manufactory	NYS 51A, New Haven	8.5 SSE	(2)
48	Stave manufactory	NYS 51, New Haven	9.8 SSE	(2)
49	Schoolhouse 9	NYS 51, New Haven	11.9 SE	(2)
63	Schoolhouse 10	N. Volney Rd, Volney	13.9 SSE	1.8
64	Methodist-Episcopal church	N. Volney Rd, Volney	13.8 SSE	1.8
71	Sawmill	Black Creek Rd, Volney	12.8 S	(2)

TABLE 2.5-35 (Cont)

Map No.[1]	Resource	Site Location	Approximate Distance and Direction from Unit 2 (km)	Approximate Distance from Centerline of Transmission Corridor (km)
72	Schoolhouse 11	NYS 45, Volney	14.4 S	(2)
73	Cooper shop	NYS 45, Volney	14.4 S	(2)
A	Flouring mill	North Rd, Scriba	5.2 SW	(2)
B	Flouring mill	O'Connor Rd, Scriba	9.9 SSE	0.2
C	Flouring mill	Hall Rd, Scriba	10.7 S	0.8

(1) See Figure 2.5-19.
(2) More than 2 km from transmission corridor.

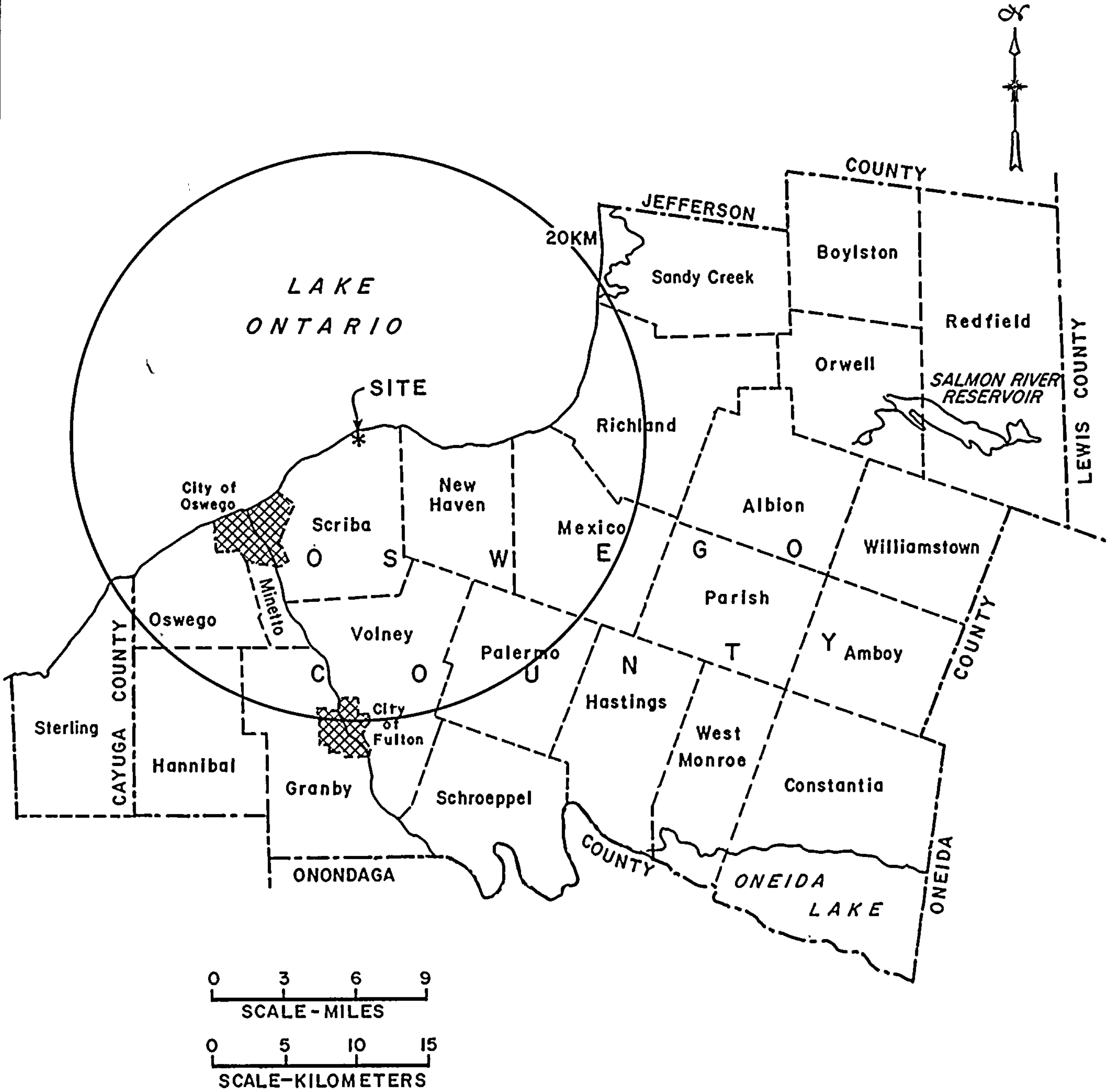


FIGURE 2.5-1

COUNTIES AND TOWNS WITHIN 20-KM OF SITE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

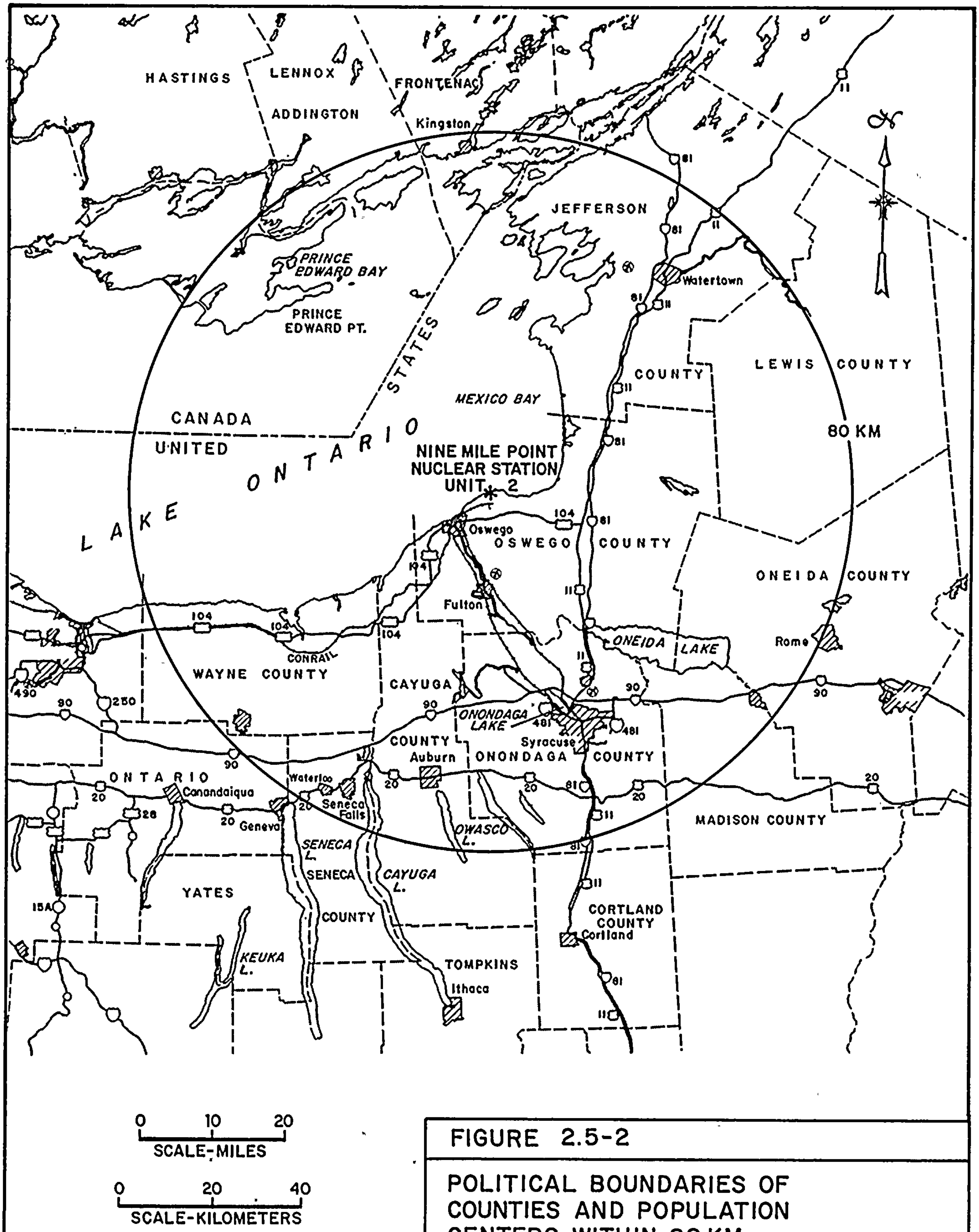


FIGURE 2.5-2

POLITICAL BOUNDARIES OF COUNTIES AND POPULATION CENTERS WITHIN 80-KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

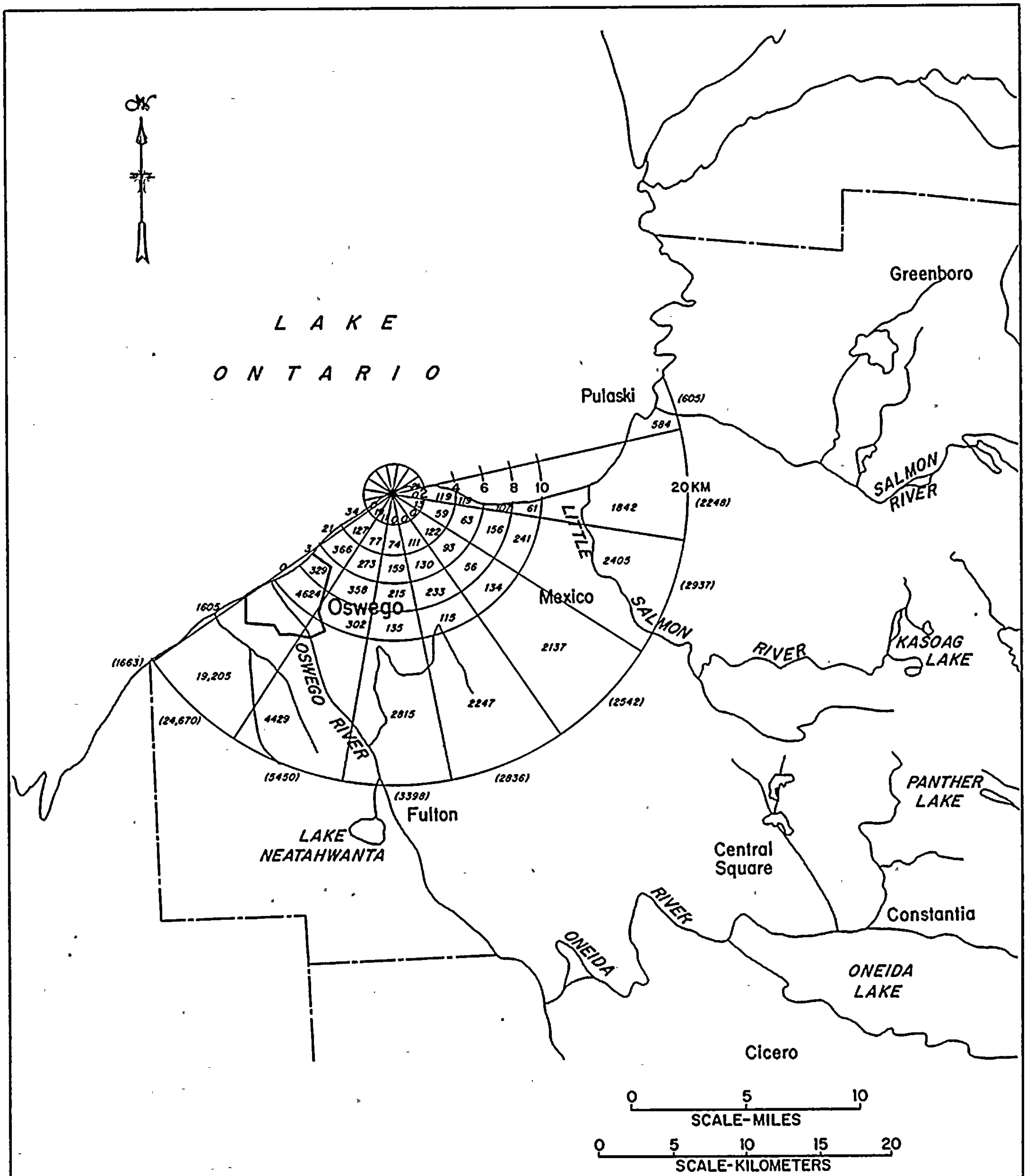


FIGURE 2.5-3

1980

POPULATION DISTRIBUTION - 20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT - UNIT 2

ENVIRONMENTAL REPORT

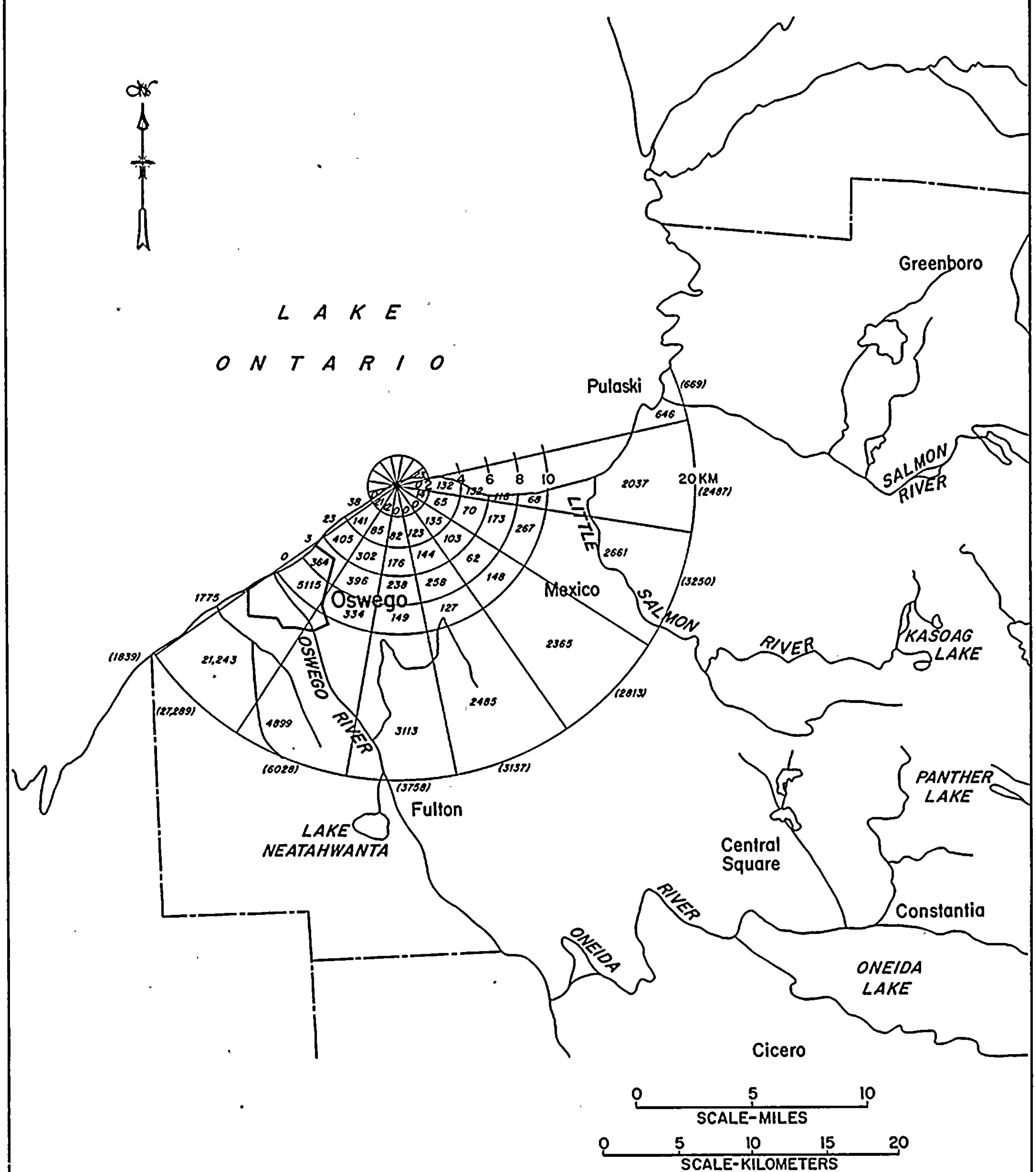


FIGURE 2.5-4

1985

POPULATION DISTRIBUTION - 20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT- UNIT 2

ENVIRONMENTAL REPORT

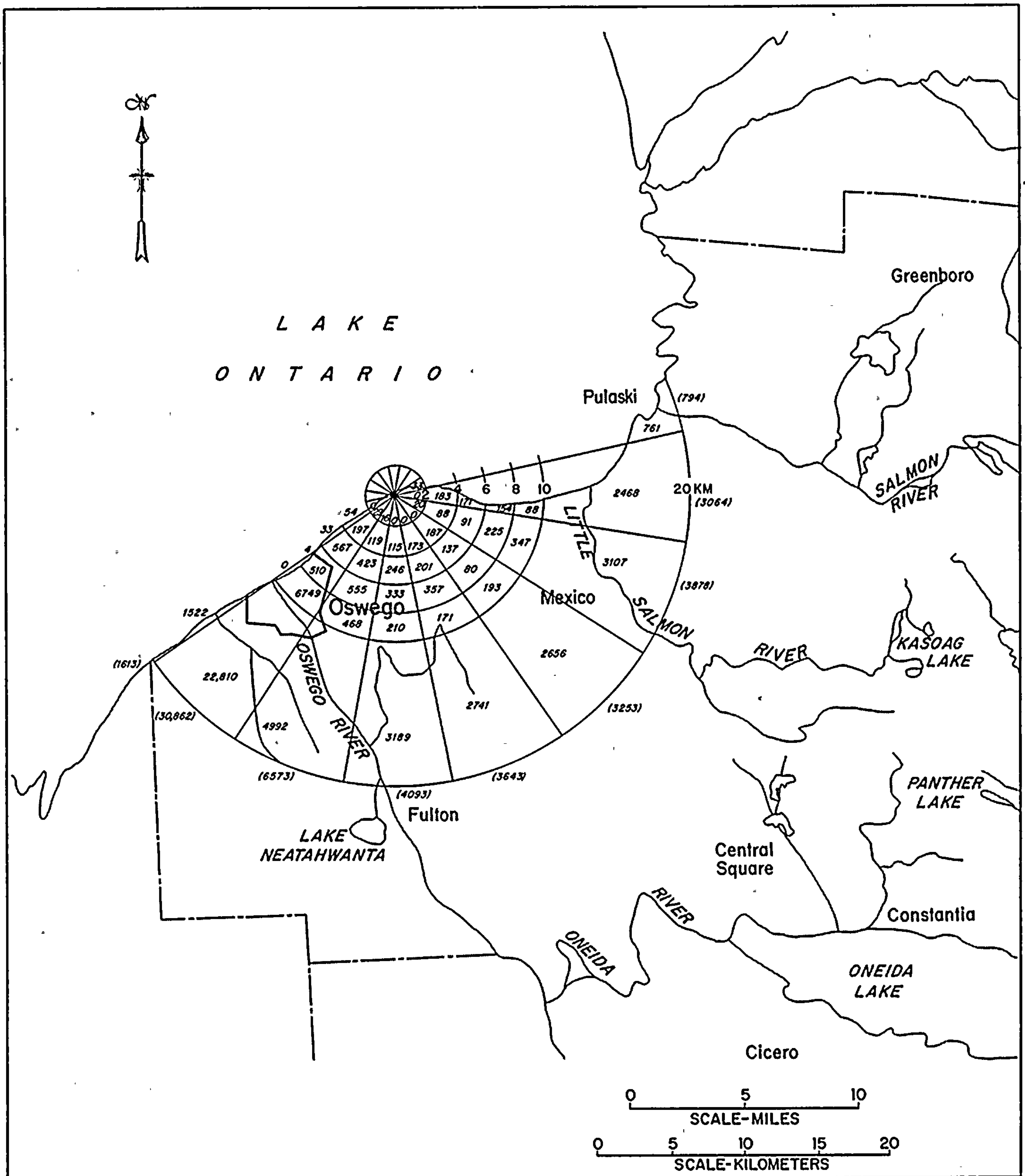


FIGURE 2.5-5

1990

POPULATION DISTRIBUTION - 20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT - UNIT 2

ENVIRONMENTAL REPORT

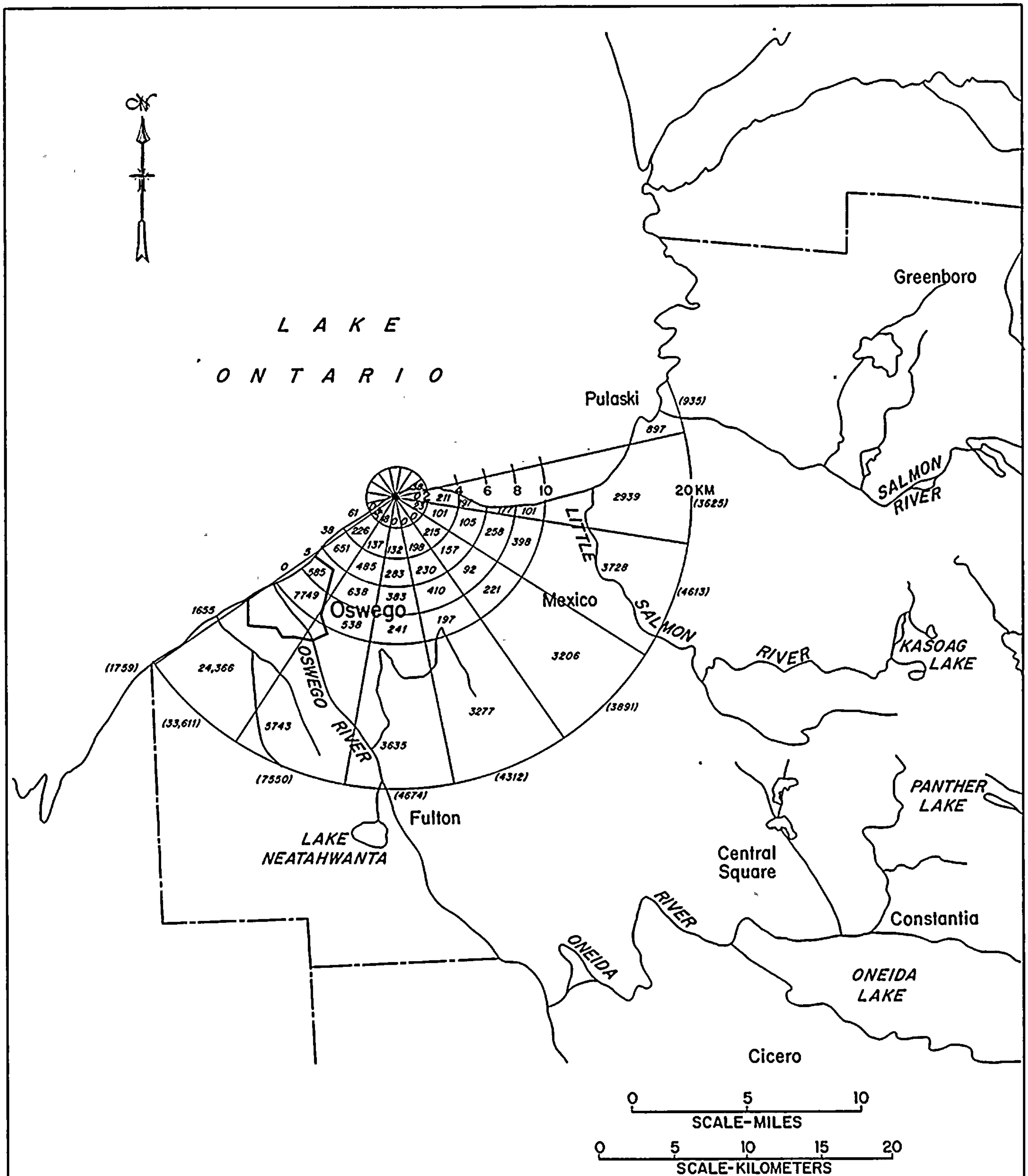


FIGURE 2.5-6

2000

POPULATION DISTRIBUTION - 20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT - UNIT 2

ENVIRONMENTAL REPORT

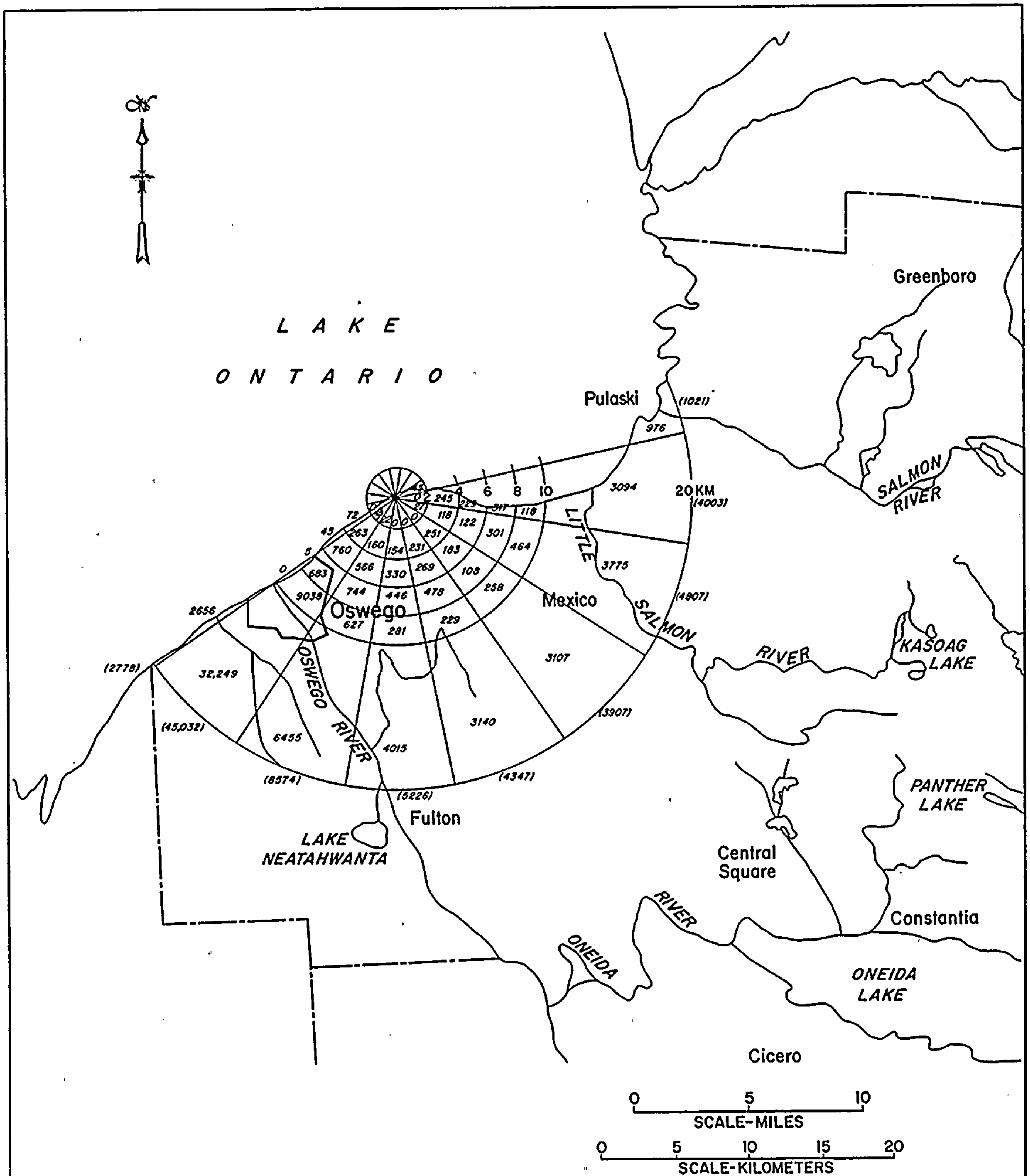


FIGURE 2.5-7

2010

POPULATION DISTRIBUTION-20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT-UNIT 2

ENVIRONMENTAL REPORT

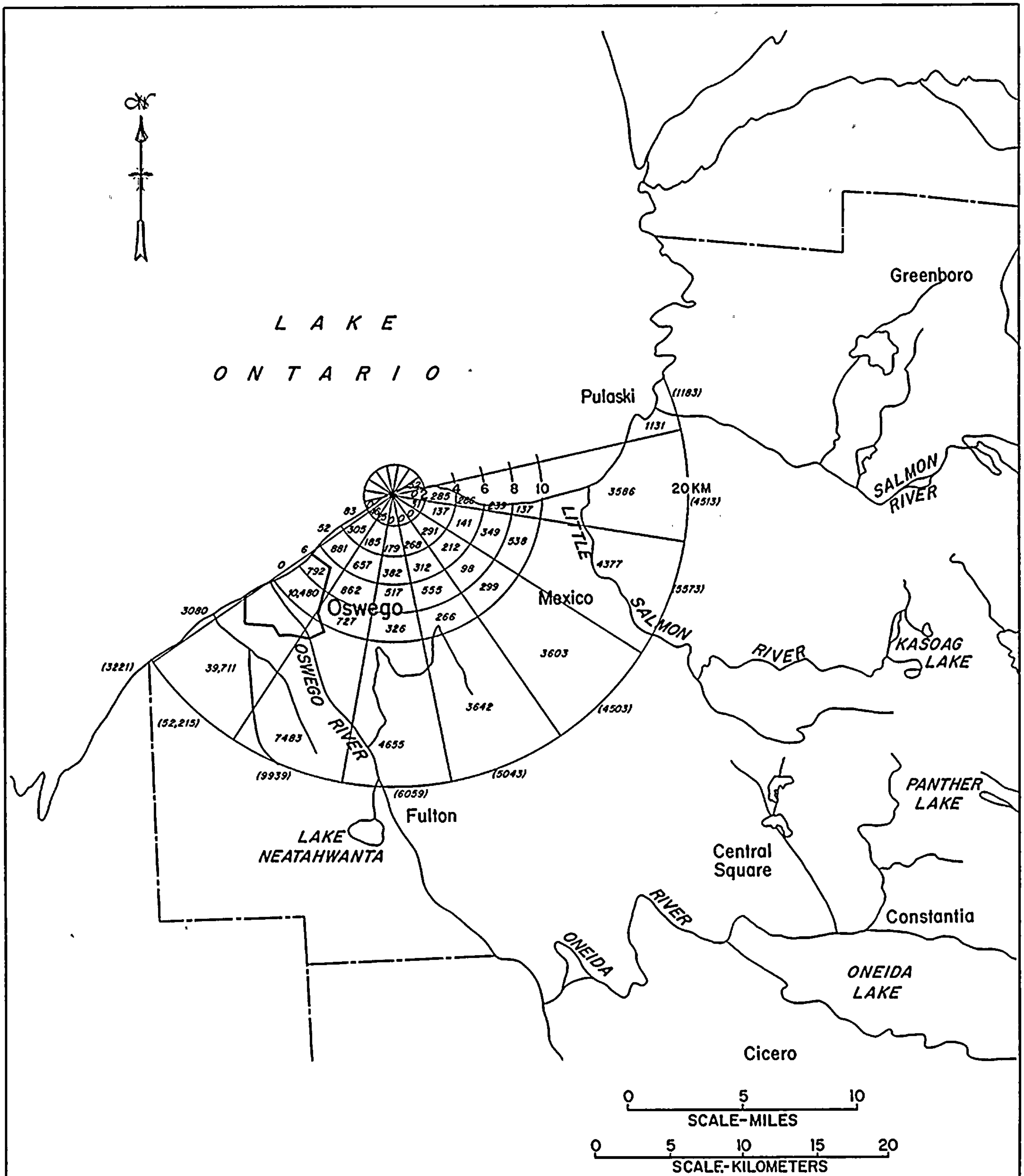


FIGURE 2.5-8

2020

POPULATION DISTRIBUTION - 20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT - UNIT 2

ENVIRONMENTAL REPORT

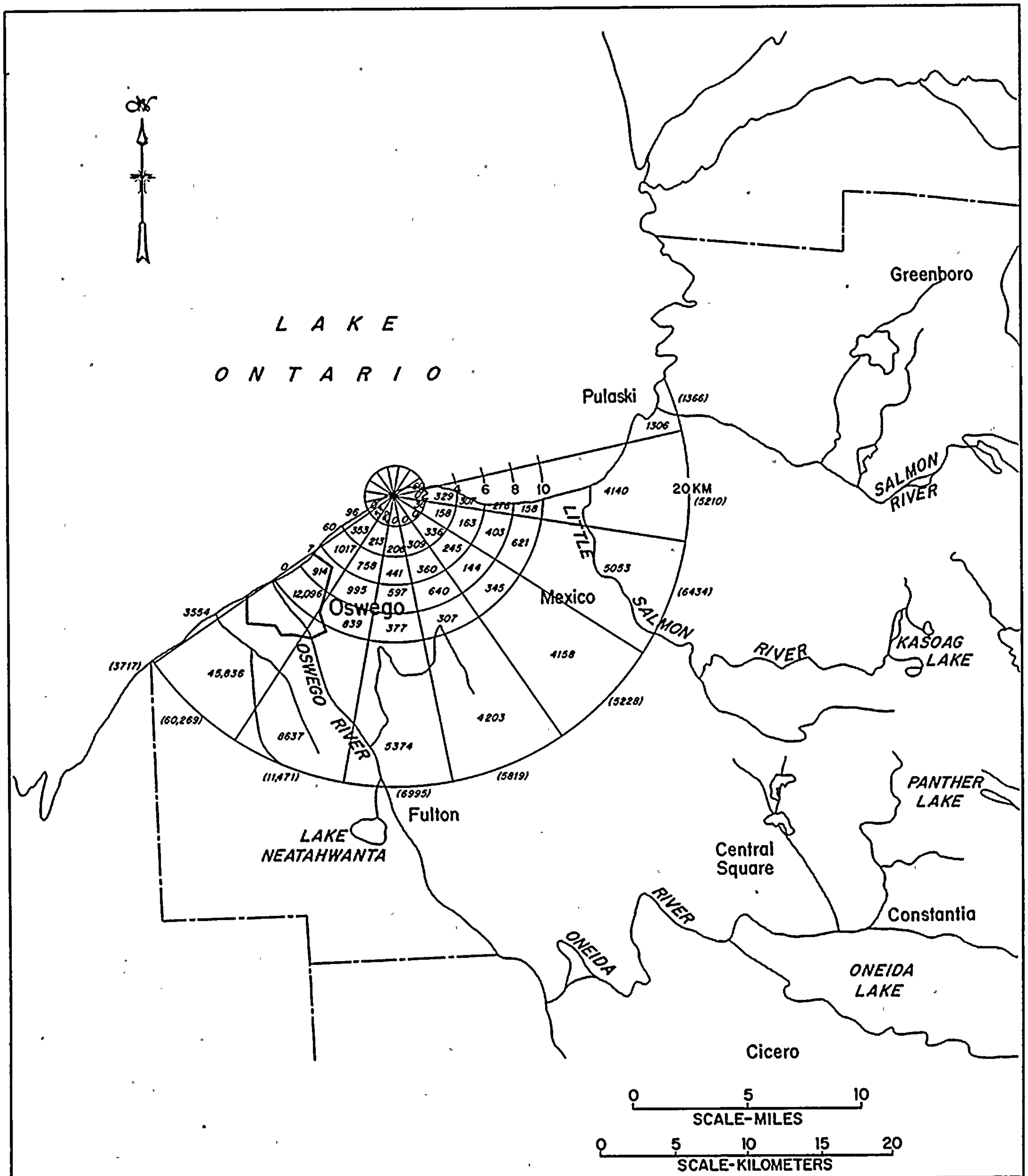


FIGURE 2.5-9

2030

POPULATION DISTRIBUTION - 20 KM

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT - UNIT 2

ENVIRONMENTAL REPORT

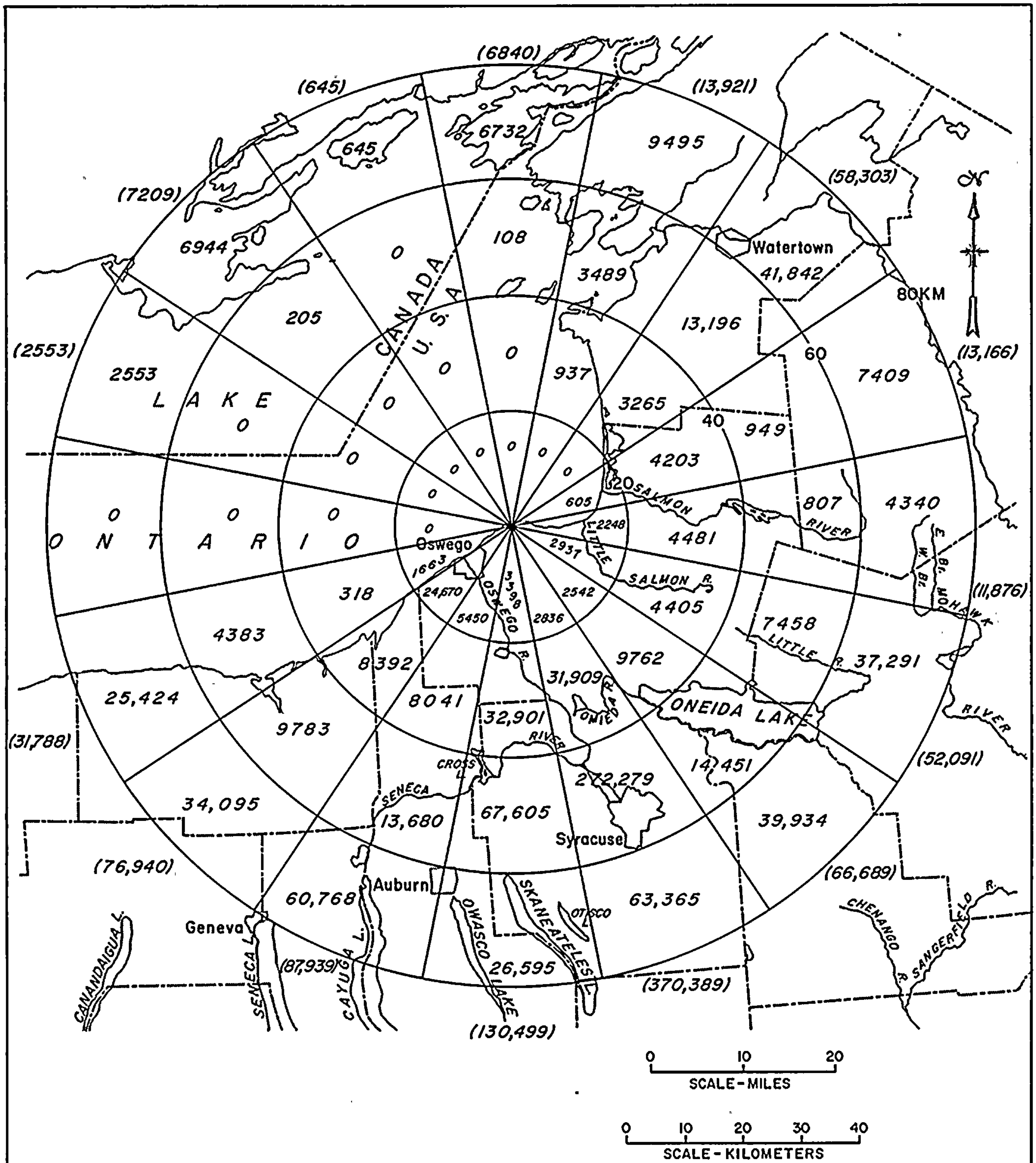


FIGURE. 2.5-10

1980
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT

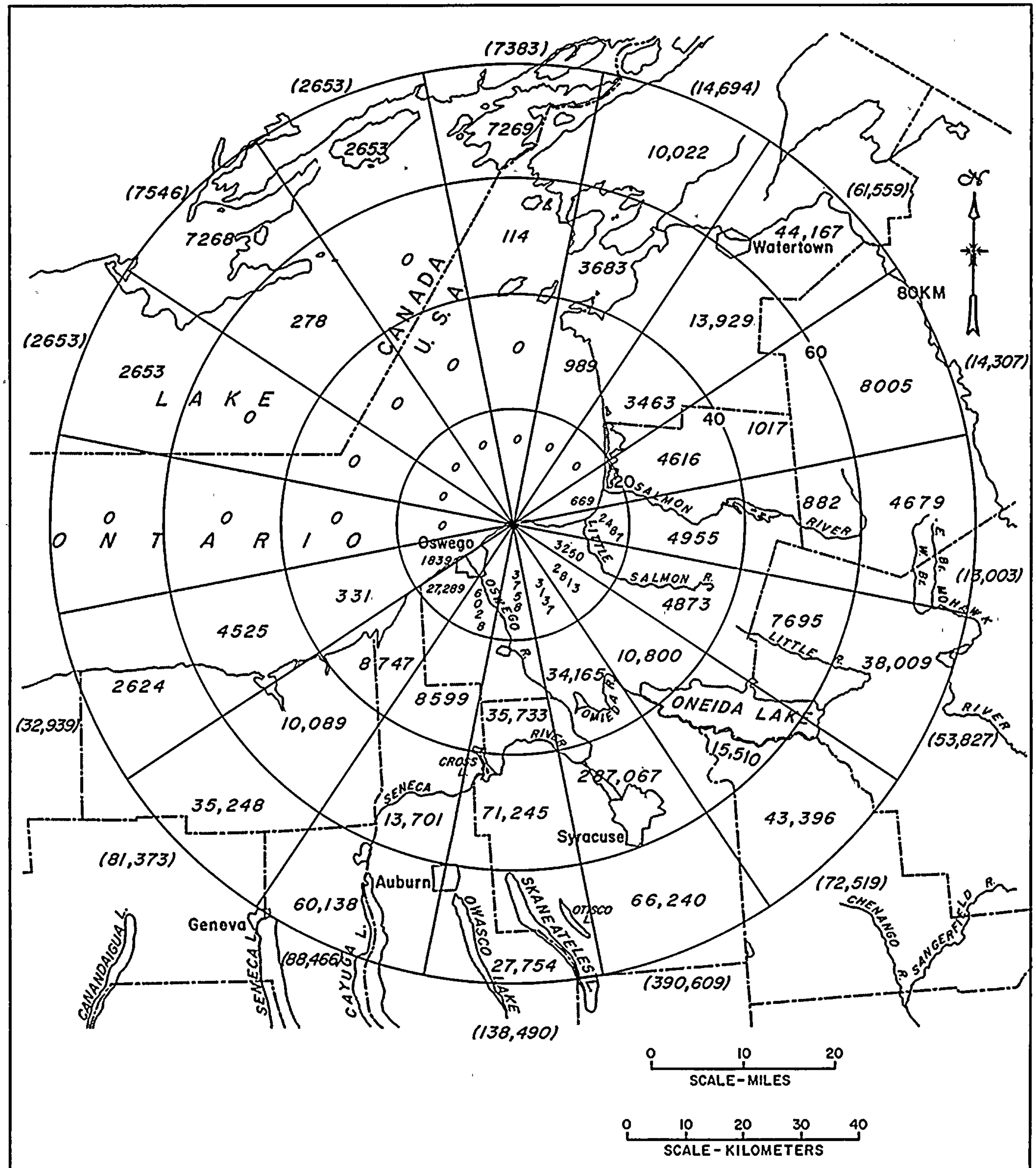


FIGURE 2.5-11

1985
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT

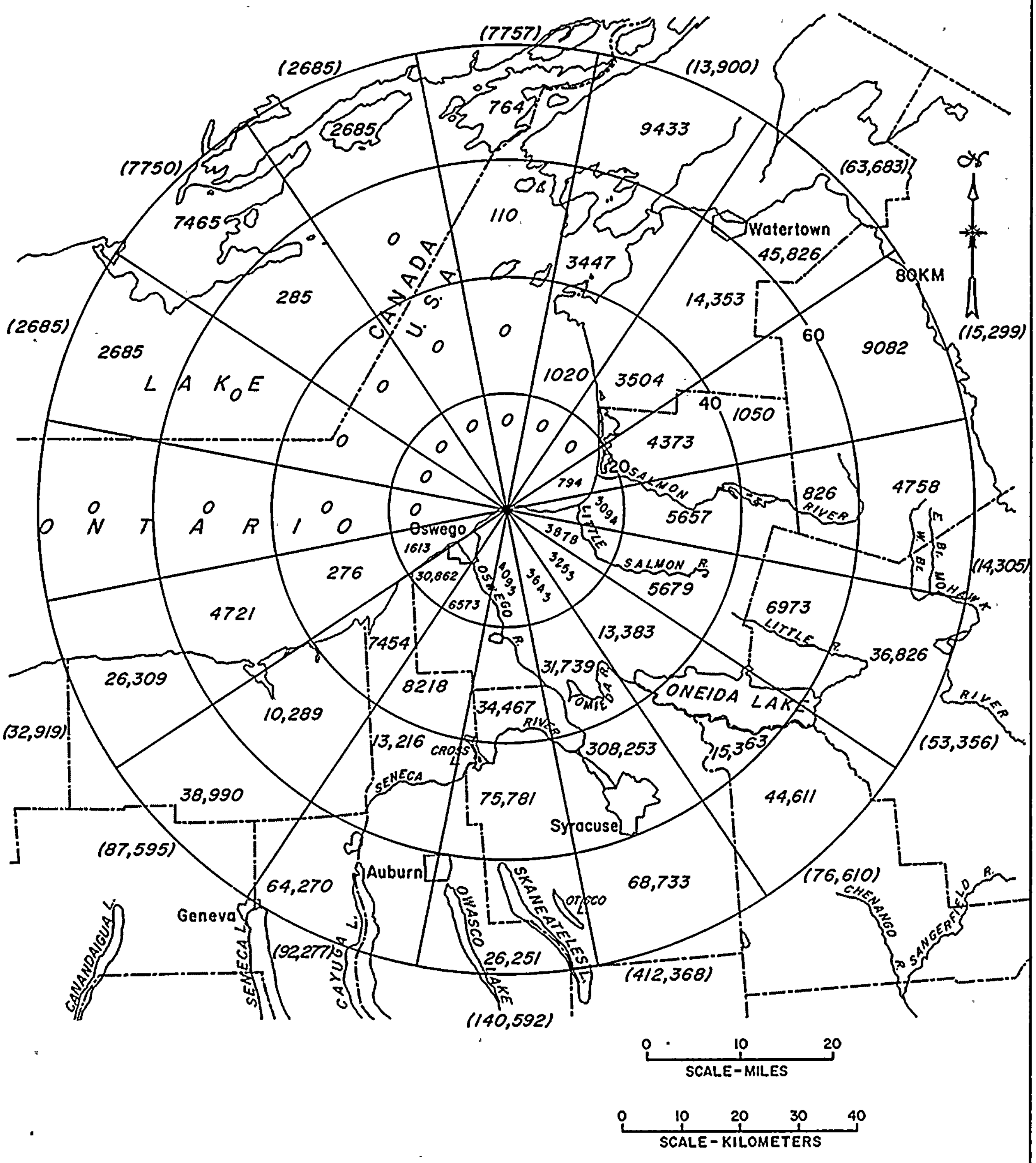


FIGURE 2.5-12

1990
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT

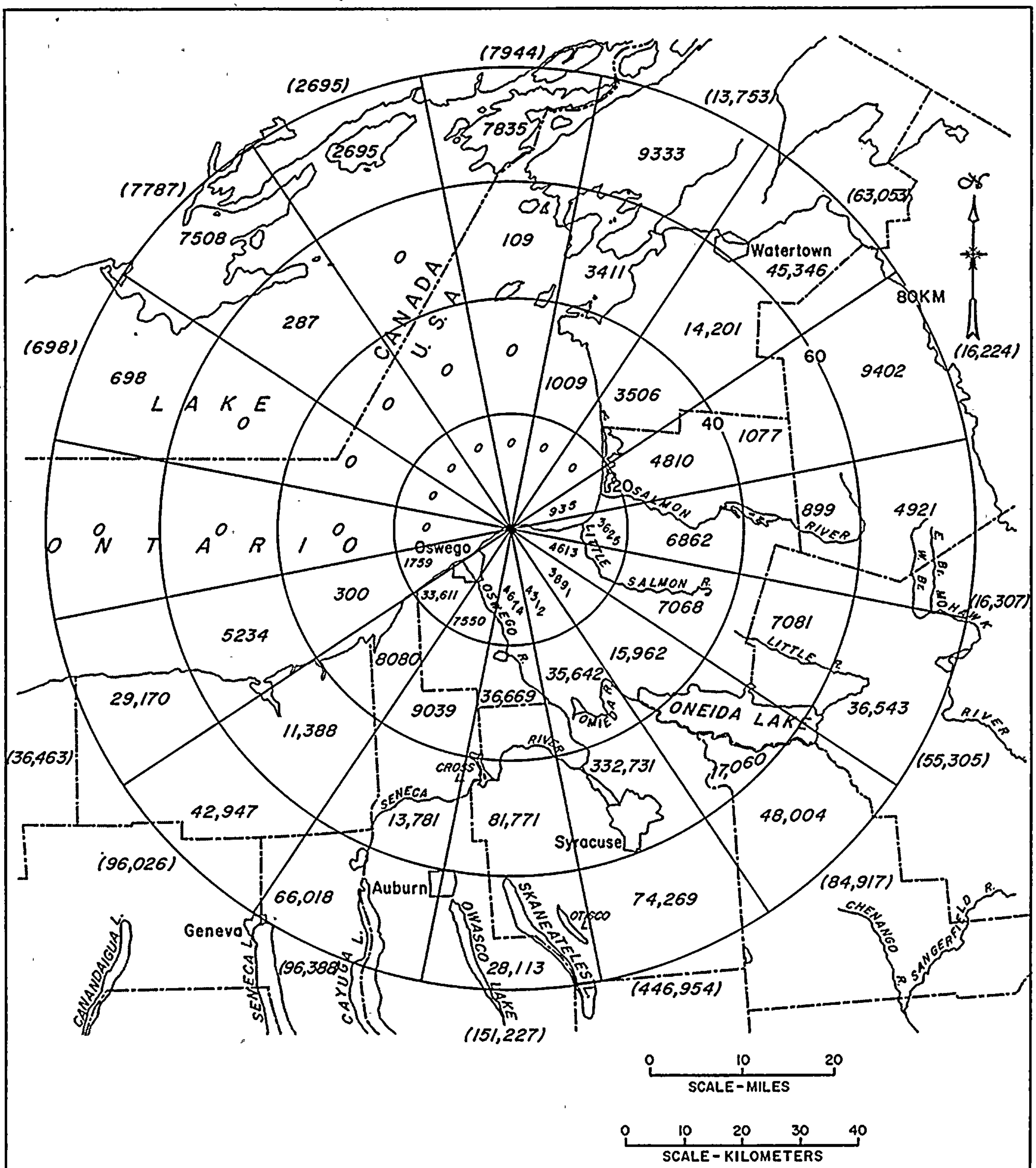


FIGURE 2.5-13

2000
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT- UNIT 2
ENVIRONMENTAL REPORT

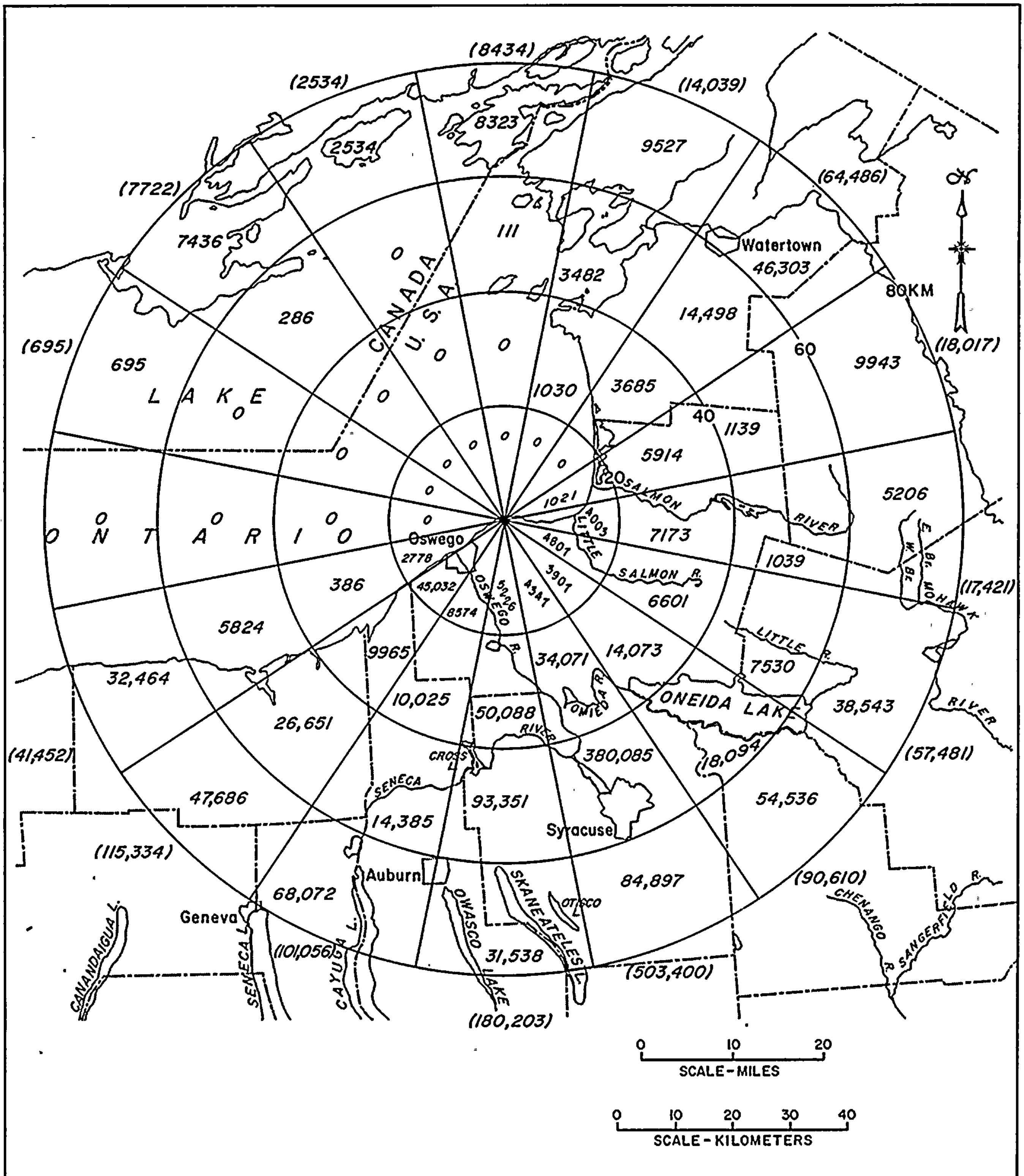


FIGURE 2.5-14

2010
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT

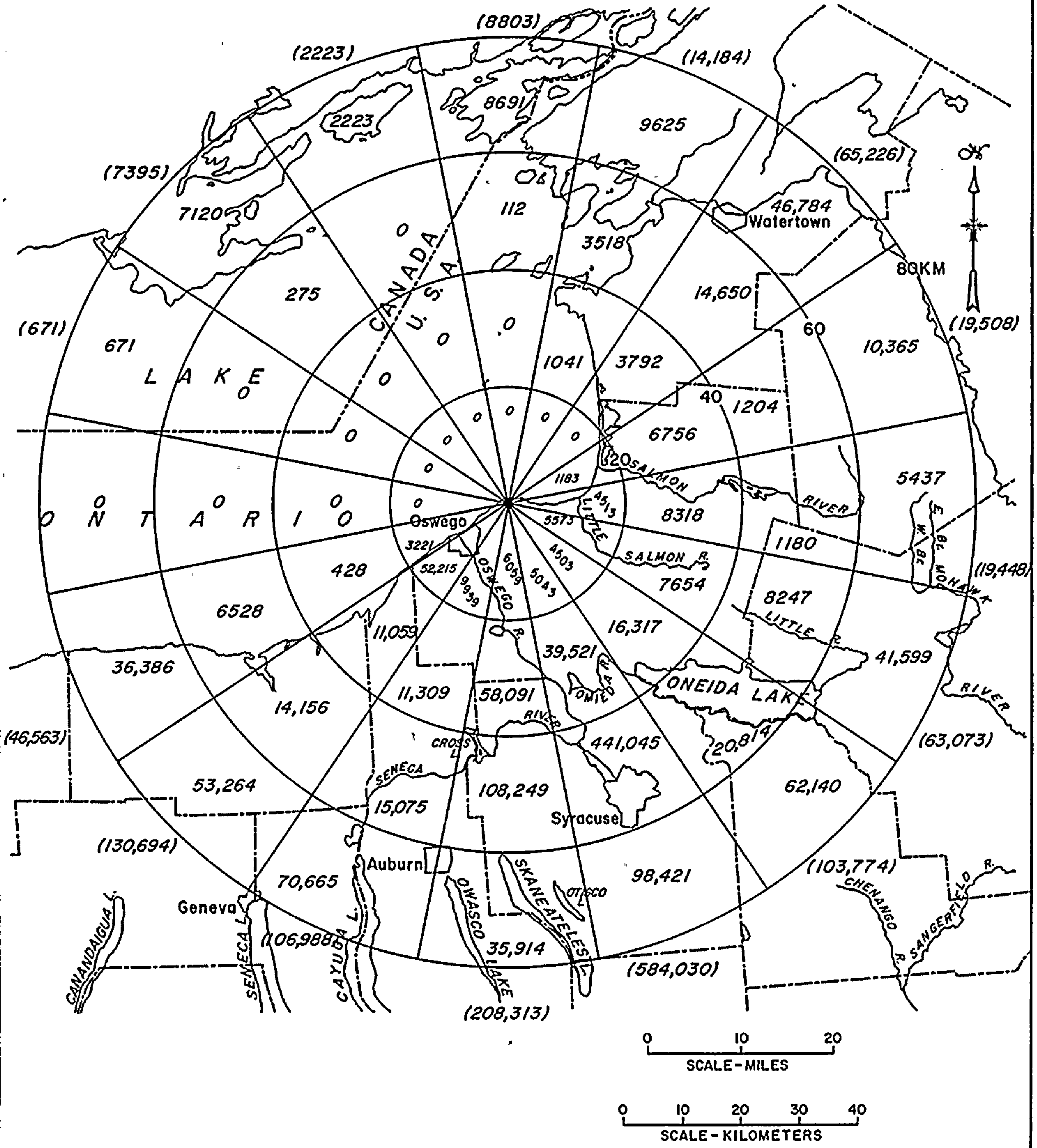


FIGURE 2.5-15

2020
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT

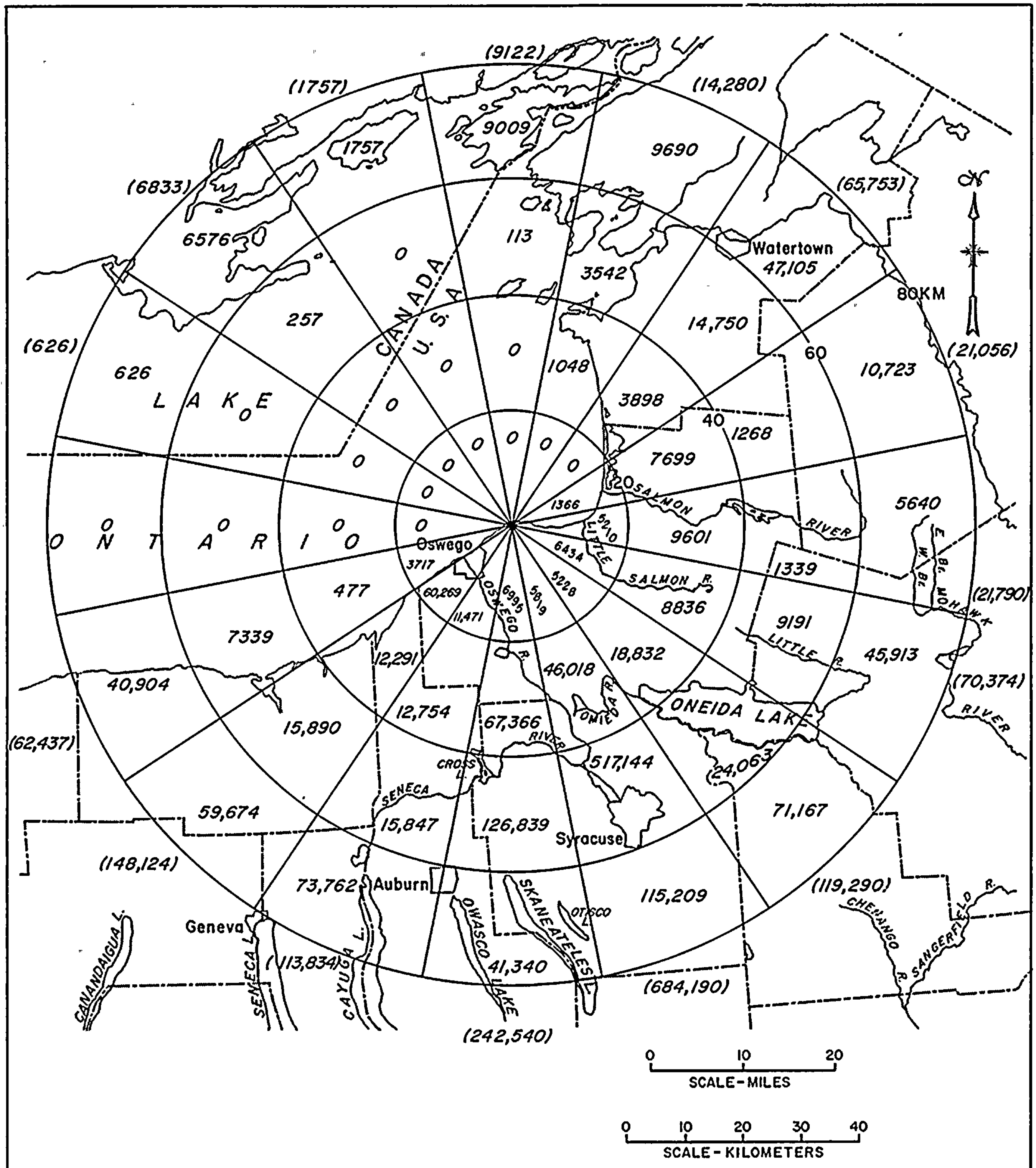


FIGURE 2.5-16

2030
POPULATION DISTRIBUTION - 80 KM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT

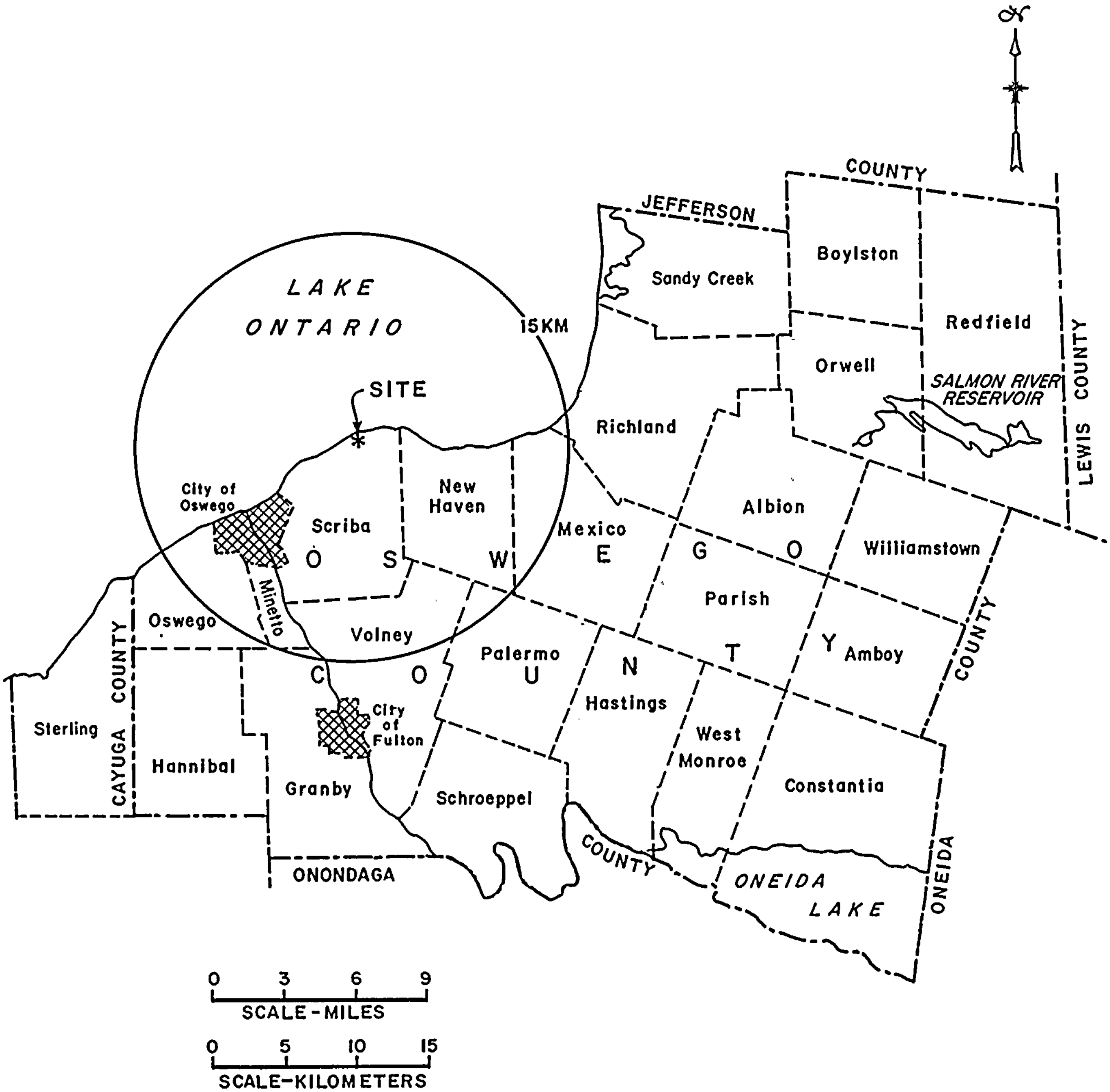


FIGURE 2.5-17

CITIES AND TOWNS WITHIN 15-KM OF SITE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT-OLS

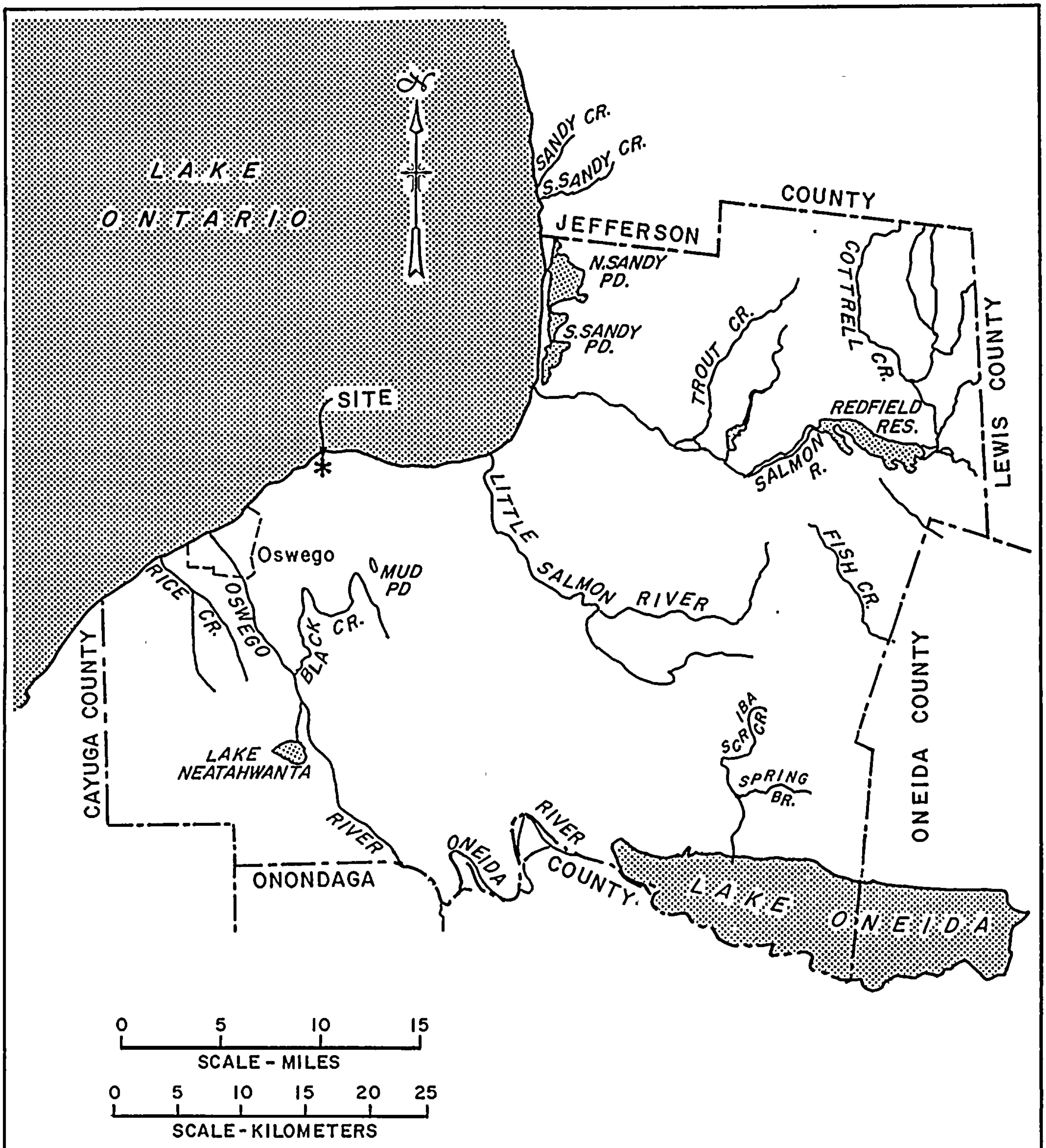


FIGURE 2.5-18

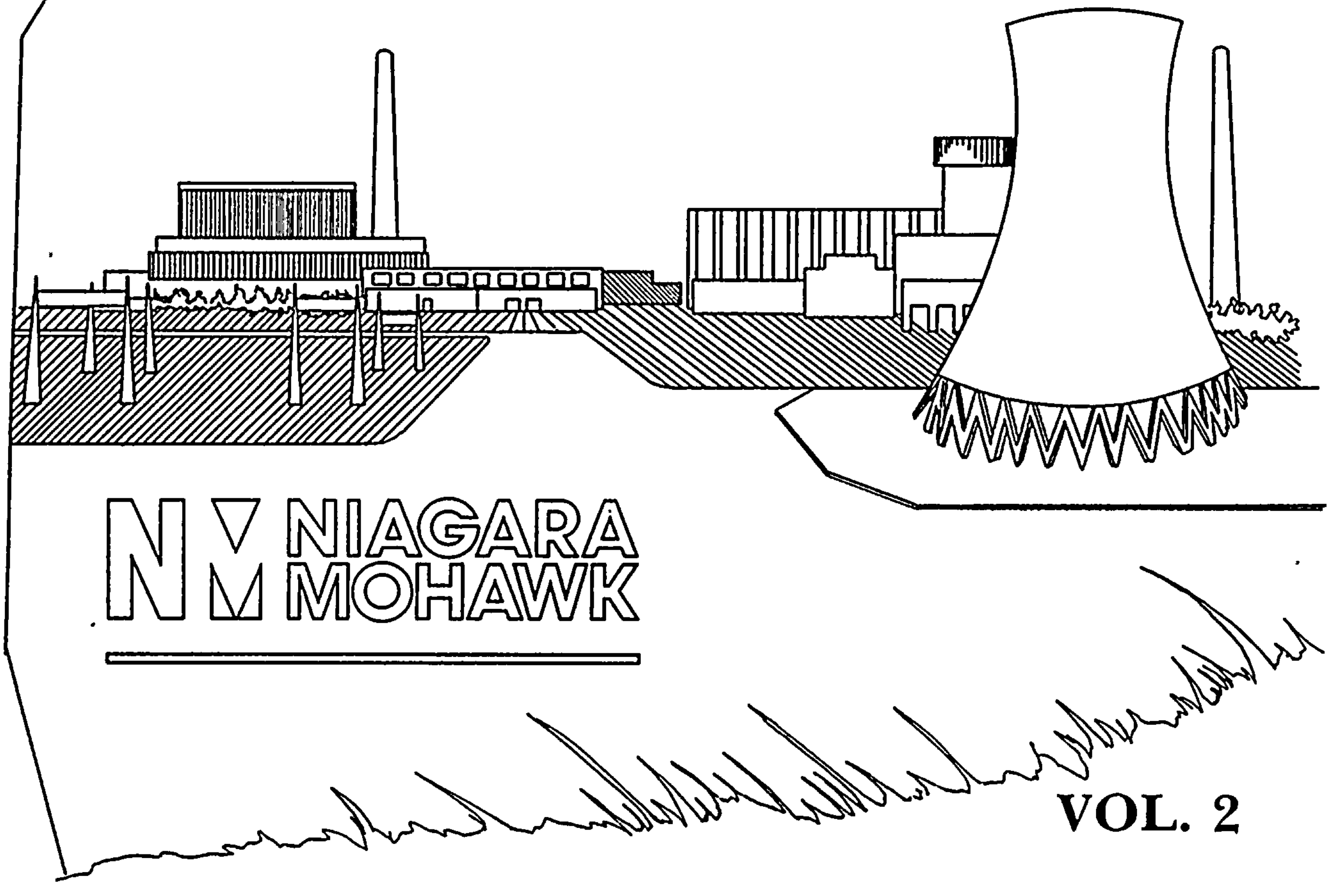
RIVERS AND LAKES IN OSWEGO COUNTY

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT-2
ENVIRONMENTAL REPORT-OLS

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

NINE MILE POINT NUCLEAR STATION — UNIT 2



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2.6 GEOLOGY

Detailed information relating to soil characteristics, topography, physiography, stratigraphy, and seismic history is presented in FSAR Section 2.5.

2.7 METEOROLOGY

The following sections provide summaries of meteorological information compiled in a detailed technical report prepared in support of the Unit 2 ER-OLS[1]. Where appropriate, references to related FSAR sections have been provided.

2.7.1 General Description of Regional Climate

The general climate in the vicinity of Nine Mile Point is best described as humid continental. Cold dry air masses from the northern interior of the continent dominate in the winter months, while warmer moist air masses originating from the south and southwest prevail from spring through fall. Nearly all storm systems and their associated fronts moving eastward across the continent pass through or near north-central New York. These storm tracks and the influence of the Great Lakes produce the characteristically cloudy climate of the region from late fall through spring.

The Syracuse National Weather Service (NWS) station is the nearest and most representative first order station with available long-term climatological records. The prevailing wind is from the west-northwest at an annual average speed of 4 m/s (10 mph). The annual mean temperature at Syracuse is 8.9°C (48.1°F). Precipitation is well distributed throughout the year, with a monthly average of 8 cm (3 in). Snowfall tends to be heavy in the region, averaging over 254 cm (100 in) each year.

The influence of Lake Ontario on the weather is most apparent during lake breezes and during lake-effect snowsqualls. Furthermore, the presence of the lake tends to suppress the temperature extremes and increase wind speeds in the vicinity.

A detailed description of the regional climate and local meteorology appears in FSAR Section 2.3.

2.7.2 Seasonal and Annual Frequencies of Severe Weather Phenomena

The Nine Mile Point region is located sufficiently inland from the Atlantic Ocean so that from 1900 through 1980 no hurricanes traversed the nearby vicinity. Tornadoes, although rare, occur during the spring and summer months. During 1951 through 1980, 14 tornadoes were reported within a 2 deg latitude by 2 deg longitude area centered on Unit 2.

Thunderstorms and lightning are also seasonal phenomena. The Syracuse NWS station records show an average of 29 thunderstorm days per year, with 27 of the days occurring during the spring and summer. Lightning can be conservatively expected to strike a square kilometer of the Nine Mile Point region about 9 times per year (23 times per sq mi).

Hail, associated with severe thunderstorms, is a relatively rare occurrence in the region. An annual frequency of 1 to 2 hail storms per year is the climatological normal for the region. Freezing rain or drizzle have a climatological frequency of 8 to 12 days per year in the region.

Additional information on severe weather occurrences appears in FSAR Section 2.3.1.

2.7.3 Description of Local Airflow Patterns and Characteristics

The analysis of the local meteorology at the Nine Mile Point site is based upon 5 yr of data (January 1974 through December 1976 and November 1978 through October 1980) collected at the onsite meteorological tower. The analysis of regional meteorology is based on long-term data, and data concurrent with the onsite record, measured at the Syracuse NWS station.

A full description of the local meteorology analysis is presented in FSAR Section 2.3.2. Detailed summaries of the meteorological parameters measured onsite and at the Syracuse NWS station are presented in FSAR Appendix 2B.

Onsite meteorological summaries of the 5-yr data base are tabulated for wind, stability, temperature, precipitation, and atmospheric moisture variables. Wind direction, speed, and stability distributions for the period concurrent with the onsite record as well as for long-term time periods are tabulated for the Syracuse NWS station. Climatological distributions of meteorological variables not routinely monitored at the site are also summarized, based upon long-term climatological records.

Comparisons of key meteorological variables measured onsite and at the Syracuse NWS station are presented to ensure the representativeness of the 5-yr onsite measurements to the long-term local meteorology. The differences between the data sets have been assessed, and it is concluded that the onsite and/or long-term Syracuse NWS data reasonably represent the meteorological conditions expected over the

lifetime of the plant.

2.7.4 Long-Term (Routine) Diffusion Estimates

Unit 2 is located on the flat Lake Ontario plain. The topography of the surrounding region varies from predominantly flat to rolling terrain. Thus, there are no severe terrain features, such as deep valleys or mountains, to complicate the atmospheric transport and diffusion of radionuclides from the plant.

The onsite meteorological tower, located on the lake plain, is particularly well suited to measure the meteorological conditions that determine the atmospheric transport of the plant's effluents. Meteorological data collected at this tower for a 5-yr period have been used to assess atmospheric diffusion. Meteorological summaries of this data base are presented in FSAR Section 2.3.2 and FSAR Appendix 2B. In addition, a full description of the tower, its location and instrumentation, is presented in FSAR Section 2.3.3.

Two potential sources for radionuclide releases have been considered for Unit 2: the main stack and the combined radwaste and reactor building vent. Annual and grazing season (April 15 through October 14) estimates of average relative concentration (X/Q) and relative deposition per unit area (D/Q) have been calculated by an atmospheric diffusion model.

The atmospheric diffusion model follows the guidance set forth in Regulatory Guide 1.111. Specific details regarding this model are presented in FSAR Section 2.3.5. The annual and grazing season X/Q and D/Q values for both sources are calculated at distances ranging from 1.0 km (0.6 mi) to 80 km (50 mi). In addition, the X/Q and D/Q values at the appropriate locations of milk animals, meat animals, vegetable gardens, and residences have been tabulated for the annual and grazing season time scales in Appendix 7B.

2.7.5 Reference

1. Meteorological and Radiological Technical Report in Support of the Nine Mile Point - Unit 2 Environmental Report - Operating License Stage. Prepared for Niagara Mohawk Power Corporation by Meteorological Evaluation Services, Inc. July 1982.

2.8 RELATED FEDERAL PROJECT ACTIVITIES

There are no federal project activities related to plant siting, transmission line routing, plant water supply, or the need for power. Therefore, no further discussion is necessary.

2.9 AMBIENT AIR QUALITY

2.9.1 Air Quality Data Base

The Unit 2 site is located in the Central New York Intrastate Air Quality Control Region, approximately 10 km (6.2 mi) northeast of Oswego, NY. The ambient air quality of the Oswego area is monitored continuously by Niagara Mohawk Power Corporation (NMPC) as part of the field monitoring network associated with the Oswego Steam Station and intermittently by the New York State Department of Environmental Conservation (NYSDEC) as part of their statewide network to satisfy mandates of the Clean Air Act.

The NMPC ambient air quality network originally consisted of six stations, which monitored sulfur dioxide (SO_2) and total suspended particulates (TSP). Four of the stations are presently operating. Three of these four stations additionally monitored nitrogen dioxide (NO_2) and oxides of nitrogen (NOx). Table 2.9-1 lists the pollutants measured at each station and describes the location of each station relative to the Unit 2 site.

The NYSDEC air quality network in the vicinity of the Unit 2 site (Oswego County) consists of three monitoring sites, all of which measure TSP. Previously, two of the sites measured SO_2 and settleable particulates. This monitoring was terminated in 1979.

As shown on Figure 2.9-1, all nine ambient air quality monitoring sites are located within 25 km (15.5 mi) of the Unit 2 site. Available air quality data from all nine monitoring sites for the years 1976 through 1979, and for the first half of 1980 are reported in this section.

The closest ozone-monitoring sites to Nine Mile Point are located in Syracuse, NY, which is approximately 53 km (32.8 mi) to the southeast. Since ozone can often be characterized on a regional basis, ozone data from the two Syracuse monitoring sites for 1976 through 1979 are also presented.

As shown on Figure 2.9-1, several of the monitoring sites (Sites 2, 4, 7, 8, and 9) are located in environments that are more urban in nature than the Unit 2 site, and two of the sites (Sites 1 and 5) are located at points which are expected to show maximum concentrations attributable to the operation of the oil-fired Oswego Steam Station. Data from these ambient monitoring sites provide a conservative

characterization of the existing air quality at Nine Mile Point.

2.9.2 Analysis of Sulfur Dioxide-Monitoring Data

All NMPC monitoring stations monitor SO_2 continuously with Meloy Flame Photometric Analyzers. Two of the NYSDEC stations monitored SO_2 intermittently with bubblers using West-Gaeke procedures. The bubbler data are presented only for comparison, since the bubbler methods are being phased out by the regulatory agencies and the two NYSDEC stations no longer monitor SO_2.

No measurements in excess of state or federal primary or secondary SO_2 ambient air quality standards (Table 2.9-2) were recorded at any of the monitoring sites during the period of analysis. This is consistent with the EPA's designation of SO_2 air quality in this air quality control region as "unclassified or better than national standards."[1] SO_2-monitoring results are presented in Table 2.9-3.

2.9.3 Analysis of Total Suspended Particulates-Monitoring Data

Analysis of the ambient air quality monitoring data for TSP, which is monitored every 6 days, indicates compliance with federal and state 24-hr and annual primary standards at all nine sites and compliance with the federal 24-hr secondary standard at all sites and in all years, except for the Alcan site in 1977 and 1980, and the Dutch Ridge site in 1980. The second highest 24-hr average TSP level recorded at the Alcan station was 168 ug/cu m in 1977 and 174.4 ug/cu m in 1980; at the Dutch Ridge station, it was 180.6 ug/cu m in 1980. These values exceeded the secondary standard of 150 ug/cu m. These high TSP concentrations occurred on days when the wind direction was from the southeast to the northeast, a wind direction that carries the Oswego plume away from the monitors. Therefore, the Oswego plant emissions were not the cause of these high concentrations. Possible causes were fugitive dust from local construction activities and rural roadways. TSP-monitoring results are presented in Table 2.9-4.

The EPA has designated the entire Central New York Air Quality Control Region except Syracuse, East Syracuse, and Solvay to be in attainment for both primary and secondary ambient TSP standards[2].

2.9.4 Analysis of Nitrogen Dioxide-Monitoring Data

Continuous NO_2 monitoring was performed at two of the NMPC stations throughout the period of analysis with Thermo Electron Chemiluminescent Analyzers. Monitoring was performed at Sites 1 and 4 prior to September 1978 and at Sites 1 and 5 from September 1978 to 1980. NO_2-monitoring results are presented in Table 2.9-5 and indicate that the federal and state annual average ambient air quality standards of 0.05 ppm were not exceeded in the vicinity of Nine Mile Point. EPA has classified the NO_2 air quality of the Central New York Air Quality Control Region as "cannot be classified or better than national standards."(2)

2.9.5 Analysis of Settleable Particulates-Monitoring Data

Two of the NYSDEC monitoring stations previously measured settleable particulates in 30-day dustfall jars. These sites are located in Fulton and Oswego and are classified by NYSDEC as Level II and Level III areas, respectively. Table 2.9-2 (footnote 2) provides a description of the New York State classification system. The appropriate state standards for the Fulton site are 0.30 mg/sq cm/30 days for the 50th percentile and 0.45 mg/sq cm/30 days for the 84th percentile. The state standards for the 50th and 84th percentiles at the Oswego site are 0.40 mg/sq cm/30 days and 0.60 mg/sq cm/30 days, respectively. Table 2.9-6 shows that these state standards were met at both sites in 1976, 1977, and 1978. Sampling was terminated during 1979 at these two stations.

2.9.6 Analysis of Ozone-Monitoring Data

The two ozone-monitoring stations in Syracuse utilize the Federal Reference Method of continuous chemiluminescence. Ozone-monitoring results are presented in Table 2.9-7. The 1-hr average federal ambient air quality standard for ozone (0.12 ppm) was exceeded at the downtown site in 1978 and at the new Syracuse site in 1979. These levels are consistent with the EPA's classification of the Central New York Air Quality Control Region as "nonattainment of the ozone standard."(2)

2.9.7 Conclusions

The ambient air quality data collected by NMPC and NYSDEC during the period January 1976 through June 1980 within 25 km (15.5 mi) of the Unit 2 site indicate that levels of SO_2, NO_2, and settleable particulates are in compliance with all federal and state ambient air quality standards.

2.9.8 References

1. Environmental Protection Agency. Attainment Status Designations, 40CFR8495-8497, January 27, 1981.

2. Environmental Protection Agency. Attainment Status Designations, 40CFR81.333, July 1, 1980.

3. New York State Air Quality Report. New York State Department of Environmental Conservation, Annual 1976, 1977, 1978, and 1979.

4. Ambient Air Monitoring in the Vicinity of the Oswego Steam Station. Niagara Mohawk Power Corporation, Environmental Affairs Department. Semiannual Reports for January 1976 through June 1980.

TABLE 2.9-1

AIR QUALITY MONITORING STATIONS
IN THE VICINITY OF THE UNIT 2 SITE

Monitoring Site[1]	Monitoring Station	Operator	Distance from Unit 2 Site (km/mi)	Downwind Direction[2] (deg)	UTM Coordinates East (km)	UTM Coordinates North (km)	Pollutants Monitored
1	Alcan	NMPC	5.8/3.6	45	382.10	4,815.85	SO_2, NO_2/NOx[3], TSP
2	Paloma	NMPC	12.9/8.0	42	378.05	4,810.65	SO_2, TSP
3	SUNY	NMPC	15.0/9.3	57	374.35	4,811.90	SO_2, TSP
4	East Side Reservoir	NMPC	11.0/6.8	39	379.40	4,811.25	SO_2[4], NO_2/NOx[5], TSP[4]
5	Dutch Ridge	NMPC	10.1/6.3	20	383.10	4,810.60	SO_2, NO_2/NOx[3], TSP
6	Fairdale Tap	NMPC	23.1/14.4	13	381.15	4,798.15	SO_2[4], TSP[4]
7	Fulton Jr. High School	NYSDEC	22.1/13.7	2	385.5	4,797.5	TSP, SP[6]
8	Oswego Post Office	NYSDEC	11.8/7.3	50	377.7	4,812.2	SO_2[7], TSP, SP
9	Oswego-Riley School	NYSDEC	11.3/7.0	41	379.0	4,811.3	SO_2[7], TSP

[1] See Figure 2.9-1.
[2] From the plant to the site.
[3] Data collection discontinued September 30, 1980.
[4] Data collection discontinued December 31, 1977.
[5] Data collection discontinued September 5, 1978.
[6] Settleable particulates.
[7] Data collection discontinued December 31, 1978.

TABLE 2.9-2

NEW YORK STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	New York State Standards[1]			Federal Standards: Primary		Federal Standards: Secondary	
		Level[2]	Concentration	Statistic[3]	Concentration	Statistic[3]	Concentration	Statistic[3]
SO_2	Annual	All	0.03 ppm	AM	80 ug/m^3 (0.03 ppm)	AM	-	-
	24 hr	All	0.14 ppm[4]	max	365 ug/m^3 (0.14 ppm)	max	-	-
	3 hr	All	0.50 ppm[5]	max	-	-	1,300 ug/m^3 (0.50 ppm)	max
CO	8 hr	All	9 ppm	max	10 mg/m^3 (9 ppm)	max	10 mg/m^3 (9 ppm)	max
	1 hr	All	35 ppm	max	40 mg/m^3 (35 ppm)	max	40 mg/m^3 (35 ppm)	max
Ozone (Photochemical oxidants)	1 hr	All	0.12 ppm[6]	max	235 ug/m^3 (0.12 ppm)	max	235 ug/m^3 (0.12 ppm)	max.
Hydrocarbons (Nonmethane)	3 hr (6-9 am)	All	0.24 ppm	max	160 ug/m^3 (0.24 ppm)	max	160 ug/m^3 (0.24 ppm)	max
NO_2	Annual	All	0.05 ppm	AM	100 ug/m^3 (0.05 ppm)	AM	100 ug/m^3 (0.05 ppm)	AM
TSP	Annual	IV	75 ug/m^3[7]	GM	75 ug/m^3	GM	60 ug/m^3[8]	GM
		III	65 ug/m^3[7]	GM	-	-	-	-
		II	55 ug/m^3[7]	GM	-	-	-	-
		I	45 ug/m^3[7]	GM	-	-	-	-
	24 hr	All	250 ug/m^3	max	260 ug/m^3	max	150 ug/m^3	max

TABLE 2.9-2 (Cont)

Pollutant	Averaging Period	New York State Standards[1]			Federal Standards			
					Primary		Secondary	
		Level[2]	Concentration	Statistic[3]	Concentration	Statistic[3]	Concentration	Statistic[3]
Settleable Particulates (Dustfall)	Annual	IV	0.60/0.90[9] $mg/cm^2/30$ days	-	-	-	-	-
		III	0.40/0.60[9] $mg/cm^2/30$ days	-	-	-	-	-
		II	0.30/0.45[9] $mg/cm^2/30$ days	-	-	-	-	-
		I	0.30/0.45[9] $mg/cm^2/30$ days	-	-	-	-	-
Lead	3 mo	All	[10]	-	1.5 ug/m^3	max	-	-

[1]New York State also has standards for beryllium, fluorides, and hydrogen sulfide.
[2]New York State has classified all land areas into four categories according to land use, with Level I as industry sparse and Level IV as heavy industry.
All except two of the nine monitoring sites analyzed are located in Level II areas.
The exceptions are Site 6 (located in a Level I area) and Site 8 (located in a Level III area).
[3]AM = arithmetic mean of 24-hr average concentrations.
max = not to be exceeded more than once per year (Ozone - not more than 1 day/yr).
GM = geometric mean of 24-hr average concentrations.
[4]Also, 99 percent of the values will not exceed 0.10 ppm.
[5]Also, 99 percent of the values will not exceed 0.25 ppm.
[6]Existing state standard of 0.08 ppm not yet officially revised by regulatory process.
[7]State standards also exist for 30-day, 60-day, and 90-day arithmetic means for enforcement only.
[8]As a guide to be used in assessing implementation plans to achieve 24-hr standard.
[9]On annual basis, 50th percentile/84th percentile.
Values at stated percentiles not to exceed values of standards.
[10]New federal standard for lead not yet officially adopted by New York State, but is currently being applied to determine compliance.

TABLE 2.9-3

SO_2-MONITORING RESULTS

Monitoring Site[1]	Monitoring Station	Annual Arithmetic Mean (ppm) 1976	1977	1978	1979	24-Hr Average (ppm) 1976 Max	1976 2nd	1977 Max	1977 2nd	1978 Max	1978 2nd	1979 Max	1979 2nd	1980[2] Max	1980[2] 2nd
1	Alcan	0.006[3]	0.005	0.007	0.006	0.024 (3/1)	0.022 (4/14)	0.036 (2/22)	0.032 (2/9)	0.032 (11/11)	0.027 (2/16)	0.056 (5/24)	0.055 (2/25)	0.029 (1/5)	0.028 (1/15)
2	Paloma	0.009	0.009	0.008	0.007	0.038 (12/19)	0.037 (1/6)	0.054 (2/9)	0.042 (1/24)	0.048 (2/16)	0.038 (2/17)	0.060 (2/20)	0.039 (1/7)	0.036 (6/24)	0.028 (6/25)
3	SUNY	0.007	0.005	0.006	0.007	0.031 (12/19)	0.024 (4/14)	0.036 (1/24)	0.033 (1/20)	0.029 (12/30)	0.028 (2/16)	0.058 (2/20)	0.039 (1/6)	0.039 (6/24)	0.031 (5/22)
4	East Side Reservoir	0.008	0.009[4]	-	-	- (4/14)	0.032 (12/19)	0.032 (2/8)	0.057 (2/9)	0.047	-	-	-	-	-
5	Dutch Ridge	0.009	0.009	0.008	0.006	0.034 (2/25)	0.033 (4/14)	0.063 (2/9)	0.048 (1/24)	0.043 (2/16)	0.037 (2/17)	0.054 (2/20)	0.045 (1/6)	0.034 (6/24)	0.030 (2/19)
6	Fairdale Tap	0.005	0.006	-	-	- (12/16)	0.029 (11/2)	0.025 (2/9)	0.054 (1/14)	0.044	-	-	-	-	-
8	Oswego Post Office[5]	0.010	0.012	0.018[3]	-	0.036	0.033	0.071	0.065	0.068	0.031	-	-	-	-
9	Oswego-Riley School[5]	0.002	0.003	0.003[3]	-	0.010	0.010	0.010	0.009	0.023	0.005	-	-	-	-

Monitoring Site[1]	Monitoring Station	3-Hr Average (ppm) 1976 Max	1976 2nd	1977 Max	1977 2nd	1978 Max	1978 2nd	1979 Max	1979 2nd	1980 Max	1980 2nd
1	Alcan	0.048 (5/9)	0.043 (3/1)	0.070 (3/8)	0.047 (1/30)	0.055 (11/12)	0.052 (11/12)	0.087 (1/7)	0.081 (5/25)	0.078 (9/17)	0.060 (4/24)
2	Paloma	0.078 (8/2)	0.058 (2/25)	0.075 (2/9)	0.067 (1/25)	0.059 (2/17)	0.056 (2/18)	0.085 (2/21)	0.075 (2/21)	0.052 (6/25)	0.047 (6/24)
3	SUNY	0.045 (12/19)	0.042 (12/16)	0.055 (1/25)	0.053 (2/3)	0.047 (11/6)	0.037 (2/17)	0.079 (2/20)	0.074 (2/21)	0.066 (6/25)	0.054 (6/25)
4	East Side Reservoir	0.048 (12/16)	0.043 (12/20)	0.075 (2/8)	0.074 (2/9)	-	-	-	-	-	-

TABLE 2.9-3 (Cont)

Monitoring Site[1]	Station	3-Hr Average (ppm) 1976 Max	1976 2nd	1977 Max	1977 2nd	1978 Max	1978 2nd	1979 Max	1979 2nd	1980 Max	1980 2nd
5	Dutch Ridge	0.057 (2/26)	0.054 (4/1)	0.106 (8/25)	0.082 (2/9)	0.063 (8/14)	0.059 (6/4)	0.136 (7/27)	0.081 (1/7)	0.136 (7/27)	0.057 (6/25)
6	Fairdale Tap	0.061 (12/16)	0.040 (7/20)	0.075 (2/9)	0.067 (1/25)	-	-	-	-	-	-
8	Oswego Post Office[5]	-	-	-	-	-	-	-	-	-	-
9	Oswego-Riley School[5]	-	-	-	-	-	-	-	-	-	-

[1]See Figure 2.9-1.
[2]January through June only.
[3]Based on less than 75 percent data.
[4]Data capture below guideline for computation of averages.
[5]This data is presented for comparison only, as it is based on manual West-Gaeke bubbler sampling procedures. SO_2 monitoring discontinued December 31, 1978.

SOURCES: Reference 3

Reference 4

TABLE 2.9-4

TSP-MONITORING RESULTS

Monitoring		Annual Geometric Mean (ug/m³)				24-Hr Average (ug/m³)							
						1977		1978		1979		1980[2]	
Site[1]	Station	1976	1977	1978	1979	Max	2nd	Max	2nd	Max	2nd	Max	2nd
1	Alcan	36	46	44.2	42.9	201 (6/6)	168 (3/14)	115.2 (4/26)	113.1 (5/26)	157.0 (3/22)	81.4 (7/20)	249.2 (3/28)	174.4 (6/26)
2	Paloma	27	30	29.1	32.7	81 (4/13)	72 (5/31)	97.4 (5/26)	82.6 (11/4)	103.6 (3/22)	77.6 (6/8)	100.3 (3/4)	77.1 (6/26)
3	SUNY	26	32	29.9	35.1	139 (5/19)	118 (4/19)	79.5 (11/4)	74.7 (5/20)	92.2 (3/22)	69.3 (2/20)	104.8 (6/26)	78.5 (5/3)
4	East Side Reservoir	25	27[3]	-	-	75 (4/13)	65 (8/29)	-	-	-	-	-	-
5	Dutch Ridge	24	24	24.3	30.7	87 (4/13)	71 (5/31)	70.1 (7/7)	64.0 (7/19)	77.1 (6/8)	61.5 (5/9)	267.5 (3/10)	180.6 (4/27)
6	Fairdale Tap	31	35	-	-	93 (4/13)	84 (4/19)	-	-	-	-	-	-
7	Fulton Jr. High School	28	33	26	24	103	97	102	94	76	53	-	-
8	Oswego Post Office	33	33	-	33	89	78	81	75	114	101	103	97
9	Oswego-Riley School	27	25	19	24	-	-	69	59	61	59	98	73

(1) See Figure 2.9-1.
(2) January through June only.
(3) Data capture below EPA guidelines.

SOURCES: Reference 3

Reference 4

TABLE 2.9-5

NO_2-MONITORING RESULTS

Monitoring Site[1]	Monitoring Station	Annual Arithmetic Mean (ppm) 1976	1977	1978	1979
1	Alcan	0.009	0.011	0.011	0.014
4	East Side Reservoir	0.009	0.012	0.011[2]	[3]
5	Dutch Ridge	-	-	0.010	0.007

[1] See Figure 2.9-1.
[2] Based on less than 75 percent data.
[3] Data collection discontinued September 5, 1978.

SOURCE: Reference 4

TABLE 2.9-6

SETTLEABLE PARTICULATES-MONITORING DATA

Monitoring Site[1]	Station	Annual Arithmetic Mean (mg/cm²/mo) 1976	1977	1978	1979[2]	Monthly (30-day) Average (mg/cm²/mo) 1976 Max	1976 2nd	1977 Max	1977 2nd	1978 Max	1978 2nd	1979 Max	1979 2nd
7	Fulton Jr. High School	0.22	0.27	0.26	-	0.36	0.34	0.47	0.43	0.50	0.38	0.43	0.38
8	Oswego Post Office	0.21	0.23	0.19	-	0.35	0.31	0.37	0.36	0.33	0.31	0.49	0.25

Site	Station	Percent of Observations 1976 >0.30	1976 >0.40	1976 >0.45	1976 >0.60	1977 >0.30	1977 >0.40	1977 >0.45	1977 >0.60	1978 >0.30	1978 >0.40	1978 >0.45	1978 >0.60	1979 >0.30	1979 >0.40	1979 >0.45	1979 >0.60
7	Fulton Jr. High School	-	-	-	-	36	27	9	0	36	9	9	0	2[3]	1	0[3]	0
8	Oswego Post Office	-	-	-	-	33	0	0	0	18	0	0	0	1	1	1	0

[1]See Figure 2.9-1.
[2]Sampling terminated during 1979.
[3]Insufficient data available to determine compliance.

SOURCE: Reference 3

TABLE 2.9-7

OZONE-MONITORING RESULTS

NYSDEC Station Number	NYSDEC Station Name	Annual Arithmetic Mean (ppm)				1-Hr Average (ppm)								Days with Maximum Hourly Average Greater than 0.12 ppm			
						1976		1977		1978		1979					
		1976	1977	1978	1979	Max	2nd	Max	2nd	Max	2nd	Max	2nd	1976	1977	1978	1979
3301-06	Syracuse	0.022	0.025	0.024	*	0.134	0.134	0.141	0.136	0.133	0.129	0.056	0.056	1	1	1	0
3301-19	Syracuse	-	-	-	-	-	-	-	-	-	-	0.141	0.132	-	-	-	2
3301-08	Syracuse Downtown	0.017	0.019	0.021	0.021	0.119	0.109	0.126	0.118	0.140	0.140	0.135	0.118	1	1	3	1

*Reception of valid data from original Syracuse location ceased in March 1979. Monitor relocated to new sampling site on same property and resumed operation in April 1979 as Site No. 3301-19.

SOURCE: Reference 3

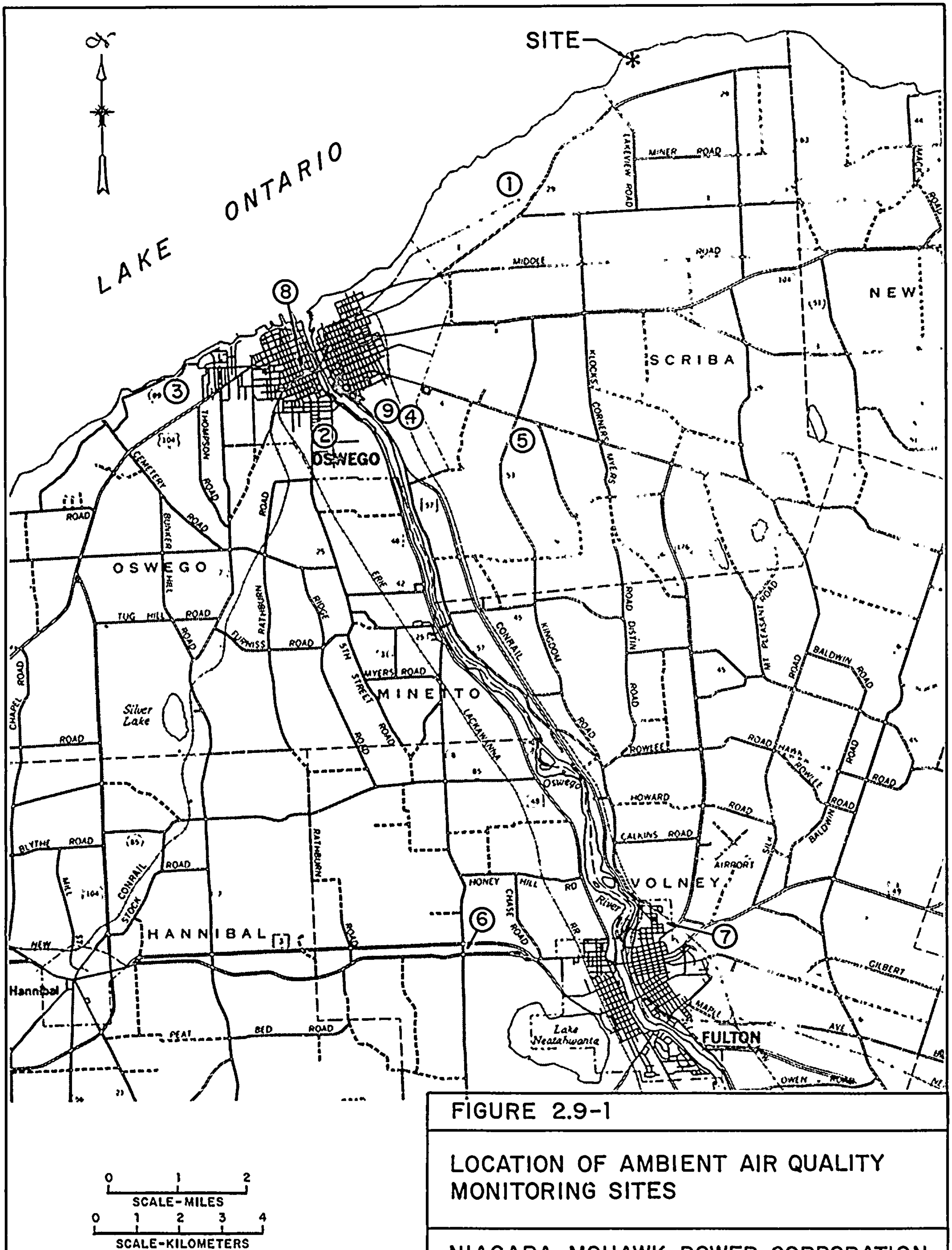

FIGURE 2.9-1

LOCATION OF AMBIENT AIR QUALITY MONITORING SITES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

2.10 NOISE

2.10.1 Site Characteristics

The Unit 2 site is located on the shore of Lake Ontario, approximately 10 km (6.2 mi) northeast of the city of Oswego. This location presently contains two operating nuclear power plants: Niagara Mohawk Power Corporation's (NMPC) Nine Mile Point Unit 1 (Unit 1) and the Power Authority of the State of New York's (PASNY) James A. FitzPatrick (JAF) plant.

The area surrounding the Nine Mile Point site consists of a generally rural environment with a low population density. Most of the permanent residences in the area are located along the main roads surrounding the site. Homes located along the shoreline of Lake Ontario include both year-round permanent homes and summer cottages. The Ontario Bible Conference Camp, located on Lake Ontario at the western boundary of the power plant site, contains several year-round homes which constitute the nearest residential area to Unit 1 (1,311 m [4,300 ft]). To the east of the power plant site, the dwellings located at the intersection of Lake Road and Route 29 are the nearest residences (approximately (1,143 m [3,750 ft]) to the JAF plant. The largest concentration of permanent year-round homes within a 4.8-km (3-mi) radius of the power plant site is located in the Lycoming area, 2,972 m (9,750 ft) southeast of Units 1 and 2, and 2,743 m (9,000 ft) from the JAF plant.

In general, the region surrounding the Nine Mile Point site consists of mostly wooded areas with some open fields and farmland. In addition to the power stations, the only other industrial complex in the area is the Alcan Aluminum Company located approximately 5.1 km (3.2 mi) west of the power plant site. Except for the traffic associated with the construction of Unit 2, the traffic in the area surrounding the site is relatively light. As a result of these factors, the land use in the area surrounding the Nine Mile Point site is relatively homogeneous, and the ambient noise levels throughout the area are expected to be quite similar.

In order to define the existing acoustical environment of the Nine Mile Point area, ambient sound level measurements were obtained at a number of locations within a 4.8-km (3-mi) radius of the power plant site. Since the ambient noise environment surrounding the site was expected to be relatively homogeneous, the primary criterion used in selecting the noise measurement sites was that they represent the ambient noise environment around the boundary of the power plant site. As a result, nine measurement

sites were selected, and their locations are shown on Figure 2.10-1 and described in Table 2.10-1. For the most part, the noise measurement sites were located near residential areas. Sites 1, 2, 3, and 4 were selected as the primary noise-monitoring sites because they define the ambient noise environment at the four corners of the power plant property line. The secondary sites (5, 6, 8, and 9) essentially fill in the open areas surrounding the site, while Site 7, located approximately 4.0 km (2.5 mi) from the power plant site, was selected because it was on a hill overlooking the entire power plant facility. Further description of monitoring site selection is given in Section 6.7.1.

2.10.2 Ambient Sound Levels

The Nine Mile Point ambient noise survey was conducted during a 5-day period between September 27 and October 1, 1979. Except for 1 day of rain (September 28) during which no noise data were obtained (because of the effects of moisture on the noise measurement equipment), the weather conditions were favorable for taking noise measurements. The wind was relatively calm during the entire measurement period, minimizing the noise impact of wind in the trees.

In order to adequately define the ambient noise levels in the Nine Mile Point area, a series of both daytime and nighttime noise measurements was obtained at each of the nine noise-monitoring sites. The primary unit of measure was the L_{90} or residual sound level, defined as the noise level that is exceeded 90 percent of the time. The residual level is that sound level measured in the absence of any intermittent local noise sources, such as passing automobiles or barking dogs. The residual level can be considered the baseline noise level below which ambient sound levels rarely drop.

Table 2.10-2 presents the ranges of the residual sound levels measured at each of the nine noise-monitoring sites. This table contains the hourly L_{90} levels obtained directly from the automatic community noise analyzer (CNA) which was used over a 24-hr period at Sites 1, 2, 3, and 4, as well as the L_{90} levels obtained from a 50-sample hand-held statistical noise measurement procedure used at all nine sites. Also included in this table are the A-weighted sound levels calculated from the residual (or minimum) octave band data as taken, and with the high-frequency cricket noise removed. Section 6.7.1 contains a detailed description of the noise measurement equipment and the data collection

methodology used during the ambient noise survey. A review of the data contained in Table 2.10-3 indicates that the residual noise levels in the Nine Mile Point area range between 30 and 50 dBA.

The residual octave band data obtained at each of the noise-monitoring sites indicated that the residual ambient sound levels were dominated by cricket noise during the survey. As a result, changes in the level of activity of the crickets generally produced significant variations in the ambient noise levels. Because of the cricket noise, power plant noise from Unit 1 and the JAF plant was inaudible at all noise-monitoring sites during the daytime hours. It was only during the nighttime hours, when the impact of the cricket noise as well as the general level of activity in the area appeared to be somewhat reduced, that the power plant noise (primarily ventilation and transformer noise) was audible or just barely audible at all noise-monitoring sites.

By removing the cricket noise from the residual octave band data and recalculating the A-weighted noise level at each site, it was possible to estimate the ambient noise levels without the impact of the cricket noise. A comparison of the dBA ambient noise levels obtained from the residual octave band data indicated that during the daytime hours the impact of the cricket noise generally added 4 to 11 dBA to the ambient noise data. At Sites 3 and 9, which were located in taller grass, the crickets added as much as 20 dBA to the ambient noise levels. However, during the nighttime hours, when the level of activity of the crickets appeared to be somewhat reduced, the cricket noise added only 2 to 5 dBA at Sites 1, 2, 4, 5, and 9 and as much as 7 to 13 dBA at the other noise-monitoring sites. The ambient noise levels contained in column 6 of Table 2.10-2 are therefore representative of the ambient noise levels expected in the Nine Mile Point area during the winter months when the crickets are inactive. These data also indicate that once the impact of the cricket noise has been removed from the data, there is very little site-to-site variation in the ambient noise levels, indicating that the acoustical environment of the Nine Mile Point area is relatively homogeneous.

Table 2.10-3 contains a summary of the hand-held statistical noise measurements obtained at each site along with the date and time of each noise measurement. In addition, the data at each site are divided into daytime and nighttime measurement periods so that the noise impact from any man-made noise sources, which generally tend to occur during the

daytime hours, can be assessed. The hand-held statistical noise data, which consisted of a series of 50-dBA weighted sound level measurements, were used to obtain the L_{90}, L_{50}, L_{10}, L_{eq}, L_{min}, and L_{max} statistical descriptors that define the existing acoustical environment of the area surrounding the Nine Mile Point site. The L_{min} and L_{max} are the minimum and maximum dBA levels measured during each sampling period. The L_{eq} levels presented in this table were calculated from the 50 hand-held dBA readings and represent the equivalent constant dBA sound level that has the same total sound energy as the fluctuating noise levels actually measured during the sampling period.

Table 2.10-3 also contains the corresponding dBA noise level calculated from the residual octave band data measured during each sampling period. The residual octave band sound levels are the minimum repeatable sound level readings obtained in each of the eight octave bands (63, 125, 250, 500, 1k, 2k, 4k, and 8k Hz) in the absence of any intermittent local noise sources, such as passing vehicles or barking dogs.

Figures 2.10-2 through 2.10-5 contain the time history plots (hourly values) of the statistical noise data (L_{eq}, L_{10}, and L_{90}) obtained from the automatic, continuously monitoring CNAs located at the primary noise-monitoring sites (1, 2, 3, and 4). For convenience and uniformity with the data obtained at the other three sites, only the first 24-hr noise-monitoring period is presented for Site 1. Because of a malfunction with the external battery power-pack, only about 10 hr of noise data were obtained at Site 2. The remaining noise data stored in the memory of the CNA were lost when the main internal power supply became too low and the emergency external battery-pack apparently did not automatically switch on. For clarity, the L_{50} levels, which were also obtained from the CNA data, have been omitted from these plots. From the data at Site 1, it can be seen that the ambient (L_{90}) noise levels range between 37 and 43 dBA. At Site 2, the ambient noise levels range between 32 and 36 dBA, at Site 3 between 40 and 48 dBA, and at Site 4 between 30 and 38 dBA. However, most of these site-to-site variations are primarily due to the impact of the crickets which was shown to dominate the ambient noise levels in the Nine Mile Point area. These figures also contain a comparison of the hand-held L_{90} statistical data and the corresponding hourly L_{90} level obtained from the CNA. These comparisons show very good agreement (generally 1 to 3 dBA), considering the differences in time duration over which the L_{90} levels were obtained (1 hr for the CNA data versus just over 4 min for the statistical hand-held data).

A comparison of the L_{eq} and L_{10} levels with the L_{90} level can be used to determine the level of activity at each site. The statistical hourly noise data obtained at Site 1, located in a relatively quiet area (the Ontario Bible Conference Camp), show very little additional noise impact above the measured ambient (L_{90}) noise levels. The same is true at Site 3, between 1800 and 0700 hr. However, the increase in the L_{eq} and L_{10} levels obtained during the other times of the day correspond with the increased levels of activity expected during the daylight hours. Sites 3 and 4 show a much larger impact in the measured ambient (L_{10}) noise levels. However, this impact is primarily due to the effect of relatively light traffic which tends to be the dominant manmade noise source in the Nine Mile Point area.

2.10.3 Federal and State Standards

There are currently no environmental noise regulations applicable to the operation of nuclear generating facilities. However, community noise guidelines have been established by such agencies as the Environmental Protection Agency (EPA) and the Department of Housing and Urban Development (HUD).

The Joint Working Paper for the Preparation of Environmental Reports for Generating Facilities in New York State[1], prepared by the NRC and the New York State Public Service Commission, does not specify allowable noise emission levels, but references the EPA's document on noise levels[2] and HUD's Circular 1390.2[3] as providing suggested levels that should be used as a guideline for license review and environmental impact assessment. The circular also contains criteria to be used in assessing noise impacts. The HUD criteria were established as departmental guidelines for review of publicly funded housing projects to ensure that the acoustical environment of the proposed site is adequately addressed. However, the HUD criteria have evolved into a widely used guideline for evaluating predicted noise levels from new facilities. HUD has established four categories of external (outdoor) noise exposure:

1. Clearly Unacceptable - exceeds 80 dBA for more than 1 hr or exceeds 75 dBA for more than 8 hr in any 24-hr period.

2. Discretionary (Normally Unacceptable) - exceeds 65 dBA for more than 8 hr in any 24-hr period.

3. Discretionary (Normally Acceptable) - does not exceed 65 dBA for more than 8 hr in any 24-hr period.

4. Clearly Acceptable - does not exceed 45 dBA for more than 30 min in any 24-hr period.

In its 1974 publication of the Levels Document[2], the EPA identifies an L_{dn} of 55 dBA as "adequate to protect the public against hearing loss, activity interference, and annoyance outdoors in residential areas, farms and other outdoor areas where people spend widely varying amounts of time and other places in which quiet is a basis for use." The 55 dBA L_{dn} (day/night) level is the A-weighted energy average sound level with a 10 dBA correction added to the nighttime levels. It is equivalent to a constant sound level of 49 dBA.

2.10.4 References

1. Nuclear Regulatory Commission and New York State Public Service Commission. Joint Working Paper for the Preparation of Environmental Reports for Generating Facilities in New York State, August 1977.

2. Environmental Protection Agency, Office of Noise Abatement and Control. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, 550/9-74-004, Washington, DC, March 1974.

3. Department of Housing and Urban Development. Noise Abatement and Control: Departmental Policy, Implementation Responsibilities, and Standards, Department Circular 1390.2, Washington, DC, September 1971.

TABLE 2.10-1

NINE MILE POINT AMBIENT NOISE SURVEY
NOISE MEASUREMENT LOCATIONS

Site No.	Location
1	Located at the end of Lakeview Road along the shore of Lake Ontario at the Ontario Bible Conference Camp. This site was located at the western boundary of the power plant property line, approximately 1.6 km (1 mi) from Units 1 and 2.
2	Located on Lakeview Road near the southwest corner of the power plant property line, approximately 2.4 km (1.5 mi) from Units 1 and 2.
3	Located on Miner Road approximately 137 m (450 ft) from the intersection of Route 29 southwest of the power plants, approximately 2.9 km (1.8 mi) from Units 1 and 2 and 2.7 km (1.7 mi) from the JAF plant.
4	Located on Lake Road at the intersection of Parkhurst Road east of the power plants, approximately 2.4 km (1.5 mi) from Units 1 and 2 and 1.6 km (1 mi) from the JAF plant.
5	Located along Lake Ontario east of the power plant site, approximately 2.7 km (1.7 mi) from Units 1 and 2 and 1.8 km (1.1 mi) from the JAF plant.
6	Located on Route 29 along the eastern boundary of the power plant site approximately 0.3 km (0.2 mi) from the intersection of Lake Road, 1.9 km (1.2 mi) from Units 1 and 2, and 1.3 km (0.8 mi) from the JAF plant.
7	Located on North Road approximately 4.0 km (2.5 mi) south of the power plant site. This location was selected because it was on a hill overlooking the entire power plant facility.
8	Located west of the power plant site just off Lake Road (130 m/425 ft), approximately 2.2 km (1.4 mi) from Units 1 and 2 and 3.1 km (1.9 mi) from the JAF plant.

TABLE 2.10-1 (Cont)

Site No.	Location
9	Located on Miner Road directly south of the power plants, approximately 2.4 km (1.5 mi) from Units 1 and 2 and 2.7 km (1.7 mi) from the JAF plant. This site was selected because it was approximately 244 m (800 ft) from the main transformer lines leading away from Unit 1.

TABLE 2.10-2

NINE MILE POINT RESIDUAL SOUND LEVELS

Site No.	Measurement Period (hr)	dBA Levels for L_{90} Community Noise Analyzer	dBA Levels for L_{90} Hand-Held Statistical Data	dBA Levels Calculated from Residual Octave Band Data With Crickets	dBA Levels Calculated from Residual Octave Band Data Without Crickets
1	Day 0700-2200	37-43	38-44	39-44	35-36
	Night 2200-0700	34-42	34-40	34-40	33-36
2	Day 0700-2200	32-36	34-40	35-42	27-33
	Night 2200-0700	35-36	30-34	32-35	31-32
3	Day 0700-2200	40-48	46-48	48-49	29-32
	Night 2200-0700	45-47	44-50	45-49	32-36
4	Day 0700-2200	31-38	38-44	38-46	35-37
	Night 2200-0700	30-32	32-40	34-40	27-35
5	Day 0700-2200	-	40-46	41-48	37
	Night 2200-0700	-	30-40	31-40	28-37
6	Day 0700-2200	-	36-46	37-44	32-33
	Night 2200-0700	-	38-40	38-41	29-31
7	Day 0700-2200	-	42	41	29
	Night 2200-0700	-	42	42	34
8	Day 0700-2200	-	44-46	44-49	35-38
	Night 2200-0700	-	38	42	31
9	Day 0700-2200	-	44-48	44-50	31-36
	Night 2200-0700	-	32-42	34-41	31-38

TABLE 2.10-3

NINE MILE POINT AMBIENT NOISE SURVEY

Site No.	Measurement Period	Date	Time (hr)	Statistical Summary Data from Hand-Held Noise Measurements (dBA Levels)						dBA Levels from Octave Band Data		Power Plant Noise
				L_{eq}	L_{10}	L_{50}	L_{90}	L_{min}	L_{max}	With Crickets	Without Crickets	
1	Day	9/27	1300	41	42	40	38	38	46	39	36	
		9/29	1600	45	46	44	44	44	46	44	35	
	Night	9/27	2200	42	44	42	40	40	48	40	36	
		9/29	2240	36	38	34	34	32	40	34	33	Clearly audible
		9/30	0200	42	42	42	40	40	42	40	35	Clearly audible
2	Day	9/27	1700	35	36	34	34	32	38	35	27	
		9/29	1525	54	58	42	40	40	68	42	33	
	Night	9/29	2220	34	34	34	34	32	34	35	32	Clearly audible
		9/30	0230	50	50	32	30	30	66	32	31	Clearly audible
3	Day	9/27	1400	50	52	48	46	46	62	48	32	
		9/29	1700	50	52	50	48	48	64	49	29	
	Night	9/27	2320	50	50	50	50	48	50	49	36	Just barely audible
		9/28	0325	35	36	34	32	32	40	-	33	Audible
		9/30	0010	46	48	46	44	44	50	45	32	
4	Day	9/27	1520	40	42	40	38	38	42	38	37	
		9/29	1330	56	56	48	44	44	70	46	35	
	Night	9/27	2350	49	54	42	40	40	62	40	35	
		9/28	0155	39	40	38	38	36	40	37	35	Clearly audible
		9/30	0120	34	34	34	32	32	36	34	27	Just barely audible
5	Day	9/28	1600	41	42	40	40	38	42	41	37	
		9/29	1410	48	50	48	46	46	50	48	37	
	Night	9/28	0120	40	40	40	40	38	42	40	37	Clearly audible
		9/30	0050	31	34	30	30	30	34	31	28	Just barely audible
6	Day	9/27	1800	57	62	48	46	46	72	44	33	
		9/29	1430	66	50	38	36	36	83	37	32	
	Night	9/28	0350	41	42	42	40	36	42	38	31	Clearly audible
		9/30	0030	56	56	40	38	36	69	41	29	Audible

TABLE 2.10-3 (Cont)

Site No.	Measurement Period	Date	Time (hr)	Statistical Summary Data from Hand-Held Noise Measurements (dBA Levels) L_{eq}	L_{10}	L_{50}	L_{90}	L_{min}	L_{max}	dBA Levels from Octave Band Data With Crickets	Without Crickets	Power Plant Noise
7	Day	9/29	1730	53	54	42	42	40	69	41	29	
	Night	9/30	0300	43	44	42	42	42	44	42	34	Just barely audible
8	Day	9/27	1730	45	46	46	44	44	48	44	35	
		9/29	1545	48	50	48	46	46	52	49	38	
	Night	9/29	2305	47	50	42	38	38	60	42	31	Clearly audible
9	Day	9/27	1830	46	48	44	44	40	50	44	36	
		9/29	1510	57	54	50	48	48	72	50	31	
	Night	9/27	2300	45	48	44	42	40	50	41	38	
		9/28	0410	42	44	42	38	38	48	38	36	Clearly audible
		9/29	2325	34	34	34	32	32	36	34	31	Clearly audible

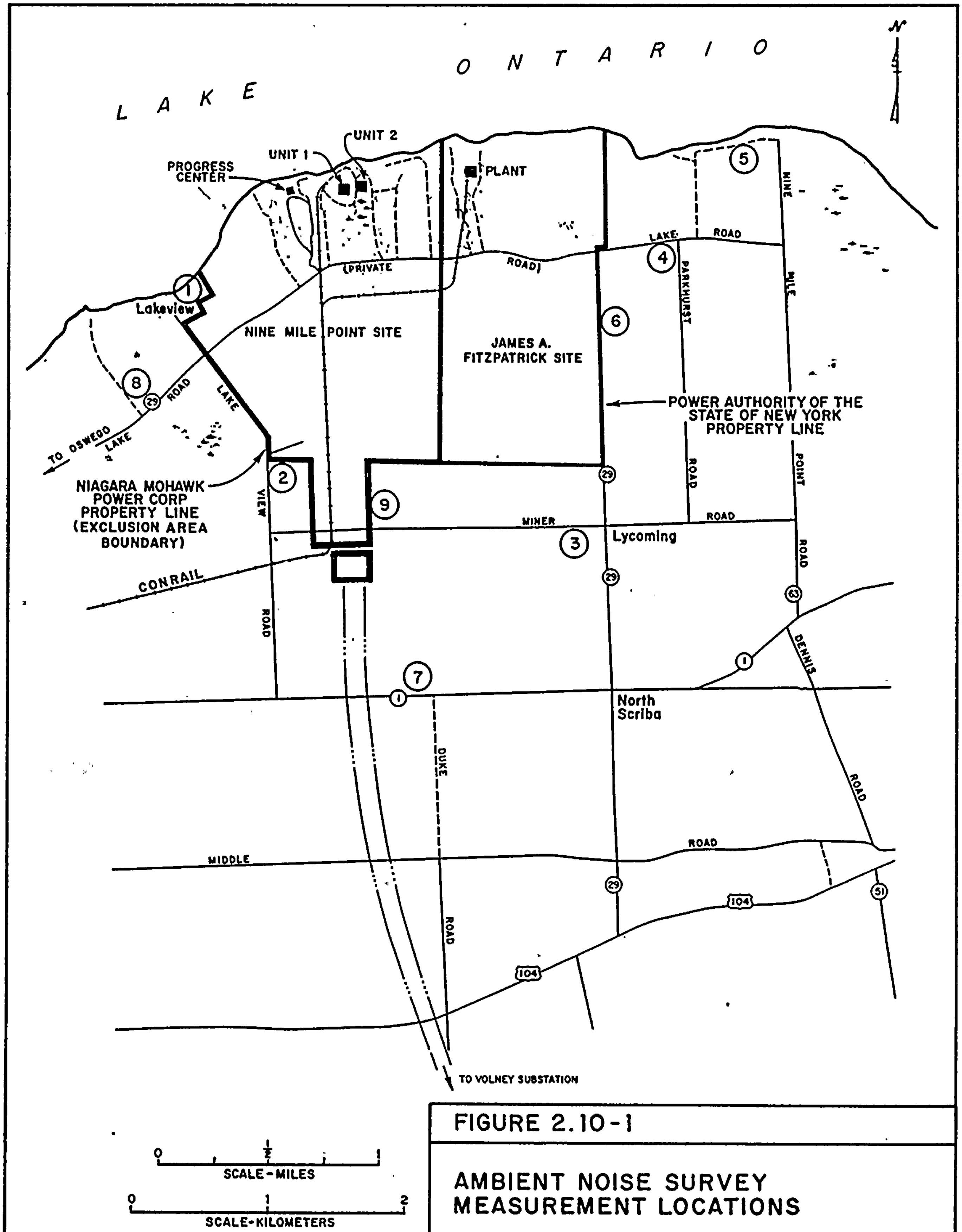

FIGURE 2.10-1

AMBIENT NOISE SURVEY MEASUREMENT LOCATIONS

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

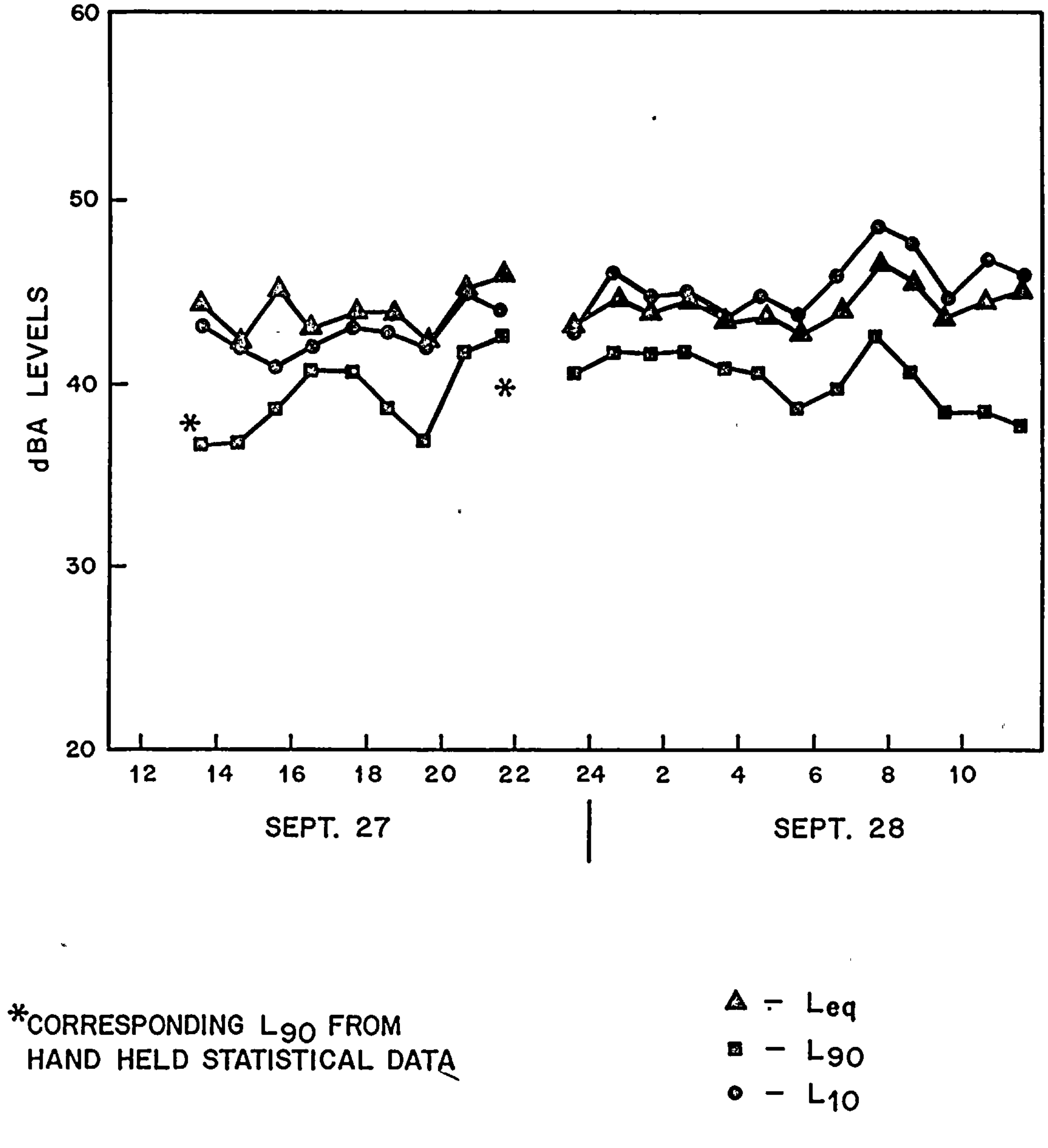

FIGURE 2.10-2

AMBIENT NOISE SURVEY CNA
HOURLY STATISTICAL NOISE DATA
SITE No. 1

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

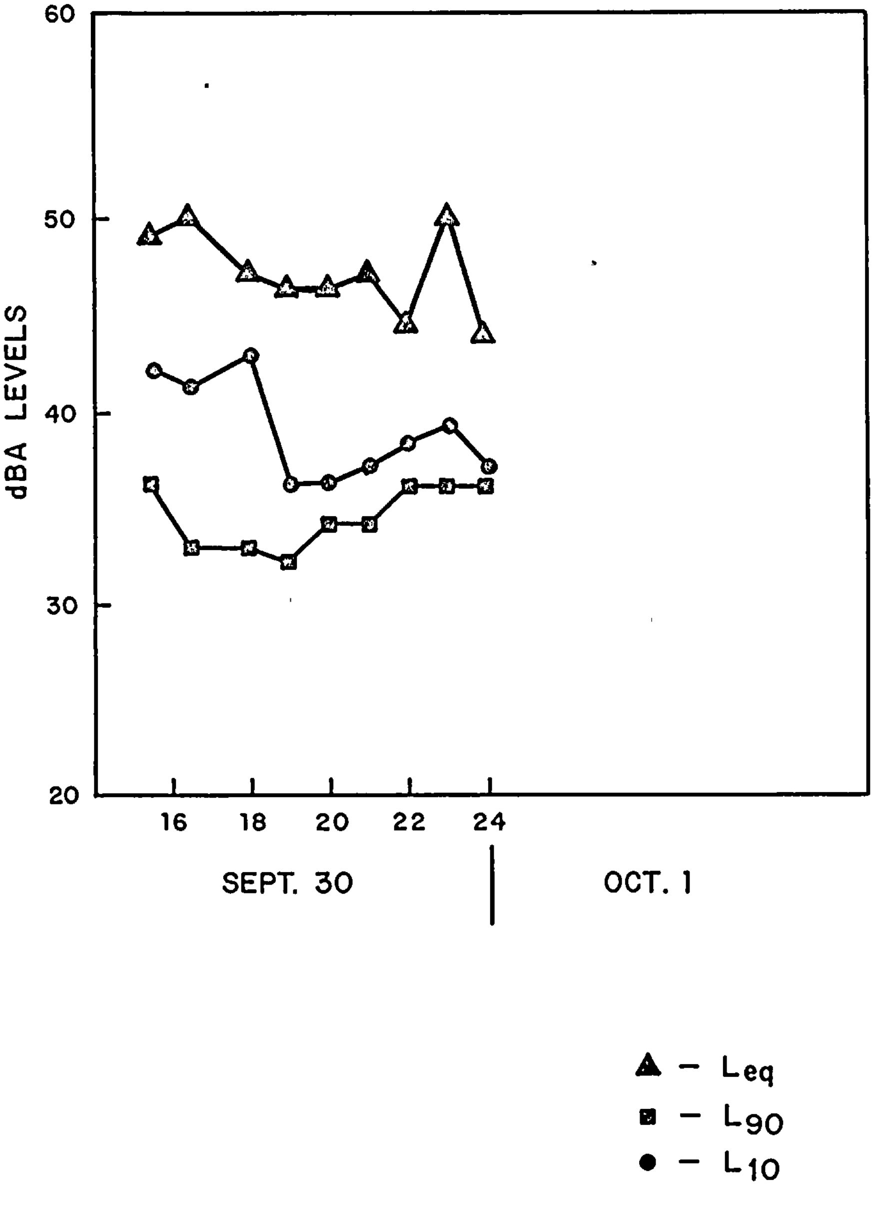

FIGURE 2.10-3

AMBIENT NOISE SURVEY CNA
HOURLY STATISTICAL NOISE DATA
SITE No. 2

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

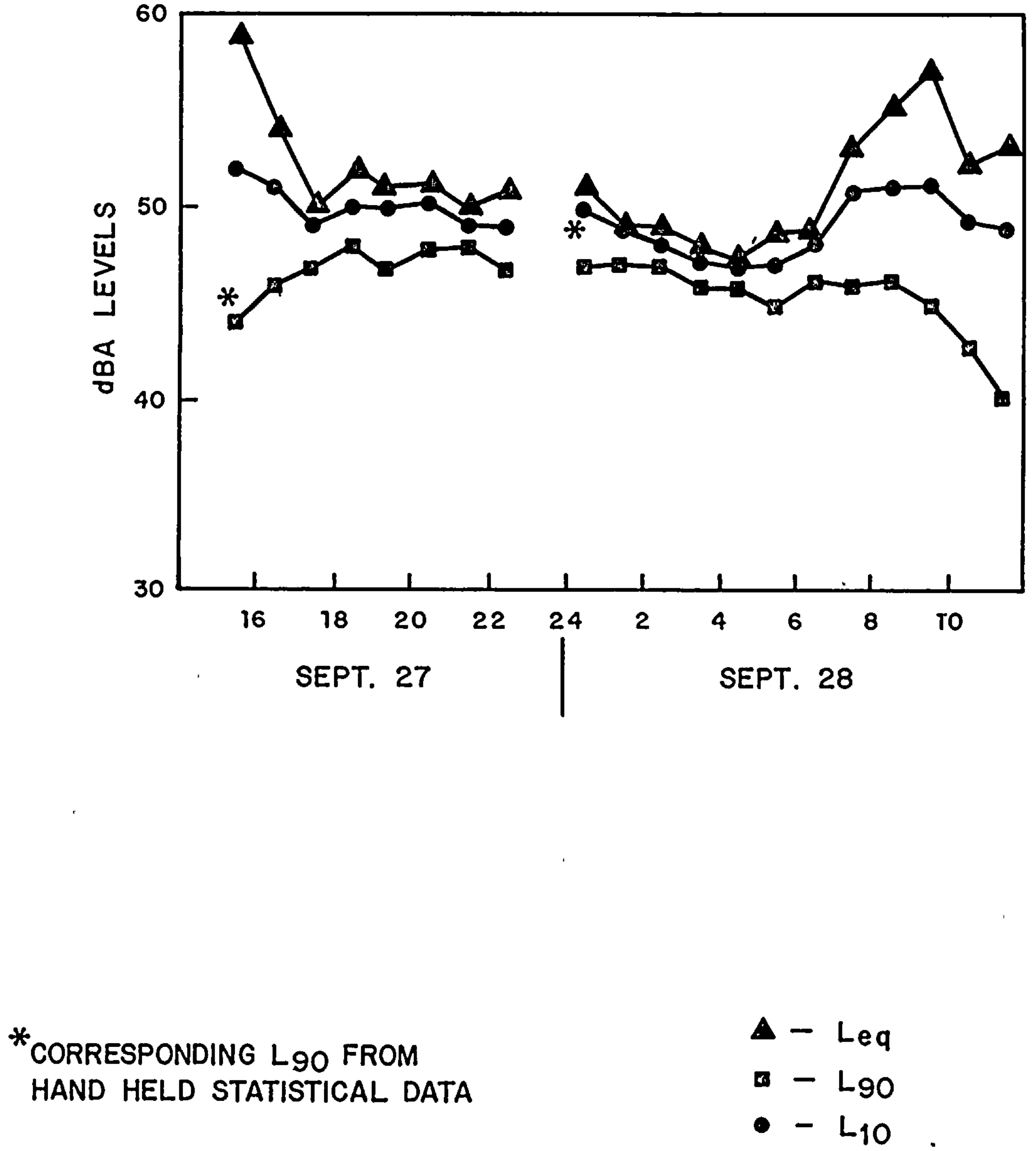

FIGURE 2.10-4

AMBIENT NOISE SURVEY CNA
HOURLY STATISTICAL NOISE DATA
SITE No. 3

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

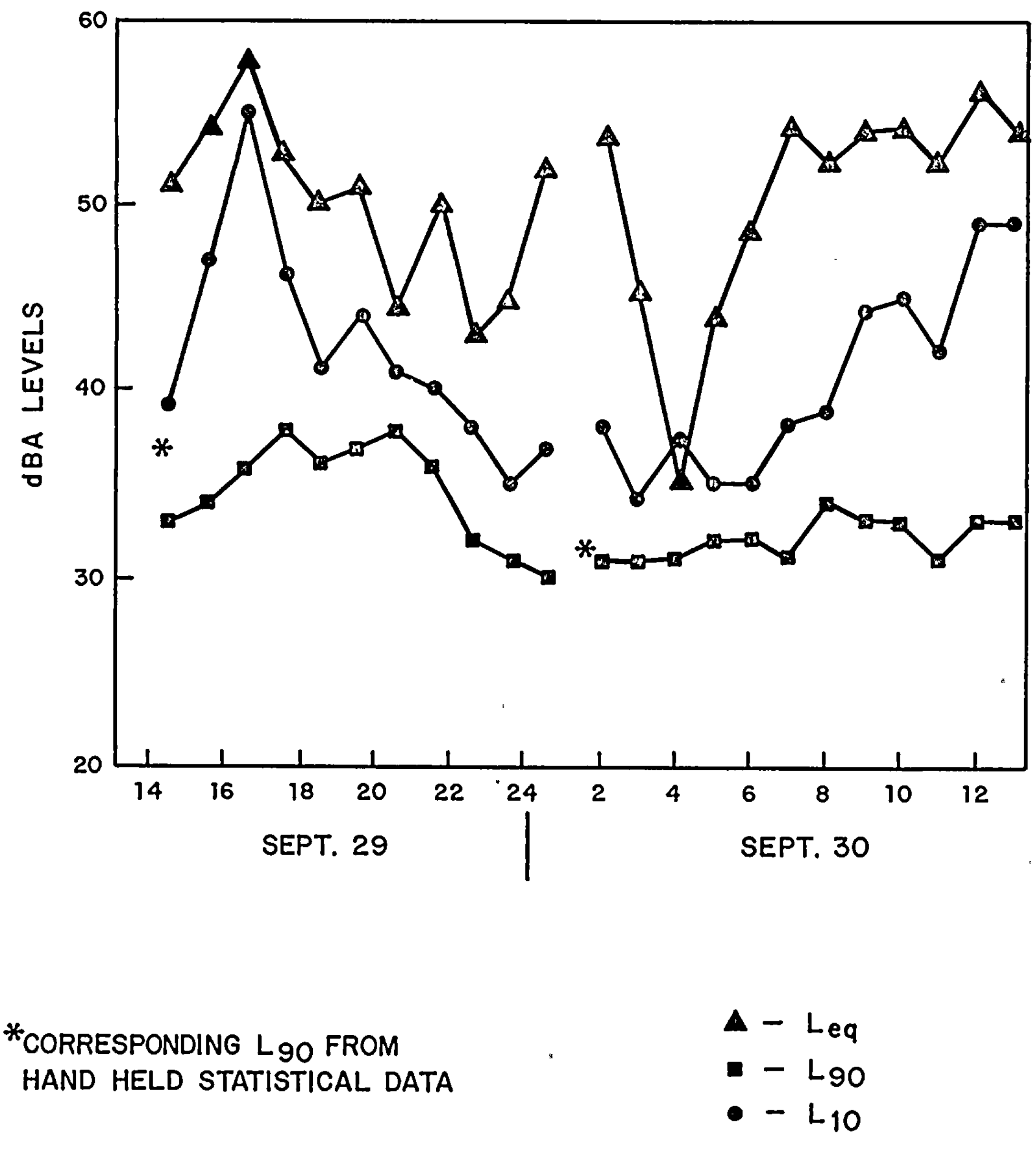

FIGURE 2.10-5

AMBIENT NOISE SURVEY CNA
HOURLY STATISTICAL NOISE DATA
SITE No. 4

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

CHAPTER 3

PLANT DESCRIPTION

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CHAPTER 3

PLANT DESCRIPTION

3.1 EXTERNAL APPEARANCE AND PLANT LAYOUT

3.1.1 Description of the Project

Unit 2 is located between Nine Mile Point Unit 1 (Unit 1) and the James A. FitzPatrick (JAF) plant. The major station structures of Unit 2 are connected to the Unit 1 station structures by a passageway. Unit 2 follows the basic visual character of Unit 1 through the use of compatible color treatment and similar materials, including concrete and metal siding.

The reactor building, natural-draft cooling tower, and main stack dominate the skyline. The reactor building has a drum-like cap sheathed in fluted metal siding that contrasts with the lower concrete portion. The exposed surface of the lower portion of the reactor building, the cooling tower, and the stack are cast-in-place concrete that is untextured and natural in color. Tanks and open metal frame structures, such as transmission towers and switchyards, are protected with corrosion-resistant coatings.

Permanent station roads and parking areas are asphalt paved. An existing railroad line extends to the Unit 2 reactor building and turbine building (Figure 3.1-1) to provide rail freight access.

The site is landscaped to blend with the surrounding natural topography, consistent with security requirements. Land previously cleared and excavated during construction of adjacent power stations has been utilized during construction of Unit 2 for temporary office facilities, laydown area, switchyard and parking areas, thus minimizing the additional excavation around the station structures. At the conclusion of construction activities, the majority of this area, except for some office facilities and portions of parking areas, will be graded and seeded to promote the return of vegetative cover. To control erosion in areas not planted with trees or shrubs, ground cover of either lawn or crushed stone is provided.

The Energy Information Center, located in the northwest portion of the site, is a contemporary stone and glass ranch-style structure used for public education and is a tourist attraction. Here, a three-part show is offered on

nuclear electric power, the growth of energy in upstate New York, the story of Niagara Mohawk Power Corporation (NMPC) and the Power Authority of the State of New York (PASNY), and the operation of Unit 1. This show includes a working scale model of the plant and a nuclear fission display. There are also energy exhibits, nature trails, and picnic areas on the bluffs overlooking Lake Ontario.

Figure 3.1-1 presents the station layout, including major structures, buildings, and important roads. The baseline site topography, including baseline and proposed contours and landscaping around the structures, is shown on Figure 3.1-2. Figure 3.1-3 shows the location and elevation of release points for gaseous wastes. Figures 3.1-4 through 3.1-7 present ground-level photographs of the site from different locations. Figure 3.1-8 shows an architectural rendering of the plant.

3.1.2 Ground-Level Photographs of Site

To assess visual impact, visually sensitive and intensive land uses (e.g., residential concentrations, major transportation routes, state and local historic sites, and recreational attractions) within 10 km (6.2 mi) of Unit 2 were identified. Properties listed in the National Register of Historic Places were identified within 16 km (10 mi) of the Unit 2 site. Visually sensitive locations were visited in late October, when foliage density was lower than at other times of the year. Sites surveyed for potential visual impact are identified and described in Table 3.1-1 and shown on Figure 3.1-9.

Surveys began with reconnaissance of all viewing locations. Photographs were taken in the direction of Unit 2 at locations from which distant views were possible. Where plant structures would be clearly visible within 10 km (6.2 mi), plant perspectives, based on distance and direction from photograph locations, were provided by computer and superimposed on the photographs. These visual perspectives are presented on Figures 3.1-4 through 3.1-7.

As discussed in Section 2.2.1, Unit 2 is located in a region of predominantly rural residential, agricultural, and forest land uses. The potential for visual impact of the plant is minimized by the remoteness of the site. Vegetation and topography screen or block views of the plant at most visually sensitive areas. In addition, since the industrial character of the area has already been established by Unit 1 and the JAF plant, the change in visual quality associated with Unit 2 is marginal. Unit 2 will not significantly im-

pact the overall visual quality of the area. The view of the cooling tower will be the only noticeable change.

The cooling tower is 165 m (541 ft) above ground level and is visible at some locations, as shown for selected locations on Figures 3.1-4 through 3.1-7. Depending on meteorological conditions, the natural-draft cooling tower will emit evaporative plumes that may be visible from locations within the 16-km (10-mi) area. Expected visible plume occurrences are described in Section 5.3.3.1, and predicted frequency of plume occurrences are shown on Figures 5.3-1 through 5.3-25. The anticipated plumes for 5-percent, 1-percent, and 0.1-percent occurrences at selected locations are shown on Figures 3.1-4 through 3.1-7, and an analysis of their visual impacts is presented in Section 5.8.1.1. The plume occurrence denotes the maximum extent of plume that is visible for a certain percent of time, as shown on the figures.

Starting in April and continuing through September, when recreational activities on the lake and along the shoreline are frequent, the cooling tower will be visible from the shoreside by fishermen, recreational users, and others at facilities such as the Ontario Bible Conference Association Camp (a lakefront facility bordering the site on the west).

Cooling tower plumes are not expected to have a significant visual impact. Most visually sensitive sites, listed in Table 3.1-1, are located in vegetated or developed areas, specifically within the city of Oswego. Therefore, distant views that might include the plume are not possible from these sites. However, at locations along the shoreline at elevated grades, such as Fort Ontario (Figure 3.1-7), plumes may be visible.

The visual impact of Unit 2 is minimal due to the limited number of locations from which the plant is visible, the lack of visibility from many visually sensitive or intensive land use areas, and the small portion of plant structures that can be seen above the surrounding vegetation.

3.1.3 Architectural Rendering of the Plant

Figure 3.1-8 shows an architectural rendering of the Unit 2 facility, including all major station features and landscaping whether actually completed or planned.

TABLE 3.1-1

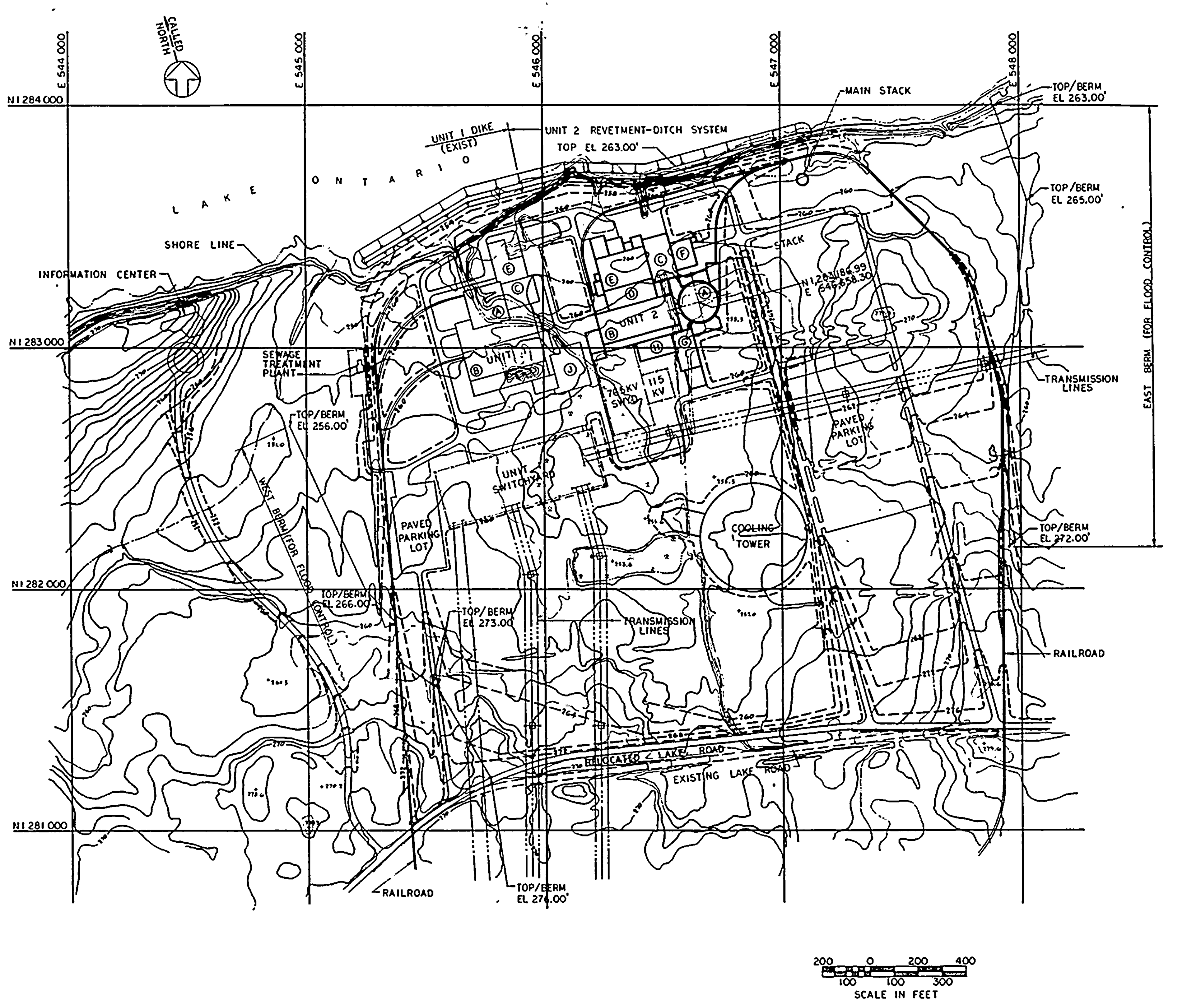
VISUALLY SENSITIVE AND INTENSIVE LAND USE AREAS
IN THE VICINITY OF UNIT 2

Map ID Number[1]	Location	Approximate Distance/Direction from Unit 2 (km)	Land Use	Station Facilities: Not Visible or Partially Visible[2]	Station Facilities: Visible
1	Lakeview Development	1.4/WSW	Residential concentration	X	
2	Intersection of NYS Route 29 and Lake Road	1.8 ESE	Transportation route link		X
3	Intersection of Miner Road and railroad site spur	2.4/S	Transportation route link		X
4	Lycoming	3.1/SE	Residential concentration	X	
5	Nine Mile Point Development	2.7/E	Residential concentration	X	
6	North Scriba	4.0/SSE	Residential concentration	X	
7	Shore Oaks Development	4.4/E	Residential concentration	X	
8	Hammonds Corner, intersection of US 104 and NYS 29	5.6/SSE	Residential concentration and transportation route link	X	
9	Scriba, US 104 and Creamery Road	6.2/SSW	Residential concentration and transportation route link	X	
10	Jones Corner, NYS 51A and NYS 29	7.0/SSE	Residential concentration and transportation route link	X	
11	Audubon Sanctuary	3.2/E	Recreational attraction	X	
12	Demster Grove Campground	8.3/ESE	Recreational attraction	X	
13	New Haven, intersection of US 104 and NYS 6	9/ESE	Residential concentration and transportation route link	X	
14	North Road	3.8/S	Transportation route link		X
15	Ontario Bible Conference Camp	1.6/SW	Church facility	X	
16	Scriba Town Park	9.1/S	Recreational attraction	X	

TABLE 3.1-1 (Cont)

Map ID Number[1]	Location	Approximate Distance/Direction from Unit 2 (km)	Land Use	Station Facilities: Not Visible or Partially Visible[2]	Station Facilities: Visible
17	New Haven Town Park	8.7/ESE	Recreational attraction	X	
18	Fort Ontario and Park	10.0/SW	National Register of Historic Places		X
19	Oswego Speedway	8.5/SW	Recreational attraction		X
20	Oswego Beach	14.9/WSW	Recreational attraction		X
21	Oswego City Library	10.8/SW	National Register of Historic Places	X	
22	Oswego Market House	11.0/SW	National Register of Historic Places	X	
23	Richardson-Bates House	10.8/SW	National Register of Historic Places	X	
24	U.S. Custom House	11.2/SW	National Register of Historic Places	X	
25	Walton and Willett Stone House (presently known as Cahill's Fish Market)	10.5/SW	National Register of Historic Places	X	
26	Oswego Harbor	10.8/SW	Lake Ontario port	X	
27	Spy Island	12.3/E	Of historic interest	X	
28	Arthur Tavern	13.2/ESE	Of historic interest	X	
29	Fruit Valley Community	15/SW	Of historic interest	X	
30	Oswego City Hall	11.2/SW	National Register of Historic Places	X	
31	Sheldon Hall	12.8/SW	National Register of Historic Places	X	

(1) Map ID numbers refer to Figure 3.1-9.
(2) Indicates not visible or lack of clear visibility due to vegetative screening or only visible from certain vantage points.



IDENTIFICATION LEGEND

- A REACTOR BUILDING
- B TURBINE BUILDING
- C RADWASTE BUILDING
- D HEATER BAYS
- E SCREENWELL BUILDING
- F CONDENSATE STORAGE TANK BLDG
- G CONTROL BUILDING
- H NORMAL SWITCHGEAR BUILDING
- J ADMINISTRATION BUILDING

LEGEND

- ORIGINAL GROUND CONTOUR
- NEW GROUND CONTOUR
- FENCE LINE

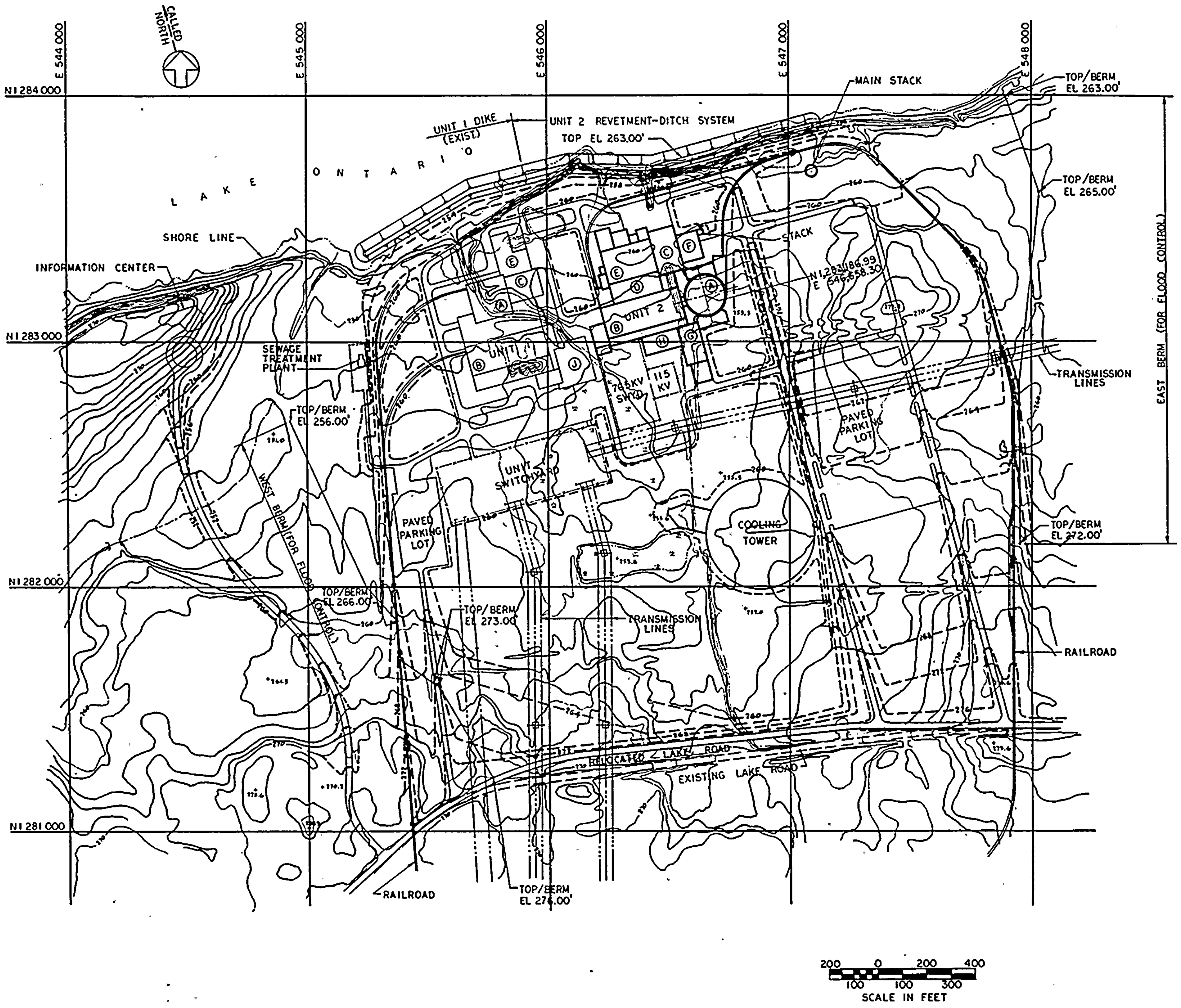
NOTES

1. GRID COORDINATES REFER TO NEW YORK STATE COORDINATE SYSTEM
2. ELEVATIONS REFER TO MEAN SEA LEVEL
3. ORIGINAL CONTOUR INTERVAL - 2 FEET

FIGURE 3.1-1

STATION LAYOUT

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



IDENTIFICATION LEGEND

A	REACTOR BUILDING
B	TURBINE BUILDING
C	RADWASTE BUILDING
D	HEATER BAYS
E	SCREENWELL BUILDING
F	CONDENSATE STORAGE TANK BLDG
G	CONTROL BUILDING
H	NORMAL SWITCHGEAR BUILDING
J	ADMINISTRATION BUILDING

LEGEND

- ORIGINAL GROUND CONTOUR
- NEW GROUND CONTOUR
- FENCE LINE

NOTES

1. GRID COORDINATES REFER TO NEW YORK STATE COORDINATE SYSTEM
2. ELEVATIONS REFER TO MEAN SEA LEVEL
3. ORIGINAL CONTOUR INTERVAL – 2 FEET

FIGURE 3.1-2

SITE PLAN

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

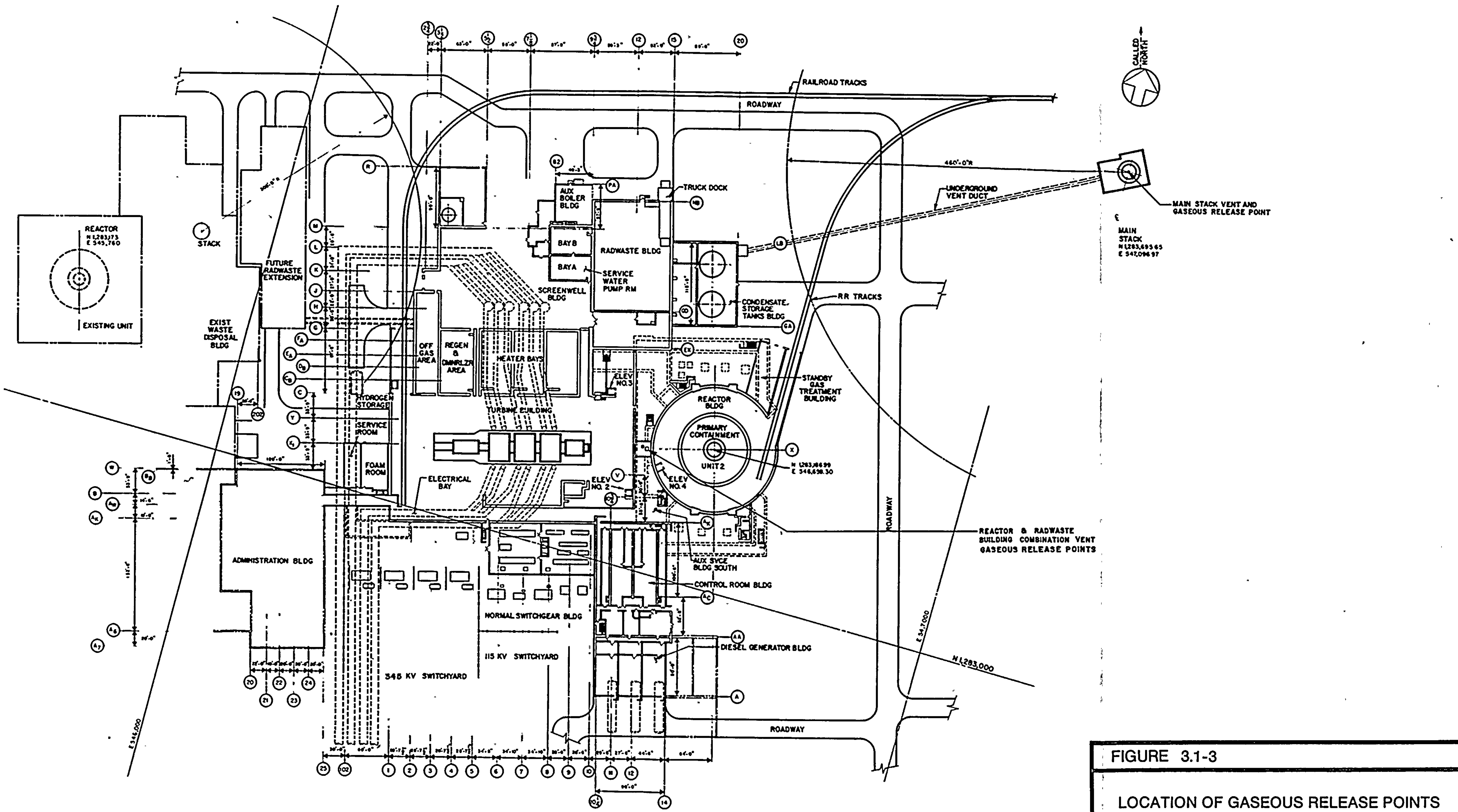
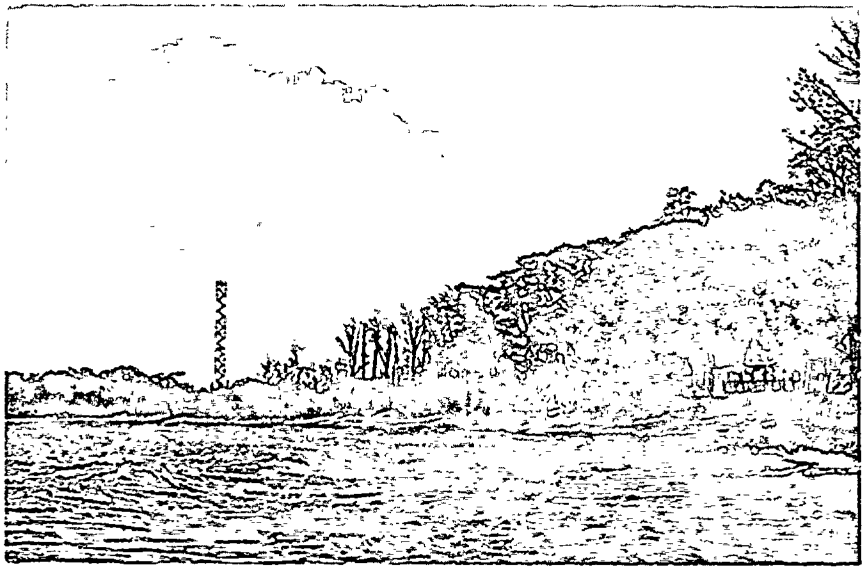


FIGURE 3.1-3

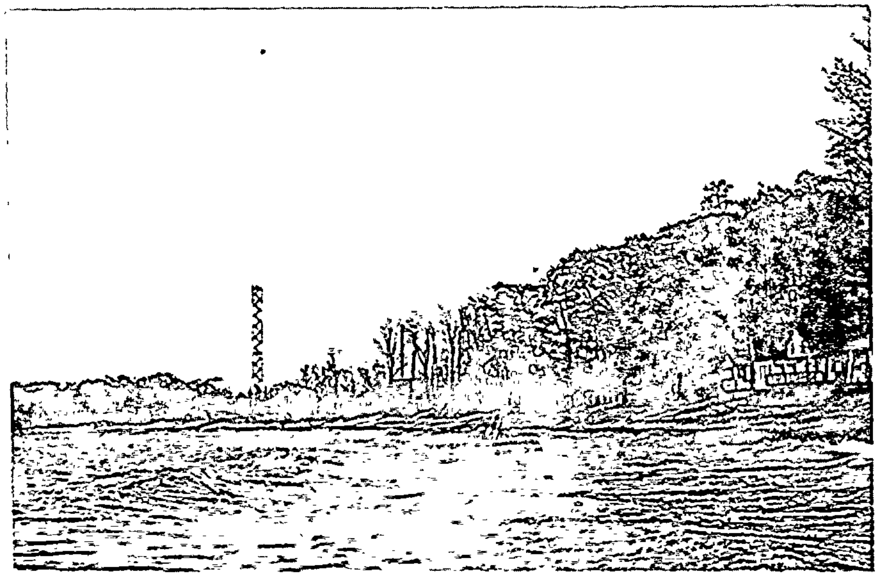
LOCATION OF GASEOUS RELEASE POINTS

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



A

PLUME OCCURRENCE 1%



B

PLUME OCCURRENCE 5%

PHOTO LOCATION 1, LAKEVIEW DEVELOPMENT OFF LAKEVIEW ROAD IS LOCATED APPROXIMATELY 1.4 km WEST-SOUTHWEST OF NINE MILE POINT UNIT 2. THE RESIDENTIAL CONCENTRATION QUALIFIES THIS SITE AS AN INTENSIVE LAND USE LOCATION.

PLUME OCCURRENCES, DEPENDENT ON SPECIFIC METEOROLOGICAL CONDITIONS, ARE SHOWN ON THE PHOTOGRAPHS AS ANTICIPATED FOR 1% AND 5% OCCURRENCE. REFER TO SECTION 5.3.3.1 FOR A DISCUSSION OF THE EXTENT AND FREQUENCY OF PLUME OCCURRENCE.

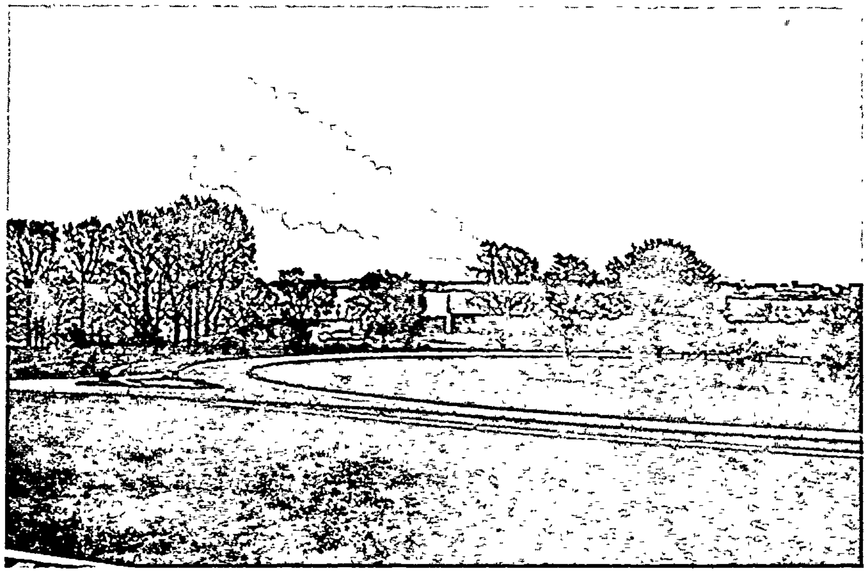
FIGURE 3.1-4

SIMULATED VIEW FROM LAKEVIEW DEVELOPMENT

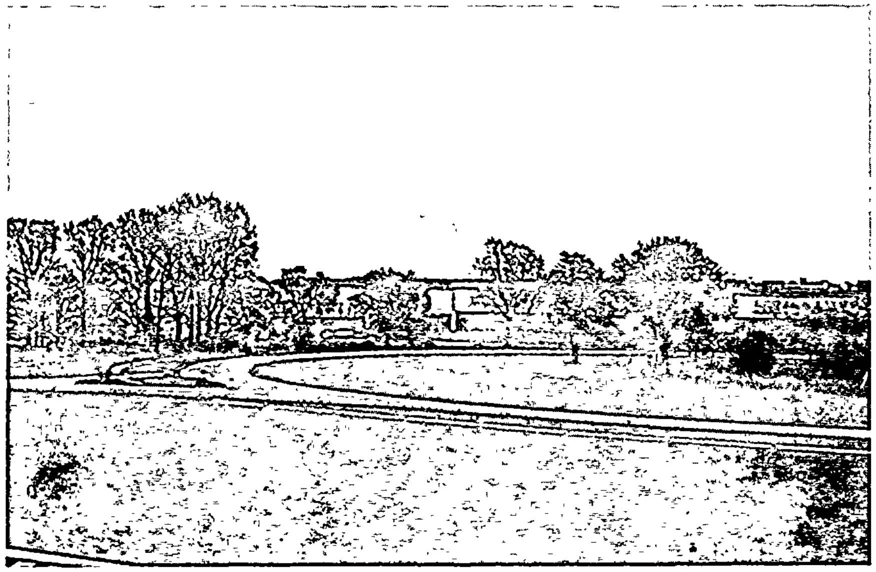
NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT-UNIT 2

ENVIRONMENTAL REPORT-OLS



A
PLUME OCCURRENCE 0.1%



B
PLUME OCCURRENCE 1%

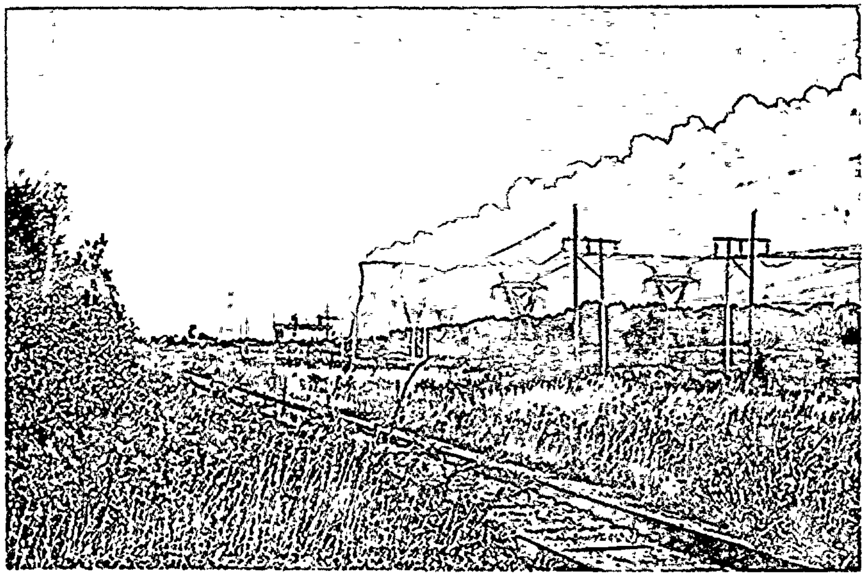
PHOTO LOCATION 4, FORT ONTARIO, IS LOCATED APPROXIMATELY 10 km SOUTHWEST OF NINE MILE POINT UNIT 2. FORT ONTARIO IS LISTED IN THE NATIONAL REGISTER OF HISTORIC PLACES WHICH QUALIFIES THIS SITE AS AN INTENSIVE LAND USE LOCATION.

PLUME OCCURRENCES, DEPENDENT ON SPECIFIC METEOROLOGICAL CONDITIONS, ARE SHOWN ON THE PHOTOGRAPHS AS ANTICIPATED FOR 0.1% AND 1% OCCURRENCE. REFER TO SECTION 5.3.3.1 FOR A DISCUSSION OF THE EXTENT AND FREQUENCY OF PLUME OCCURRENCE.

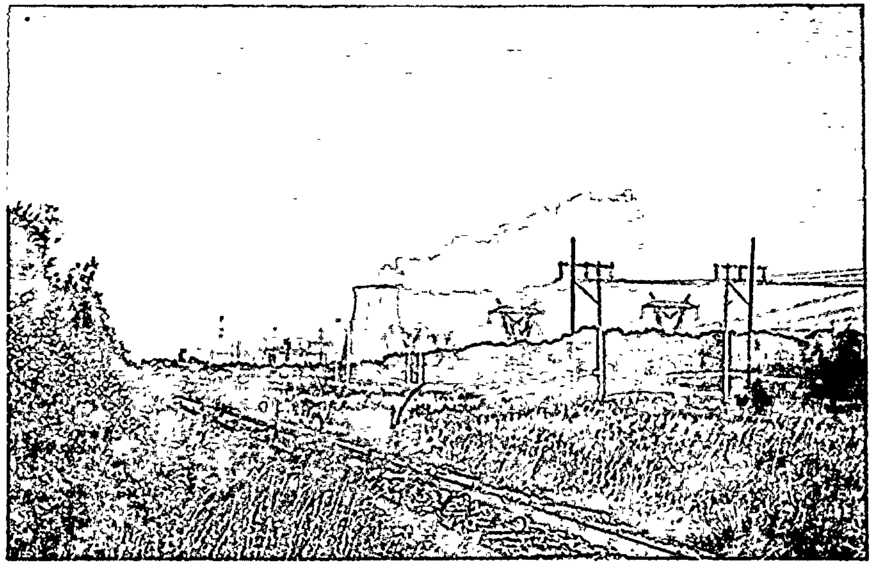
FIGURE 3.1-5

SIMULATED VIEW FROM FORT ONTARIO

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



A
PLUME OCCURRENCE 1%



B
PLUME OCCURRENCE 5%

PHOTO LOCATION 2, THE INTERSECTION OF MINER ROAD AND THE CONRAIL RAILROAD SPUR, IS LOCATED APPROXIMATELY 2.4 km SOUTH OF NINE MILE POINT UNIT 2. MINER ROAD SERVES AS A TRANSPORTATION LINK WHICH QUALIFIES IT AS AN INTENSIVE LAND USE LOCATION.

PLUME OCCURRENCES, DEPENDENT ON SPECIFIC METEOROLOGICAL CONDITIONS, ARE SHOWN ON THE PHOTOGRAPHS AS ANTICIPATED FOR 1% AND 5% OCCURRENCE. REFER TO SECTION 5.3.3.1 FOR A DISCUSSION OF THE EXTENT AND FREQUENCY OF PLUME OCCURRENCE.

FIGURE 3.1-6

SIMULATED VIEW FROM MINER ROAD & RAILROAD

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

A

PLUME OCCURRENCE 0.1%

B

PLUME OCCURRENCE 0.5%

C

PLUME OCCURRENCE 1%

PHOTO LOCATION 3, A POINT ALONG NORTH ROAD, IS LOCATED APPROXIMATED 3.8 Km SOUTH OF NINE MILE POINT UNIT 2. AS NORTH ROAD SERVES AS A MAJOR TRANSPORTATION ROUTE IN THE AREA, AS WELL AS A RESIDENTIAL STREET IT QUALIFIES AS AN INTENSIVE LAND USE LOCATION.

PLUME OCCURRENCES, DEPENDENT ON SPECIFIC METEOROLOGICAL CONDITIONS, ARE SHOWN ON THE PHOTOGRAPHS AS ANTICIPATED FOR 0.1%, 0.5% AND 1% OCCURRENCE. REFER TO SECTION 5.3.3.1 FOR A DISCUSSION OF THE EXTENT AND FREQUENCY OF PLUME OCCURRENCE

FIGURE 3.1-7

SIMULATED VIEW FROM NORTH ROAD

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

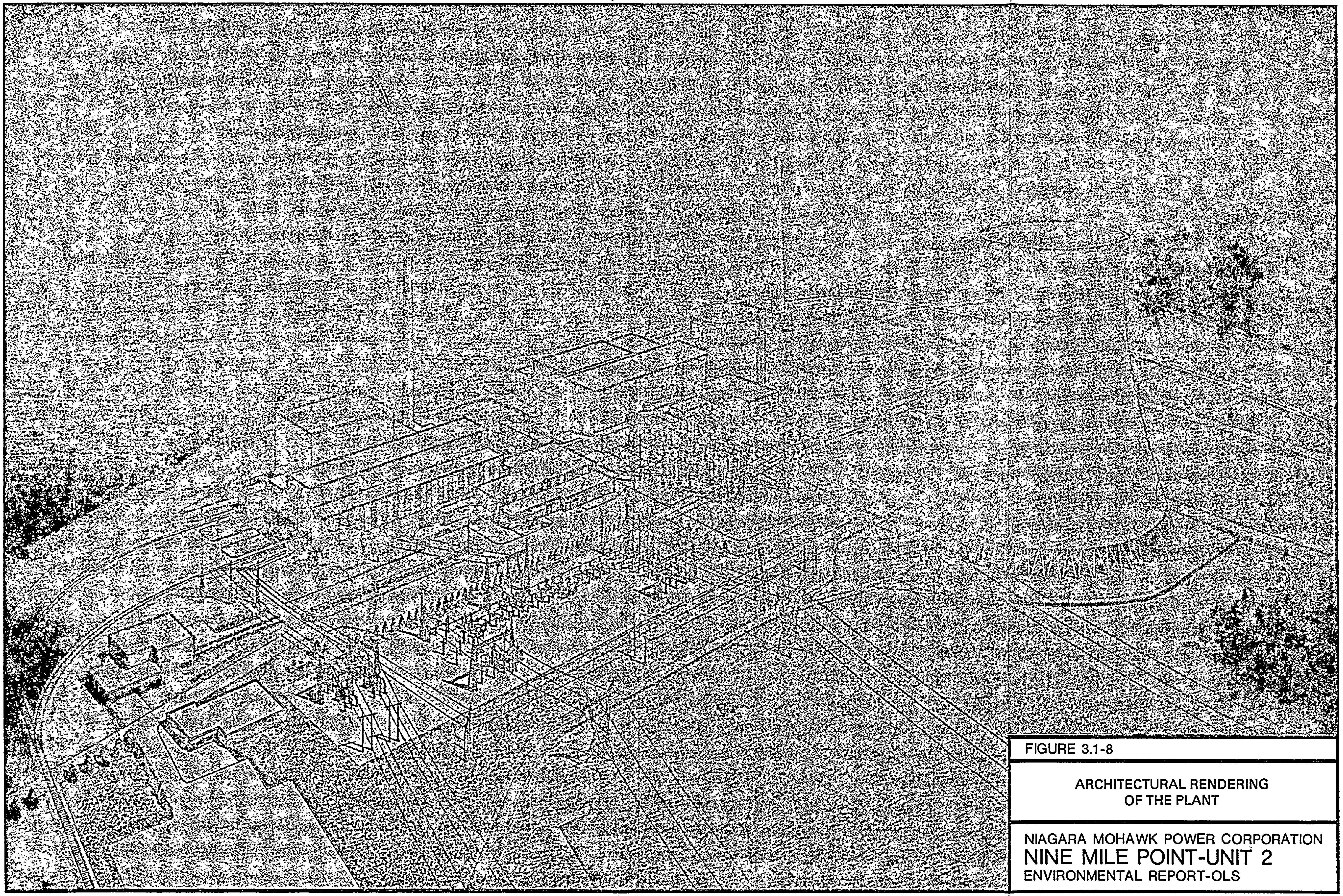


FIGURE 3.1-8

ARCHITECTURAL RENDERING
OF THE PLANT

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

3.2 REACTOR STEAM-ELECTRIC SYSTEM

3.2.1 Number of Units and Description of Reactor

Unit 2 utilizes a boiling water nuclear steam-generating system manufactured by the General Electric Company (GE), with a rated core thermal power of 3,323 MW. The electrical output of the turbine generator is approximately 1,100 MW. The unit is designed and constructed by Stone & Webster Engineering Corporation (SWEC). The principal components are the turbine generator and nuclear steam-generating system. The major components and operation of a boiling water reactor (BWR) power station are shown diagrammatically on Figure 3.2-1.

The BWR is a direct-cycle, light water moderated, thermal reactor. Heat is produced in the reactor vessel by the fission of Uranium-235, which is contained within 764 fuel assemblies in the reactor core.

Each fuel assembly contains 62 fuel rods and 2 "water rods" arranged in an 8 by 8 fuel rod configuration. A fuel rod is a Zircaloy-2 clad tube that contains fuel pellets composed of UO_2 stacked vertically in the tube. Fuel enrichment varies from initial core to subsequent reload cores. For the initial core, three average fuel bundle enrichments are utilized, with an initial average enrichment of 1.88 percent Uranium-235. The anticipated initial core irradiation is approximately 9,600 MWd/short ton. The weight of UO_2 in the core is approximately 349,000 lb (158,300 kg).

Water enters the reactor from the feedwater system and is circulated through the core, where it receives heat from the fission reaction and vaporizes into steam. The steam is directed through moisture separators and steam dryers in the top of the reactor vessel. The water also serves as a moderator to slow the fast neutrons emitted during fission to the thermal range, where they can be captured by Uranium-235 to continue the fission process.

The reactor vessel is fabricated from low-alloy steel, the interior of which is clad with stainless steel. It has an inside diameter of 251 in (638 cm) and an overall height of approximately 74 ft (22.5 m). The top head is flanged and removable for access to the core for refueling and servicing. The bottom head is fixed and contains penetrations for the 185 control rod drive (CRD) mechanisms that position control rod blades within the core.

Two reactor recirculation pumps take suction from the annulus between the core region and the reactor vessel wall and return flow to nozzles on the reactor vessel that are connected to a total of 10 pairs of internal jet pumps. The high-velocity water flowing from the jet pump nozzle entrains the balance of the feedwater flow and directs it to the plenum at the bottom of the vessel as coolant for the reactor core.

The CRD system is composed of 185 CRD mechanisms with hydraulic control units, each servicing a control rod within the core. The system uses a double-acting hydraulic piston which uses water supplied from the condensate system as the operating fluid. The drive mechanisms can position the rods at intermediate increments over the entire core length, thus allowing selection of the desired thermal neutron flux pattern within the core. Nitrogen-charged accumulators provide stored energy for rapid insertion (scram) of the control rod.

Reactor water quality is maintained by the reactor water cleanup system, which removes fission products, corrosion products, and other soluble and insoluble impurities. Reactor water to be processed is taken from the suction side of each of the two reactor water recirculation pumps and from the bottom of the reactor pressure vessel. The temperature of the water is reduced to 120°F by first passing the water through the tube side of the regenerative heat exchanger and then through the tube side of the nonregenerative heat exchanger. After filtration and deionization by the filter/demineralizer units, the water is reheated when passed through the shell side of the regenerative heat exchanger and returned to the reactor vessel by way of the feedwater system.

The filter/demineralizer units are a pressure precoat type, with holding elements coated with Solka-Floc and powdered ion exchange resins that serve as filter media and a demineralizing agent, respectively. Upon exhaustion, backwashing, and storage for radioactive decay, the precoat is conveyed to the radwaste system for disposal.

The residual heat removal (RHR) system removes both decay heat and sensible heat from the reactor water within the nuclear boiler system during reactor shutdown. The shutdown cooling mode has the capability of reducing the reactor vessel to a temperature of 125°F, including draining and flushing, in approximately 20 hr after the control rods are inserted for shutdown and then maintaining the water at this temperature or lower (FSAR Section 5.4.7). The reactor

water is taken from one of the reactor water recirculation loops, pumped through the RHR heat exchangers, and returned to the reactor vessel via the reactor water recirculation loop. Flow from the RHR system during the shutdown cooling mode can be diverted to the spray nozzle located above the core in the reactor vessel to condense steam while the vessel is being flooded.

In the event that the reactor vessel becomes isolated from the main condenser and the feedwater becomes unavailable to maintain reactor vessel water level, the reactor core isolation cooling (RCIC) system is initiated automatically to allow the complete, orderly shutdown of the plant. After reactor pressure has decreased to a predetermined value, the shutdown cooling mode of the RHR system is initiated manually. The RCIC system maintains sufficient water in the reactor pressure vessel to cool the core and maintain the reactor plant in standby condition. It includes a steam turbine which drives the RCIC pump and necessary accessories, instrumentation, and controls. The pump supplies makeup water from the condensate storage tank, the steam condensed in RHR heat exchangers, or, in the emergency case, from the suppression pool within the containment. The turbine is driven by part of the decay heat steam generated within the reactor vessel and exhausts to the suppression pool within the containment. The RCIC pump discharge water flows into the reactor vessel through a connection on the reactor head. The water is distributed to obtain mixing with the hot water or steam.

The steam produced in the reactor flows to the turbine generator, which is part of the station power conversion system, for conversion to electrical energy. The station power conversion system consists of components of conventional design proven by use in large power stations. Where necessary, equipment is modified and shielded to conform to federal rules and regulations on radiation standards.

In addition to the preceding systems used for normal power generation, standby conditions, and shutdown cooling, several systems are installed to provide emergency core cooling in the unlikely event of a reactor accident. These systems include the high-pressure core spray system, low-pressure core spray system, and the low-pressure coolant injection mode of the RHR system. These systems function to provide cooling water for the reactor core to restore and maintain, if necessary, the water inventory in the reactor vessel after a design basis loss-of-coolant accident so that the core is sufficiently cooled to prevent fuel cladding damage.

3.2.2 Description of the Turbine Generator and Condenser

The turbine generator, manufactured by GE, is an 1,800-rpm tandem compound unit consisting of one double-flow, high-pressure casing and three double-flow, low-pressure casings. The turbine and generator design information is detailed in FSAR Table 10.1-1 and Section 8.3.1. The turbine provides extraction steam for six stages of feedwater heating. Combination moisture-separator reheaters located on each side of the high-pressure turbines are in the steam path between the high-pressure and low-pressure sections. Each combination moisture-separator reheater contains one stage of moisture separation and one stage of reheat in one shell.

There are three one-third capacity feedwater heater trains that receive extraction steam from the high- and low-pressure turbines. For additional information, refer to the feedwater and condensate system description in FSAR Section 10.4.7.

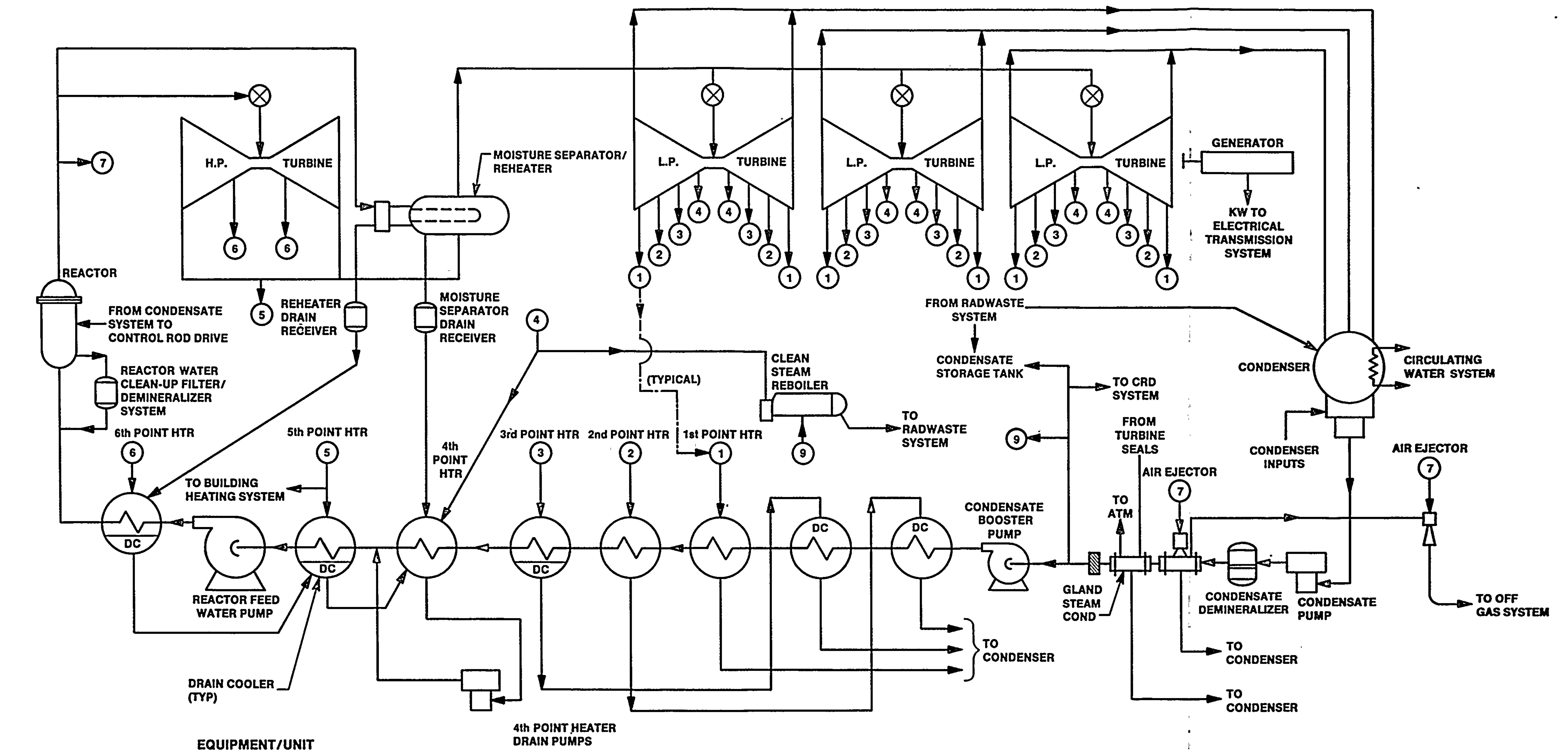
Steam exhausting from the low-pressure turbines flows to the main surface condenser and is condensed by circulating water. The condenser is a three-shell, single-pass, divided water box arrangement with a surface of approximately 672,000 sq ft (62,430 sq m). The shells are set transverse to the turbine shafts.

Radiolytically generated oxygen and hydrogen and air inleakage to each condenser are removed to the off-gas system by one of two two-stage steam jet-air ejectors during normal operation.

Two motor-driven mechanical vacuum (hogging) pumps exhausting to the main stack are used during startup to evacuate the condenser and turbine casing.

The condensate stored in each condenser is pumped via three condensate pumps through the condensate-demineralizer system; two (one spare) steam jet-air ejectors arranged in parallel; two gland steam leakoff condensers; three condensate booster pumps; second and third point external drain coolers; first, second, third, fourth, and fifth point heaters; and then to the suction of the three reactor feed pumps. The feedwater discharge from each of the three feed pumps passes through the sixth point high-pressure feedwater heater and flows to the reactor.

The condensate demineralizer system consists of nine mixed-bed, equally sized ion exchange units (two as spares).



EQUIPMENT/UNIT

1 REACTOR
2 MOISTURE SEPARATOR REHEATERS
3 50% REACTOR FEEDWATER PUMPS
3 STRINGS OF HEATERS, PLUS 3rd & 2nd HEATER DRAIN COOLERS
2 100% GLAND STEAM CONDENSER
2 100% AIR EJECTORS
9 CONDENSATE DEMINERALIZER ION EXCHANGERS
3 100% 4th POINT HEATER DRAIN PUMPS
2 CLEAN STEAM REBOILER
3 50% CONDENSATE PUMPS
3 50% CONDENSATE BOOSTER PUMPS

FIGURE 3.2-1

STATION FUNDAMENTAL
FLOW DIAGRAM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

3.3 PLANT WATER USE

3.3.1 Water Consumption and Use

During normal operation, an average of 3,380 l/s (53,600 gpm) of lake water is withdrawn from Lake Ontario and utilized mostly as cooling water. Figure 3.3-1 schematically illustrates the water flow and use at Unit 2. As illustrated, the water from Lake Ontario enters the system via the screenwell and is circulated throughout the system by the service water pumps. Table 3.3-1 lists the calculated cooling water flows and associated temperatures for Unit 2 over a 12-month period. Data presented in Table 3.3-1 represent the maximum, minimum, and average flows expected. The total flow is significantly reduced during a shutdown condition. The following discussion describes the pattern of flow for normal operation.

Upon entering the screenwell, 940 l/s (14,925 gpm) of flow are directed to the fish diversion system, which discharges to Lake Ontario. The remaining 2,440 l/s (38,675 gpm) of flow passes through the screenwell to the service water system.

The main flow path from the service water system is to the circulating water system and the service water bypass. Approximately 1,580 l/s (25,000 gpm) are utilized as makeup to the circulating water system, and an average of 860 l/s (13,675 gpm) are returned to the lake. Of the 1,580 l/s (25,000 gpm) entering the circulating water system, an average of 625 l/s (9,920 gpm) is lost by evaporation and drift from the cooling tower. The remaining outflow from the circulating water system is 955 l/s (15,080 gpm), which returns to the lake via the discharge tunnel.

Minimal flow is anticipated for the makeup demineralizer, chemical waste treatment, reactor building usage, turbine building usage, and radwaste system. Initially, these systems would require filling (approximately 3.4×10^6 l [900,000 gal]) at a rate of 13 l/s (200 gpm). These systems are shown on Figure 3.3-1 as the dashed-block section, because these systems require minimal flow (closed circuit area). Minimal losses are anticipated and only makeup water is required.

Table 3.3-2 lists the estimated water use outflows for the various systems, which vary depending on the mode or condition of the system. Therefore, the various flows for minimum, maximum, and refueling conditions are tabulated.

As indicated, the discharge rate under a maximum condition is low, once the system is online.

Flows for various water uses are listed in Table 3.3-2. During normal plant operation, the reactor building systems utilize a minimum of 0 to 1.3 l/s (20 gpm) and a maximum of 57 l/s (910 gpm) for the durations noted. Collectively, the turbine building users and the radwaste building users consume a minimum of 0 to 27 l/s (425 gpm) and 0 to 2.8 l/s (45 gpm), respectively, under normal plant operation.

The water treatment system is designed for a maximum flow of 16 l/s (250 gpm), of which 3 l/s (40 gpm) are used as seal water for the circulating water pumps. The remaining 13 l/s (210 gpm) are for makeup water system use, as needed.

The Oswego City Water Supply is the water source for the sanitary system. Other uses of the Oswego City Water Supply are as shown on Figure 3.3-1.

In summary, the station water use is extremely small. The Unit 2 withdrawal rate is approximately 0.03 percent of the average flow through Lake Ontario, as discussed in Section 5.2.1.

3.3.2 Water Treatment

3.3.2.1 Circulating Water System

Sulfuric acid and sodium hypochlorite are added to the circulating water system to maintain scale-free and clean heat exchange surfaces. Descriptions of both the sulfuric acid and sodium hypochlorite subsystems follow. A schematic flow diagram of sulfuric acid and hypochlorite addition systems is shown on Figure 3.3-2. Neither pretreatment of the makeup water nor treatment of the cooling tower blowdown is necessary.

<u>Sulfuric Acid Addition</u>

Calcium carbonate scaling in piping, in the tower, and in the condenser is controlled by converting calcium carbonate, a natural constituent of the lake water, to calcium sulfate via sulfuric acid addition. Sulfuric acid is added to reduce, but not completely remove, the alkalinity of the circulating water, thereby controlling calcium carbonate scaling by shifting the carbonate/bicarbonate equilibrium.

When Unit 2 is operating at full load, approximately 0.06 l/s (1 gpm) of 93 percent sulfuric acid is added to

the circulating water system at the discharge side of the condenser. Acid addition is continuous and manually controlled.

The sulfuric acid storage tanks are installed in an acid-resistant building and have inherent design features that contain any spillage due to rupture or leakage of a tank.

Sodium Hypochlorite Addition

Biofouling in the circulating water system is controlled by using sodium hypochlorite, which acts essentially the same as chlorine, but is safer to handle. Sodium hypochlorite reduces reproduction of algae, fungi, and bacteria. The condenser and cooling tower will be treated daily with sodium hypochlorite within the limits prescribed by the EPA[1]. These limits are 2 hr/day of chemical treatment, not to exceed a residual chlorine level of 0.2 mg/l (average) and 0.5 mg/l (maximum).

Sodium hypochlorite is produced onsite by the reaction of salt and water in an electrolytic cell. The equipment has the capacity to generate sodium hypochlorite at a maximum rate of 907 kg (2,000 lb) of chlorine equivalent per day. The hypochlorite produced is stored in a hypochlorite storage tank from which it is fed into the circulating water system as needed. Similar to the acid storage tanks, the hypochlorite storage tank is also designed to contain any spillage. Sodium hypochlorite solution is injected into the circulating water system directly ahead of the condenser. The amount of hypochlorite added depends on the chlorine demand of the circulating water as well as the frequency and duration of chlorination. The rate of chlorine addition is controlled automatically by a continuous chlorine analyzer, located immediately downstream of the condenser, to ensure that the concentration of free available chlorine is below 0.5 mg/l at the outlet of the condenser, in conformance with EPA standards. Automatic feedback control is performed by the free chlorine analyzer. The circulating water system is expected to be chlorinated once a day for a 30-min period. Based on the preceding chlorination characteristics and the EPA Residual Model[2], calculations indicate that both free available and total residual chlorine concentrations comply with applicable federal effluent regulations specified in 40CFR423[1].

3.3.2.2 Makeup Water Treatment System

The makeup water treatment system is designed to remove dissolved and suspended solids from raw lake water to produce high-quality filtered demineralized water. Demineralized water is necessary for use during plant operation as makeup or washdown by various systems in the turbine, reactor, and radwaste buildings. The makeup water system is composed of:

1. Pretreatment process - an anthracite and an activated carbon filter.

2. Demineralizer process - degasifer, weak and strong cation, weak and strong anion, and mixed-bed ion exchange units.

The demineralized water product is pumped to the makeup water system and distributed as required or stored for subsequent use.

The expected makeup water system product water quality is as listed in Table 3.3-3.

Essentially, all dissolved constituents present in water are removed by the cation and anion demineralizers. The mixed-bed demineralizers serve as a polishing unit to remove trace quantities of dissolved solids that may pass through the cation or anion demineralizers.

The cation-anion and mixed-bed demineralizers require periodic regeneration using sulfuric acid and sodium hydroxide to restore resins to the hydrogen and hydroxyl form. During normal operation, it is expected that the makeup demineralizer system will require regeneration approximately twice a month. During startup, the demineralizers may be regenerated as frequently as once a day to provide sufficient demineralized water to the steam generator. The approximate quantities of chemicals expected to be used per regeneration are as follows:

1. Sulfuric acid (489 kg [1,079 lb] as 93% H_2SO_4).
2. Sodium hydroxide (267 kg [589 lb] as 50% NaOH).

3.3.2.3 Condensate Demineralizer System

The condensate demineralizer system demineralizes and polishes water from the condensate system. The expected condensate demineralizer system product water quality is as listed in Table 3.3-4.

Mixed-bed demineralizers require regeneration to restore resins. During normal operation, one of the nine resin beds in the condensate demineralizer system will require regeneration approximately once a week, with an additional regeneration during startup. The approximate quantities of chemicals expected to be used per regeneration are:

1. Sulfuric acid (567 kg [1,250 lb] as 93% H_2SO_4).
2. Sodium hydroxide (500 kg [1,100 lb] as 50% NaOH).

Table 3.3-5 lists quantities and purposes of chemical additions to the water used for station operation.

Treatment of nonradioactive wastewater is further discussed in Section 3.6. The expected flows and chemical composition of station effluents are also presented in that section. Because wastewater from the regeneration of the condensate demineralizer system is radioactive, treatment of the wastewater from regeneration of this system is discussed in Section 3.5. Chemicals added to the radwaste system are also described in Section 3.5.

3.3.3 References

1. Environmental Protection Agency. Steam Electric Power Generating Point Source Category: Effluent Guidelines and Standards. 40CFR423, July 1, 1980.

2. National Environmental Research Center, Office of Research and Development. Predicting and Controlling Residual Chlorine in Cooling Tower Blowdown. EPA-R2-73-73-293, Environmental Protection Agency, Corvallis, OR, July 1973.

TABLE 3.3-1

MONTHLY WATER USE DATA FOR UNIT 2

Month	Wet Bulb Temperature (°F) (A)[1]	Relative Humidity (%) (B)	Lake[2] Temperature (°F) (C)	Lake Level (ft) (D)	Est. Average Service Water Flow (gpm) (E)	Fish System Flow (gpm) (F)	Tempering Water Flow (gpm) (G)	Cooling Tower Evaporation (gpm) (H)	Total Lake Intake (gpm) (I)	Service Water Discharge Flow (gpm) (J)	Service Water Discharge ΔT (°F) (K)	Cooling Tower Blowdown Flow[3] (gpm) (L)	Cooling Tower Blowdown ΔT[4] (°F) (M)	Combined Plant Flow[5] (gpm) (N)	Combined Plant ΔT[4] (°F) (O)
January	41.0(Max)	47.0(Min)	32.0(Min)	244.63	39,600	14,925	4,960	10,550(Max)	49,565	14,600	17.35	9,490	35.8	24,090	24.62
	21.5(Avg)	78.3(Avg)	35.0(Avg)	244.63	39,600	14,925	3,210	7,800(Avg)	51,315	14,600	14.35	13,990	24.0	28,590	19.07
	-16.0(Min)	100.0(Max)	42.0(Max)	244.63	39,600	14,925	-	4,560(Min)	54,525	14,600	11.35	20,440	10.6	35,040	10.56
February	43.0(Max)	33.0(Min)	32.0(Min)	244.63	39,600	14,925	5,050	11,200(Max)	49,640	14,600	17.35	8,915	37.2	23,515	24.90
	23.0(Avg)	78.4(Avg)	33.0(Avg)	244.63	39,600	14,925	4,885	8,000(Avg)	49,375	14,600	16.35	11,950	27.0	26,550	21.14
	-15.0(Min)	100.0(Max)	41.0(Max)	244.63	39,600	14,925	-	4,731(Min)	54,525	14,600	11.35	20,269	12.0	34,869	11.15
March	57.0(Max)	37.0(Min)	32.0(Min)	244.73	39,610	14,925	4,305	12,250(Max)	50,230	14,610	17.35	8,445	46.4	23,055	27.99
	29.4(Avg)	75.0(Avg)	34.0(Avg)	244.73	39,610	14,925	3,830	8,650(Avg)	50,705	14,610	15.35	12,520	30.0	27,130	22.11
	-4.0(Min)	100.0(Max)	42.0(Max)	244.73	39,610	14,925	-	3,928(Min)	54,535	14,610	11.35	19,072	11.0	33,682	11.73
April	63.0(Max)	24.0(Min)	34.0(Min)	245.43	39,682	14,925	2,730	13,150(Max)	51,877	14,682	15.33	9,120	46.4	23,802	27.23
	41.5(Avg)	69.9(Avg)	38.0(Avg)	245.43	39,682	14,925	-	9,950(Avg)	54,607	14,682	11.33	15,050	32.0	29,732	21.79
	16.0(Min)	100.0(Max)	42.0(Max)	245.43	39,682	14,925	-	7,508(Min)	54,607	14,682	11.33	17,492	11.7	32,174	11.69
May	76.0(Max)	28.0(Min)	40.0(Min)	246.13	39,754	14,925	-	13,700(Max)	54,679	14,754	11.31	11,300	47.2	26,054	26.88
	59.0(Avg)	66.9(Avg)	43.0(Avg)	246.13	39,754	14,925	-	10,850(Avg)	54,679	14,754	11.31	14,150	33.0	28,904	21.93
	28.0(Min)	100.0(Max)	52.0(Max)	246.13	39,754	14,925	-	8,100(Min)	54,679	14,754	11.31	16,900	10.0	31,654	10.61
June	71.0(Max)	29.0(Min)	42.0(Min)	246.43	39,784	14,925	-	13,400(Max)	54,709	14,784	11.30	11,600	46.1	26,384	26.60
	59.0(Avg)	67.6(Avg)	56.0(Avg)	246.43	39,784	14,925	-	11,500(Avg)	54,709	14,784	11.30	13,500	25.0	28,284	17.84
	36.0(Min)	100.0(Max)	63.0(Max)	246.43	39,784	14,925	-	8,750(Min)	54,709	14,784	11.30	16,250	3.0	31,034	6.95
July	79.0(Max)	28.0(Min)	46.0(Min)	246.43	39,784	14,925	-	13,800(Max)	54,709	14,784	11.30	11,200	45.0	25,984	25.83
	63.4(Avg)	68.9(Avg)	69.0(Avg)	246.43	39,784	14,925	-	11,750(Avg)	54,709	14,784	11.30	13,250	14.0	28,034	12.58
	41.0(Min)	100.0(Max)	78.0(Max)	246.43	43,316	14,925	-	9,100(Min)	59,586	18,316	10.38	15,900	-9.0	34,216	1.37
August	79.0(max)	27.0(Min)	48.0(Min)	246.13	39,754	14,925	-	13,800(Max)	54,679	14,754	11.31	11,200	39.6	25,954	23.52
	62.4(Avg)	72.4(Avg)	70.0(Avg)	246.13	39,754	14,925	-	11,550(Avg)	54,679	14,754	11.31	13,450	12.0	28,204	11.64
	43.0(Min)	100.0(Max)	74.0(Max)	246.13	39,754	14,925	-	9,300(Min)	54,679	14,754	11.31	15,700	-4.0	30,454	3.42
September	76.0(Max)	27.0(Min)	45.0(Min)	245.63	39,702	14,925	-	13,700(Max)	54,627	14,702	11.32	11,300	36.0	26,000	22.05
	56.2(Avg)	73.7(Avg)	63.0(Avg)	245.63	39,702	14,925	-	11,100(Avg)	54,627	14,702	11.32	13,900	16.0	28,602	13.59
	30.0(Min)	100.0(Max)	72.0(Max)	245.63	39,702	14,925	-	8,200(Min)	54,627	14,702	11.32	16,800	-8.0	31,502	1.02
October	71.0(Max)	33.0(Min)	42.0(Min)	245.13	39,651	14,925	-	13,300(Max)	54,576	14,651	11.34	11,700	34.5	26,351	21.62
	47.1(Avg)	72.8(Avg)	54.0(Avg)	245.13	39,651	14,925	-	10,350(Avg)	54,576	14,651	11.34	14,650	19.0	29,301	15.17
	25.0(Min)	100.0(Max)	63.0(Max)	245.13	39,651	14,925	-	7,800(Min)	54,576	14,651	11.34	17,200	-2.0	31,851	4.14
November	60.0(Max)	38.0(Min)	38.0(Min)	244.83	39,620	14,925	-	12,600(Max)	54,545	14,620	11.35	12,400	37.3	27,020	23.26
	37.4(Avg)	76.1(Avg)	45.0(Avg)	244.83	39,620	14,925	-	9,300(Avg)	54,545	14,620	11.35	15,700	23.0	30,320	17.38
	9.0(Min)	100.0(Max)	52.0(Max)	244.83	39,620	14,925	-	6,816(Min)	54,545	14,620	11.35	18,184	1.0	32,804	5.61
December	52.0(Max)	46.0(Min)	35.0(Min)	244.83	39,620	14,925	2,340	11,550(Max)	52,205	14,620	14.35	11,110	34.2	25,730	22.92
	25.9(Avg)	78.3(Avg)	38.0(Avg)	244.83	39,620	14,925	-	8,250(Avg)	54,545	14,620	11.35	16,750	23.0	31,370	17.57
	-7.0(Min)	100.0(Max)	43.0(Max)	244.83	39,620	14,925	-	5,586(Min)	54,545	14,620	11.35	19,414	13.5	34,034	12.58

[1] (E) through (O) indicate reference points on Figure 3.3-1 (A through D are not shown).

[2] Based on data from 1972 Nine Mile Point Unit 1 for maximum and minimum temperatures and Unit 2 Environmental Report Construction Permit Stage Figure 2.5-1 for average temperature.

[3] Average and maximum cooling tower blowdown flows are based on Rochester, New York, weather data from 1955 to 1964. Cooling tower blowdown flows for maximum ΔT are based on Rochester, New York, weather data for 1955. Maximum discharge flow will not be exceeded during normal operation.

[4] ΔT is the difference between discharge temperature and lake temperature. Maximum ΔT will be exceeded less than 5% of the time. Maximum ΔT could occur during the month of May, resulting in a maximum blowdown ΔT of 49°F and a combined plant ΔT of 27.66°F.

[5] These flows are associated with normal plant operation. The maximum combined plant discharge flow will occur during a normal plant shutdown.

TABLE 3.3-2

ESTIMATED WATER USAGE

	Normal Plant Operation			Plant Shutdown			Plant Refueling			Normal Plant Usage*	
User	Note	Min (gpm)	Max (gpm)	Note	Min (gpm)	Max (gpm)	Note	Min (gpm)	Max (gpm)	Note	(gal)
Reactor Building											
Spent fuel cooling	1	-	250	1	-	250	1	-	250		2,500
Reactor water cleanup	2	-	560	2	-	560	2	-	560		2,800
HPCS/LPCS	-	-	-	3	0-100	150	3	0-100	150		3,000
Residual heat removal	-	-	-	3	0-200	300	3	0-200	300		3,000
Service water	3	0-20	100	3	0-20	100	3	0-20	100		1,000
Radwaste Building											
Liquid radwaste	3	0-25	200	3	0-25	200	3	0-25	200		6,000
Solid radwaste	2	-	100	2	-	100	2	-	100		500
Decontamination room	3	0-20	100	3	0-20	100	3	0-20	100	6	
Turbine Building											
Condenser makeup	-	0-200	500	-	-	-	-	-	-		-
Condensate demineralizer	4	0-225	300	5	0-225	300	-	-	-		30,000
Total											48,800

*Normal plant usage estimate based on one resin regeneration and approximate usage for 1 week.

NOTES:
1. Once or twice a week usage for short duration (less than 15 min).
2. Daily usage for short duration (less than 5 min).
3. Intermittent usage for short duration (less than 30 min).
4. Required for resin regeneration for 5 hr when condensate temperature exceeds 120°F.
5. Required for resin regeneration for 5 hr.
6. Not normally anticipated.

TABLE 3.3-3

MAKEUP WATER SYSTEM - WATER QUALITY

Parameter	Concentration
Total dissolved solids	0.04 ppm
Hardness (as $CaCO_3$)	trace
Silica	0.02 ppm
Carbon dioxide	trace
Conductivity	0.2 umhos
pH	6.6-7.5
Sodium	0.02 ppm
Iron	trace
Chlorides	trace

TABLE 3.3-4

CONDENSATE DEMINERALIZER SYSTEM - WATER QUALITY

Parameter	Concentration
Silica	5 ppb (max)
Metals	10 ppb (max)[1]
Lead	Nondetectable[2]
Chloride	<2 ppb
Hardness	0
pH	6.5 to 7.5
Conductivity	0.10 umho/cm (max)

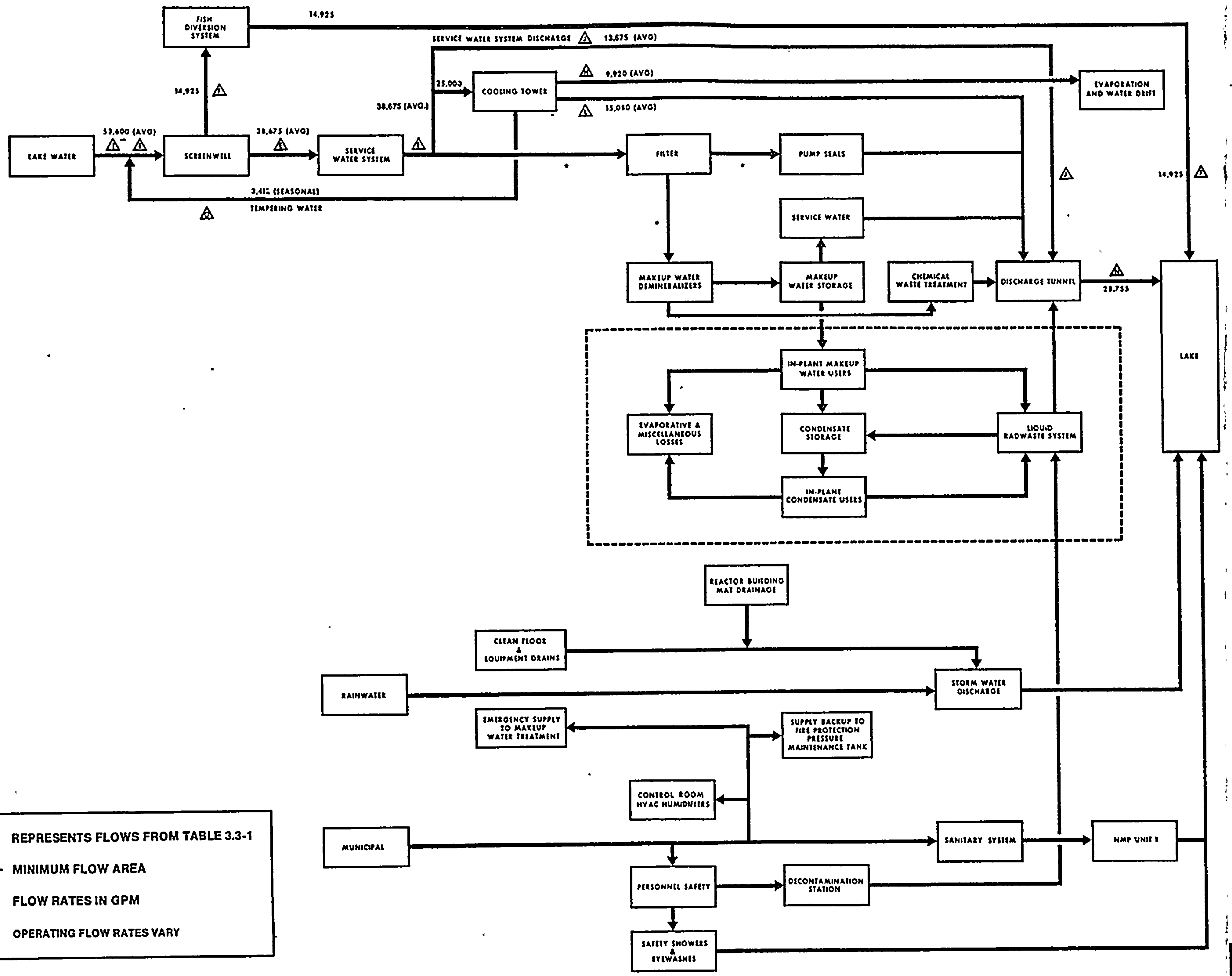
(1) Of which copper will not exceed 2 ppb.
(2) By acceptable reference method.

TABLE 3.3-5

CHEMICAL ADDITIONS TO WATER USED FOR STATION OPERATION

Chemical Added and System Involved	Reason for or Source of Addition	Estimated Daily Quantities Average (lb/day)	Maximum (lb/day)	Frequency
Sodium hypochlorite (as NaOCl)				
Circulating water system	Biofouling control	Variable[1]	2,000	Daily
Sulfuric acid (as 93% H_2SO_4)				
Demineralized water makeup treatment system	Regeneration of ion exchange resins	71.0	1,079[2]	Bimonthly
Condensate polisher system Circulating water system	Regeneration of ion exchange resins	207.1	1,450[2]	Weekly
Circulating water system	Sealing control	21,951	21,951	Daily
Sodium hydroxide (as 50% NaOH)				
Demineralized water makeup treatment system	Regeneration of ion exchange resins	38.8	589[2]	Bimonthly
Condensate polisher system	Regeneration of ion exchange resins	157.1	1,100[2]	Weekly

[1]Value depends on frequency, duration, and dosage of chlorination, which is added only in amounts sufficient to prevent biofouling.
[2]Maximum value occurs only as a result of regeneration during startup operations.



△ REPRESENTS FLOWS FROM TABLE 3.3-1

---- MINIMUM FLOW AREA

FLOW RATES IN GPM

* OPERATING FLOW RATES VARY

FIGURE 3.3-1

WATER USE DIAGRAM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

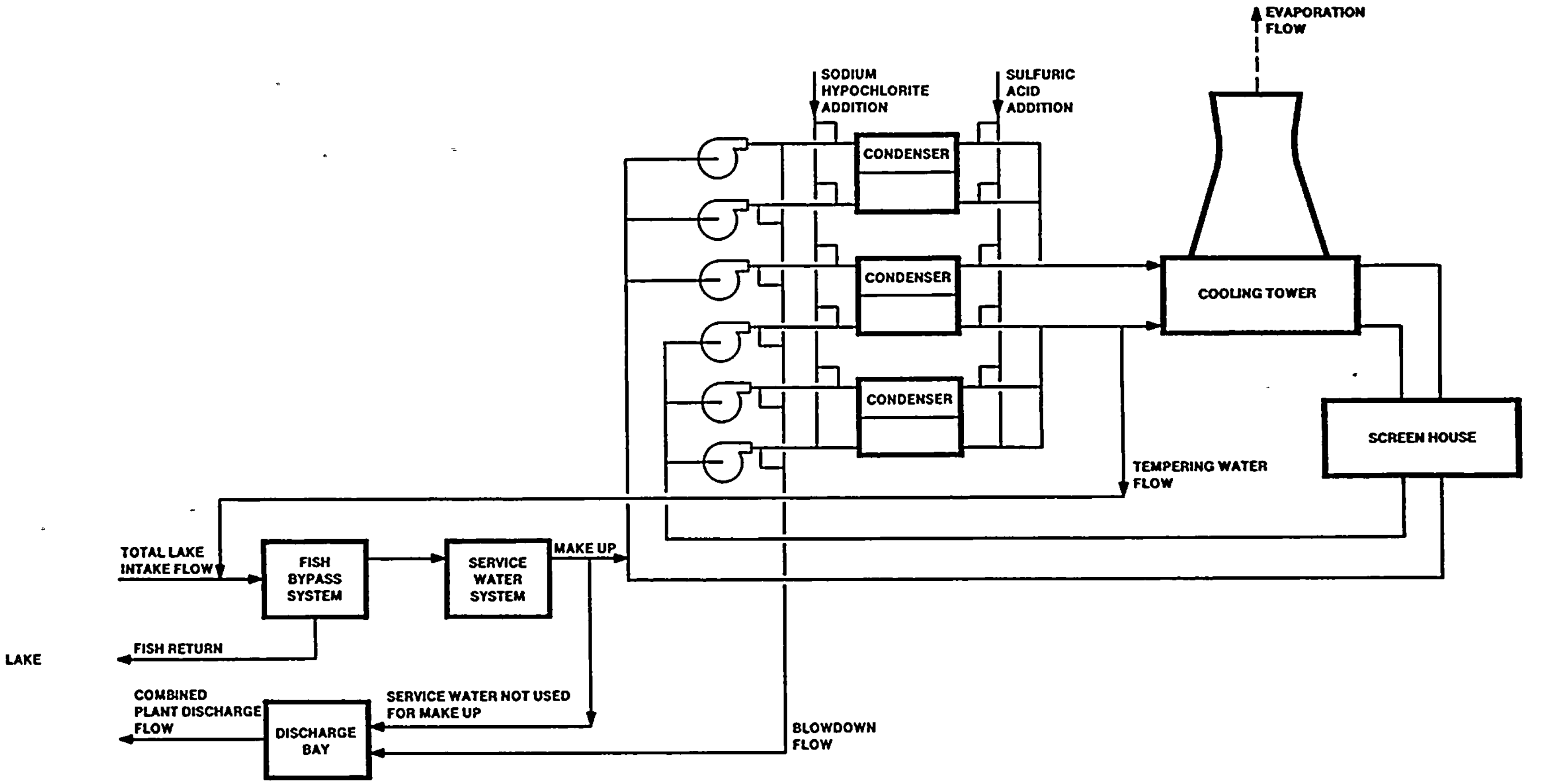


FIGURE 3.3-2

SCHEMATIC OF CIRCULATING WATER SYSTEM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

3.4 COOLING SYSTEMS

3.4.1 System Description and Operational Modes

3.4.1.1 Circulating Water System

The circulating water system provides the main condenser with a continuous supply of cooling water. The water is used to remove the heat rejected from the turbine exhaust, turbine bypass steam, and other power conversion cycle inputs over the full range of operating loads.

3.4.1.1.1 System Description

The closed-loop circulating water system is discussed in detail in FSAR Section 10.4.5.2.

3.4.1.1.2 Operational Modes

The circulating water system is designed to convey 36,590 l/s (580,000 gpm) of cooling water between the main condenser and the natural-draft cooling tower. Operational modes are further discussed in FSAR Section 10.4.5.

Details of the cooling tower operation and performance are discussed in Section 3.4.2.3.

3.4.1.1.3 Quantities of Heat Distributed

The circulating water system is designed to reject a heat load of 5.513×10^8 g-cal/sec (7.875×10^9 Btu/hr) from the main condenser to the atmosphere. This is further described in FSAR Section 10.4.5.

3.4.1.1.4 Quantities of Water Withdrawn, Consumed, and Discharged

Makeup water for the closed-loop circulating water system is obtained from the service water system. Therefore, the only cooling water withdrawn from Lake Ontario is for the service water requirements (Section 3.4.1.2) and the fish diversion system. A constant 1,580 l/s (25,000 gpm) makeup is provided[1].

Depending on the meteorological conditions, the anticipated cooling tower evaporation rate ranges from 290 l/s to 870 l/s (4,560 gpm to 13,800 gpm) during normal operation. The maximum, average, and minimum monthly anticipated evaporation rates are listed in Table 3.3-1. The maximum water drift emitted from the cooling tower is 0.005 percent

of the circulating water flow. The cooling tower performance characteristics are discussed in Section 3.4.2.3.

The cooling tower blowdown flow ranges from 530 l/s to 1,290 l/s (8,445 gpm to 20,440 gpm) during normal operation. The cooling tower blowdown is discharged into the screenwell discharge bay, where it mixes with the service water bypass and is discharged to the lake (FSAR Section 9.2.5).

Figure 3.4-1 shows the circulating water system water use. The maximum, average, and minimum monthly cooling tower blowdown flows, evaporation rates, and tempering water flows are listed in Table 3.3-1.

3.4.1.1.5 Water Temperatures

The cold water basin temperature of the cooling tower ranges from 6.7°C to 34°C (44°F to 93°F) during normal operation, depending on the meteorological conditions[2]. The hot water temperature in the discharge of the condenser ranges from 22°C to 49°C (71°F to 120°F). This is further discussed in FSAR Section 10.4.5.

The maximum, average, and minimum monthly blowdown temperature differentials above the ambient lake temperature are listed in Table 3.3-1.

3.4.1.2 Service Water System

The service water system provides cooling water from Lake Ontario to all safety-related components in the reactor, control, diesel generator, and screenwell buildings. Service water is also supplied to various nonsafety-related components in the reactor and turbine buildings, as well as the secondary sides of the heat exchangers for the reactor building and the turbine building closed-loop cooling water systems.

The service water system cooling water is pumped from the service water system intake bay by six motor-driven, horizontal, centrifugal pumps, each rated at 630 l/s (10,000 gpm) at 56.4 m (185 ft) of head (TDH). The service water system discharge supplies 1,580 l/s (25,000 gpm) of makeup water to the circulating water sytem. The remaining water passes to the discharge bay, where it is discharged to the lake by the intake/discharge structures. The service water system discharge to the discharge bay is monitored for temperature, pH, conductivity, radioactivity, and flow.

All components cooled by the service water system are designed based on a maximum service water system inlet temperature of 25°C (77°F). Table 3.4-1 provides the maximum flow rates and heat gains for each of the following plant conditions:

1. Normal operation.

2. Normal shutdown.

3. Loss-of-coolant accident (LOCA) without loss of offsite power (LOP).

4. LOCA coincident with a LOP.

The actual service water system flow and heat gain will vary below the maximum values given in Table 3.4-1 depending on plant and ambient conditions.

3.4.1.3 Intake and Discharge Systems

3.4.1.3.1 System Description

The source and discharge point of all cooling water required by Unit 2 is Lake Ontario. Six service water pumps supply water for the two cooling systems: the service water system and the circulating water system. A detailed description of the intake and discharge systems is provided in FSAR Section 9.2.5.

3.4.1.3.2 Operational Modes

During normal plant operation, the intake flow required for the service water pumps is conveyed through two intake structures that are connected to the onshore screenwell via pipes located within tunnels below the lake bottom. The plant discharge is conveyed from the discharge bay through the diffuser nozzles to the lake via the discharge tunnel below the lake bottom. This is further discussed in FSAR Section 9.2.5.

3.4.1.3.3 Quantities of Heat Distributed

The average heat rejected to the lake by the service water discharge system is 1.75 x 10^7 g-cal/sec (2.5 x 10^8 Btu/hr). During normal operation, the maximum heat rejected is 3.29 x 10^7 g-cal/sec (4.7 x 10^8 Btu/hr).

3.4.1.3.4 Quantities of Water Withdrawn, Consumed, and Discharged

During normal operation, an average total flow of 3,380 l/s (53,600 gpm) is withdrawn from the lake: 2,440 l/s (38,675 gpm) for the service water system requirements and 940 l/s (14,925 gpm) for the fish diversion system. Table 3.3-1 lists monthly minimum, average, and maximum total intake flows.

The closed-loop circulating water system uses discharge from the service water system for its makeup requirements.

Depending on the meteorological conditions, the combined plant discharge flow ranges from a minimum of 1,450 l/s (23,055 gpm) to a maximum of 2,210 l/s (35,040 gpm) during normal operation. During a normal shutdown, the maximum plant discharge is approximately 3,080 l/s (48,800 gpm).

Discharge flows from the water treatment system and the radwaste system flows are discussed in Section 3.3.

FSAR Figure 9.2-1 shows the service water intake and discharge systems' water use. The monthly minimum, maximum, and average cooling water intake and discharge flows are listed in Table 3.3-1.

3.4.1.3.5 Water Temperatures

The ambient lake water temperature ranges from 0°C to 26°C (32°F to 78°F). When intake water temperature is less than 3.3°C (38°F), tempering flow is provided to maintain a minimum mixed intake flow temperature of 3.3°C (38°F).

The combined plant discharge temperature ranges from 0.6°C to 15.6°C (1.0°F to 28.0°F) above the ambient lake temperature. The submerged discharge diffuser will cause considerable cold water dilution of the heated discharge. Therefore, the maximum predicted change in the lake surface temperature, resulting from the plant discharge, is 1.3°C (2.3°F). This value is consistent with the New York State Water Quality Standards limiting lake surface temperature to a maximum of 1.7°C (3°F) above ambient. The monthly minimum, maximum, and average plant discharge differential temperatures above the lake temperatures are listed in Table 3.3-1.

During normal operation, the plant discharge flow and temperature vary with fluctuations in the meteorological conditions (Section 2.3.2).

During a normal plant shutdown, the greatest temperature change in the plant discharge occurs during the first 16.5 hr after initiation of the shutdown. During the first 12 hr, the combined plant discharge temperatures slowly drop, with an anticipated maximum rate of change of 0.72°C/hr (1.3°F/hr). Between 12 and 14 hr, the discharge temperature remains constant. At 14 hr, the discharge temperatures go through a step change ranging from 0°C to 5.6°C (0°F to 10°F) upward, depending on the lake temperature and meteorological conditions. At 16.5 hr, the circulating water system is shut down. Between 14 and 16.5 hr, the discharge temperature remains constant at 11.7°C (21°F) above the ambient lake temperature. After 16.5 hr, the plant discharge temperature slowly decreases from 11.7°C to 2.7°C (21°F to 5°F) above the lake temperature.

The shutdown condition that causes the greatest rate of temperature change in the discharge is a reactor scram, when the main steam isolation valves remain open. In this case, the temperature change is the same as during the normal plant shutdown operation starting at 12 hr.

Other shutdowns do not cause as great a rate of discharge temperature change, because the reactor is cooled at a slower rate by releasing heat to the suppression pool and then by cooling the suppression pool via the RHR system with service water (Section 3.2).

3.4.2 Component Descriptions

3.4.2.1 Intake System

The lake intake water system is designed to supply the plant cooling water requirements through two offshore intake structures connected to the onshore screenwell.

The two identical intake structures are located approximately 290 and 320 m (950 and 1,050 ft) from the existing shoreline (Figure 3.4-2). The structures are located at lake bottom contour, el 68.43 m (224.5 ft) (USLS 1935 Datum). A minimum water depth of 3 m (10 ft) over the top of each structure is provided during the navigational season, when the mean low water elevation is 74.4 m (244.0 ft) (USLS 1935 Datum), as recommended by the U.S. Corps of Engineers and the U.S. Coast Guard.

Details of the two intake structures are shown on Figure 3.4-3. The structures are hexagonal in shape with a 6.9-m (22.5-ft) width between opposite faces. The design of the structures includes a bottom sill height of 1.4 m

(4.5 ft) to limit the amount of sediment entering the structure, six intake openings 2.3 m (7.5 ft) wide by 0.9 m (3.0 ft high), and a 0.6-m (2-ft) thick roof. The total area of the 12 openings, 6 on each structure, is designed to limit the maximum approach velocity to 0.2 m/s (0.5 fps) while drawing water through both structures. The 12 openings are equipped with electrically heated vertical bar racks, which have a 25-cm (10-in) clear space between bars to prevent large debris from entering the intake system and to eliminate the potential for frazil ice adhesion.

The two intake structures are designed and located to minimize the possibility of fish entering the structures (Section 5.3.1.2).

Each structure is independently connected to the onshore screenwell by a 1.4-m (4.5-ft) diameter, concrete-encased, partially steel-lined intake pipe. Each encased intake pipe is located within a Gunite-lined tunnel, as shown on Figures 3.4-4 and 3.4-5. In addition to the encased intake pipe, Tunnel No. 1 (the west tunnel) contains electrical conduits and has a discharge area of approximately 9.5 sq m (102 sq ft). Tunnel No. 2 (the east tunnel) contains, in addition to the intake pipe, a 107-cm (42-in) diameter fiberglass fish return pipe and electrical conduits for heating elements in the bar racks. Both tunnels and the encased pipes slope downward toward the shoreline at a minimum of 0.01 m/m (0.01 ft/ft).

At the onshore screenwell, each intake pipe connects to a separate vertical shaft. Water velocity decreases from approximately 0.9 m/s (3 fps) in the intake pipe to approximately 0.3 m/s (1.0 fps) in the shafts. The base of each shaft extends below the point where the 1.4-m (4.5-ft) diameter intake pipe intersects the shaft. These extensions act as sediment traps. Access to these traps is provided through the operating deck above each shaft for cleaning, as necessary.

After rising through the two shafts, the flow enters the onshore screenwell, which has a floor elevation of 68.3 m (224.0 ft). The screenwell arrangement is shown on Figure 3.4-6. Two motor-operated rectangular rotary gates, arranged in series and normally open, are located between the north shaft and the intake bay. When these gates are closed, no flow enters the intake bay through the north shaft. The function of these gates is described in FSAR Section 9.2.5.

Downstream of the rotary gates, flow from both vertical shafts merges into a common bay and then divides into two 1.2-m (4-ft) wide screenbays. A trash rack and an angled, flush-mounted traveling water screen are located in each screenbay. The two traveling water screens are angled 25 deg to the upstream direction of flow with their downstream ends converging.

The trash rack is cleaned by a rake, and debris collected by the rack is deposited into the trash rake hopper and disposed of in a New York State-approved landfill.

After passing through the traveling water screens, the two screenbays merge into a common intake bay from which the service water pumps take suction. Two motor-operated rotary valves, arranged in parallel and normally closed, are located upstream of the two screenbays to provide a redundant flow path to the service water pumps.

A fish bypass and return system is provided at the downstream end of the screens.

Fish entering the screenbays pass through the trash racks and are guided by two angled, flush-mounted traveling water screens into 15-cm (6-in) wide bypass slots at the downstream end of the screens. The two slots converge and at their junction the fish are transported through a funnel-shaped transition of two 46-cm (18-in) pipes which combine into a single 61-cm (24-in) pipe leading to the jet pump. The jet pump discharges a bypass flow and the fish into the fish discharge pipe located in Tunnel No. 2, which is not utilized for plant discharge. A fish holding tank is also provided at the jet pump discharge for periodic sampling. The fish are transported through the return pipe to a vertical riser and discharged into the lake in an easterly direction, parallel to the lake bottom.

3.4.2.2 Discharge System

The discharge flow consists of service water bypass (service water discharge not utilized as circulating water system makeup), circulating water system blowdown, water treatment system discharge, and liquid radwaste; all of which discharges into the discharge bay.

The discharge system consists of an onshore discharge bay, a discharge portion of Tunnel No. 1, a discharge tunnel, and a two-port diffuser, as shown on Figure 3.4-4. The discharge bay is located on the west side of the two intake shafts and is separated from the shafts by a wall that extends up to

el 85 m (279 ft) and which acts as a weir, as shown on Figure 3.4-6. Stoplog slots are provided from the top of each weir, el 85 m (279 ft), to the operating deck, el 87 m (285 ft), with a stoplog gate normally in place between the south shaft and the discharge bay. This provides an alternate discharge path, as discussed in FSAR Section 9.2.5. The discharge flow enters a 1.4-m (4.5-ft) diameter steel discharge pipe that is located on the north wall of the discharge bay and which connects the discharge bay to the discharge portion of Tunnel No. 1. Tunnel No. 2 does not have discharge capability.

After traveling through the discharge portion of Tunnel No. 1, the discharge flow continues past the point where the 1.4-m (4.5-ft) diameter intake pipe rises to its intake structure, and enters into the smaller Gunite-lined discharge tunnel, as shown on Figure 3.4-4. Both the discharge portion of the intake tunnel and the discharge tunnel have sufficient area for the plant discharge flow.

The discharge portion of Tunnel No. 1 terminates at a point approximately 457 m (1,500 ft) from the shoreline, where the discharge flow enters a 1.4-m (4.5-ft) diameter steel riser leading to a two-port diffuser located on the lake bottom. The 1.4-m (4.5-ft) diameter riser divides into two 0.9-m (3.0-ft) diameter steel pipes with 0.46-m (1.5-ft) diameter nozzles at the end of each, as shown on Figure 3.4-7. The nozzles are oriented to face offshore 120 deg apart and inclined upward at a 5-deg angle from horizontal to minimize bottom scouring. The invert of the nozzle openings is 0.9 m (3.0 ft) off the lake bottom, providing 11.35 m (37.25 ft) of water above the nozzle centerlines at minimum controlled lake el 74.4 m (244.0 ft) (USLS 1935 Datum).

The location and orientation of the nozzles were designed and located to comply with New York Codes, Rules, and Regulations (6NYCRR704), 1976. This regulation stipulates that the lake surface temperature will not be increased by more than 1.7°C (3°F) after the addition of heat from an artifical origin.

To meet the 1.7°C (3°F) requirement of 6NYCRR704, the mathematical model developed by Koh and Fan for a row of equally spaced round jets discharging at an arbitrary angle of inclination to the horizontal into stagnant water was used[3]. From this model, standard nomograms published by the EPA were generated[4]. Depth corrections by Robideau were applied to the EPA nomographs to obtain more conservative results[5]. New York State Regulation 6NYCRR652 (1976) governs discharges to hypolimnetic waters

of a lake. Through an extensive lake temperature monitoring program conducted in 1973 in the Oswego-Nine Mile vicinity, it was determined that a seasonally stable stratified layer or thermocline does not exist at Nine Mile Point. Therefore, the discharge does not enter the hypolimnion.

Input data for the preceding mathematical models are listed in Table 3.3-1. Analysis of worst-case conditions resulted in the predicted temperature distribution presented on Figure 5.3-6. The model predicts the maximum surface temperature rise to be 1.3°C (2.3°F).

3.4.2.3 Cooling Tower

The cooling tower is a single-cell, wet-evaporative, natural-draft cooling tower utilizing a counterflow-type design.

The location of the tower is shown on Figure 3.1-1. The cooling tower design point is at an atmospheric condition of 23°C (74°F) wet-bulb temperature and 50 percent relative humidity. During these meteorological conditions, the tower is designed to operate at an 8.9°C (16°F) approach, with a 15°C (27°F) range. Depending on the meteorological conditions, the cooling tower is designed to supply water ranging from 6.7°C to 34°C (44°F to 93°F) to the main condenser.

Selection of the design conditions for the cooling tower was based upon meteorological data from Rochester, NY, for the period January 1, 1949, through December 31, 1958. Onsite meteorological data obtained during 1974 and 1978 show the Rochester data to be similar to site data. Rochester, located approximately 113 km (70 mi) west of the Nine Mile Point site on the shore of Lake Ontario, is the nearest meteorological station with a sufficiently long period of data and a climate approximately that of the site upon which the cooling tower design could be based. The frequency distribution of hourly joint dry-bulb temperature - wet-bulb temperature occurrences is plotted on Figure 3.4-8, with the relative humidity curves superimposed. The cooling tower performance curve for the design condition is also plotted on this figure. This curve defines the frequency with which the design point is equaled or exceeded. From Figure 3.4-8, the design point is equaled or exceeded approximately 33 hr per year, or approximately 3 percent of the summertime hours when the wet-bulb temperatures are over 18°C (65°F).

The cooling tower performance curves are shown on FSAR Figures 2C-2 and 2C-3. At the design point of 23°C (74°F)

wet-bulb temperature and 50 percent relative humidity, the cold water temperature is 31.9°C (89.5°F) and the evaporation rate is 820 l/s (12,950 gpm), or 2.2 percent of the circulating water flow.

The concrete cooling tower is 165 m (541 ft) in height, with a bottom diameter of 123 m (405 ft) and a top diameter of 83 m (273 ft) (Figure 3.4-9). The top of the cold water basin wall is at el 80.01 m (262.5 ft), providing 0.6 m (2 ft) of freeboard above the normal water elevation in the basin. The bottom of the tower fill is at el 90.2 m (295.8 ft), the centerline of the upper distribution piping is at el 93.2 m (305.75 ft), and the drift eliminator is approximately at el 93.4 m (306.3 ft).

Slide gates are provided in the upper distribution flumes to isolate the center section of the tower fill and force all water to the perimeter of the tower during winter operation. An ice prevention ring is provided at the top of the air inlet opening around the tower perimeter. The ice prevention ring provides a veil of water to restrict the air inlet opening and prevent ice formation during extremely cold weather conditions.

Bypass gates are provided on three of the six inlet risers at the cold water basin level for winter startup and shutdown operations. The bypass gates each have a capacity of approximately 14,130 l/s (224,000 gpm).

Sixteen wind baffles, spaced 22.5 deg apart, are located around the perimeter of the tower air inlet opening. These baffles minimize the local blow-through from the tower during high-wind conditions.

Aircraft warning lights are provided on the tower in accordance with FAA requirements.

An access ramp is provided into the cold water basin for periodic removal of sedimentation. All sedimentation removed from the tower basin is disposed of in a New York State-approved landfill.

3.4.2.4 Main Condenser

The main condenser provides a heat sink for the turbine exhaust steam, turbine bypass steam, and other flows. It also provides deaeration and holdup capacity for the condensate which is reused after a period of radioactive decay.

The main condenser is designed for a heat load of 5.513×10^8 g-cal/sec (7.875×10^9 Btu/hr) at a circulating water inlet temperature of 32°C (90°F) and an outlet temperature of 47°C (117°F).

The main condenser is a three-shell, horizontal tube, cooling tower-cooled unit. The design circulating water flow through the condenser is 36,586 l/s (580,000 gpm). The tube material is admiralty in the main bank and 70-30 copper-nickel in the periphery.

Each condenser has divided waterboxes that permit isolation of one-half of the shell while the other half remains in operation.

The hotwell storage capacity is approximately 567,750 l (150,000 gal). The condenser is located beneath the low-pressure sections of the main turbine. The condenser tubes are transverse to the turbine generator axis.

Equalizing connections between adjacent condenser shells are provided for both the steam space and hotwell.

During normal operation, steam from the low-pressure turbines exhausts directly downward into the condenser shells through exhaust openings in the bottom of the turbine casings. The condenser serves as a heat sink for several other flows, such as cascading heater drains, air ejector intercondenser drain, steam packing exhauster drain, feedwater heater shell operating vents, and condensate pump suction vents.

There are also other intermittent flows into the main condenser, such as condensate booster and reactor feed pump minimum recirculation flow, feedwater line prestartup cleaning and recirculation, extraction steam line drains, and condensate makeup.

3.4.3 References

1. Studies to Alleviate Potential Fish Entrapment Problems, Final Report, Nine Mile Point Unit 2, Niagara Mohawk Power Corporation. Prepared by Stone & Webster Engineering Corporation, May 1977.

2. Report on Circulating Water Cooling System Employing a Natural Draft Cooling Tower, Nine Mile Point Unit 2, Niagara Mohawk Power Corporation. Docket No. 50-410, July 1976.

3. Koh, R. C. Y. and Fan, Loh-Nien. Mathematical Models for the Prediction of Temperature Distributions Resulting from the Discharge of Heated Water into Large Bodies of Water. EPA-16130 DWO 10/70, Water Pollution Control Research Service, October 1970.

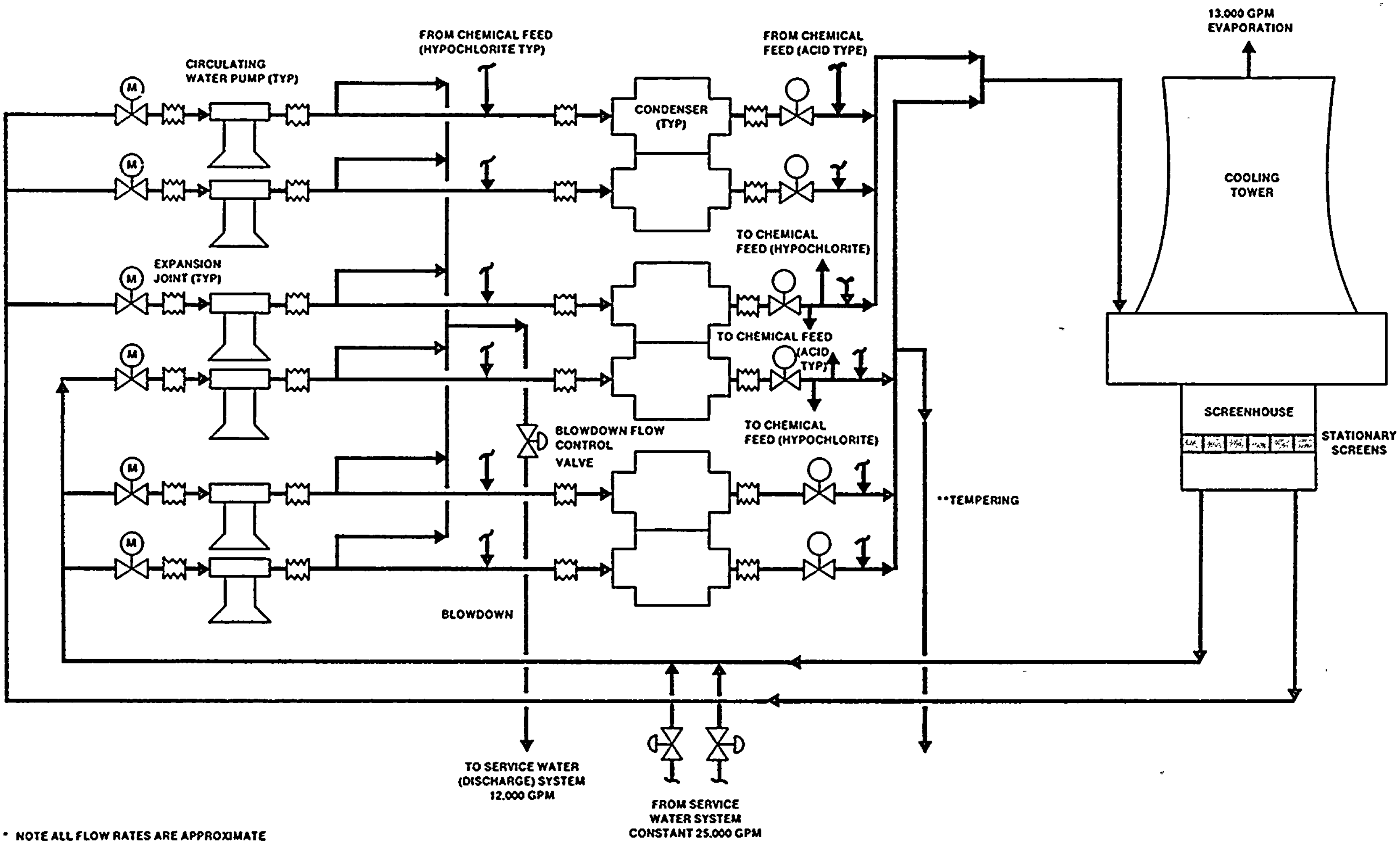
4. Shirazi, M. A. and Davis, L. A. Workbook of Thermal Plume Prediction. I. Submerged Discharge. EPA-R2-72-005a, U.S. EPA, National Environmental Research Center, August 1972.

5. Robideau, R. F. The Discharge of Submerged Buoyant Jets into Water of Finite Depth. U440-72-121, General Dynamics, Electric Boat Division, Groton, CT, 1972.

TABLE 3.4-1

SERVICE WATER SYSTEM
FLOW REQUIREMENTS AND HEAT GAINS

Mode of Operation	Maximum Flow (l/s)	Maximum Flow (gpm)	Maximum Heat Gain ($x10^6$ Btu/hr)
Normal	2,336	37,038	232.4
Normal shutdown	3,150	49,938	613.8
LOCA without loss of offsite power	3,387	53,687	379.7
LOCA with loss of offsite power	1,348	21,373	180.9



* NOTE ALL FLOW RATES ARE APPROXIMATE

** TEMPERING WILL BE PROVIDED DURING WINTER WHEN INTAKE WATER TEMPERATURE IS BELOW 38 F

FIGURE 3.4-1

CIRCULATING WATER SYSTEM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

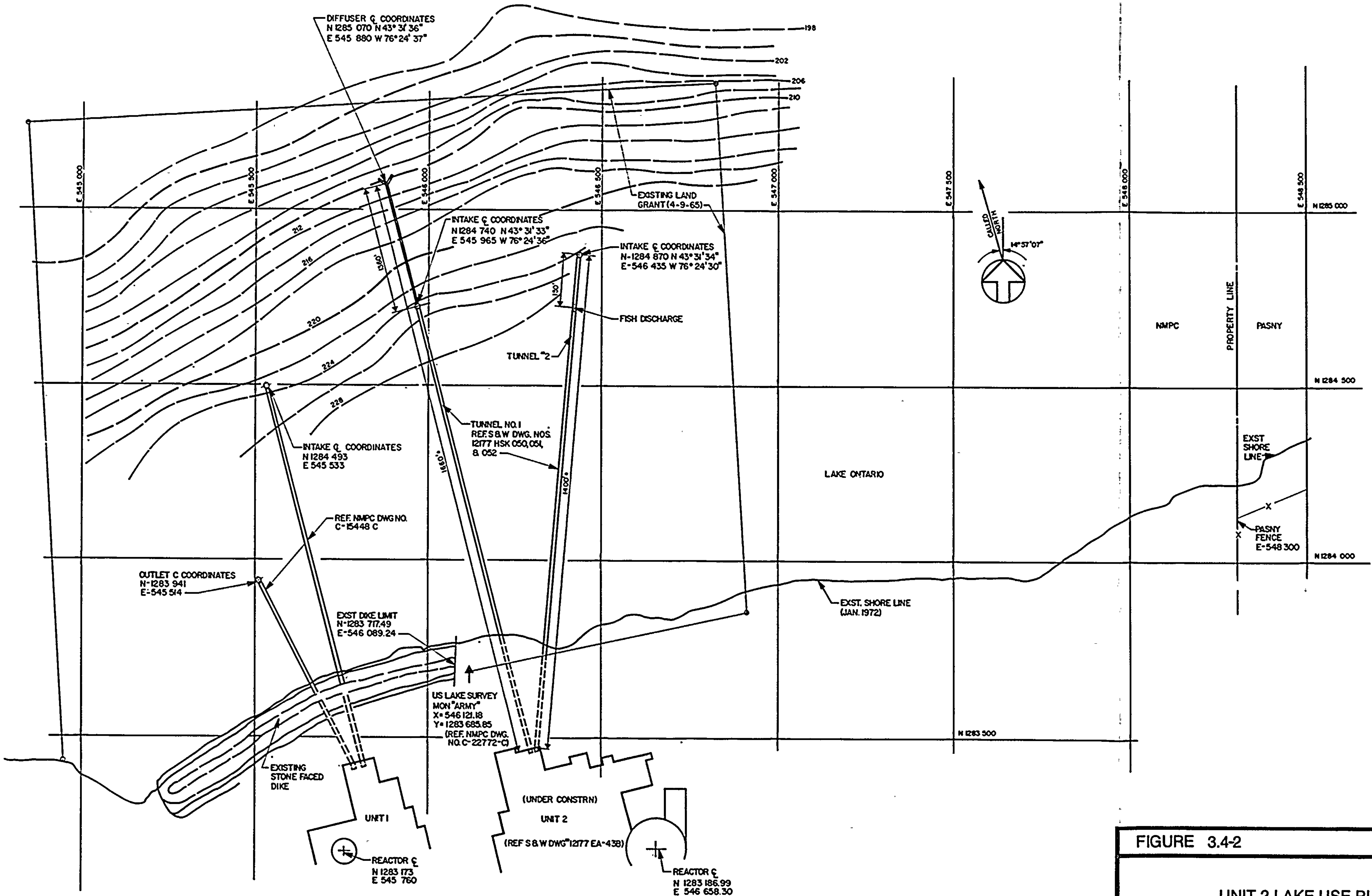


FIGURE 3.4-2

UNIT 2 LAKE USE PLAN

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NINE MILE POINT-UNIT 2
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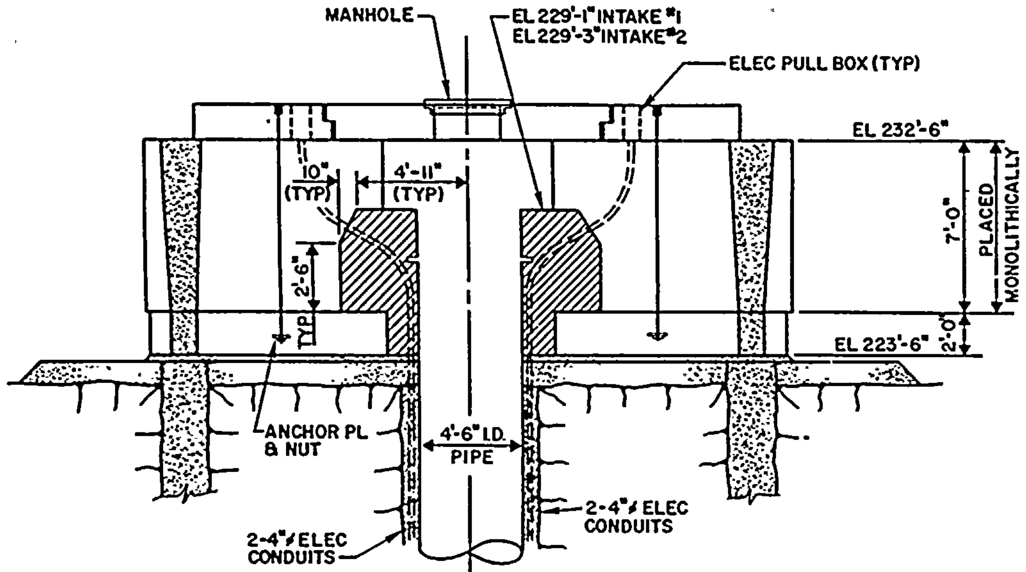
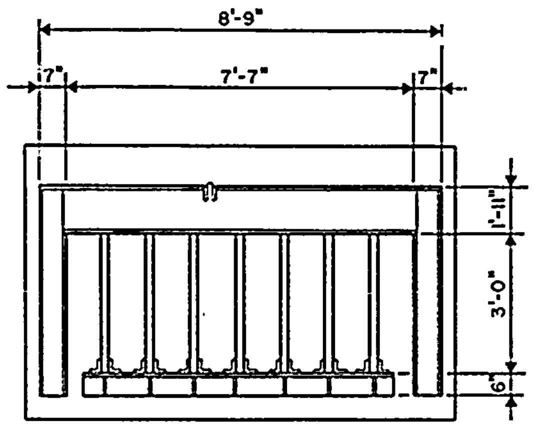


INTAKE SHAFT
A-A



TYP RACK ASSEMBLY
SEE B-B

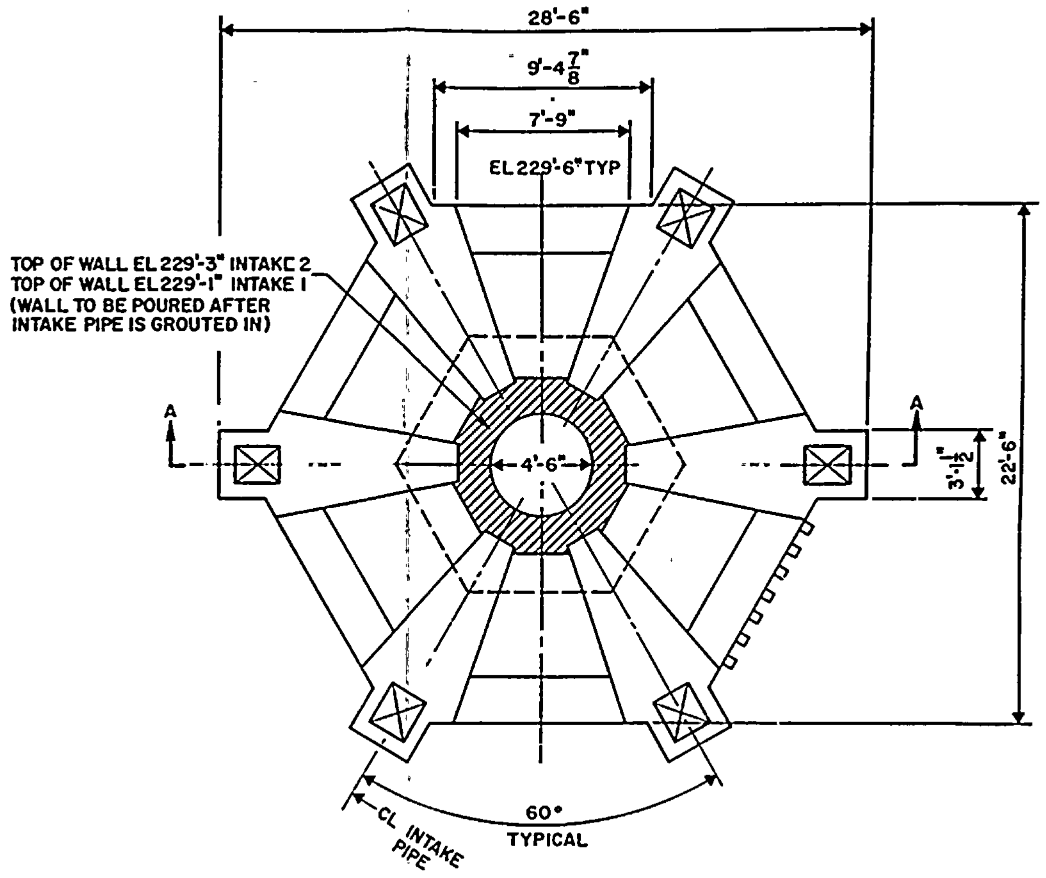


FIGURE 3.4-3

DETAILS OF INTAKE STRUCTURES

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NINE MILE POINT-UNIT 2
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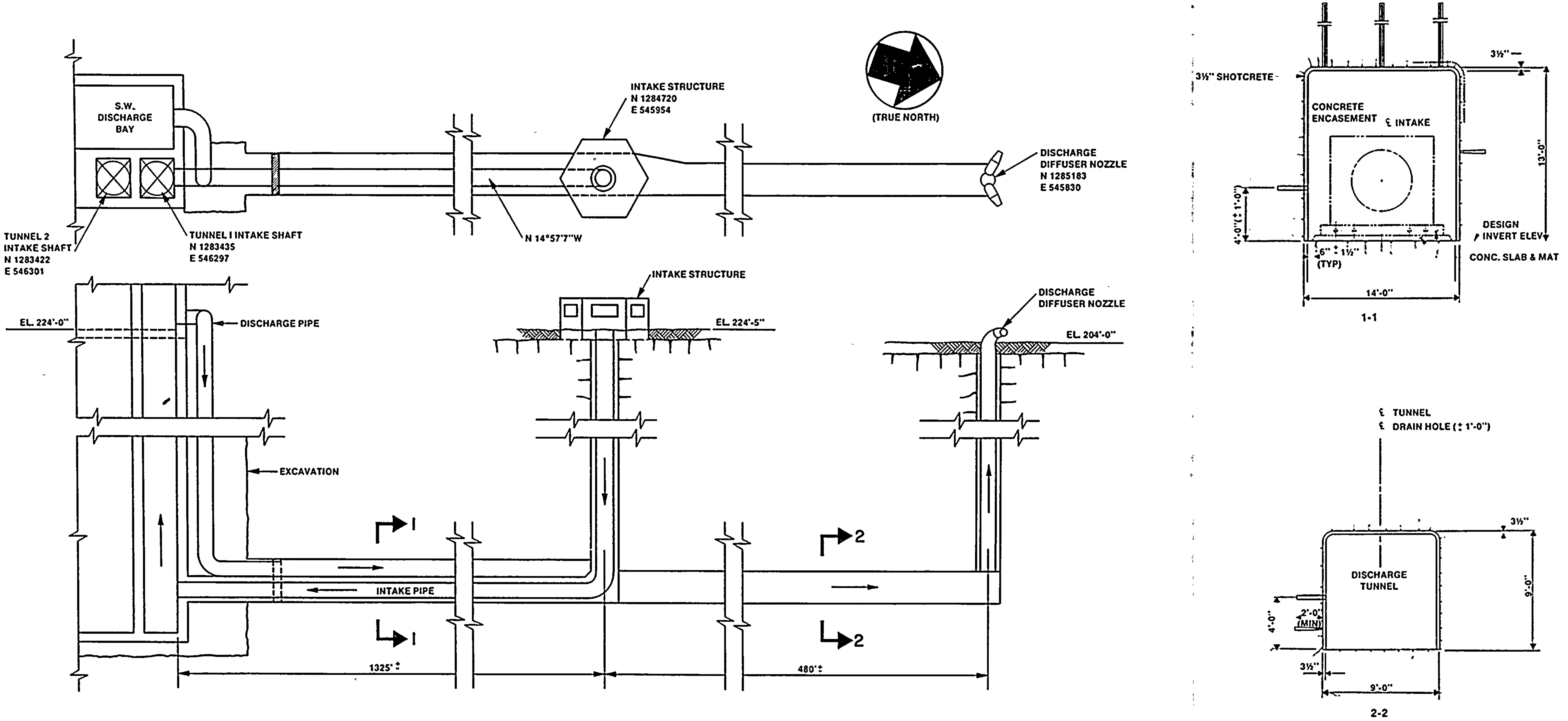

FIGURE 3.4-4

NO. 1 INTAKE TUNNEL & DIFFUSER

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NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

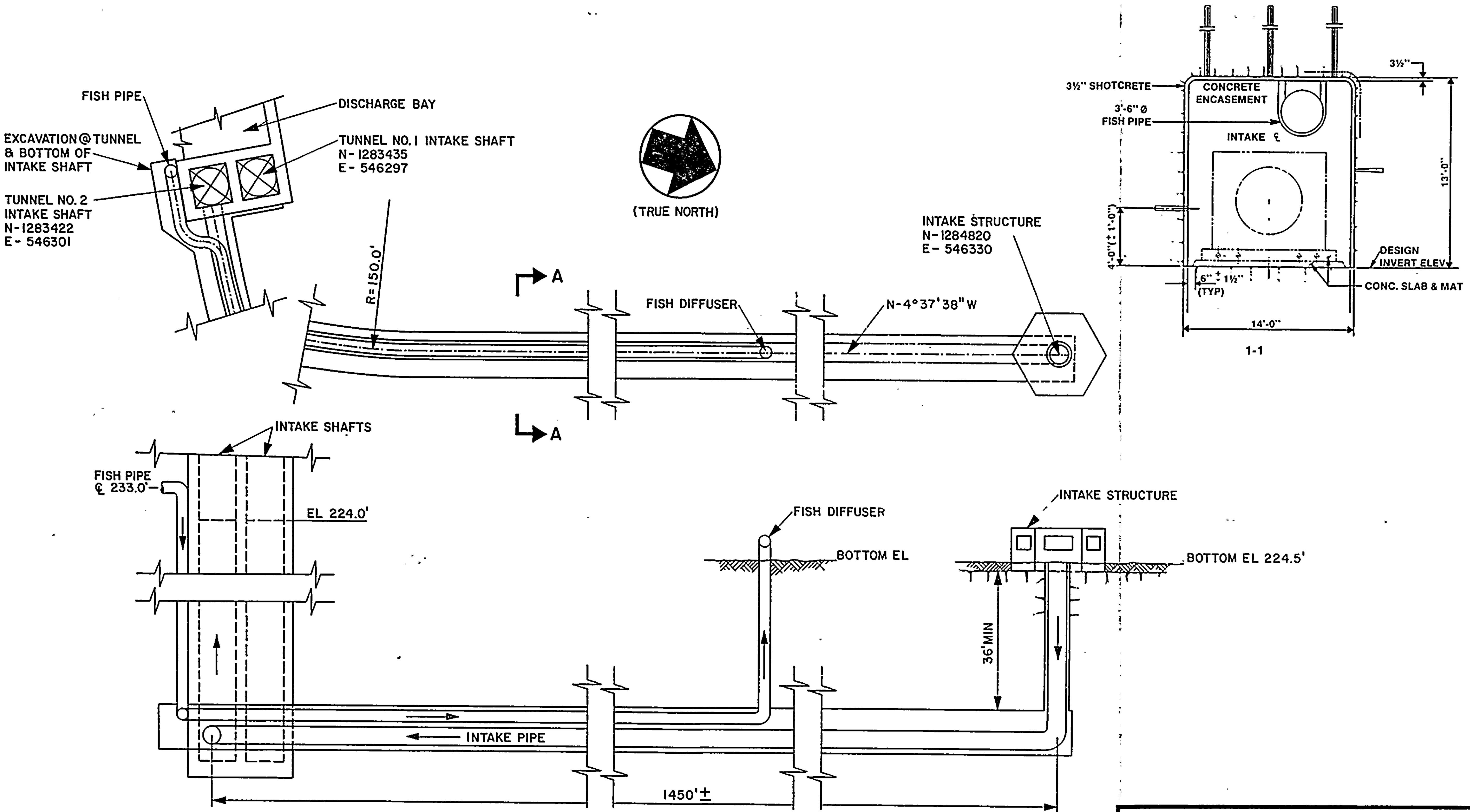

FIGURE 3.4-5

NO. 2 INTAKE TUNNEL

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
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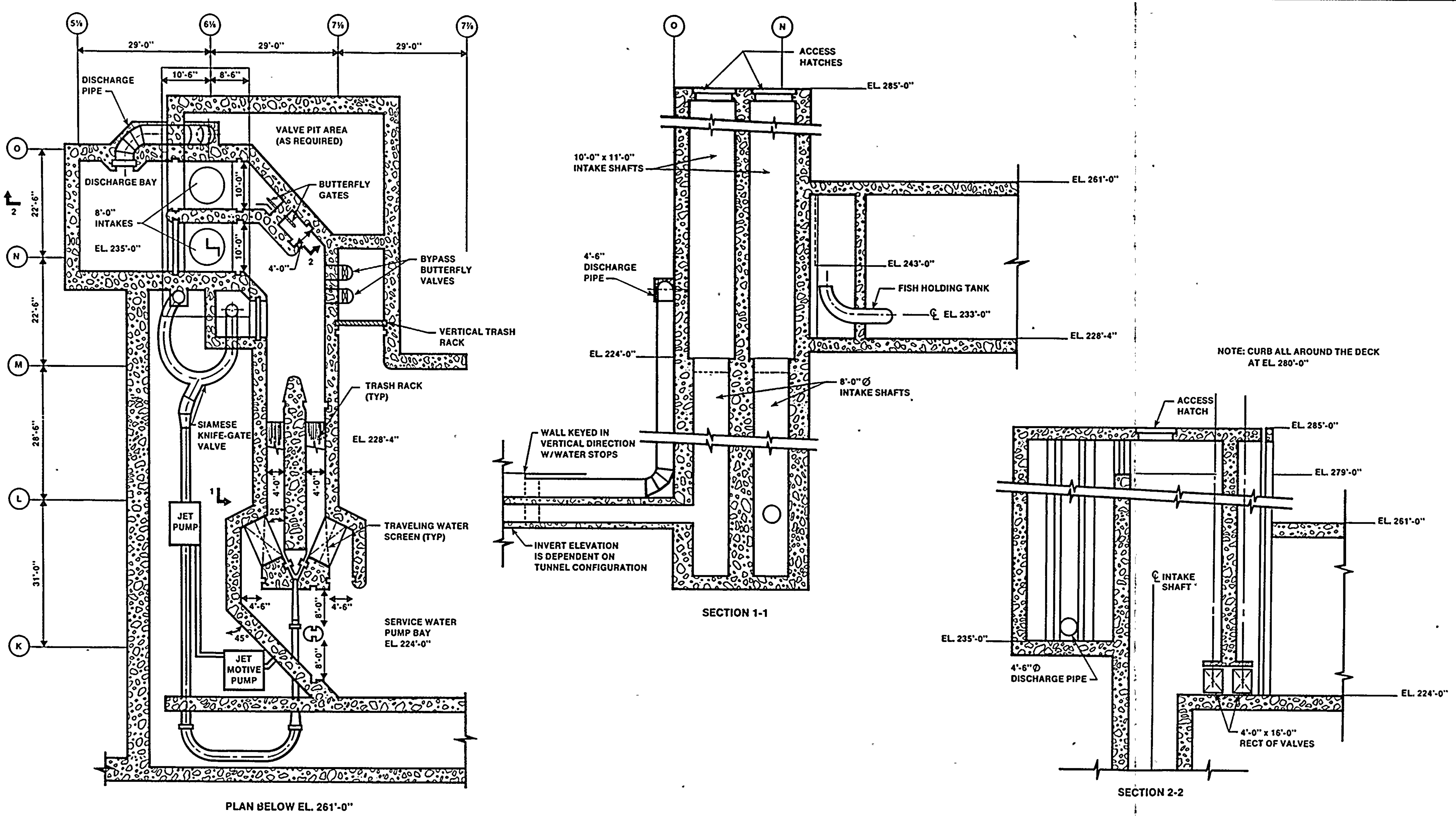

FIGURE 3.4-6

SCREENWELL LAYOUT

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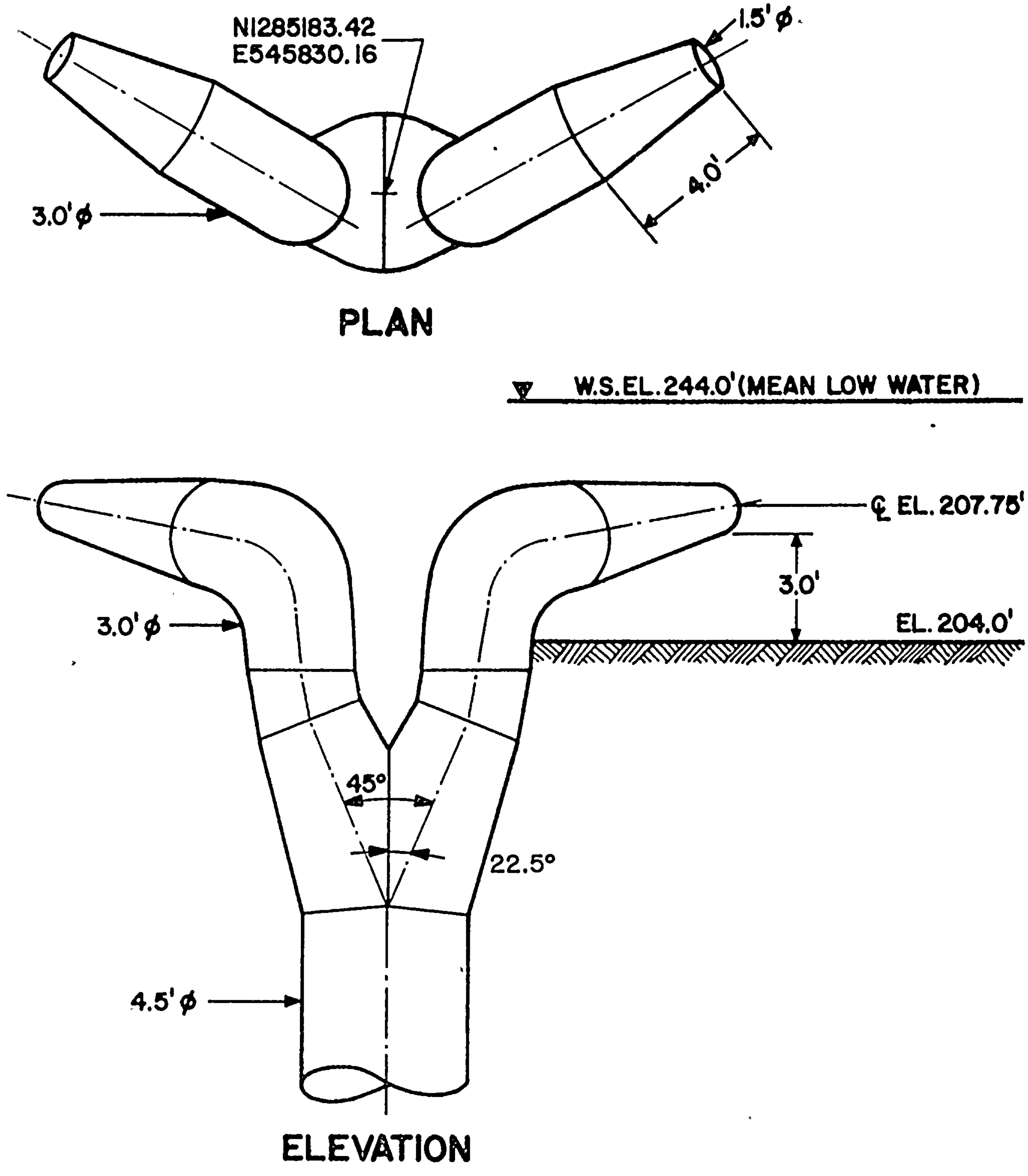

FIGURE 3.4-7

DISCHARGE DIFFUSER

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WET BULB TEMPERATURES (°F)

DRY BULB TEMPERATURES (°F)	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79
63															
64															
65	6.9														
66	13.8	4.4													
67	16.2	10.6	2.5												
68	16.9	13.4	12.0	3.9											
69	12.9	13.3	10.4	14.1	2.2										
70	13.1	11.5	9.0	13.6	8.4	1.2									
71	11.5	8.2	9.2	10.8	9.7	5.8	0.7								
72	10.2	8.9	10.8	11.1	8.3	7.5	5.0	0.8							
73	5.2	8.1	8.5	8.7	8.1	5.4	4.5	1.6	0.3						
74	8.2	7.5	7.6	6.9	8.6	5.7	4.4	2.5	1.0						
75	7.8	6.8	8.0	7.7	8.9	6.7	3.3	2.9	0.9	0.5					
76	7.3	6.4	6.0	7.6	7.6	5.9	4.2	2.9	1.3	0.7					
77	6.1	5.1	5.1	5.9	6.0	7.2	3.2	2.2	1.9	0.6					
78	6.6	6.3	5.1	6.9	4.9	5.4	3.6	3.5	2.5	0.8	0.8	0.1			
79	5.9	4.9	5.3	5.4	5.7	5.5	3.0	3.7	2.5	0.9	0.5	0.1	0.1		
80	5.1	5.4	6.9	6.5	5.0	6.6	4.8	2.5	3.7	1.1	0.7	0.1	0.0		
81	4.4	3.8	5.3	4.0	3.8	4.4	3.9	3.7	2.0	2.1	0.5	0.1	0.1		
82	5.6	3.0	4.8	4.7	3.9	5.3	4.8	4.0	2.9	2.1	0.7	0.2	0.1		
83	3.4	3.2	4.0	5.2	2.5	4.6	4.0	4.6	3.5	1.9	0.6	0.0	0.2		
84	2.7	2.6	3.4	3.2	2.8	4.0	3.4	5.0	2.5	1.8	0.5	0.2	0.0		
85	2.2	2.2	2.7	4.7	2.2	4.0	2.3	3.1	2.4	1.8	1.5	0.6	0.2		
86	1.4	2.1	2.5	2.9	2.3	3.0	3.3	3.8	3.0	2.8	1.0	0.7	0.0	0.1	
87	0.5	1.1	1.7	1.9	2.4	2.1	2.7	1.6	3.0	2.2	1.2	0.8	0.2	0.0	
88	0.4	1.1	1.5	2.3	1.8	2.5	2.1	2.6	2.2	1.8	1.2	0.8	0.4	0.1	
89	0.5	0.6	0.5	1.6	0.8	1.7	1.1	2.4	1.4	1.8	1.1	0.6	0.4	0.0	0.1
90		0.4	0.3	0.9	1.2	1.3	1.8	3.2	2.1	1.5	0.9	1.3	0.3	0.1	0.1
91		0.5	0.1	0.2	0.8	1.3	0.7	1.7	2.4	1.2	0.9	1.0	0.4	0.0	0.0
92		0.1	0.2	0.2	0.3	1.0	1.1	2.2	1.2	1.1	0.6	0.9	0.8	0.1	0.1
93				0.3	0.3	0.3	0.5	0.9	1.1	0.4	0.9	0.2	0.3	0.1	0.1
94				0.1	0.3	0.1	0.4	0.4	1.0	0.4	1.0	0.4	0.4	0.4	0.2
95					0.1	0.2	0.2	0.4	0.5	0.3	0.3	1.0	0.1	0.3	0.0
96						0.1	0.2	0.4	0.3	0.2	0.5	0.1	0.3	0.1	0.1
97						0.1	0.1	0.1	0.2		0.3	0.1	0.0	0.0	0.2
98												0.1	0.1	0.0	
99														0.1	
TOTALS	174.8	141.5	133.4	141.3	108.9	98.9	69.4	62.7	45.8	28.0	15.7	9.4	4.4	1.4	0.9 ← TOTAL HOURS OCCURRENCE
PERCENT	1.99	1.61	1.52	1.61	1.24	1.13	0.79	0.72	0.52	0.32	0.18	0.11	0.05	0.02	0.01 ← % ANNUAL OCCURRENCE

NATURAL DRAFT COOLING TOWER PERFORMANCE CURVE

100% RH, 90% RH, 80% RH, 70% RH, 60% RH, 50% RH, 40% RH, 30% RH, 20% RH

BASED ON ANNUAL AVERAGE OF 8764.7 HOURS OF COMPLETE DATA. INCOMPLETE OR MISSING HOURS OF RECORD FOR TOTAL TEN YEAR PERIOD OF RECORD IS 19 HOURS.

FIGURE 3.4-8

DESIGN TEMPERATURE SELECTION FOR COOLING TOWERS

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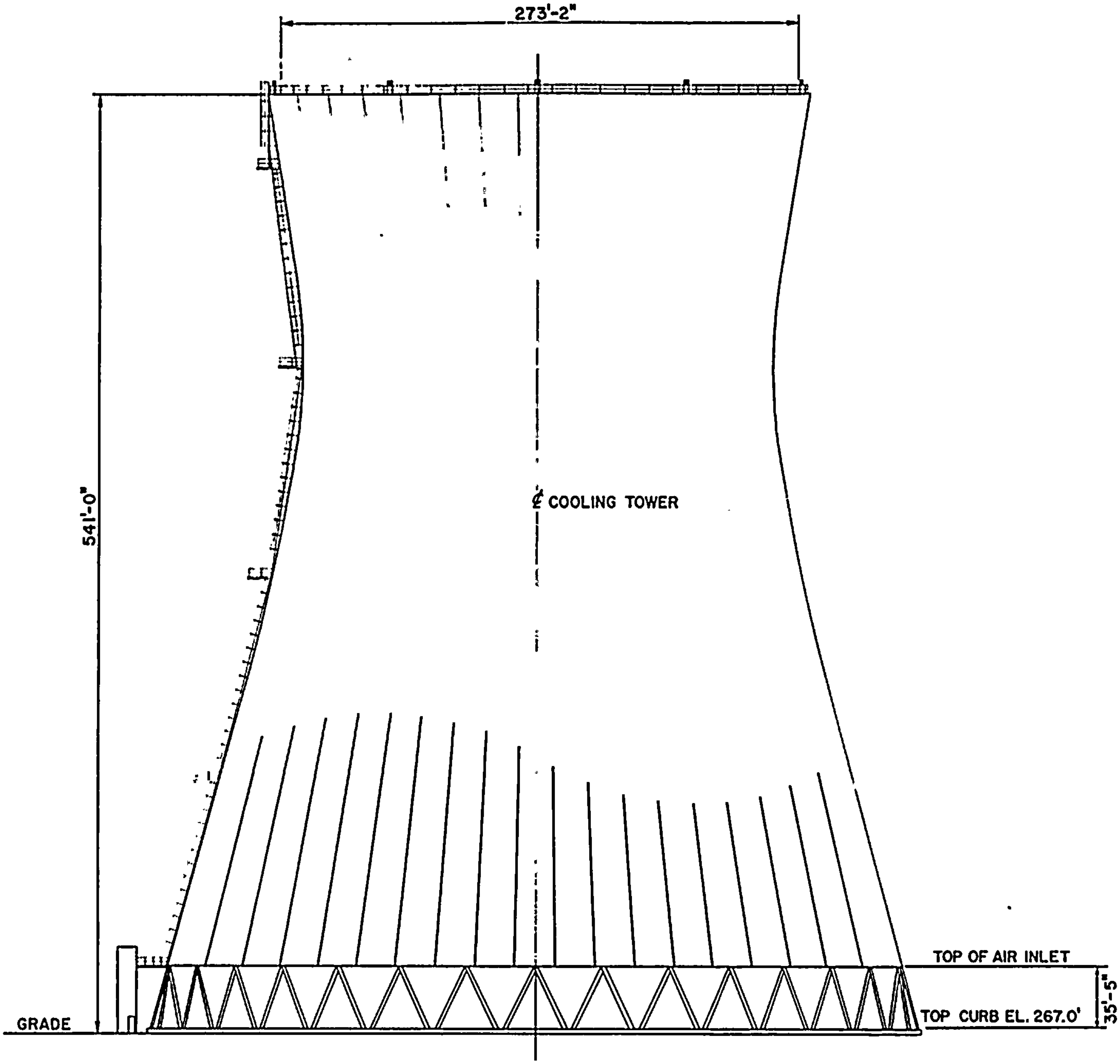

FIGURE 3.4-9

COOLING TOWER

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NINE MILE POINT-UNIT 2
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3.5 RADIOACTIVE WASTE MANAGEMENT SYSTEMS

3.5.1 Radioactive Liquid Waste System

The radioactive liquid waste system (LWS) collects, monitors, and processes for reuse or disposal all liquids received from the reactor coolant system or liquids that can become contaminated from contact with the reactor coolant system.

The LWS is capable of processing the anticipated quantities and activities of liquid waste resulting from normal operation and maintenance, as listed in Table 3.5-1. The LWS is capable of processing the maximum daily input from all sources, except for regenerant chemical wastes, within 24 hr. Tanks are provided for storage of the regenerant chemical wastes not processed within 24 hr. The majority of the processed effluent is reused. The waste effluent discharged from the station is within the limits of 10CFR20 and meets the guidelines of Appendix I to 10CFR50.

The system is divided into three major subsystems and one minor subsystem. The waste collector, floor drain, and regenerant chemical subsystems are the three major subsystems, and the phase separator is the minor subsystem. A piping and instrumentation flow diagram for the LWS is shown on FSAR Figure 11.2-1.

3.5.1.1 Waste Collector Subsystem

Wastes entering the waste collector subsystem have variable activity levels, depending on their source and conductivity (less than 50 umho/cm). There are three waste collector tanks plus one waste collector surge tank receiving liquid wastes from designated systems. Radioactive materials are removed from these wastes by filtration (insolubles removal) and ion exchange (soluble and colloidal removal). The filter backwash is decanted and the sludge transferred to the solid radwaste system. Mixed-resin deep-bed demineralizers purify the filter effluent. Spent resin is transferred to the condensate demineralizer regeneration system for cleanup.

Following batch sampling and analysis, the processed liquids are either returned to the condensate storage tank or recycled to the waste collector tank for reprocessing.

Inflow to the waste collector subsystem includes drains from piping and equipment containing high-quality water that cannot be returned directly to the condenser hotwell and

wastes from the reactor coolant system, condensate system, feedwater system, off-gas system drains, and associated auxiliary systems. It also includes low-conductivity wastes from the condensate demineralizer regeneration system (resin transfer and backwash water), and ultrasonic resin cleaning waste.

Off-standard process effluents, such as water of relatively high-radioactive concentration, are recycled to the waste collector tank or other appropriate subsystems for reprocessing. Sample analysis will indicate the most appropriate method.

3.5.1.2 Floor Drain Subsystem

Potentially high-conductivity wastes in the floor drain subsystem are collected in the floor drain collector tanks. Floor drain waste is either filtered and demineralized or evaporated and demineralized. The wastes come from radwaste building floor sumps, reactor building floor drain sumps, drywell floor drains, turbine building floor drain sumps, laboratory drains, and decontamination area drains. Normally, floor drains will be a source of recoverable water, if not contaminated with chemicals or oil prior to collection. Chemical wastes are normally processed in the waste evaporator or packaged at the point of use.

The waste evaporator is a forced-circulating design, with a vertical external reboiler and an overhead rectifying tower. The concentrated bottoms are partially cooled and stored prior to transfer to the waste solidification system for disposal. Evaporator overhead is routed to the waste collector tanks for demineralization prior to reuse as condensate, or to the floor drain collector tanks for reuse as condensate, or to the discharge sample tanks for discharge.

The floor drain filter is a flat bed, precoat type, capable of discharging filter cake slurry to the solid radwaste sludge tank for waste solidification.

3.5.1.3 Regenerant Chemical Waste Subsystem

Chemicals resulting from regeneration of condensate demineralizers are collected, neutralized, and sampled in the regenerant waste tank. The neutralized chemical solution (approximately 1 percent solids) is then processed through the regenerant evaporator. Periodically, the evaporator bottoms are partially cooled and directed to the evaporator bottoms tank for storage prior to transfer to the

waste solidification system for disposal. Evaporator overhead is routed to the waste collector tanks for demineralization prior to reuse as condensate, or to the floor drain collector tanks for reuse as condensate, or to the discharge sample tanks for discharge.

3.5.1.4 Phase Separator Subsystem

Continuous processing of a portion of reactor water through the four filter demineralizer units of the reactor water cleanup system located in the reactor building produces a radioactive effluent from the backwashing and precoating cycles. This effluent is directed to one of two phase separators in the reactor building, where the liquid is held for fission product decay. The liquid in the phase separator tanks is decanted and sent to the waste collector tank for processing. The remaining liquid and sludge are pumped to the spent resin tank in the radwaste building to be further decanted for feed to the solid waste system. A similar phase separator tank receives backwash from the spent fuel pool filter/demineralizer. The liquid is decanted and the sludge is held for decay before transfer to the spent resin tank for final processing. The decant from the spent resin tank is sent to the floor drain collector tanks.

3.5.1.5 System Operation Analysis

Table 3.5-2 lists the expected annual activity releases from the LWS. The method used to calculate the expected releases conforms to NUREG-0016, Revision 1.

The following bases were used to develop the quantities estimated in Table 3.5-2:

1. Input sources to the LWS, average daily flow rate, primary coolant concentration fraction, and discharge fraction are listed in Table 3.5-1.

2. Decay time for all streams is based on the minimum fill time for the respective tanks. There is no holdup due to any processing equipment. LWS tank capacities and fill times are listed in Table 3.5-3.

3. Process equipment capacities are listed in Table 3.5-4. Process equipment decontamination factors are listed in Table 3.5-5.

4. Supplemental data for calculating the annual expected activity released are listed in Table 3.5-6.

3.5.1.6 Release of Processed Waste

Liquid waste from one of two waste discharge sample tanks is discharged on a batch basis to the cooling water discharge tunnel and directed to Lake Ontario. Table 3.5-7 identifies the principle release points for radioactive materials to the environment and the associated monitoring processes. Prior to release, each batch is analyzed for gamma activity, and the activity discharge to the lake is recorded.

The dilution factor used in evaluating the release of radioactive effluents is that provided by the service water flow of 116,250 l/min (30,000 gpm). The calculated annual average discharge of liquid radwaste is less than 8 l/min (2 gpm).

Isotopic analyses or composites of retained samples are made and documented. Detailed administrative records of all radioactive liquid releases are maintained. Table 3.5-2 presents the maximum expected annual average discharge concentrations of radionuclides after dilution by service water. Approximately 0.18 Ci/operating day of tritium will be released. An average of about 6,316 l/day (1,630 gpd) of liquid waste is anticipated to be released after being processed by the LWS.

3.5.2 Radioactive Gaseous Waste System

The radioactive gaseous waste system is designed so that the release of activity from the plant and the resultant doses and dose equivalents to persons in unrestricted areas are below the allowable limits established by 10CFR20, 10CFR50, 40CFR190, 40CFR141, and the EPA. Tables 3.5-8 and 3.5-9 list the quantities of radioactive gaseous effluents released to the environment from the reactor building, turbine building, radwaste building, mechanical vacuum pump, and off-gas system. Table 3.5-7 identifies the principal release points for radioactive materials to the environment and the associated monitoring processes. Table 3.5-10 lists radioactive gaseous effluents from the two release points during normal plant operation.

3.5.2.1 Sources and Releases of Radioactive Gases

Sources of potentially radioactive gases that are processed by the radioactive gaseous waste system are:

1. Process off gas.
2. Mechanical vacuum pump exhaust.
3. Containment purge exhaust.
4. Reactor building ventilation.
5. Turbine building ventilation.
6. Radwaste building ventilation.

Gaseous effluents from the preceding sources are released to the environment through the main stack or the radwaste/reactor building vent. The online isotopic monitors in both the main stack and the radwaste/reactor building vent measure the activity level at the point of release to the environment. The activity concentrations of process off gas, primary containment purge exhaust, reactor building ventilation, and radwaste building ventilation are analyzed by radiation monitors in the individual systems. Any effluent streams having activity concentrations higher than that allowed for the system are either filtered to allowable levels or isolated.

3.5.2.1.1 Process Off Gas

Noncondensable radioactive process off gas is continuously removed from the main condensers by steam jet air ejectors. The off-gas system is described in Section 3.5.2.2. Table 3.5-11 provides off-gas system process data. Condenser off gas is greater than all other sources combined and normally contains both activation gases from the reactor coolant system and fission gases that may leak through the fuel cladding. Activation gases result from irradiation of reactor coolant passing through the reactor vessel. Composition of activation gases is principally N-16, O-19, and N-13. Both N-16 and O-19 have half-lives of less than 1 min, while N-13 has a half-life of approximately 10 min. Process off gas also contains radioactive noble gas parents (Kr and Xe) of Sr-89, Sr-90, Ba-140, and Cs-137. Concentration of these noble gases depends on the amount of tramp uranium on the cladding surfaces, and on the number and size of fuel cladding perforations. Table 3.5-8 gives

estimated activity flow rates at 30-min decay and associated activity release rates at the point of discharge.

3.5.2.1.2 Mechanical Vacuum Pump Air Removal

During unit startup, air is removed from the main condenser by two 50-percent capacity mechanical vacuum pumps. Exhaust from these pumps is monitored before release to the atmosphere via the main stack. These pumps are in service only during unit startup when little or no radioactive gas is present.

3.5.2.1.3 Primary Containment Purge Exhaust

Exposure of drywell air to neutron leakage around the reactor vessel results in some activation products. Activity may also be introduced into the drywell atmosphere by venting the primary system safety relief valves into the suppression chamber and from drywell equipment and floor drain tanks. The drywell forms a closed system that may be purged with normal reactor building air, if necessary, when access is required. The drywell can also be vented during startup to accommodate expansion of air as the temperature increases. This air will be discharged to the main stack by way of the standby gas treatment system (SGTS). Radiation levels in the purge exhaust air from the drywell are monitored by a process radiation monitor.

3.5.2.1.4 Reactor Building Ventilation

The secondary containment of the reactor building is continuously purged with outside air to maintain radiation levels acceptable for required personnel access. The reactor building ventilation, both above and below the refueling floor, is equipped with two online area-type monitors to provide automatic ventilation isolation. During accident conditions, the ventilation from above and below the refueling floor may be diverted to the SGTS, which is equipped with prefilters, a bank of high-efficiency particulate air (HEPA) filters, charcoal adsorber beds, and a second bank of HEPA filters. Radiation levels in the exhaust air from all areas of the reactor building are monitored by radiation detection instrumentation.

3.5.2.1.5 Turbine Building Ventilation

The prime potential source of airborne halogen releases to the atmosphere is from the vaporization of steam leaks in the turbine building. Evaluations of radioactivity levels in such building ventilation releases are approximate, since

certain assumptions have been made regarding quantity of leakage, removal in the turbine building, radioactivity levels in the leakage, and partition factors. Estimated doses are based on a level of 50,000 uCi/sec (after 30-min decay). The turbine building ventilation system discharges through the main plant stack. All releases from the stack are measured by an online isotopic effluent monitor. The radioactive gaseous effluent from the turbine building ventilation system is presented in Table 3.5-9. In calculating doses for Section 5.4, activities listed in Table 3.5-9 were used.

3.5.2.1.6 Radwaste Building Ventilation

Certain tanks and equipment and some radwaste building service areas are vented to discharge gases to the combined radwaste/reactor building exhaust vent. This release point is monitored to ensure that the discharge is below the limits required by applicable regulations. FSAR Section 12.2.1.5 presents a description of radiation sources in the radwaste building.

3.5.2.2 Description of the Off-Gas System

The off-gas processing system is provided to reduce the total amount of gaseous radwastes released from the plant. The piping and instrumentation diagram for the off-gas system is shown on FSAR Figure 11.3-1. Two trains of four charcoal beds each are arranged in series to provide a 522-hr decay period for xenon isotopes and a 29.6-hr decay period for krypton isotopes, assuming 25-scfm flow rate (preceding holdup-time values are based on NUREG-0016, Revision 1, calculation methods). The minimum decay period provided by the system, assuming 52.5-cfm flow rate, is 274 hr for xenon and 13.7 hr for krypton. The system also provides for a delay time of 7.6 hr for Argon-41 (calculated using NUREG-0016, Revision 1). The design is based on 348,900 uCi/sec continuous activity flow rate for noble gases measured after a 30-min decay period. Consequently, the activity flow rate used as a design basis is significantly higher than the activity flow rate of 50,000 uCi/sec given in Table 3.5-8, which is an expected value and considered more representative for normal plant operation (Section 5.4).

Process off gas is removed from the main condenser by steam jet air ejectors. The estimated mass flow rates for off gas to be handled by each steam jet air ejector unit is:

Dry air	63 kg/hr (138 lb/hr)

H_2	20 kg/hr	(43 lb/hr)
O_2	156 kg/hr	(344 lb/hr)
H_2O	1,696 kg/hr	(3,740 lb/hr) (as dilution steam)
Noble gases		Negligible

NOTE: The off-gas system inlet temperature is approximately 121°C (250°F).

The preceding quantities are used as the design basis for the off-gas system. Furthermore, the system is designed to accommodate variations in flow rates without compromising performance abilities.

The off-gas system is located in the turbine building and operates in the following manner. Steam jet air ejectors remove noncondensable gases from the main condenser, provide the required pressure at the inlet of the off-gas system, and maintain the hydrogen concentration below the 4-percent (by volume) flammability limit by providing the required steam flow for dilution at all power levels. Hydrogen analyzers are used to confirm these concentrations. Low steam flow is sensed and results in an alarm signal. A steam preheater raises the temperature of the gas stream prior to entering the catalytic recombiner, where all but approximately 6.4 kg/hr (14 lb/hr) of water vapor recombines. Further water removal occurs in the freezeout dryer. The activity of the off gas is reduced by passage through a series of ambient temperature charcoal adsorber tanks, and HEPA filters are used to remove any particulate matter.

Major components of the off-gas system are duplicated to provide two parallel off-gas trains. Components requiring servicing are placed in individually shielded cubicles to minimize personnel exposure during maintenance.

The off-gas system includes the following equipment and is shown on FSAR Figure 11.2-1.

3.5.2.2.1 Preheaters

Following pressurization of the gas stream and dilution by the air ejectors, the off-gas mixture enters a preheater. The preheater uses steam from the auxiliary steam system to raise the temperature of the gaseous mixture to 143°C (290°F). This temperature rise serves to:

1. Ensure complete vaporization of any liquid water.

2. Minimize the inhibiting influence of halogens on reactor kinetics.

3. Limit the adiabatic temperature rise of the gas to 216°C (420°) for an effluent temperature of 377°C (710°F) (3.5 percent by volume maximum inlet hydrogen concentration).

3.5.2.2.2 Catalytic Recombiners

Preheated off gas is directed to one of two catalytic recombiners where the radiolytically disassociated hydrogen and oxygen react catalytically to form water vapor, eliminating the hydrogen hazard and reducing the volume of gas to be handled. The hydrogen concentration downstream of the recombiner is less than 4.0 percent by volume at all power levels.

Recombination is accomplished by introducing the process off gas to a ceramic-based catalyst to form water. Since the hydrogen-oxygen recombination reaction is exothermic, it is necessary to cool the process stream before it can be passed to the charcoal delay tanks.

3.5.2.2.3 Off-Gas Condenser

Newly formed water vapor and dilution steam are removed downstream of the recombiner by a condenser, where the heat of reaction developed in the recombiner is also removed. Condensate from the off-gas condenser returns to the main condenser hotwell.

The recombiner effluent is cooled to approximately 49°C (120°F). Water that condenses drains to the main condenser. A wire mesh mist eliminator is installed in the outlet of the recombiner condenser to remove entrained water droplets from the process stream.

3.5.2.2.4 Holdup Pipe

Downstream of the off-gas condenser is a pipe which provides a 75-sec holdup of the off gas so that some additional decay of short-lived radioisotopes can occur, thereby reducing the activity of the gas.

3.5.2.2.5 Freezeout Dryers

Gas is passed from the holdup pipe through freezeout dryers, where the process stream temperature is cooled to 4.4°C (40°F) to lower the moisture content of the gas. The

temperature is further reduced to -29°C (-20°F). This is done because moisture reduces the efficiency and life of charcoal beds downstream.

3.5.2.2.6 Charcoal Adsorbers

Charcoal beds are arranged in two parallel trains of four each. Each train is designed to handle 50 percent of the gas flow. The trains can be operated in parallel or in series.

Xenon and krypton isotopes are adsorbed by the charcoal and delayed from the bulk carrier gas (essentially air), permitting them to decay and significantly reducing the offsite dose. Design basis holdup times of 480 hr for xenon and 26.6 hr for krypton have been selected.

3.5.2.2.7 HEPA Filters

Two identical HEPA filter vessels are provided downstream of the charcoal beds. The filter is designed to trap at least 99.97 percent of particles 0.3 microns and larger. The filters are each designed to process 100 percent of design flow and are installed such that one is on stream while the other is on standby or undergoing maintenance.

3.5.2.2.8 Vacuum Pumps

The motive force used to draw the off gas through the system is provided by two lobe-type, rotary, positive displacement vacuum pumps. Each pump blower is designed to handle 100 percent of the process flow. These vacuum pumps discharge waste gas through the main stack, where it is monitored for radioactivity before release to the atmosphere.

3.5.3 Solid Radwaste System

The objective of the solid radwaste system is to collect, process, package, and provide temporary storage facilities for solid wastes. A piping and instrumentation diagram for the solid radwaste system is shown on FSAR Figure 11.4-1.

The system is designed to the following criteria:

1. Solidification and packaging of liquid wastes and sludges with asphalt in shipping containers as a homogeneous, immobile mix prior to shipment for offsite disposal.

2. All solid waste containers, shipping casks, and methods of packaging meet applicable state and federal regulations. Wastes will be shipped to a licensed disposal site in accordance with applicable NRC and Department of Transportation (DOT) regulations (i.e., 10CFR71 and 49CFR171-178).

3. Filling of containers and solidification and storage of radioactive solid wastes conform to 10CFR20 and 10CFR50 requirements in terms of as low as is reasonably achievable doses to plant personnel and the general public.

3.5.3.1 Sources of Solid Radwaste

Radioactive solid wastes resulting from plant operation consist of:

1. <u>Process Waste Materials</u>

   a. Concentrated liquid wastes from the evaporators in the radioactive liquid waste stream.

   b. Spent resins from all plant demineralizers handling radioactive liquids and filter sludges from the phase separators and waste filters.

   c. Contaminated compressible materials, such as paper and rags accumulated in a controlled manner during operation of the plant, and incompressible materials, such as tools.

2. <u>Irradiated Reactor Components</u>

   a. Control rods.

   b. Fuel channels.

   c. Other reactor solid wastes.

Table 3.5-12 is a conservative estimate of the solid radwaste system inputs and the yearly volumes that are generated. The expected activity levels of the waste are given in Table 3.5-13.

3.5.3.2 Equipment Description

The solid waste system provides the capability for collecting in wet form, solidifying, and packaging process waste material in 1.4-cu m (50-cu ft) containers or 213-l (55-gal) drums and for compacting compressible, dry waste into low specific activity (LSA) boxes.

The solid radwaste system includes:

1. Waste sludge tank with facilities for decantation and dilution.

2. Metering and mixing equipment for combining waste with asphalt-solidifying agent.

3. Packaging system for discharging mixed waste and solidifying agent directly to shipping container.

4. Remote facilities for sealing containers.

5. Handling equipment for transferring loaded radioactive containers to storage or shipping.

3.5.3.3 Description of Solids Processing Procedure

The basic operation of the solid radwaste system is as follows.

<u>Process Waste Materials</u>

Process spent resins are collected in a waste sludge tank. Any liquid that may have been used to transfer the waste into the tank can be decanted and sent to the liquid radwaste system. When the spent resin is to be solidified, a pump located below the waste sludge tank recirculates the slurry. Another pump meters the waste to an evaporator/extruder. Simultaneously, the asphalt-solidifying agent is metered to the extruder from an asphalt tank. From the extruder, the effluent is discharged into an approved shipping container. The shipping containers are monitored for radiation level before storage and/or shipping.

Process waste filter sludges are processed in the same manner.

Evaporator bottoms are metered from the evaporator bottoms tank into the evaporator/extruder along with the asphalt-solidifying agent. The effluent is discharged into approved

shipping containers and monitored for radiation level before storage and/or shipping.

Dry solid waste, such as paper and rags, are compacted into LSA boxes for shipment. During the waste-compacting operation, the airflow is directed by an exhauster through a HEPA filter and then to the building ventilation system.

Irradiated Reactor Components

Irradiated reactor components are handled underwater within the reactor refueling cavity and fuel transfer canal and may be stored in the fuel pool until packaged for offsite shipment. Handling of such equipment depends on radiation level, transportation facilities, and available storage sites.

3.5.3.4 Storage and Shipping

All solid radwaste material is packaged in approved shipping containers that meet the requirements of 10CFR71 and DOT regulation 49CFR173, Sections 389 through 395, and shipped to licensed offsite disposal locations.

The design and utilization of shipping containers meet the regulations for transportation of radioactive materials found in 49CFR171, 49CFR172, 49CFR177, and 49CFR178.

The activity of the compressible dry wastes is low enough to permit handling of the packages. These wastes are collected in containers located in appropriate zones around the station, as dictated by the volumes of wastes generated during operation and maintenance.

Filled containers are sealed and moved to a controlled-access enclosed storage area for temporary storage. The packaged solid waste, depending on its activity level, is stored in one of two storage areas located within the radwaste building. High-activity waste is stored in a shielded area within the radwaste building; low-activity waste is stored in a limited-access area within the building. This limited-access storage area is also used for storage of uncontaminated containers and low-activity waste packaged by the dry waste compactor.

Packaged wastes are shipped, shielded as necessary, to an approved disposal facility for storage or burial. Shipments of radioactive solid waste are made by licensed carriers using either rail or truck transport. The packaged solid waste is shipped on a regular basis, depending on quantity

and activity, in accordance with the applicable NRC and DOT regulations. The expected number of shipments and the expected activities of the wastes are summarized in Tables 3.5-12 and 3.5-13.

TABLE 3.5-1

LIQUID RADWASTE SYSTEM INPUT SOURCES, FLOW RATES, PRIMARY COOLANT CONCENTRATIONS, AND DISCHARGE FRACTIONS

Stream Number[1]	Input Stream Description	Average Daily Flow Rate (gpd)	Primary Coolant Concentration Fraction	Discharge Fraction (%)
2	Equipment drains	14,100	0.823	1
1	Condensate demineralizer backwash	3,150	0.002	1
10	Ultrasonic resin cleaner	15,000	0.05	1
42	Floor drain filter effluent	2,716	0.001	1
44	Waste evaporator distillate	7,390	0.001	1
31	Decant from RWCU and SFC phase separator tanks	944	0.002	1
11	Floor drains - reactor building, turbine building, and decontamination area	11,200	0.001	10
33	Spent resin tank decant	452	0.002	10
20	Regenerant chemical waste	3,150	9,600[2]	1

[1] Refer to FSAR Figure 11.2-1.
[2] Fraction of reactor steam activity.

KEY: RWCU = Reactor water cleanup
SFC = Spent fuel cleanup

TABLE 3.5-2

EXPECTED ANNUAL LIQUID RELEASES*

Isotope	Activity (uCi/g)	Released (Ci)
Na-24	1.8-10	1.1-02
P-32	7.2-12	4.2-04
Cr-51	2.1-10	1.3-02
Mn-54	2.5-12	1.5-04
Mn-56	3.4-11	2.0-03
Fe-55	3.7-11	2.2-03
Fe-59	1.1-12	6.6-05
Co-58	7.2-12	4.3-04
Co-60	1.5-11	9.0-04
Ni-63	3.7-14	2.2-06
Ni-65	1.9-13	1.1-05
Cu-64	4.5-10	2.7-02
Zn-65	7.2-12	4.4-04
Zn-69m	0.0	0.0
Sr-89	3.8-12	2.3-04
Sr-90	2.5-13	1.5-05
Sr-91	4.9-11	2.8-03
Sr-92	8.0-12	4.8-04
Y-91	1.8-12	1.1-04
Y-92	4.9-11	2.9-03
Y-93	5.4-11	3.1-03
Zr-95	2.9-13	1.7-05
Zr-97	1.1-13	6.7-06
Nb-95	2.9-13	1.7-05
Nb-98	2.3-15	1.4-07
Mo-99	6.3-11	3.7-03
Tc-99m	1.3-10	7.4-03
Tc-101	0.0	0.0
Tc-104	0.0	0.0
Ru-103	7.2-13	4.3-05
Ru-105	6.7-12	4.0-04
Ru-106	1.1-13	6.7-06
Ag-110m	3.7-14	2.2-06
Te-129m	1.5-12	8.8-05
Te-131m	2.5-12	1.5-04
Te-132	3.1-13	1.9-05
Ba-139	3.0-13	1.8-05
Ba-140	1.4-11	8.6-04
Ba-141	0.0	0.0
Ba-142	0.0	0.0
La-142	3.4-13	2.0-05
Ce-141	1.1-12	6.6-05

TABLE 3.5-2 (Cont)

Isotope	Activity (uCi/g)	Released (Ci)
Ce-143	8.0-13	4.7-05
Ce-144	1.1-13	6.7-06
Pr-143	1.5-12	8.8-05
Nd-147	1.1-13	6.4-06
W-187	6.7-12	4.1-04
Np-239	2.4-10	1.4-02
Br-83	3.5-12	2.1-04
Br-84	9.4-18	5.5-10
Br-85	0.0	0.0
I-131	1.5-10	9.1-03
I-132	2.7-11	1.6-03
I-133	1.3-09	7.4-02
I-134	7.6-14	4.6-06
I-135	4.0-10	2.4-02
Rb-89	0.0	0.0
Cs-134	5.4-11	3.1-03
Cs-136	3.5-11	2.1-03
Cs-137	1.4-10	8.7-03
Cs-138	8.9-16	5.3-08
H-3	8.9-07	5.2+01

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*Anticipated operational occurrences 1.50-01 Ci/yr added to release. Dilution release rate (g/yr) 5.97+13.
Total release (excluding tritium) is 3.7-01 Ci.
Total release (excluding tritium) is 8.9-07 uCi/g.

NOTE: 1.8-10 = 1.8×10^{-10}

TABLE 3.5-3

LWS TANK CAPACITIES AND FILL TIMES

Tank	No. of Tanks	Capacity (gal)	Fill Time/ Tank[1] (hr)
Waste collector	3	25,101	11.3
Floor drain collector	2	25,401	38.2
Regenerant waste	2	25,101	153
Recovery sample	2	25,101	11.3[2] 158[3]
Waste discharge sample	2	25,101	568
Waste collector surge	1	25,101	NA[4]
Floor drain collector surge	1	25,101	NA[4]

[1] Used to calculate actual releases.
[2] Waste collection sources.
[3] Regenerant waste sources.
[4] Only when needed.

TABLE 3.5-4

PROCESS EQUIPMENT CAPACITIES

Process Equipment	Capacity (gpm)	Type
Radwaste filter	200	Etched disc
Floor drain filter	60	Flat bed precoat
Radwaste demineral-izers	200	Mixed-bed ion ex-changer
Waste evaporator and regenerant evapor-ator	30	Forced circulation

TABLE 3.5-5

DECONTAMINATION FACTORS OF PROCESSING UNITS

Equipment	Decontamination Factor	Remarks
Radwaste and floor drain collector filters	1	For corrosion/activation products (insolubles)
Radwaste demineralizers (mixed-bed type)	2 100	For Cs and Rb For anions and all other nuclides
Waste and regenerant evaporators	1,000 10,000	For anions For all nuclides except anions

TABLE 3.5-6

LWS ANNUAL RELEASE DATA

Realistic Basis Assumption	Parameter
Maximum core thermal power	3,489 MWt
Total steam flow rate	15,009,750 lb/hr
Mass of coolant in reactor pressure vessel	6.015×10^5 lb
RWCU average flow rate	1.58×10^5 lb/hr
RWCU filter/demineralizer	
Type	4 deep-bed resin
Size	220 cu ft each
Regeneration frequency	1 vessel/1.5 days
Regeneration backwash volume	1,482 gal (including solids)
Condensate Demineralizers	
Type	9 deep-bed resin
Size	220 cu ft each
Regeneration frequency	1 vessel/week
Regeneration backwash volume per event	22,050 gal
Ultrasonic resin rinse volume	15,000 gpd

TABLE 3.5-7

IDENTIFICATION OF PRINCIPAL RELEASE POINTS FOR RADIOACTIVE MATERIALS TO THE ENVIRONMENT AND MONITORING PROCESSES

Release Point	Continuous Monitor	Automatic Control Function on Continuous Monitor
Reactor building/ radwaste building ventilation vent (reactor building roof)	Yes[1]	No[2]
Main stack	Yes[1]	No[2]
Liquid discharges to discharge tunnel		
Liquid radwaste discharge to Lake Ontario	Yes	Yes[3]
Service water system discharge to Lake Ontario	Yes	No

[1] Gaseous effluent release points are monitored by online isotopic detection systems.

[2] Continuous monitors upstream of the isotopic detectors on selected process streams provide isolation of release point inputs. Isotopic monitors do not generate isolation signals. See FSAR Figures 11.5-7 and 11.5-8 for details.

[3] Liquid radwaste discharge is isolated by the continuous monitor.

TABLE 3.5-8

ESTIMATED QUANTITIES OF FISSION PRODUCT ISOTOPES RELEASED TO THE ENVIRONS FROM THE OFF-GAS PROCESSING SYSTEM

(Failed Fuel Basis - 50,000 uCi/sec)

Fission Gas Isotope	Half-Life T 1/2	Activity at 30-Min Decay (uCi/g)	Off-Gas Release to Main Stack (Ci/yr)
Kr-83m	1.9 hr	9.1-04	7.7-01
Kr-85m	4.4 hr	1.6-03	7.3+02
Kr-85	10.8 yr	5.0-06	2.4+02
Kr-87	76 min	5.5-03	2.2-02
Kr-88	2.8 hr	5.5-03	1.9+02
Xe-131m	11.8 days	3.9-06	5.3+01
Xe-133m	2.3 days	7.5-05	4.6+00
Xe-133	5.3 days	2.1-03	5.8+03
Xe-135m	15.6 min	7.0-03	-
Xe-135	9.1 hr	6.0-03	2.2-12
Ar-41*	1.8 hr	NA	7.1+01
C-14*	5,730 yr	NA	9.5+00
Total		2.9-02	7.1+03

*Nonfission product isotopes.

TABLE 3.5-9

RADIOACTIVE GASEOUS EFFLUENT
FROM SOURCES OTHER THAN OFF GAS (Ci/yr)

Isotope	Reactor Building	Turbine Building	Radwaste Building	Mechanical Vacuum Pump
Kr-85m	3.0+00	2.5+01	-	-
Kr-87	2.1+00	6.1+01	-	-
Kr-88	3.8+00	9.1+01	-	-
Kr-89	2.4+00	5.8+02	2.9+01	-
Xe-133	1.1+02	1.5+02	2.2+02	1.3+03
Xe-135m	6.1+01	4.0+02	5.3+02	-
Xe-135	1.3+02	3.3+02	2.8+02	5.0+02
Xe-137	1.9+02	1.0+03	8.3+01	-
Xe-138	7.3+00	1.0+03	2.0+00	-
Cr-51	9.7-04	9.0-04	7.0-06	-
Mn-54	1.3-03	6.0-04	4.0-05	-
Fe-59	3.5-04	1.0-04	3.0-06	-
Co-58	2.9-04	1.0-03	2.0-06	-
Co-60	5.1-03	1.0-03	7.0-05	-
Zn-65	4.1-03	6.0-03	3.0-06	-
Sr-89	1.7-04	6.0-03	-	-
Sr-90	7.9-06	2.0-05	-	-
Zr-95	6.2-04	4.0-05	8.0-06	-
Nb-95	1.1-02	6.0-06	4.0-08	-
Mo-99	6.3-02	2.0-03	3.0-08	-
Ru-103	5.9-04	5.0-05	1.0-08	-
Ag-110m	2.6-06	-	-	-
Sb-124	2.1-05	1.0-04	7.0-07	-
Cs-134	4.3-03	2.0-04	2.4-05	-
Cs-136	4.9-04	1.0-04	-	-
Cs-137	5.7-03	1.0-03	4.0-05	-
Ba-140	1.4-02	1.0-02	4.0-08	-
Ce-141	7.9-04	1.0-02	7.0-08	-
I-131	2.3-02	1.1-01	1.0-02	4.3-02
I-132	4.1-01	1.9+00	1.8-01	7.4-01
I-133	3.0-01	1.6+00	1.4-01	5.9-01
I-134	7.5-01	4.7+00	3.4-01	1.7+00
I-135	3.2-01	1.6+00	1.4-01	6.1-01
H-3	2.6+01	2.6+01	-	-
Ar-41	1.5+01	-	-	-

TABLE 3.5-10

RADIOACTIVE GASEOUS EFFLUENT FROM THE TWO RELEASE POINTS (Ci/yr)

	Radwaste/Reactor Building Vent		Main Stack		Mechanical Vacuum Pump Releases
Isotope	Power Operations	Shutdown	Power Operations	Shutdown	
Kr-83m	-	-	7.7-01	-	-
Kr-85m	3.0+00	-	7.6-02	-	-
Kr-85	-	-	2.4-02	-	-
Kr-87	2.1+00	-	6.1+01	-	-
Kr-88	3.8+00	-	2.6+02	-	-
Kr-89	3.1+01	-	5.8+02	-	-
Xe-131m	-	-	5.3+01	-	-
Xe-133m	-	-	4.6+00	-	-
Xe-133	3.3+02	-	6.0+03	-	1.3+03
Xe-135m	5.9+02	-	4.0+02	-	-
Xe-135	4.1+02	-	3.3+02	-	5.0+02
Xe-137	2.7+02	-	1.0+03	-	-
Xe-138	9.3+00	-	1.0+03	-	-
Cr-51	9.7-04	1.4-05	7.2-04	1.8-04	-
Mn-54	1.3-03	3.4-05	4.8-04	1.2-04	-
Fe-59	3.5-04	4.4-06	8.0-05	2.0-05	-
Co-58	2.8-04	8.6-06	8.0-04	2.0-04	-
Co-60	5.1-03	9.0-05	8.0-04	2.1-04	-
Zn-65	4.0-03	1.1-04	4.8-03	1.2-03	-
Sr-89	1.7-04	1.3-06	4.8-03	1.2-03	-
Sr-90	7.6-06	2.3-07	1.6-05	4.0-06	-
Zr-95	6.2-04	1.2-05	3.2-05	8.9-06	-
Nb-95	1.1-02	2.0-05	4.8-06	3.0-06	-
Mo-99	6.3-02	3.7-06	1.6-03	4.0-04	-
Ru-103	5.8-04	1.2-05	4.0-05	1.1-05	-
Ag-110	2.5-06	6.9-08	-	6.2-09	-
Sb-124	2.1-05	1.2-06	8.0-05	2.0-05	-
Cs-134	4.3-03	3.9-05	1.6-04	4.3-05	-
Cs-136	4.8-04	6.9-06	8.0-05	2.1-05	-
Cs-137	5.6-03	6.8-05	8.0-04	2.1-04	-
Ba-140	1.4-02	2.7-05	8.0-03	2.0-03	-
Ce-141	7.8-04	8.2-06	8.0-03	2.0-03	-
I-131	2.9-02	3.3-03	1.0-01	1.2-02	4.3-02
I-132	5.2-01	5.9-02	1.7+00	2.1-01	7.4-01
I-133	3.9-01	4.4-02	1.4+00	1.6-01	5.9-01
I-134	9.5-01	1.1-01	4.2+00	4.8-01	1.7+00
I-135	4.1-01	4.6-02	1.4+00	1.7-01	6.1-01
H-3	2.6+01	-	2.6+01	-	-
Ar-41	-	-	7.1+01	1.5+01	-
C-14	-	-	9.5+00	-	-

TABLE 3.5-11

OFF-GAS SYSTEM PROCESS DATA

Parameter	System Inlet	Recombiner Inlet	Recombiner Outlet	Condenser Outlet	Dryer Outlet	Charcoal Adsorber Outlet	HEPA Filter Outlet	System Outlet
Pressure (psia)	14.7	13.3	12.5	11.5	11.3	11.1	10.9	14.8
Temperature (°F)	250	290	710	120	-20	70	70	180
Flow (kg/hr)								
Air	63	63	63	63	63	63	63	63
H_2	20	20	0	0	0	0	0	0
O_2	156	156	0	0	0	0	0	0
H_2O	4,837	4,837	5,012	6	0	0	0	0
Total	5,075	5,075	5,075	68	63	63	63	63
Flow (lb/hr)								
Air	138	138	138	138	138	138	138	138
H_2	43	43	0	0	0	0	0	0
O_2	344	344	0	0	0	0	0	0
H_2O	10,665	10,665	11,052	13	0	0	0	0
Total	11,190	11,190	11,190	151	138	138	138	138

TABLE 3.5-12

ANNUAL SOLID WASTE QUANTITIES VOLUME

Source of Waste	Expected: Unsolidified Waste Volume (ft^3)	Expected: 50 ft^3 Containers	Expected: Packaged Volume[3] (ft^3)	Expected: Shipments	Design: Unsolidified Waste Volume (ft^3)	Design: 50 ft^3 Containers	Design: Packaged Volume[3] (ft^3)	Design: Shipments
Spent resins (radwaste demineralizer, condensate demineralizer)	1,210	31	1,628	19	4,400	113	5,933	68
Filter sludges and radwaste floor drain filter	4,840	124	6,510	74	9,064	232	12,180	140
Evaporator bottoms								
1. Radwaste	2,487	8	420	35[1]	4,504	14	735	64[1]
2. Regenerative	5,653	39	2,048		10,236	71	3,728	
Subtotal	14,190	202	10,606	128	28,204	430	22,576	272

Source of Waste	Expected: LSA Boxes[2]	Expected: 55-Gal Drums[4]	Expected: Packaged Volume (ft^3)	Expected: Shipments	Design: LSA Boxes[2]	Design: 55-Gal Drums[4]	Design: Packaged Volume (ft^3)	Design: Shipments
Compacted	-	1,228	9,210	18	-	2,052	15,390	29
Miscellaneous	8	-	1,024	1	13	-	1,664	2
Subtotal	8	1,228	10,234	19	13	2,052	17,054	31
Total			20,840	147			39,630	303

[1] Combined shipments of radwaste and regenerative evaporator bottoms.
[2] LSA boxes contain 128 ft^3 volume.
[3] Packaged volume based on 52.5 ft^3 of external volume.
[4] Packaged volume based on 7.5 ft^3.

TABLE 3.5-13

EXPECTED AND DESIGN SOLID WASTE ACTIVITIES

Source of Waste	Expected uCi/cc	Expected Ci/ft^3	Total Activity (Ci/yr)	Design uCi/cc	Design Ci/ft^3	Total Activity (Ci/yr)
Spent resin (radwaste demineralizer, condensate demineralizer)	58.62	1.66	2.01×10^3	497.96	14.10	6.20×10^4
Filter sludges						
1. Radwaste filter	1.58	0.05	43.42	2.60	0.07	133.47
2. Floor drain filter	5.46	0.16	598.95	9.18	0.26	1,884.60
Evaporator bottoms (radwaste and regenerative)	35.50	1.00	8.18×10^3	293.02	8.30	1.22×10^5

NOTE: Compacted and miscellaneous trash contain negligible activity.

3.6 NONRADIOACTIVE WASTE SYSTEMS

3.6.1 Wastes Containing Chemicals or Biocides

3.6.1.1 Discharges to Water

3.6.1.1.1 Description of Nonradioactive Waste Treatment Systems and Sources of Discharges

The Unit 2 chemical waste treatment system handles wastewaters from regeneration of ion exchange resins used in the makeup demineralization water treatment system. A 227,100-l (60,000-gal) capacity waste neutralizing tank, sized for two complete regenerations of the makeup demineralizer system, provides for acid and caustic wastewater self-neutralization. Additional neutralization, if required, is achieved through the addition of concentrated sulfuric acid or sodium hydroxide (caustic). The acid or caustic is added into the tank and mixed by use of a full-flow recirculation line to achieve a pH of not less than 6.5 and not greater than 8.5. After neutralization and sampling, the waste neutralization tank's contents are routed to the discharge bay and subjected to extensive dilution prior to discharge, as described in Section 3.3.1. Figure 3.3-1 illustrates the flow pathways.

The cooling tower blowdown is a flow of water released from the unit to minimize the buildup of total dissolved solids (TDS) in the circulating water. Sodium hypochlorite is added to the cooling water immediately upstream of the condensers, while sulfuric acid is added immediately downstream of the condensers. A fraction of the cooling water is continually removed from the system. This cooling tower blowdown is routed to the discharge bay and released to Lake Ontario, as described in Section 3.3.1 and shown on Figure 3.3-1.

3.6.1.1.2 Chemicals Processed Through Each System

The average and maximum quantities of chemicals added to the circulating water and used for regeneration of makeup demineralizer ion exchange resins are listed in Table 3.3-3. The frequency and purpose of these additions are also indicated in Table 3.3-3. Sulfuric acid and sodium hypochlorite are added to the circulating water system. Sulfuric acid and sodium hydroxide are used for regeneration of makeup water treatment ion exchange resins.

3.6.1.1.3 Average and Maximum Concentrations of Natural Materials in Effluent Streams

Average and maximum expected concentrations of selected chemicals discharged in the Unit 2 combined discharge (cooling tower blowdown, demineralizer regeneration wastewater, and service water bypass) are listed in Table 3.6-1. These elements represent the response of natural lake water constituents to evaporative concentration in the cooling cycle. Trace constituents listed in Table 2.3-13, but not appearing in Table 3.6-1, are conservative and respond in the manner indicated for elements not subject to inplant additions. Average and maximum water quality constituent values were calculated using Nine Mile Point regional water quality data (Section 2.3.3). Average water quality parameter concentrations and average cooling tower evaporation rates were used to estimate average effluent values; maximum values of monthly mean water quality concentrations were coupled with maximum evaporation rates to estimate maximum effluent values. Chemicals added to this discharge due to demineralizer regeneration wastes, corrosion of condenser tubing, and biofouling/corrosion control were included in the calculations. The chemical constituents listed in Table 3.6-1 consist primarily of lake water constituents, concentrated by the evaporative cooling process.

Average (202 mg/l) and maximum (266 mg/l) TDS concentrations of ambient intake water taken directly from the lake exceed the 200 mg/l TDS standard for New York State Class A - Special Waters (discussed in detail in Section 2.3.3). Sodium hypochlorite, sodium hydroxide, and sulfuric acid are added to the plant effluent as a result of additions to the circulating water system and discharges generated during the regeneration of makeup water demineralizer ion exchange resins. In general, the chemical contribution of Unit 2 to the Nine Mile Point regional water quality of Lake Ontario is a minor increase in TDS levels of the receiving waters in the immediate vicinity of the discharge, as discussed in detail in Section 5.5.

3.6.1.1.4 Concentration Factor as a Seasonal Basis for Evaporative Cooling Systems

The cooling tower is expected to be operated at a yearly average of 1.67 cycles of concentration, based on average monthly concentration factors. The maximum hypothesized monthly concentration factor is 2.23, which may occur during the months of July and August. Seasonally, the concentration factors based on average evaporation rates are

as follows: for the January-March period, 1.48; April-June, 1.76; July-September, 1.85; and October-December, 1.60.

3.6.1.1.5 Operating Cycles for Each Waste Treatment System or Discharge

The cooling tower blowdown represents a continuous and relatively constant flow waste stream during normal Unit 2 operation. The average blowdown rate is 950 l/s (15,068 gpm); the minimum blowdown rate, which dictates the maximum chemical concentrations, is 706 l/s (11,188 gpm). Sodium hypochlorite addition is not constant and depends on the chlorine demand of the circulating water. In addition, the duration and frequency of sodium hypochlorite addition are altered to assure compliance with regulatory requirements of no greater than 0.5 mg/l maximum free available chlorine for no longer than 2 hr/day.

Sulfuric acid additions to the circulating water system are likewise controlled by demand, in this case, alkalinity. Quantities are not likely to fluctuate to any great degree, due to the rather narrow range of alkalinity values reported for Lake Ontario's Nine Mile Point region (Section 2.3.3).

Makeup demineralization wastewaters are generated approximately once per month. During startup, the large additional demand of high-quality water necessitates regeneration once a day. The quantities of sodium hydroxide and sulfuric acid per regeneration are listed in Section 3.3.2.

3.6.1.2 Discharges to Land: Characteristics and Quantities of Sludges and Proposed Methods of Ultimate Disposal

Sludge and sediment accumulated in the cooling tower basin are projected to be removed at 5-yr intervals. These materials consist of solids including chemicals and biocides, concentrated through the evaporative cooling process and collected in the cooling tower basin. The 5-yr estimated volume is 1,668 cu m (58,900 cu ft). The sludge will be chemically analyzed, removed, and disposed of offsite in a New York State-licensed disposal facility suitable for wastes of this nature. There are no other planned discharges to land.

3.6.1.3 Discharges to Air

The natural-draft cooling tower requires 19 to 38 million l/s (40 to 80 million cfm) of ambient air to dissipate the waste heat from the main condenser in the circulating water system. The airflow rate is dependent on ambient atmospheric conditions and therefore varies throughout the year, reaching a maximum in the winter. The effluents are commonly described as cooling tower drift and visible plumes.

3.6.1.3.1 Cooling Tower Drift

As the circulating water flows through the fill section of a cooling tower, the action of the falling water over the splash bars creates small water droplets, some of which are entrained in the air flowing through the tower. The size distribution of these droplets is given in Section 5.3.3.1.1.2. Most droplets are between 10 and 600 microns. Those droplets which leave the tower in the exit airflow are referred to as drift. The drift rate for natural-draft cooling towers varies with the exit airflow. Based on manufacturers' standard designs for natural-draft cooling towers, a maximum drift rate of 0.0005 percent of the circulating water flow is assumed. This results in a maximum drift emission rate of about 0.76 l/s (12 gpm).

3.6.1.3.2 Evaporation

Ambient air induced through a cooling tower becomes heated and moisture-laden as a result of the evaporative cooling process, and a visible plume is formed when the air is discharged from the tower. The frequency of occurrence and extent of the visible plume depend upon meteorological conditions existing at the time and upon the design and physical parameters of the cooling tower. A detailed evaluation of visible plume occurrences is presented in Section 5.3.3.1.1.1.

For a given ambient wet-bulb temperature, an increase in relative humidity of ambient air results in a decrease in total moisture removed by cooling tower exit air and a decrease in the evaporative cooling. Conversely, a decrease in ambient relative humidity results in an increase in cooling tower exit air moisture content and an increase in the evaporative cooling. At the design wet-bulb temperature of 23°C (74°F) and a relative humidity of 50 percent, the increase in moisture content of air in the tower is 0.018 kg (0.039 lb) of water per 0.454 kg (1 lb) of dry air. With ambient relative humidities of 25 and 100 percent, the

increases in moisture content are 0.024 and 0.012 kg (0.053 and 0.026 lb) of water per 0.454 kg (1 lb) of dry air, respectively. The effects of these additional amounts of moisture added to the atmosphere on ground-level ambient relative humidity are discussed in Section 5.3.3.1.1.5.

3.6.2 Sanitary Waste Treatment

The normal sanitary waste flow from Unit 2, based on a normal operating force of 300 people and an estimated 124 l/day/person (33 gpd/person), is 37,472 l/day (9,900 gpd). The maximum flow, based on an estimated maintenance outage work force of 1,500 people, is 187,358 l/day (49,500 gpd).

Sanitary wastes from Unit 2 will be treated along with sanitary wastes generated at Unit 1. The combined sanitary waste flows will be treated and monitored to comply with the following State Pollutant Discharge Elimination System (SPDES) permit effluent limitations:

Parameter	Limits
Settleable solids	0.1 mg/l maximum daily
Total suspended solids	25 mg/l average daily[1] 45 mg/l maximum daily[2]
5-day biochemical oxygen demand (BOD_5)	25 mg/l average daily[1] 45 mg/l maximum daily[2]
Chlorine residual	0.5 ppm maximum daily
pH	6.0-9.0
Fecal coliforms	200 MPN/100 ml - 30-day geometric mean 400 MPN/100 ml - 7-day geometric mean

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[1] Daily average calculated by dividing monthly discharge by number of days in month.
[2] Daily maximum is the maximum discharged in 1 day.

3.6.3 Other Wastes

3.6.3.1 Descriptions of Miscellaneous Wastes

Waste streams discussed in this section include filter backwash, storm water, roof drains, nonradioactive plant drains, treated radioactive wastewater, transfer pit drain, and cooling tower sludge. Filter backwash consists of resuspended filtered lake water solids. The quality and quantity of storm water and roof drains are essentially that of incident precipitation. The nonradioactive plant drains consist of administration building, service building, and water treatment and demineralizer building floor drains. (Turbine and reactor building drains go to the radwaste treatment system.) Treated radioactive wastewater is composed of drains and reject waters treated for removal of radioactive substances (Section 3.5). The floor drain for the diesel generator building and the transfer pit drain have the potential for contamination with oil. Cooling tower sludge consists of suspended solids retained in the cooling basin.

3.6.3.2 Estimates of Waste Quantities to be Disposed and Their Pollutant Concentration at Points of Release

The filter backwash generates 0.032 cu m/sec (50 gpm) of wastewater for a 15-min period once every 3 weeks. The suspended solids concentration will vary as a function of the quantity of suspended matter in the lake water filtered to supply the makeup water system.

The quantities of storm water and roof drainage vary and are directly dependent upon the storm event that generates them. The design flow is based on a maximum daily (24-hr) rainfall of 12.7 cm (5 in), with a return frequency of 100 yr. Nonradioactive floor drains are discharged to the storm drain system at variable flow rates, dependent upon maintenance and cleaning schedules for the facility. The combined nonradioactive floor drains, storm water, and transfer pit and roof drains are estimated to generate a flow not greater than 14,000 cu m/day (3.7 mgd). Treated radioactive wastewaters are quantified in Section 3.5. The volume of cooling tower sludge generated in 5 yr is estimated to be approximately 1,668 cu m (58,900 cu ft). The cooling tower sludge removal frequency from the cooling tower basin is anticipated to be once every 5 yr.

3.6.3.3 Procedures by Which All Effluents Will be Treated, Controlled, and Discharged to Comply with Effluent Limitation Guidelines

Filter backwash, treated radioactive wastewaters, and nonradioactive floor drains discharges are limited to concentrations prior to dilution of 15 mg/l oil and grease, 30 mg/l average and 50 mg/l maximum suspended solids, and a pH of 6.0 to 9.0.

The filter backwash is discharged to the lake via the discharge tunnel. The storm water is discharged from six outfall locations to Lake Ontario. Diesel generator building floor drainage and transfer pit drainage flow through oil-water separators, where oil is recovered; treated drainage is discharged with uncontaminated floor and equipment drains to the storm water drain system. Collected oil will be removed by a New York State Department of Environmental Conservation-approved disposal contractor. Filter backwash, storm water, roof drains, and nonradioactive floor drains, with the exception of the diesel generator building floor drainage, transfer pit drainage, and turbine building and reactor building drainage, are discharged directly to the lake without treatment.

The cooling tower sludge will be removed, tested, and disposed of without treatment in a New York State-licensed disposal facility, suitable for disposal of wastes of this quality.

3.6.3.4 Estimation of Gaseous Effluents

Auxiliary Boilers

Two auxiliary electric boilers that have no direct exhaust emissions are provided at the station. Since the auxiliary boilers are electrically operated, resulting in no gaseous emissions, current state and federal new-source performance standards for electric utility generating units do not apply.

Standby Diesel Generators and Diesel Fire Pump Exhaust

Two standby diesel generators and one high-pressure core spray (HPCS) system diesel generator are used only under emergency conditions, but are tested for approximately 2 hr per month. The generators are used to provide electric power for essential onsite needs when offsite power is not available. The standby diesel generators and the HPCS

system diesel generator burn No. 2 diesel fuel oil, which typically contains 0.5 percent sulfur and 0.08 percent ash. The exhaust from each of the two standby diesel generator engines is discharged to the atmosphere through two short stacks projecting from the roof of the diesel generator building. The exhaust from the HPCS system diesel generator is discharged to the atmosphere through a separate stack. The standby diesel generator and HPCS system diesel generator specifications and the fuel and flue gas parameters are listed in Table 3.6-2.

There are no federal new-source performance standards or state emission standards applicable to the standby diesel generators, except for the State of New York limit for a stationary combustion installation of 40 percent opacity for any time period or 20 percent opacity for a period of 3 or more minutes during any continuous 60-minute period[1]. Because the diesel generators are emergency standby units, they are exempt from the prevention of significant deterioration (PSD) requirement.

The diesel-operated fire protection pump is normally operated only during fire emergencies. The pump burns No. 2 diesel fuel oil and is tested approximately 1/2 hr per week. Emissions from the diesel-operated fire protection pump are discharged to the atmosphere through a separate stack. Pump specifications and fuel parameters are listed in Table 3.6-3. The emission contributions from these units are listed in Table 3.6-4.

3.6.4 Reference

1. Codes, Rules, and Regulations, State of New York. Stationary Combustion Installations, 6NYCRR Part 227.4. Department of Environmental Conservation, New York, May 10, 1981.

TABLE 3.6-1

CONCENTRATIONS OF WASTE AND SELECTED CHEMICALS IN PLANT EFFLUENT

Constituent	Quantities Added in Plant, kg/day (lb/day)	Concentration (mg/l, except where noted)								
		Effluent Location				Nine Mile Point Water Quality[3]			Applicable Criteria	
		Discharge Point[1]		Edge of Dilution Zone[2]			Range of Monthly Means[5]		State Effluent Standard[6]	EPA Point-Source Release[8]
		Max	Avg	Max	Avg	Avg[4]	Min	Max		
Na	5(11.2)[9]	42	23	28	17	16	12	26		
pH (pH units)		7.9	7.7	8.5	8.3	8.4	8.0	8.6	6.7-8.5	6.0-9.0
Sc (umhos/cm)		661	491	449	378	365	315	425		
Alk ($CaCO_3$)		80	70	103	92	94	81	106		
Ca		73	56	50	43	42	35	47		
Cl		82	48	56	36	35	27	53		
Mg		14	11	10	8	8	7	9		
TDS		413	272	281	209	202	154	266	200	
TSS		28	<5	19	<4	<3.7	<0.1	18		30[10]
SO_4	16(34.8)[9]	147	99	50	38	31	25	40		
NO_3		0.50	<0.24	0.34	<0.19	<0.18	<0.04	0.32		
PO_4		0.028	<0.009	0.019	<0.007	<0.007	<0.002	0.018		
Total P		0.089	<0.036	0.060	<0.028	0.027	0.011	0.057		
Cr		0.003	<0.001	0.002	<0.001	<0.001	<0.001	0.002		
Cu	17(36.9)[11]	0.105	<0.027	0.070	<0.020	<0.019	0.002	0.066	0.2[7]	
Fe		0.267	0.122	0.182	0.094	0.091	0.013	0.172	0.3	
Mn		0.061	0.024	0.041	0.019	0.018	<0.001	0.039		
Ni		0.014	<0.005	0.010	<0.004	<0.004	<0.001	0.009		
Zn	6(13.7)[11]	0.437	<0.065	0.297	<0.050	<0.048	0.004	0.281	0.3[7]	
Cl[12] Free	≤907(≤2,000)	<0.27	<0.09				0[13]	0[13]		0.5 (max) 0.2 (avg)

[1]Effluent flow rates used were 1,813 l/s (28,743 gpm) for average concentrations and 1,568 l/s (24,863 gpm) for maximum concentrations, except for sulfate and sodium, which were calculated by assuming a regeneration in 1 day when average evaporation prevails, based on normal plant makeup water demands. Average water quality parameter concentrations and average evaporation rates were used to estimate average effluent values; maximum values of monthly mean water quality concentrations were coupled with maximum evaporation rates to estimate maximum effluent values.

[2]Based on 10x dilution.

[3]Based on data summarized in Section 2.3.3.

[4]Based on data from 1978 Nine Mile Point Aquatic Ecology Studies (see Section 2.3.3).

[5]Based on monthly data from 1978 Nine Mile Point Aquatic Ecology Studies (see Section 2.3.3).

[6]NYS Class A - Special (International Boundary) Waters, Section 702.1, Chapter X, Article 2, Part 702.

[7]The values for copper and zinc are guidelines, not criteria, based on ambient alkalinity levels.

[8]40CFR423 - Effluent Guidelines and Standards for Steam-Electric Power Generating.

[9]See Section 3.3.2.

[10]40CFR423 - Applicable for Low-Volume Wastes, Including Water Treatment Wastewaters Prior to Entering the Discharge Bay.

[11]Based on a corrosion rate of 0.8 mil/yr (0.03 in/yr).

[12]Based on 2-hr restriction.

[13]Assumed to be zero.

TABLE 3.6-2

STANDBY DIESEL GENERATORS AND DIESEL GENERATOR HPCS SYSTEM FUEL AND FLUE GAS PARAMETERS

	Parameters	
	Standby Diesel Generator	HPCS Diesel Generator
Number of units onsite	2	1
Size (output), kW	4,400	2,600
Number of stacks	2	1
Stack height, ft above ground	43 (13 m)	43
Stack diameter, in	30 (76 cm)	24 (61 cm)
Fuel type, No.	2	2
Fuel sulfur, %	0.5	0.5
Fuel ash, %	0.08	0.08
Maximum fuel rate, lb/hr	2,310 (1,048 kg/hr)	1,350 (612 kg/hr)
Heat input, MBtu/hr*	45.02	26.31
Flue gas exit temperature, °F	990 (532°C)	735 (391°C)
Flue gas flow, lb/hr	85,937 (38,981 kg/hr)	46,371 (21,034 kg/hr)
Flue gas velocity, fps	175.6 (54 m/s)	122.1 (37 m/s)

*Million Btu per hour.

TABLE 3.6-3

DIESEL FIRE PUMP, FUEL, AND FLUE GAS PARAMETERS

	Parameter
Number of units onsite	1
Size (output), hp	313
Number of stacks	1
Stack height, ft above ground	30 (9 m)
Stack diameter, in	6 (15 cm)
Fuel type, No.	2
Fuel sulfur, %	0.5
Fuel ash, %	0.08
Maximum fuel rate, lb/hr	110.3 (50 kg/hr)
Heat input, MBtu/hr*	2.15
Flue gas exit temperature, °F	1,000 (538°C)
Flue gas flow, lb/hr	3,069.4 (1,392 kg/hr)
Flue gas velocity, fps	158.2 (48 m/s)

*Million Btu per hour.

TABLE 3.6-4

DIESEL GENERATOR AND FIRE PUMP EMISSIONS

Generator	lb/hr	ton/yr	lb/10^6 Btu
Standby[1]			
SO_2[2]	23.1	2.31	0.5130
Particulates[2]	1.663	0.1663	0.0369
NOx[3]	7.049	0.7049	0.1566
HPCS[1]			
SO_2[2]	13.500	0.657	0.513
Particulates[2]	0.972	0.0486	0.0369
NOx[3]	4.120	0.2059	0.1565
Fire Pump[4]			
SO_2[2]	1.103	0.0165	0.513
Particulates[2]	0.0794	0.00119	0.0369
NOx[3]	0.3366	0.005	0.1566

[1] Based on 100-hr annual operating rate.
[2] Based on concentration in fuel.
[3] Based on EPA AP-42 emission factor.
[4] Based on 30-hr annual operating rate.

3.7 POWER TRANSMISSION SYSTEMS

The power transmission system consists of a new single-circuit 345-kV transmission line extending from Unit 2 to the new Scriba Substation, and from Scriba Substation to Niagara Mohawk Power Corporation's (NMPC) existing Volney Station. The line is needed to provide a generator lead from Unit 2 to the New York Power Pool interconnected electric system.

The Nine Mile 2-Volney 345-kV transmission line will be constructed adjacent and parallel to an existing transmission facility, along its entire length within an existing right-of-way (ROW). The line will traverse in a southerly direction approximately 15 km (9.4 mi), passing through the town of Scriba, and terminating in the town of Volney at the existing Volney Station (Figure 3.7-1).

3.7.1 Basic Electrical Parameters

Designed to operate at a nominal voltage of 345 kV, the line's power conductors will consist of six individual 1,192.5 KCM, steel-reinforced aluminum cables in bundles of two per phase. Spacing of 7.9 m (26 ft) will be provided between phases. Two overhead ground wires will be employed.

A minimum conductor clearance of 8.5 m (28 ft) will be maintained over fields and roads, at a temperature of 125°C (257°F). This temperature corresponds to the New York Power Pool short-term emergency transmission line loading criteria.

The maximum predicted electric field strength associated with the operation of the proposed transmission line at 1 m (3.3 ft) above ground will be <7 kV/m (2.1 kV/ft) over public roads and <11 kV/m (3.4 kV/ft) over all other areas. The predicted electric field strength at 1 m (3.3 ft) above ground at all locations along the eastern edge of the ROW will be <1.6 kV/m (0.49 kV/ft). The predicted sound levels at the edge of the ROW are minimal (approximately 52 dBA) and are consistent with those found on other 345-kV ROWs that are successfully operated by NMPC and other utilities in the U.S.

At Unit 2, the new transmission line will terminate directly at a structure for the high-voltage terminals of the generator step-up transformer.

The proposed Scriba Station, which will serve as an intermediate transmission station, will be constructed

approximately 305 m (1,000 ft) south of Lake Road and within the ROW for the Nine Mile 2-Volney 345-kV transmission line. Within the Scriba switchyard will be a 345-kV breaker and half transmission station, which will terminate transmission lines from Nine Mile Point Units 1 and 2, plus two transmission lines from Volney Station. One of the Scriba-Volney transmission lines and the transmission line from Unit 2 will be new construction. Also included at Scriba Station will be a 345/115-kV transformer bank, with associated 115-kV equipment, to supply offsite power to Unit 2 and the James A. FitzPatrick Plant via overhead 115-kV transmission lines.

After exiting the proposed Scriba Station, the new transmission line will proceed in a southerly direction for 14.35 km (8.9 mi) and terminate at the existing Volney Station.

3.7.2 Basic Structural Design Parameters

The principal supporting structures of the proposed Nine Mile 2-Volney 345-kV transmission line will be wood-pole, H-frame structures. Lattice steel towers (galvanized structural steel) will be utilized at angle locations. These structure types are illustrated on Figures 3.7-2 and 3.7-3. The foundation material for the wood-pole, H-frame structures will consist of an auger-dug hole, backfilled with crushed stone. Foundations for the steel tower angle structures will consist of galvanized structural steel grillages.

The design standards for the structures of the line (wood or steel) will meet or exceed all requirements of the National Electric Safety Code (NESC) for Grade B construction[1].

The structures will be spaced at intervals on the average of 213 m (700 ft), requiring approximately seven structures per circuit mile. Typical structure height will be approximately 26 m (85 ft), with taller poles installed where necessary to maintain required clearances. Actual spans will vary in length depending upon topographical conditions, with minimum spacing of approximately 183 m (600 ft) and maximum spacing of approximately 305 m (1,000 ft).

The conductor will be 1,192.5 KCM 26/7 aluminum, steel-reinforced conductor containing 26 strands of aluminum and 7 strands of steel, and will have an overall diameter of 3.3 cm (1.3 in) with an ultimate strength of 15,059 kg (33,200 lb). Six conductors (two per phase) will be

installed on the transmission line. The conductor tension will be 4,536 kg (10,000 lb) per subconductor under NESC heavy-loading conditions. The overhead ground wire (shield wire) will be 1.12 cm (0.44 in) extra-high-strength, 7-wire galvanized steel strand, which has an ultimate stength of 9,435 kg (20,800 lb). Two overhead ground wires will have a tension of 2,722 kg (6,000 lb) under NESC heavy-loading conditions.

The insulator assembly will employ brown-glaze porcelain suspension insulators on wood-pole structures and grey glaze on steel towers with galvanized ferrous integral hardware. The insulator design will conform with the appropriate standards of the American National Standards Institute.

3.7.3 Right-of-Way Description

The proposed Nine Mile 2-Volney 345-kV transmission line will be part of an existing transmission line corridor occupied by the following lines:

1. Nine Mile Point-Clay No. 9 345-kV line.

2. Nine Mile Point-Clay No. 8 345-kV line.

3. Nine Mile Point-Lighthouse Hill No. 4 115-kV line.

4. Oswego-Nine Mile Point No. 1 115-kV line.

The relationship between this corridor and other electric and gas corridors in the region is illustrated on Figure 3.7-4.

The existing Unit 2-Volney ROW consists of a fee-owned, 152-m (500-ft) wide corridor (Figure 3.7-5). The existing lines are generally located on the center and western portions of this ROW. There exists, therefore, available area along the eastern edge of the 152-m (500-ft) corridor for the new line. For a distance of approximately 6.45 km (4 mi) south from the Unit 2 site, the western portion of the existing ROW is occupied by the two 115-kV lines identified previously, which provide offsite power capability to NMPC's Nine Mile Point Unit 1.

It has been proposed that the Nine Mile 2-Volney 345-kV line utilize the available area along the eastern edge of the existing corridor for its entire length. The new 345-kV line will directly parallel the two existing 345-kV lines 30.5 m (100 ft) to the east of the eastern most

345-kV centerline from Unit 2 to the Volney Station. This alignment will not require acquisition of additional ROW.

3.7.4 Compliance with Local, State, and Federal Regulations

In April 1982, NMPC filed an amended application with the New York State Public Service Commission (PSC) for a Certificate of Environmental Compatibility and Public Need, pursuant to Article VII of the Public Service Law. Certification of the Nine Mile 2-Volney 345-kV transmission line by the PSC is anticipated by April 1983.

No other local, state, or federal approvals are required with respect to the construction, operation, and maintenance of the proposed transmission facilites.

3.7.5 Environmental Management and Construction Plans

Article VII of the Public Service Law [Part 86.5(3)-86.5(9)] requires information concerning the environmental impact of construction, restoration, and management of the transmission facility. Details on the environmental impact of construction, restoration, and management of the transmission facility will be provided in the Environmental Management and Construction Plan (EM&CP), which will be prepared by NMPC after certification of the route by the PSC. A general discussion addressing these requirements is provided in Section 5.6.1.3.

3.7.6 Reference

1. National Bureau of Standards Handbook No. 81, 6th edition, Washington, DC, 1961.

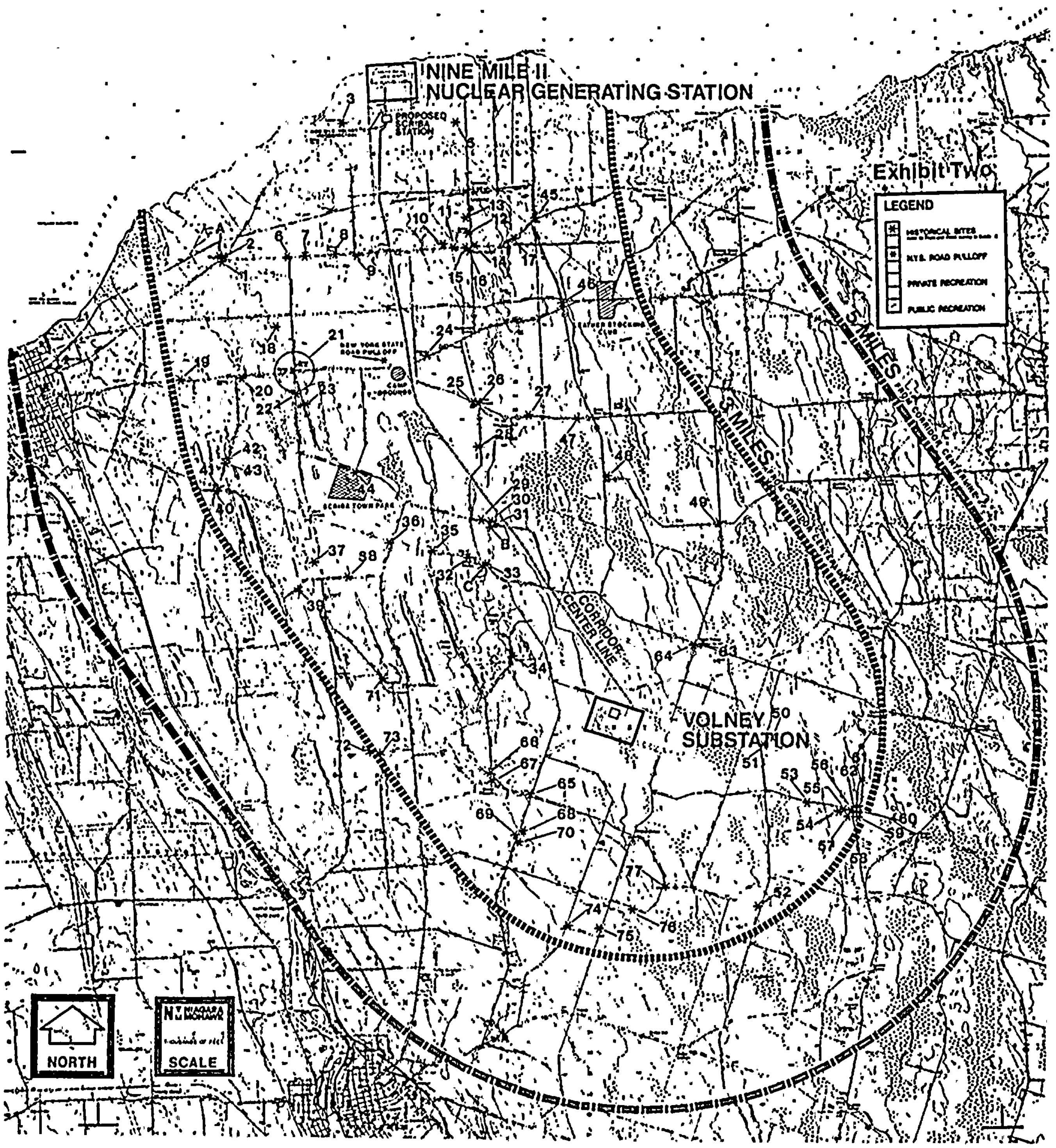
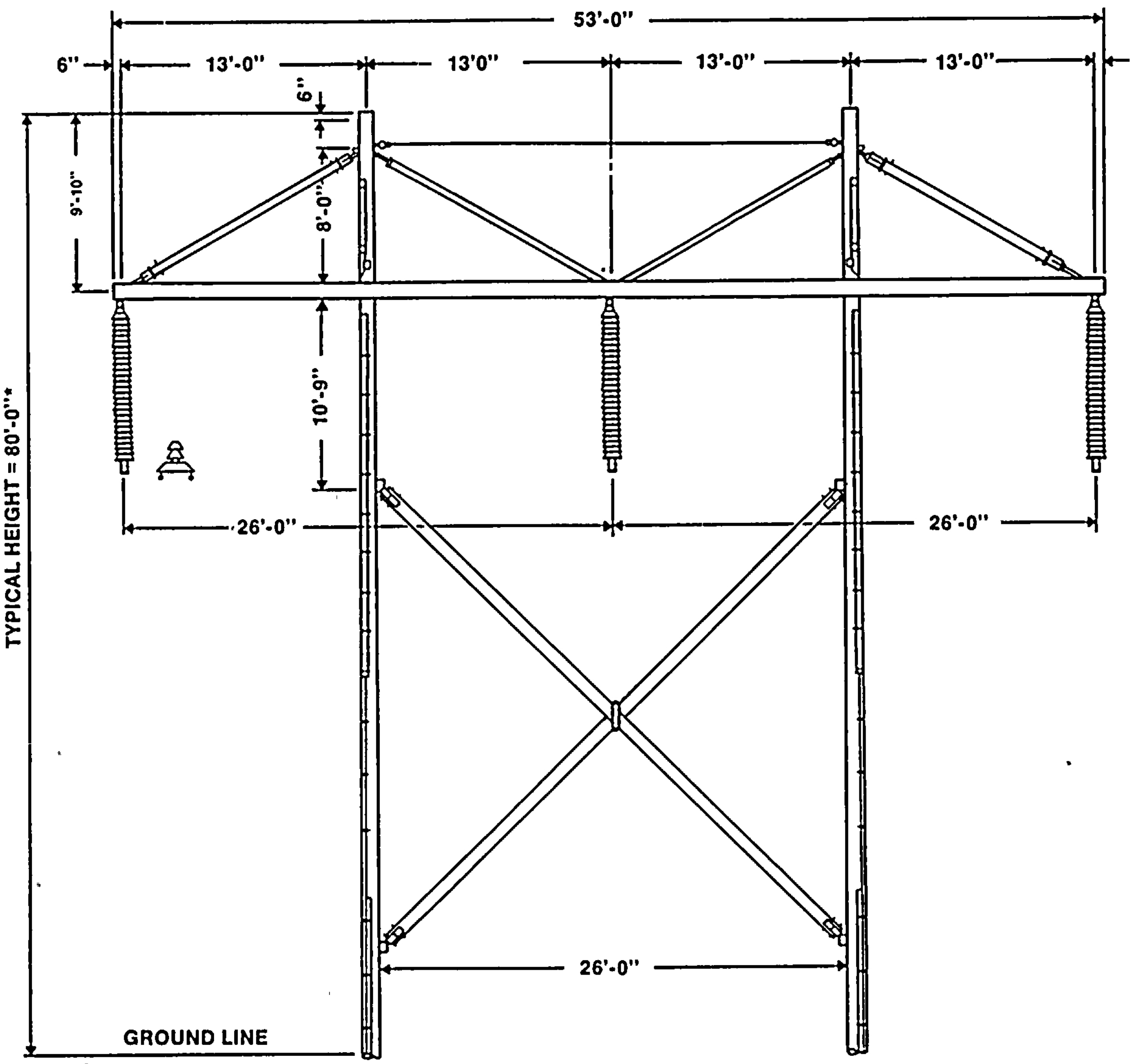


FIGURE 3.7-1

UNIT 2 — VOLNEY
345-KV TRANSMISSION FACILITY

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



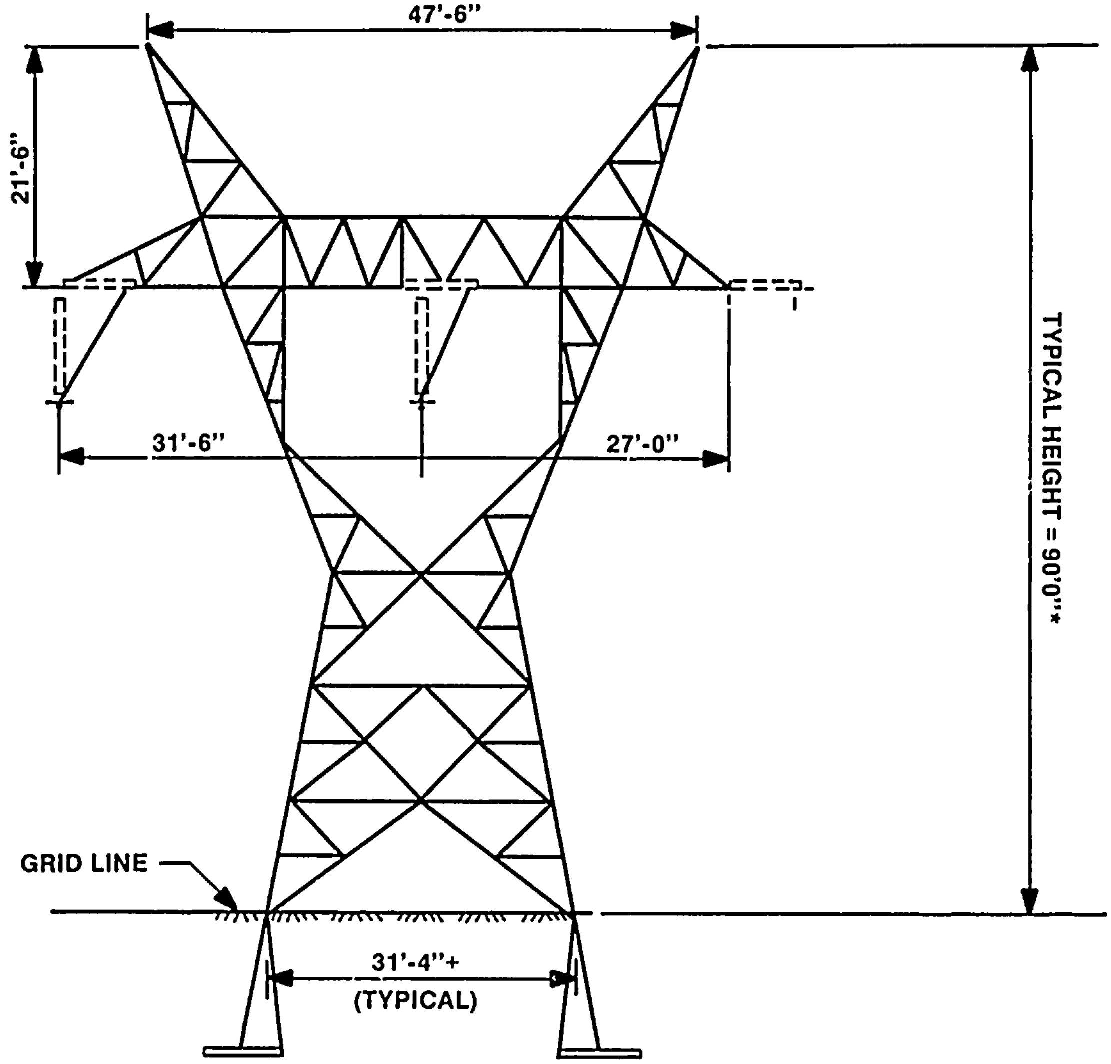
* ADDITIONAL HEIGHT MAY BE UTILIZED WHERE NECESSARY TO MAINTAIN REQUIRED CLEARANCE

** APPROXIMATE DIAMETER OF WOOD POLES AT GROUND LINE IS 19".

FIGURE 3.7-2

TWO POLE TANGENT "H" FRAME
345 KV

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



* ADDITIONAL HEIGHT MAY BE UTILIZED WHERE NECESSARY TO MAINTAIN REQUIRED CLEARANCE

FIGURE 3.7-3

SINGLE CIRCUIT STEEL 60° ANGLE SQUARE BASE D.E. TOWER 345 KV

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

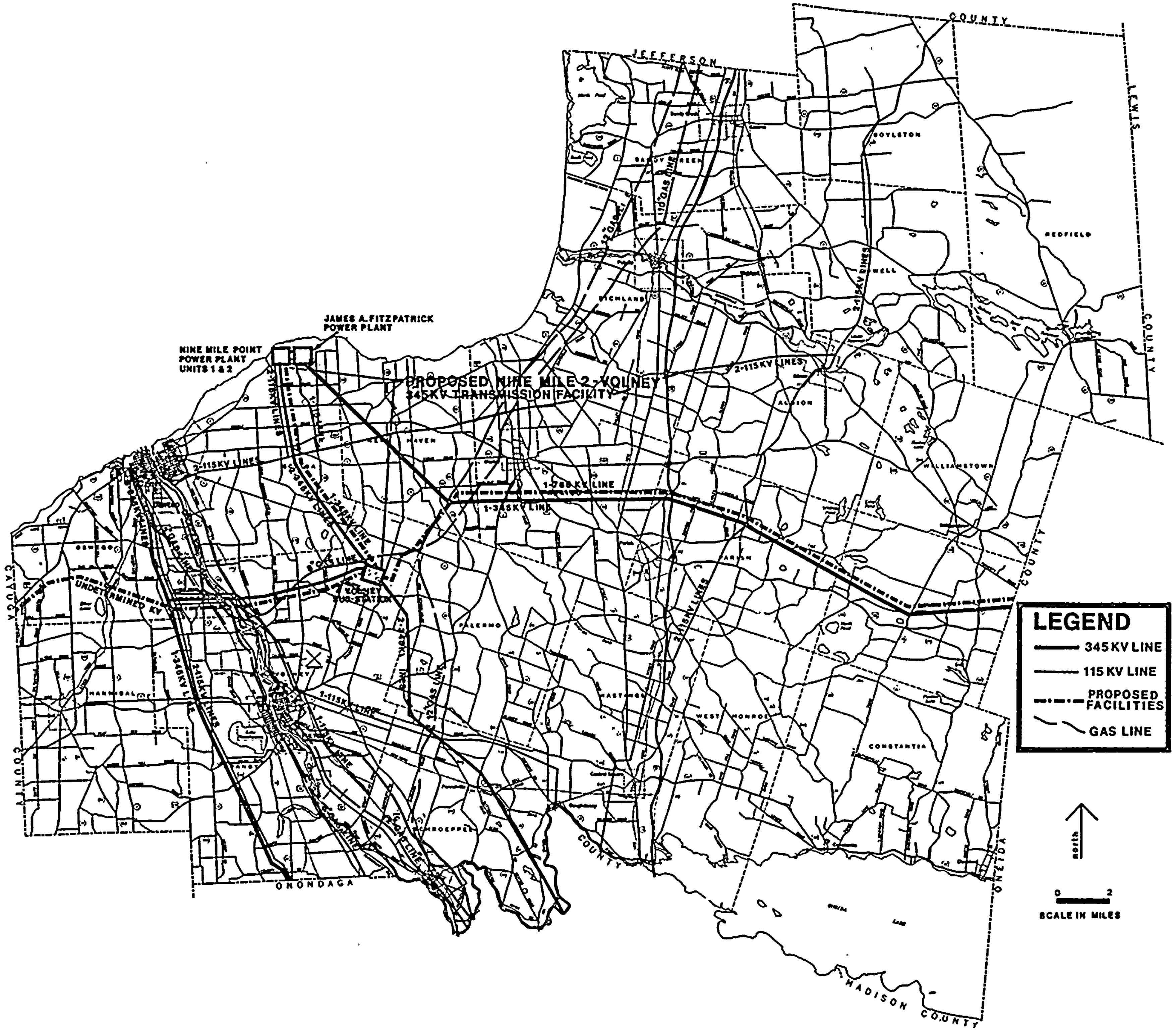


FIGURE 3.7-4

SYSTEM RELATIONSHIP

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

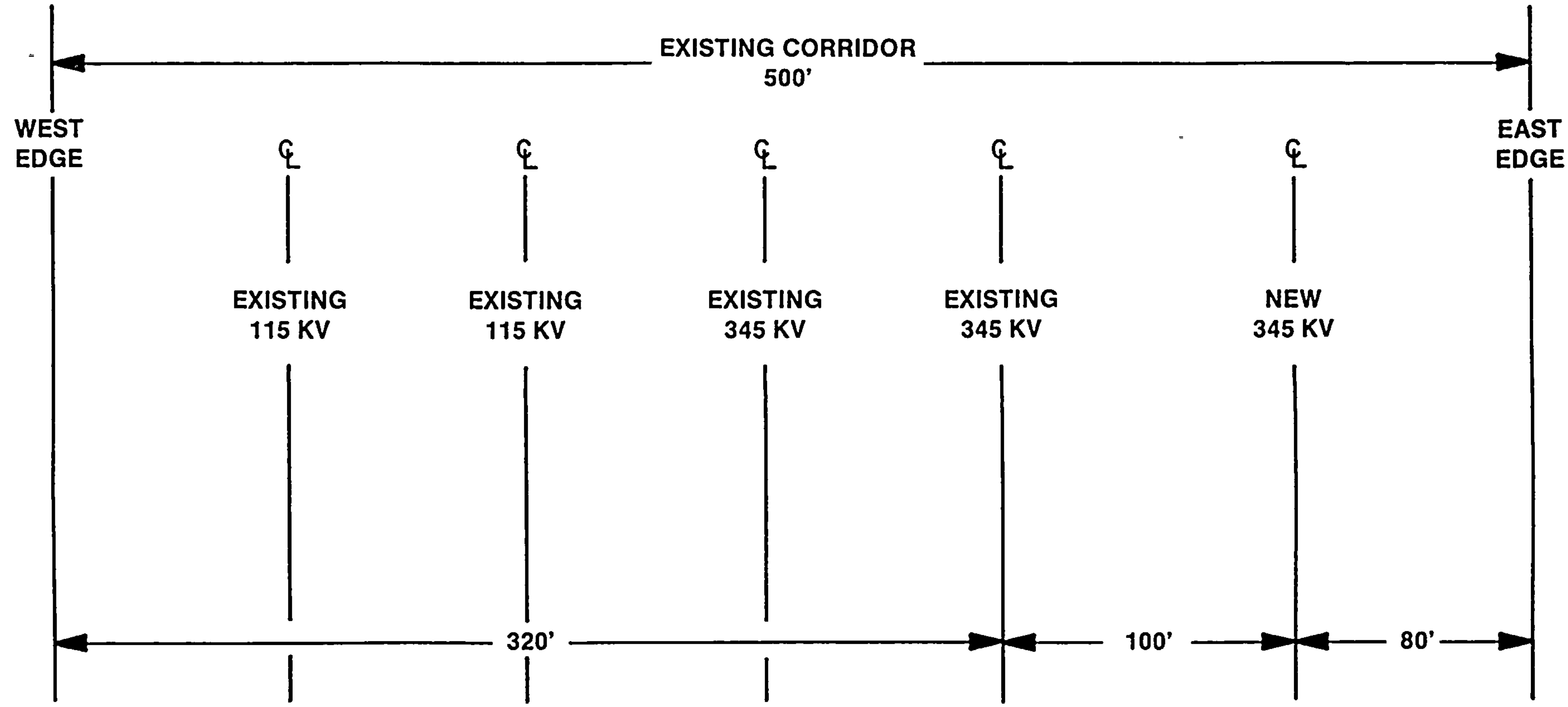


FIGURE 3.7-5

EXISTING UNIT 2 —VOLNEY
RIGHT-OF-WAY

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

3.8 TRANSPORTATION OF RADIOACTIVE MATERIALS

3.8.1 Onsite Storage of Irradiated Fuel

The onsite irradiated fuel storage facility has the capacity to store approximately 3,400 fuel bundles. Refueling of the reactor will take place approximately every 18 months, with approximately 35 percent of the core, or 260 fuel assemblies, replaced during each refueling period.

3.8.2 Treatment and Packaging Procedures for Radioactive Wastes

The collection, processing, and packaging of solid radioactive waste materials are described in Section 3.5.3. Solid radioactive waste material will be packaged and shipped offsite for proper disposal at Nuclear Regulatory Commission (NRC) licensed radioactive waste disposal facilities. Disposal facilities currently available to Unit 2 are located in Barnwell, SC; Beatty, NV; and Richland, WA.

Containers that meet appropriate NRC and U.S. Department of Transportation (DOT) requirements will be used for the packaging of radioactive wastes. These containers provide the required containment of wastes during normal and accident transport conditions, as well as sufficient shielding for low-level radioactive waste shipments. Additional container shielding, probably in the form of concrete or lead packs, will be used if required for the shipment of high-level radioactive wastes.

It is anticipated that the majority of the solid wastes produced at Unit 2 will be of low specific activity. This limited concentration, plus the solidified nature of the wastes, will ensure that no adverse environmental effects will occur during transportation.

Solid wastes generated with high specific activity are shipped in special containers (identified by DOT as Type B packaging), which are designed to withstand the various accident conditions specified in NRC and DOT regulations. The containers will minimize the environmental impact of an accident during the transportation of high-level radioactive wastes.

The anticipated mode of transportation for solid radioactive wastes from Unit 2 is by use of legal-weight and licensed trucks or rail casks. The number of annual shipments is listed in Table 3.5-12.

3.8.3 Transportation of Fresh and Irradiated Fuel

New fuel for the initial core will be shipped by truck to the site from the General Electric fuel fabrication plant in Wilmington, NC. Future reload procurement plans have not been finalized; however, possible suppliers include General Electric, Westinghouse, and Exxon Nuclear.

New-fuel shipping containers have been designed and constructed to meet applicable NRC and DOT requirements. A typical container which is designed to hold two new-fuel assemblies weighs 1,273 kg (2,800 lb) in a loaded condition. The loaded containers will be shipped to the station by legal-weight truck. Due to weight limitations, each truck only has the capacity for 16 containers loaded with 32 new-fuel assemblies.

Each refueling, at approximately 18-month intervals, will require approximately nine truck shipments of new fuel. These shipments will be routed by the most direct route, whenever possible, to minimize the probability of accidents. The new-fuel containers will be furnished by the nuclear fuel supplier, and, after the fresh fuel has been unloaded, the empty containers will be returned to the fuel fabrication plant for reuse.

The new-fuel shipping container is a cushioned, metal container supported within an outer wooden box, designed to protect the new assemblies from physical damage due to normal handling and shipping vibrations. Because the new fuel (uranium oxide) contains no fission products or radioactive gases, the external radiation will be insignificant. The results of an accident, even if the fuel should be damaged, would be only the economic loss.

As discussed in Section 3.8.1, the onsite irradiated fuel storage facility has the capacity to store the irradiated fuel bundles from several refueling cycles. The irradiated fuel will be allowed to decay in the onsite irradiated fuel storage facility for a minimum of 90 days prior to being shipped offsite. When it becomes necessary to ship spent fuel offsite, it will be shipped by truck or train to a facility for reprocessing or disposal.

A typical spent-fuel shipping truck cask can hold four irradiated BWR fuel assemblies. Therefore, approximately 65 truck shipments would be required every 18 months to remove discharged spent fuel. A typical rail cask can hold approximately 24 irradiated BWR fuel assemblies; therefore, approximately 11 rail shipments would be required every

18 months to remove discharged spent fuel. All of these casks are massive, and their payload-to-cask weight ratio is extremely low (1 to 4 percent). About 90 percent of the cask weight is the radiation shielding, with supplemental weight in the auxiliary cooling equipment and additional structural material necessary to meet the stringent shipping requirements. NRC and DOT regulations establish performance standards for radioactive shipping container designs. Only spent-fuel casks that have been designed and licensed in accordance with NRC and DOT regulations will be used to ship spent fuel from Unit 2.

CHAPTER 4

ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Construction impacts were identified and evaluated during the construction permit stage[1]. Further information on the plant cooling system and shoreline protection was provided to the NRC after submission of the ER-CPS.

The cooling system was altered by incorporation of a natural-draft cooling tower (NDCT), with related intake and discharge system modifications. The alteration was reported to the NRC and was evaluated and found acceptable by the NRC[2,3].

A revetment-ditch system was added at the site to prevent flooding and shoreline erosion. The revetment is designed to withstand severe wave action resulting from the occurrence of the probable maximum windstorm. A discussion of this system is provided in an NMPC report[4]. An application for a permit to build the system has been submitted to the Army Corps of Engineers and the New York State Department of Environmental Conservation. The detailed plan regarding construction of the revetment ditch was provided to the NRC in a letter dated June 28, 1979[5].

References

1. Nine Mile Point Nuclear Station Unit 2, Applicant's Environmental Report - Construction Permit Stage. NRC Docket No. 50-410, Niagara Mohawk Power Corporation, June 1972.

2. Report on Circulating Water Cooling System Employing a Natural Draft Cooling Tower, Nine Mile Point Nuclear Station Unit 2. NRC Docket No. 50-410, Niagara Mohawk Power Corporation, July 1976.

3. Nuclear Regulatory Commission. Evaluation of the Environmental Effects Due to the Change in Cooling Systems at Nine Mile Point Unit 2 from a Once-Through System to a Closed Cycle System Utilizing a Natural Draft Cooling Tower - Related to the Operation of Nine Mile Point Nuclear Station - Unit 2, NRC Docket No. 50-410, April 1981.

4. Design and Analysis Method for Revetment-Ditch System, Nine Mile Point Nuclear Station Unit 2, NRC Docket No. 50-410, Niagara Mohawk Power Corporation, August 1977.

5. Letter from G. K. Rhode, Niagara Mohawk Power Corporation, to H. Denton, Nuclear Regulatory Commission, June 28, 1979.

CHAPTER 5

ENVIRONMENTAL IMPACTS OF STATION OPERATION

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ENVIRONMENTAL IMPACTS OF STATION OPERATION

5.1 LAND USE IMPACTS

5.1.1 The Site and Vicinity

Principal onsite land uses during station operation will be in the categories of utilities, transportation, and communication. Main plant structures and the cooling tower occupy approximately 9.3 ha (22.9 acres), or 2.6 percent of the total site area of 364 ha (900 acres). Hectares committed to major plant structures are given in Table 5.1-1. Of this 9.3 ha (22.9 acres), access roads occupy approximately 3.41 ha (8.43 acres); onsite transmission corridors and switchyards, 0.71 ha (1.74 acres).

Land uses in the vicinity of Unit 2 are not expected to be significantly affected by the plant's operation. The character of the vegetation and topography throughout the area surrounding the station is expected to screen or block most views of the facility from residential, recreational, or other sensitive land use areas. Section 5.3.3.1 indicates that visible plumes from the cooling tower could extend beyond a distance of 1.6 km (1 mi). Since it is expected that the visible plume will rarely descend below heights of 91.4 m (300 ft) above ground and will not impinge upon the ground surface, it is not likely to create ground fogging or icing. Agriculture in the site vicinity will be subject to minimal or no impacts as a result of station operation.

Deliveries to the station are expected to arrive by truck and rail transport. Since impacts on local transportation facilities were minimal during the higher level of activity which occurred during plant construction, it is expected that there will be no significant impacts on transportation resources during operation.

Operations personnel are expected to number approximately 300 and will be hired, to the extent possible, from the local area. All operations personnel are expected to reside in communities throughout the region surrounding Unit 2. As a result, impacts on land use will be dispersed and therefore minimized.

5.1.2 Transmission Corridors and Offsite Areas

Transmission corridors and offsite areas are discussed in Section 2.2.2. An existing right-of-way (ROW) was utilized for the construction of the Nine Mile 2-Volney 345-kV transmission line. There should be no adverse impacts associated with maintenance of the line, since existing local roads and access roads will be used.

Farming and grazing land crossed by the transmission lines will not be significantly impacted, as these activities will be able to continue with, at most, short-term disruptions for maintenance activities and minor long-term inconveniences on farming operations due to the presence of transmission structures in the fields.

5.1.3 Historic and Archeological Sites

None of the historically or archeologically significant sites discussed in Section 2.5.3 will be directly affected, relocated, or removed by the operation of Unit 2.

As discussed in Section 3.1, vegetation and topography screen or block views of station facilities from most visually sensitive sites in the Unit 2 vicinity. Of the historical sites in the vicinity of Unit 2, the cooling tower will only be visible from Fort Ontario. Visitors to Fort Ontario will not be adversely affected, however, by the view of the tower. Historic sites in the area are listed in Tables 2.5-34 and 3.1-1.

Section 2.5.3 discusses historic and archeological sites along the transmission ROW. These sites will not be disturbed during operation. When maintenance is required near a historic or archeological site, the guidelines followed during construction to minimize impacts and preserve these sites will be adhered to.

TABLE 5.1-1

AREA REQUIRED FOR CONSTRUCTION OF UNIT 2

	Hectares	Acres
Construction Facilities and Support		
Construction shops and warehouses	0.86	2.12
Batch plant and gravel area	3.92	9.65
Construction offices	0.60	1.49
Construction laydown	32.11	79.35
Parking	4.22	10.44
Other construction facilities	0.25	0.62
Spoil piles	4.77	11.79
Total	46.73	115.46
Unit 2 Facilities and Support		
Reactor building	0.25	0.61
Turbine building	0.41	1.02
Heater bays	0.16	0.40
Screenwell and pumping building	0.27	0.66
Radwaste building	0.19	0.46
Control building	0.14	0.34
Administrative building	0.25	0.62
Cooling tower	1.49	3.69
Roads and railroads	3.41	8.43
345-kV switchyard	0.58	1.43
115-kV switchyard	0.13	0.31
Riprap	1.29	3.19
Other support facilities	0.72	1.78
Total	9.29	22.94
Total Site Disturbed by Construction		
Construction facilities and support	46.73	115.46
Unit 2 facility and support	9.29	22.94
Total	56.02	138.40

5.2 HYDROLOGICAL ALTERATIONS, PLANT WATER SUPPLY, AND WATER USE IMPACTS

5.2.1 Hydrological Alterations and Plant Water Supply

5.2.1.1 Hydrological Alterations

Station operation will not significantly alter the hydrological characteristics of Lake Ontario. Water is supplied from an intake structure in Lake Ontario to the station service water system and cooling water system as described in detail in Sections 3.3 and 3.4, respectively. The average rate of water withdrawal from the lake is 3,445 l/s (54,605 gpm), and the maximum rate is 3,759 l/s (59,586 gpm). The approach velocity at the intake structure is 0.15 m/s (0.5 fps). The induced velocity in the water around the intake is estimated to be reduced to 0.03 m/s (0.1 fps) within 3 m (10 ft) of the structure. Water is returned to Lake Ontario via a discharge structure as described in Section 3.4. The average discharge flow rate is approximately 1,817 l/s (28,800 gpm), and the maximum discharge flow rate is approximately 2,210 l/s (35,040 gpm). Since the quantities of water withdrawn and discharged are extremely small compared to the size of the lake, there is no significant alteration to the circulation pattern of the lake.

Consumptive water use, principally due to evaporative losses from the cooling tower, also has a negligible effect on Lake Ontario due to the size of the lake (approximately 6.8×10^{14} cu m [2.4×10^{16} cu ft]) and the flow through the Great Lakes system. The average and maximum evaporative losses from the station are approximately 625 and 870 l/s (9,900 and 13,800 gpm), respectively, while the average flow through Lake Ontario and the St. Lawrence River is greater than 6.94×10^{6} l/s (1.1×10^{8} gpm).

The revetment-ditch system (Figure 5.2-1), which protects the station from flooding due to wave activity including the effects of a probable maximum windstorm, also protects the shoreline from erosion. The structure follows the existing shoreline and, therefore, will not alter current patterns, significantly affect the littoral zone, or cause sedimentation.

Drainage paths for site runoff have been modified due to the plant drainage system and the revetment-ditch system. In the immediate vicinity of the plant, the grade is sloped to a series of collection ditches and a storm drain system. Runoff collected by this system is carried by a drainage

ditch to the point where it is discharged to the lake at the eastern edge of the site. Overland runoff reaching the revetment-ditch system flows in the ditch to the east and is discharged to the lake at the eastern edge of the structure.

Groundwater is not used during station operation. However, groundwater is drawn down in the vicinity of the plant structures. No offsite effects are expected from station dewatering. FSAR Section 2.5.4 provides additional information on groundwater.

5.2.1.2 Plant Water Needs and Available Water Supplies

The majority of station water is used for the service water system and the cooling water system, and is described in detail in Sections 3.3 and 3.4. Average and maximum combined service water and cooling water requirements are approximately 2,440 and 2,735 l/s (38,700 and 43,350 gpm), respectively. Average and maximum fish diversion system water requirements are 943 and 1,028 l/s (14,950 and 16,300 gpm), respectively. The circulating water system uses the service water system as a source for the makeup requirement of approximately 1,580 l/s (25,000 gpm). Since these requirements are met by drawing water from Lake Ontario's large volume of water, no impact to other Lake Ontario water users will occur.

Potable water requirements for drinking and sanitary purposes are estimated to be a maximum of 3,785 l/d (1,000 gpd). There is no planned expansion that would increase this value over the expected lifetime of the plant. This water is obtained from the city of Oswego water supply, whose average daily demand is 2.12×10^7 l/d (5.6×10^6 gpd). Since the requirements for Unit 2 are small compared to this value, there are no impacts upon the Oswego water supply.

5.2.2 Water Use Impacts

5.2.2.1 Analysis of the Hydrologic Alterations Posing Potential Impacts to Water Use and Availability

Surface Water

Unit 2 operation will not have a significant impact on water use and its availability to the Nine Mile Point region. The plant uses Lake Ontario water, mainly for cooling, at a rate of 0.03 percent of the average flow through Lake Ontario (Section 5.2.1). The maximum and minimum consumptive usages (excepting evaporation), listed in Table 3.3-2, are a small

fraction of the station water use. Table 3.3-1 details the evaporative losses associated with plant cooling water use (a maximum of 0.871 cu m/sec [13,800 gpm], a minimum of 0.246 cu m/sec [3,900 gpm]) and lists service water and fish diversion system maximum, average, and minimum monthly flow rates.

Lake Ontario water is used for drinking water supply, industrial water supply, agricultural water supply, commercial fishing, sportfishing, swimming, boating, and commercial shipping, as discussed in Section 2.3.2. Unit 2 operation will not impact the availability of drinking, agricultural, and industrial water supplies, considering the low rate of consumption of Lake Ontario water (Section 5.2.1).

No impact on swimming, recreational boating, or commercial shipping will occur as a result of Unit 2 operation. The facility intake structures, located approximately 304.8 m (1,000 ft) offshore and approximately 146.3 m (480 ft) closer to shore than the discharge structure, are well removed from any swimming recreational use (Section 2.1.3). The intake structures (located at a lesser depth than the discharge structure) are submerged 3.05 m (10 ft) below the mean low surface water elevation. Station operation will not change surface water elevations, and no significant alteration of circulation patterns is expected (Section 5.2.1); thus recreational boating will not be affected by station operation. Commercial shipping vessels pass no closer than 11.3 km (7 mi) from the intake and discharge structures and will not be affected by station operation (Section 2.3.2).

Commercial and sportfishing water uses will be minimally affected by hydrologic alterations resulting from Unit 2 operation, with impacts restricted to the dilution zone of the thermal plume and localized regions of the intake structures. Standing stocks of commercially and recreationally important species will be subject to insignificant alterations, as discussed in detail in Sections 5.3.1 and 5.3.2.

Groundwater

Groundwater is used for public and private water supplies by several communities in Oswego County (Section 2.3.2). No other groundwater use has been identified. Unit 2 operation will not affect this water use. No station effluents will be discharged to groundwater. An ongoing groundwater dewatering program for the reactor containment foundation will produce a minor cone of depression (Section 5.2.1).

Since all groundwater use occurs upgradient of the site and groundwater discharge onsite is toward the lake, no present or anticipated groundwater uses will be affected by station operation.

5.2.2.2 Analysis of Water Quality Changes and Potential Impacts to Water Use

Lake Ontario water uses that are susceptible to impacts resulting from station operation, due to changes in water quality, include swimming, drinking, agricultural and industrial water consumption, commercial fishing, and sportfishing. As discussed in Sections 5.3 and 5.5, thermal and chemical releases from Unit 2 become significantly diluted within a defined region, well before the point of withdrawal or use for drinking water, agricultural or industrial water supplies, or swimming.

Effluent chemical constituents from Unit 2 are largely natural lake constituents concentrated in the circulating water system by a maximum factor of 2.33 and an average factor of 1.67 (Section 3.6.1). Table 3.6-1 lists the concentrations of important water quality parameters at the edge of the dilution zone of the thermal plume and the average concentration in Nine Mile Point regional waters. There is a minor increase of these concentrations at the edge of the dilution zone as a result of station operation. Extensive additional dilution prior to withdrawal or in situ use will result in a negligible impact of plant operation on swimming, drinking, agricultural, and industrial water uses.

Aquatic biota will be subject to impacts of heat, induced flow patterns, and elevated concentrations of water quality constituents in the dilution zone (Sections 5.3.2 and 5.5). However, as discussed in Section 5.3.2, the dilution zone is an extremely small volume fraction of the receiving water body, and wastes discharged to this volume will not produce a significant impact on the average standing stock of commercially and recreationally important fish species. Consequently, there will be no significant impacts to commercial or recreational fishing.

5.2.2.3 Mitigating Measures

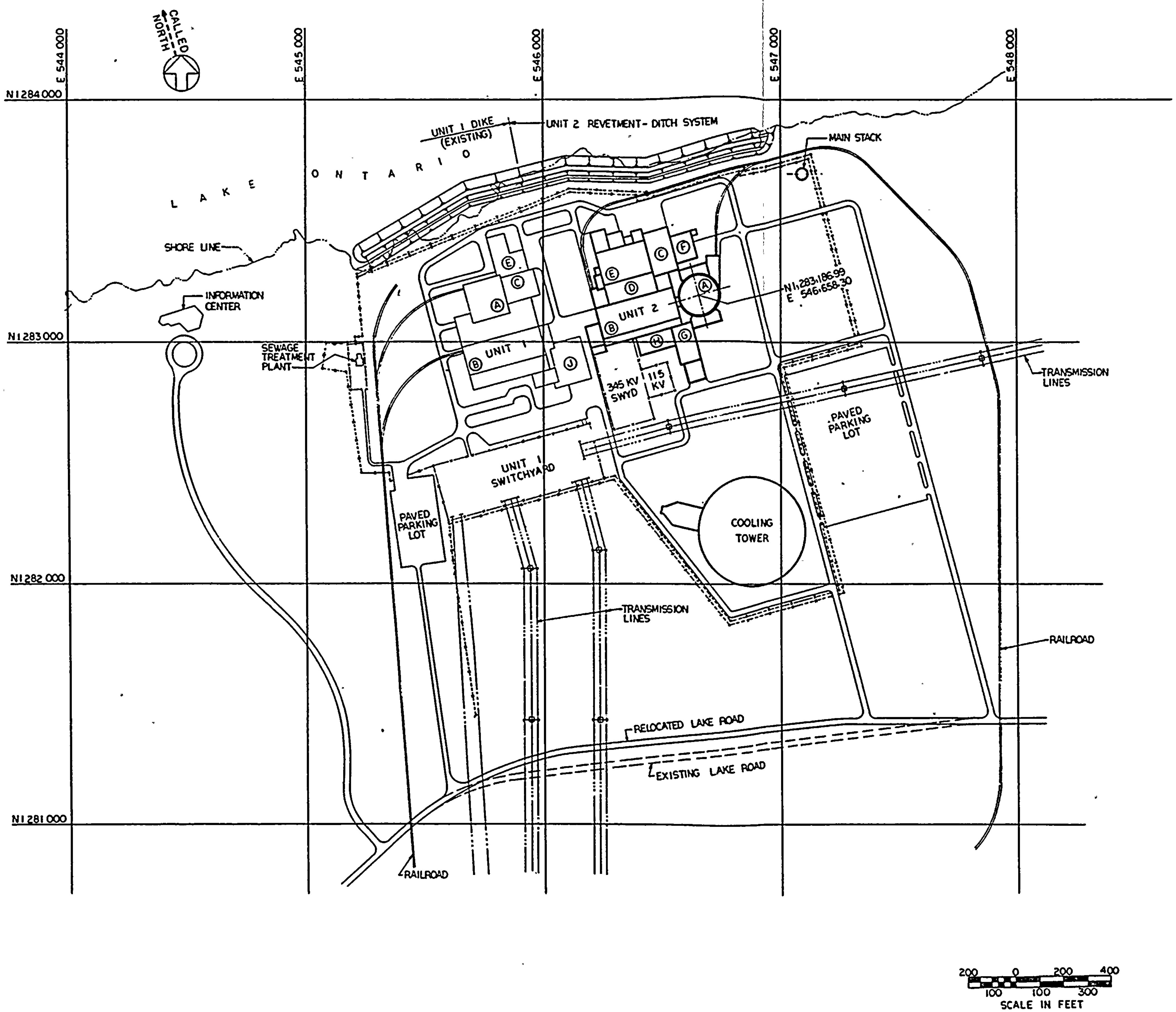
Impacts to Lake Ontario water use resulting from the operation of the facility are minimal. Impacts to aquatic biota are mitigated by the fish diversion system (Section 5.3.1). Further mitigation of the minor impacts associated with the water use of Unit 2 is, therefore, unwarranted.

5.2.2.4 Unavoidable Impacts

The unavoidable impacts to water use associated with station operation are minor, consisting of the restriction of use for best purposes of Lake Ontario waters in the dilution zone volume and local redistribution of some fish species, based on their thermal preferences and responses to local circulation patterns produced by the plume. In addition, a minimal fraction of Lake Ontario waters will be evaporated by the cooling tower.

5.2.2.5 Irreversible and Irretrievable Commitment of Resources

No irreversible and irretrievable commitment of water resources will be made for station operation.



IDENTIFICATION LEGEND

A	REACTOR BUILDING
B	TURBINE BUILDING
C	RADWASTE BUILDING
D	HEATER BAYS
E	SCREENWELL BUILDING
F	CONDENSATE STORAGE TANK BLDG
G	CONTROL BUILDING
H	NORMAL SWITCHGEAR BUILDING
J	ADMINISTRATION BUILDING

NOTES

1 GRID COORDINATES REFER TO NEW YORK STATE COORDINATE SYSTEM

FIGURE 5.2-1

PLOT PLAN REVETMENT-DITCH

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

5.3 COOLING SYSTEM IMPACTS

5.3.1 Intake System

5.3.1.1 Hydrodynamic Description and Physical Impacts

5.3.1.1.1 Hydrodynamic Description of Affected Area

Cooling water for Unit 2 is withdrawn from Lake Ontario through two hexagonal intake structures. Both intake structures are located at lake bottom contour, el 68.4 m (224.5 ft) (USGS 1935 datum); the west intake is approximately 290 m (950 ft) offshore, and the east intake is approximately 320 m (1,050 ft) offshore. The two intakes are approximately 120 m (400 ft) apart and located on the same bottom contour. The discharge structure is located approximately 146 m (480 ft) offshore of the west intake structure and 450 m (1,500 ft) from the existing shoreline. The locations of the intake and discharge structures are illustrated on Figure 3.4-2.

Each hexagonal intake structure has six intake openings 2.3 m (7.5 ft) wide by 0.9 m (3 ft) high, a 0.6-m (2-ft) roof thickness, and a 3.1-m (10-ft) clearance between the top of the structure and the lake surface at the mean low water level of 74.4 m (244 ft) (USGS 1935 datum). The width of each structure is 6.9 m (22.5 ft) between opposite openings. The total area of the 12 openings is designed to provide a maximum intake velocity approaching the bar racks of 0.15 m/s (0.5 fps) while drawing water through both structures. Section 3.4 provides a complete description of the cooling system and the expected flow rates for alternative operating modes.

5.3.1.1.2 Theoretical Framework of Mathematical Model

A mathematical model was used to simulate the nearfield and intermediate field velocity patterns in Lake Ontario resulting from the operation of the two intakes and one discharge at Unit 2.

The model calculates fluid flow streamlines, equipotential lines and velocity near the intakes, and discharge on the basis of steady potential flow. The intakes are treated as sinks of equal and steady strength and the discharge as a source of steady strength. The model is steady state, two dimensional, depth averaged, and does not account for friction.

The theory of potential flow states that any particle in two-dimensional fluid flow can be expressed as a complex potential [A(z)]. Complex flow patterns can be described by the superposition of flow or the addition of complex potentials.

For Unit 2 intakes and discharge:

$$A(z) = k_1 \ln(z-b) - k_2 \ln(z+a) - k_3 \ln(z-a)$$

Where:

k_1 = Strength of source located at b

k_2 = Strength of sink located at a

k_3 = Strength of sink located at -a

By differentiating the complex potential, the complex velocity is derived:

$$\frac{dA}{dz} = V_x + iV_y = \frac{k_1}{z-b} - \frac{k_2}{z+a} - \frac{k_3}{z-a}$$

Using the following substitutions and solving for the magnitudes of velocity (speed), V_x and V_y:

$$r_1 e^{iC_1} = z-b$$

$$r_2 e^{iC_2} = z+a$$

$$r_3 e^{iC_3} = z-a$$

$k_2 = k_3$ (both intakes have equal flow)

Where:

$$r_1 = \sqrt{(x+a)^2 + (y-b)^2}$$

$$r_2 = \sqrt{(x+a)^2 + y^2}$$

$$r_3 = \sqrt{(x-a)^2 + y^2}$$

$$C_1 = \text{Arctan}\left(\frac{y-b}{x+a}\right)$$

$$C_2 = \text{Arctan}\left(\frac{y}{x+a}\right)$$

$$C_3 = \text{Arctan}\left(\frac{y}{x-a}\right)$$

$$V_x = \frac{k_1 r_2 r_3 \cos C_1 - k_2 r_1 r_3 \cos C_2 - k_2 r_1 r_2 \cos C_3}{r_1 r_2 r_3}$$

$$V_y = -\frac{k_1 r_2 r_3 \sin C_1 + k_2 r_1 r_3 \sin C_2 + k_2 r_1 r_2 \sin C_3}{r_1 r_2 r_3}$$

The complex potential, A(z), describes equipotential lines and streamlines:

$$A(z) = B + iC$$

Where:

B = Function of (x,y) and describes the equipotential lines

C = Function of (x,y) and describes the streamlines

For the Unit 2 arrangement:

$$A(z) = k_1 \ln(z-b) - k_2 \ln(z+a) - k_2 \ln(z-a)$$

Substituting:

$$B = m = k_1 \ln r_1 - k_2 \ln r_2 - k_2 \ln r_3$$

$$C = n = k_1 C_1 - k_2 C_2 - k_2 C_3$$

Since the equations describing magnitudes of velocity, equipotential lines, and streamlines cannot be easily solved numerically, they are solved by the input of a series of x,y coordinates. The calculation of speed is direct for each

x,y; however, for equipotential lines and streamlines, the terms m and n are calculated. Then, by connecting various m and n, the equipotential lines and streamlines are drawn.

5.3.1.1.3 Streamlines and Velocity Distribution

The streamlines and velocity pattern near the intakes and discharge of Unit 2 were calculated by the preceding model using two lake conditions: no current and a 0.15 m/s (0.5 fps) west to east, alongshore current. Historical current data from the site are discussed in Section 2.3.1.1.4 and indicate that currents alongshore from the west-or-east are equally likely to occur and are the dominant currents at the site. The frequency of on- or offshore currents was low and, when present, at low velocities. Approximately 30 percent of the meter readings in the stated survey were below detection limits. West-to-east currents of 0.08 to 0.15 m/s (0.25 to 0.50 fps) occurred approximately 10 percent of the time during the survey. Stillwater condition (low to no current) represents the worst case for an intake/discharge, system since all velocities are induced by the intake/discharge and are not masked by local currents.

The intake/discharge flow model was run for one worst-case situation at high intake and discharge flow in January. The modeled flows are those presented in Table 3.3-1 for a January condition of minimum wet bulb. This case is perceived to be a worst case as it represents the highest discharge flow, a typically high intake flow, and the highest ratio of discharge to intake flow which will cause the highest interaction between the intakes and discharge.

Because the model is two dimensional, the intake/discharge flows are averaged over depth and input as a point source in a two-dimensional plane. Thus, the model describes the depth-averaged streamlines and velocities induced by the intakes and the discharge.

Since the intakes are hexagonal and draw water from all sides, the model's representation of the intakes as point sources is accurate, and with the exception of the immediate nearfield, the intake-induced velocities tend to be uniform with depth.

The discharge is designed to be a double-port diffuser aimed offshore, and the model does not simulate the momentum or directional component of the discharge. However, since the results of the discharge studies (Section 5.3.2.1) indicate that the discharge loses its momentum and initially mixes from top to bottom within 18 m (60 ft) of the diffuser, the

model represents the discharge at that location. By not moving the discharge to this virtual source point in the model, the model results are conservative, with more interaction between the intakes and discharge than in the prototype.

The input terms of the model are as follows:

$$a = 59 \text{ m } (195 \text{ ft})$$
$$b = 146 \text{ m } (479 \text{ ft})$$
$$Q_{intake} = 3.44 \text{ cu m/s } (54{,}525 \text{ gpm})$$
$$Q_{discharge} = 2.21 \text{ cu m/s } (35{,}040 \text{ gpm})$$
$$k_1 = 0.0274 \text{ sq m/s } (0.295 \text{ sq ft/sec})$$
$$k_2 = 0.0450 \text{ sq m/s } (0.484 \text{ sq ft/sec})$$

The predicted streamlines with no lake current are illustrated on Figure 5.3-1. Velocity patterns are given on Figure 5.3-2. The directional component of the calculated speed was obtained from the streamlines. With no lake current, almost all streamlines in the area are directed into one or the other intake. The only streamlines not directed into the intakes are the offshore components of the discharge, although the paths of travel for many of the other discharge streamlines are very long before reaching an intake. The magnitudes of the velocities were less than 0.0015 m/s (0.005 fps) for all locations 61 m (200 ft) or more away from either intake or the discharge. The predicted velocities were slightly higher within 61 m (200 ft) of the source or sinks; however, within that region, the special features of the intakes and discharge play an important role and the velocities are not constant with depth as assumed by the model. If a mean velocity of 0.0018 m/s (0.006 fps) from the discharge to the intake is assumed, the shortest possible travel time is 20 hr, during which the plume will thoroughly dissipate by ambient dispersion and atmospheric heat transfer.

The predicted streamlines with a 0.15 m/s (0.5 fps) west-to-east lake current are shown on Figure 5.3-3. These streamlines illustrate that the lake current dominates the flow pattern even immediately near the intakes and discharge. The only noticeable effects of the intake/discharge are a very slight slant to the streamlines and minor deflections at the intakes and discharge. The velocity patterns are not presented because the magnitudes are all 0.15 m/s (0.5 fps), except very near the intake where a speed of 0.16 m/s (0.54 fps) was calculated. The intake/discharge-induced velocities are insignificant when compared to the lake current.

The results of the two model runs indicate that the Unit 2 intakes and discharge will have an insignificant effect on the natural velocity pattern in the area. Theoretically, some recirculation from the discharge to the intakes may occur at stillwater conditions; however, the travel time is long and considerable dilution will occur before reentry into the intake. With any significant lake current, the recirculation will be further reduced.

Because of the low induced velocities and minimal impact on the current patterns at the site, the operation of the intakes will not alter erosion of the shoreline, localized turbidity levels, or siltation patterns in the area.

5.3.1.2 Aquatic Impacts

The estimated impacts of entrainment of ambient water into the Unit 2 intake on each of the major biotic groups are discussed in subsequent sections. Since Unit 2 utilizes a closed-cycle cooling system, only the organisms diverted by the fish collection system are expected to survive entrainment into the power plant intake. Under average operating conditions, 27 percent of the total intake flow is returned through the fish diversion system.

5.3.1.2.1 Phytoplankton

The impact of entrainment cropping on phytoplankton was evaluated based on projected water flow into Unit 2, general water circulation in Lake Ontario, and reproduction times for plankton populations in lakes[1]. The general circulation patterns in Lake Ontario have been documented and were reviewed by Lawler, Matusky & Skelly Engineers (LMS)[2]. The predominant currents are alongshore, however, onshore and offshore currents also occur[3]. Thus, no parcel of water will be subject to entrainment for any length of time and no portion of the plankton community will be continuously cropped.

If a water body segment is assumed to extend east of Nine Mile Point and west of Oswego Steam Station (OSS) as described by LMS[2], the cropping due to either Unit 2 alone or Unit 2 in conjunction with the other plants located within this segment (JAF, Unit 1, and OSS) can be examined. This segment contains approximately 9.6×10^9 cu m (3.4×10^{11} cu ft) of water. The daily water intake for Unit 2 is approximately 3.3×10^5 cu m/day (1.2×10^7 cu ft/day), or 0.0034 percent of the volume of the water body segment per day. In a year's time, Unit 2 would withdraw only 1 percent of the volume of the segment if the segment were

not being naturally flushed by lake circulation and dispersion. When the turnover time of organisms in the water body segment is considered, the effect of entrainment cropping becomes negligible.

Data collected in the Nine Mile Point vicinity (Section 2.4.2.1) have indicated no long-term changes in the abundance or species composition of the plankton community that are attributable to the operation of the existing stations. The influence of Unit 2 is projected to be minimal because of the low volume of cooling water used. Since, on an annual basis, the plant will withdraw less than 1 percent of the volume of the surrounding water body for cooling, this small withdrawal rate, coupled with the potential for regeneration, leads to the conclusion that Unit 2 will have a negligible impact on the phytoplankton community[3].

5.3.1.2.2 Microzooplankton

As indicated in Section 2.4.2.1.2, seasonal abundance and species composition have been similar for microzooplankton for the last 6 yr. No major shifts in this community have been noted. In addition, analysis of spatial trends has revealed no consistent patterns in the abundance of zooplankters[3].

Based on the same rationale developed for phytoplankton in Section 5.3.1.2.1, the impact on microzooplankton will be small and probably not distinguishable from natural variability.

5.3.1.2.3 Macrozooplankton

To assess the projected impact of macrozooplankton entrainment by Unit 2, impact on Gammarus fasciatus, an amphipod selected as a Representative Important Species in the Nine Mile Point vicinity[1,4] (Section 2.4.2.1.3) is discussed. While numerically more abundant in the benthic collections, this epibenthic organism will be subject to entrainment only when present in the water column. Therefore, for discussion purposes, Gammarus is classified as a macrozooplanktor.

To assess the impact of plant entrainment on this species, estimates were made of the total number entrained into the plant. These estimates were compared to the calculated standing stock of Gammarus in the lake in the vicinity of the plant[3]. Since Unit 2 will have closed-cycle cooling, 100 percent mortality through the plant was assumed. Data collected during 1976 JAF entrainment studies were used[5].

Table 5.3-1 gives the results of the cropping calculations for two plant flow conditions, the projected mean and maximum plant flow at Unit 2. The estimated percent cropping is the percentage of the Gammarus standing stock[3] present in the water body segment removed by entrainment mortality.

Estimated percent cropping during either projected mean or maximum plant flow conditions was less than 0.5 percent of the population throughout each sampling period, except during January-February 1976. At this time, the increase in the estimated percent cropping resulted from the high January entrainment abundance. Since similarly high abundances were not detected during either the summer period of naturally high lake abundance or the following winter period, it is probable that the January 1976 estimate was an anomaly in the data and not representative of actual entrainment cropping during the month.

The results of the Gammarus entrainment cropping analysis clearly indicate that the projected numbers removed by entrainment at Unit 2 represent an extremely small percentage of the local population and that such mortalities would have a negligible effect on the population.

5.3.1.2.4 Ichthyoplankton

To assess the projected impact of plant entrainment on the ichthyoplankton community, data collected during entrainment studies at Unit 1 and the JAF plant have been utilized in conjunction with the results of the aquatic ecology studies presented in Section 2.4.2.

Nearly all species identified from the lake collections were also found during entrainment sampling at either Unit 1 or the JAF plant, and their temporal occurrence in the entrainment collections coincided with their occurrence in the lake[1,4-8]. Peak concentrations of eggs and larvae in the lake occurred during the late spring/summer period and were dominated by alewives and rainbow smelt (Section 2.4.2.1.4). Peak entrainment also occurred during this period, with alewife and rainbow smelt dominating the collections[1,4-8]. Rainbow smelt and alewife are the only two Representative Important Species of fish[1] collected in sufficient numbers during ichthyoplankton entrainment surveys to allow impact assessment.

The projected total numbers of alewife and rainbow smelt eggs and larvae entrained at Unit 2 were computed from the day/night abundance data from the regular 1976 entrainment

sampling program at Unit 1 and the JAF plant[3]. This data set was chosen since the JAF plant was shut down for refueling during the summer of 1977 and only limited analyses were conducted on 1978 data. The Unit 2 and the JAF plant data are considered to be representative of the intake abundance that will occur at Unit 2 since all the intakes are all at approximately the same depth contour. Since 100 percent mortality is assumed for the Unit 2 closed-cycle cooling system, no adjustment has been made for the fish diversion system flow. This flow normally represents 27 percent of the total flow withdrawn and would not be expected to incur 100 percent mortality to organisms entrained in it. However, since no studies have been made, the conservative approach, assumption of 100 percent mortality, has been taken.

The estimated total number of alewife eggs entrained per week at Unit 2 under projected average flow conditions was compared with the estimated number present in the adjacent segment of the lake during the same week[3]. The area of the lake chosen for comparison was a water body segment bounded by the extent of sampling (i.e., larval tows) which extends out to the 34-m (112-ft) depth contour and 5.8 km (3.5 mi) along the Nine Mile Point shoreline[3].

Table 5.3-2 lists the estimated percent of alewife eggs cropped by Unit 2 based on Unit 1 and the JAF plant entrainment and the estimated number of alewife eggs present in the water segment. As can be seen from the table, extremely low percentages of the weekly standing crops of alewife eggs are removed by entrainment. The overall seasonal cropping rates based on the Unit 2 flow rate and either the Unit 1 or the JAF plant entrainment data is 0.01 percent.

Since rainbow smelt eggs are demersal and adhesive and spawning in the Great Lakes occurs on stream bottoms or, under adverse weather conditions, in the offshore areas on gravel shoals (Section 2.4.2.1.6), their eggs are not usually subject to entrainment. Because the eggs are attached to the bottom, plankton tows or entrainment collections are not representative of the actual numbers available.

To attain a better concept of the entrainment egg abundances, the estimated total number of alewife and rainbow smelt eggs entrained was compared with the average fecundity of these species in Lake Ontario. The estimated total number of eggs entrained for each species was divided by the mean number of total eggs per female to determine the average number of females required to produce the eggs lost

to entrainment[3]. The results of these calculations indicate that the entrainment rate for Unit 2 based on the Unit 1 or the JAF plant results is equivalent to the fecundity of 2,200 or 3,400 alewives and about 23 to 91 smelts, a very small fraction of the population estimate[3].

Plant cropping estimates for alewife and rainbow smelt larvae were based on the same water body segment described for eggs as well as on an estimate of the lakewide larval standing crops of these species. A lakewide cropping estimate was developed because alewife and rainbow smelt are distributed throughout the lake and apparently use the entire shoreline for spawning. Fishery and impingement sampling at widely spaced locations on Lake Ontario on both the United States and Canadian sides has shown the alewife and rainbow smelt to be abundant at all locations[3].

Because the larval stage lasts more than 1 week, both weekly cropping estimates and total entrainment are compared with an average standing crop during the peak of larval abundance. This approach is conservative because the actual population present in the water body segment throughout the larval period is greater than the number present during the peak abundance period. Furthermore, because larvae living in the deeper portions of the lake were not accounted for in the computation of cropping rate, an additional conservative factor was added to the estimate.

The weekly cropping estimates for alewife larvae in the water body segment of interest ranged from 0 to approximately 4 percent (Table 5.3-3). Weekly cropping estimates for rainbow smelt larvae ranged from 0 to 10 percent (Table 5.3-4).

During their period of maximum abundance in the vicinity of Nine Mile Point (August 1 to September 4), alewife larvae had a mean weekly abundance of 143×10^6. Cropping percentages based on total alewife larvae entrained in 1976 were approximately 0.3 and 1.2 percent based on Unit 1 and JAF plant data, respectively (Table 5.3-3). Rainbow smelt larvae had a mean weekly abundance of 3×10^6 during the period of peak abundance (May 30 to July 17) in the vicinity of Nine Mile Point. Annual cropping percentages of approximately 0.1 and 0.4 percent based on Unit 1 and JAF plant data, respectively, were obtained from the estimated total number entrained during 1976 (Table 5.3-4). The conservative nature of this calculation should be emphasized in that the standing stock estimates do not account for the immigration and emigration of larvae to and from the water body segment[3].

Considering the demersal nature of the eggs of both alewife and rainbow smelt, a low percentage of cropping (less than 1 percent) of eggs is indicated. The egg cropping estimate, in terms of the number of average mature females required to produce the eggs lost (2,200-3,400 alewife and 23-91 smelt), indicates that this loss represents only a small fraction of the spawning potential of these populations[3].

Water body segment cropping of larvae, based on an average entrainment during the peak abundance period and conservative estimates of the population size during the same period, produced percentages cropped ranging up to 1.2 percent. These percentages are conservative estimates since only those larvae inside the 34-m (112-ft) depth contour were included and the assumption of 100 percent plant mortality increases the estimated cropping over that actually occurring.

The projection of plant cropping on a lakewide larval population basis is only a rough estimate. It is based on an average standing crop for only a small portion of the total potential spawning area, and it does not factor in additional sources of cropping within the system. The actual larval population density would be expected to vary significantly from place to place along the shoreline. However, the lakewide cropping estimates do provide a rough estimate for the lake as a whole, which is an important perspective for impact assessment. The lakewide cropping estimates attributed to Unit 2 are very low (0.02 percent)[3].

The combined cropping of eggs and larvae of alewife and rainbow smelt by the JAF plant and Units 1 and 2 will remove an undetectable amount of the reproductive potential of these populations[1]. The impact of Unit 2 alone will be immeasurable since projected cropping is more than an order of magnitude lower than cropping by the existing plants whose effects have been undetectable (Section 2.4.2.1).

5.3.1.2.5 Benthos

The degree to which the Unit 2 intake system interacts with the adjacent invertebrate communities is a function not only of flow rate and design characteristics of the plant but also of the nature of the organisms themselves. Of significance is the life history of each taxon under consideration. Some benthic forms, for example, pass their entire lives closely associated with the bottom, moving within (infauna) or upon (epifauna) the lake bottom. Others make transient use of the water column either for breeding, feeding, active swimming, or drifting with water currents.

Benthic species that utilize the water column are susceptible to power plant entrainment. During these life stages, their degree of susceptibility depends mainly upon their pelagic movement (near the surface, bottom, or throughout the entire water column) and swimming ability.

In considering intake system impacts, both direct and indirect effects are evaluated. Direct effects include entrainment of all life stages. Indirect effects may occur via attraction of nektonic predators to the intake area. If either type of interaction occurs, it is likely to be discernible near the existing Unit 1 intake where long-term monitoring at nearfield and farfield stations has continued during a 6-yr study period.

As reported in Section 2.4.2.1, benthic organisms near the intake of Unit 1 showed a variety of natural changes since the initial sampling in 1968 and during the 6 yr of intensive study. The key factors involved in these fluctuations, however, were natural environmental changes over time, climate, substrate nature, and organic content of the sediment. The data base described in Section 2.4.2.1 indicates typical benthic patterns over time and does not suggest adverse processes that were identifiable with the operation of the Unit 1 intake system[3].

Because of the large data base showing no impact on the benthic communities by the operation of Unit 1 intake, it is reasonable to expect no impact from the withdrawal of a lesser amount of water for Unit 2.

5.3.1.2.6 Fish

The impingement sampling data for Unit 1 and the JAF plant provide a basis for estimating the total annual entrapment by species at the Unit 2 intake. Because a fish diversion and return system was incorporated into the Unit 2 intake, only a fraction of the fish entrapped in the offshore intake will be impinged. The major portion of these fish will be returned to the lake. The studies of fish protection systems for Unit 2 and ongoing studies on a similar system at the OSS Unit 6 provide estimates of survival subsequent to passage through the diversion system. This information was used to estimate the mortality expected for selected species at Unit 2. A complete description of the diversion system is provided in Section 3.4.1.3.

The impingement rate for Unit 2 was estimated by extrapolating the impingement rates of Unit 1 to Unit 2 by the

ratio of the plant flows. This method assumes that the impingement rate is directly proportional to plant flow rate.

The Unit 1 impingement data were selected as the primary bases for extrapolation because there are 9 yr of continuous sampling as compared to only 6 yr at the JAF plant. The trend in both fishery and impingement sampling indicated cyclic trends in abundance of some species. Because the Unit 1 data cover a longer time than the JAF plant data, they better reflect the changing abundances of these species in the Nine Mile Point vicinity. In addition, the Unit 2 intake design is similar to the Unit 1 design and differs substantially from the JAF plant design.

The estimated impingement rate for Unit 2 assumes that the plant will operate all days of the year, because it is impossible to predict when plant outages will occur. This method will, therefore, produce an estimated total annual mortality greater than the actual one. The difference between the estimated total and the actual total will depend on the duration and seasonal occurrences of downtime. Extended downtime in early spring would have the most pronounced effect on the annual total because the spring peaks in alewife and rainbow smelt impingement would be eliminated.

The Unit 2 intake structure will incorporate a diversion system to return entrapped fish to the lake. This system was designed by Stone and Webster Engineering Corporation (SWEC), which conducted laboratory tests of diversion efficiency and survival of alewife after passage through the system. These tests indicated a test mortality rate of 11.8 percent and a control mortality of 7.8 percent[9]. Preliminary studies conducted by LMS on the OSS Unit 6 diversion system, similar in design to the Unit 2 diversion system, have demonstrated substantially lower alewife survival following passage through the system. The results of the Oswego studies indicate alewife survivals between 2 and 34 percent, with an estimated yearly survival rate of 9.6 percent[10]. The rainbow smelt, white perch, and spottail shiner estimated yearly survival rates were 13.1, 41.1, and 85.1 percent, respectively. The major game fish (brown trout, smallmouth bass, lake trout) collected from the system all demonstrated greater than 95 percent survival.

Since the LMS studies were conducted on an operating system as compared to the SWEC studies which were conducted on a laboratory scale, the results from the LMS Oswego studies will be used for this assessment. These results are believed to be conservative (effects are overestimated)

because no adjustments were made for control or handling mortality.

Table 5.3-5 contains the estimated monthly impingement and estimated yearly total number impinged for selected species at Unit 1[3]. Table 5.3-6 provides an estimate of Unit 2 entrapment, obtained by the multiplication of the Unit 1 total by 0.20, the ratio of Unit 2 to Unit 1 plant flows, and mortality, obtained by the multiplication of the number entrapped by the mortality observed from the Oswego diversion system[3].

The estimated mortality is low for all species except alewife, and when the alewife total is compared with annual impingement rates at other Lake Ontario power plants, the mortality at Unit 2 is estimated to be a very small contribution. The effects of impingement cropping at power plants on Lake Ontario were evaluated in the 316(b) demonstration for the JAF plant[1].

The analysis of the impact of removing a number of fish from a population can be addressed in many different ways. In this analysis, the removal of fish is related to such measures of population size as 1) lake standing stock estimates, 2) commercial fishing removals, 3) stocking statistics for the species, and 4) exploitation rates based on tagging studies.

The analyses of impingement cropping are presented separately below for the Representative Important Species identified by the EPA for the Nine Mile Point vicinity: alewife, rainbow smelt, white perch, yellow perch, smallmouth bass, coho salmon, threespine stickleback, and brown trout.

Alewife

Alewife standing stock estimates based on New York State Department of Environmental Conservation (NYSDEC) data[1] are presented in Table 5.3-7. These estimates are only for the near bottom waters where the trawl fished and are based on the assumption of 100 percent trawl efficiency. Edsall et al[11], in an analysis of the standing stock of alewives in Lake Michigan, concluded that only 3 percent of the fish (80-139 mm [3-5.5 in] long) taken in gill nets fished from surface to bottom in 26 fathoms were in the lower 12 m (40 ft) of water. They, therefore, used a factor of 10 to expand standing stock estimates, based on the assumption that only 10 percent of the fish were in the lower 1.2-2.4 m (4-8 ft) of the water column where the trawl fishes. In the

results presented, the alewife standing stock is estimated with and without the factor of 10 to show bottom-trawled standing stocks and the full water column estimate (adjusted standing stock).

This analysis is open to two possible sources of error, in addition to fish distribution in the water column and the assumption of 100 percent gear efficiency. First, the NYSDEC estimates extended only to the 110-m (360-ft) depth contour. Since these estimates represent 18 percent of the total New York State lake area, the standing stock estimates were divided by 0.18 for extrapolation to the total New York State lake area. This may result in an error if the total population estimate of the alewife is not uniformly distributed from shore to midlake.

Second, the average weight of the alewives collected by NYSDEC was 27.2 g (0.06 lb), while the average weight of impinged fish was 18.0 g (0.04 lb), indicating that a greater percentage of younger fish were present in impingement collections than were sampled by the trawl. The trawling program conducted by NYSDEC either did not collect young fish (young-of-the-year and yearlings) or natural mortality of these ages had occurred by the time of the trawling, and the average weight reflects the true average weight/individual of the remaining stock. The NYSDEC trawling program was conducted between October 18 and November 12 1976, late enough in the year so that mortality of young fish could have occurred, whereas impingement collections were conducted throughout the year. Thus, the NYSDEC stock estimate may not be representative of the populations affected by impingement; however, no stock estimates are available for other times of the year.

The former hypothesis that NYSDEC simply did not collect young fish is supported by several observations. Smith[12] stated that young alewives reside in the water column off the bottom for at least the first year of life. NYSDEC stated that many targets were observed with hydroacoustic equipment in the upper water column at the time of the surveys in the Rochester area. Wells[13] found alewives in the water column throughout the year in Lake Michigan. It appears, therefore, that the trawling conducted by NYSDEC would result in an underestimate of the true standing stock since a large portion of the population would be above the bottom waters sampled by the trawl. This is additional evidence supporting the use of the multiplier to estimate total standing stock from bottom trawls. The evidence on alewife distribution in the water column, the weight differential between impinged and netted fish, and the assump-

tion of 100 percent gear efficiency all support the use of the stock adjustment.

The estimated yearly impingement mortality at Unit 2 was divided by the NYSDEC standing stock estimates to determine alewife impingement cropping. The cropping effect of Unit 2, 0.20 percent, is extremely small for the Oswego sector and even smaller for other designated areas of the U.S. waters of Lake Ontario (Table 5.3-7). The cropping estimates for Unit 1 based on its once-through cooling system are included in this table to contrast Unit 2 which has a fish diversion system. For the preceding reasons, these estimates of cropping are considered conservative.

<u>Rainbow Smelt</u>

The NYSDEC forage fish standing stock estimate included an estimate of the rainbow smelt stock. The standing stock data derived in this section were calculated in the same manner as the alewife data. The results, therefore, are subject to the same conservative approach as the alewife results. The rainbow smelt mortality at Unit 2 was estimated to represent 0.12 percent, an extremely small percentage of the estimated standing stock in the Oswego sector and other designated areas of the U.S. waters of Lake Ontario (Table 5.3-7).

<u>White Perch</u>

Storr[14] tagged a total of 1,421 white perch in the Nine Mile Point vicinity from 1972 to 1976, of which 488 were tagged in 1976. Only one tagged white perch was recovered in the JAF plant impingement collections (April 1977) with no tag returns observed at the Nine Mile Point plant. Since annual mortality rates for tagged white perch were not computed, it is impossible to determine the total number of tags available at the time of the recovery in 1977. But with an assumed 50 percent mortality rate and only those fish tagged during 1976 considered, an exploitation rate of 0.82 percent would result after adjustment for impingement sampling frequency. The lack of any tagged fish in the Unit 1 impingement studies, which have been ongoing since 1973, indicates that impingement cropping of white perch is negligible.

A total of 20,525 kg (45,249 lb) of white perch were harvested by commercial fishermen from New York State waters of Lake Ontario during 1976[15]. If an average weight of 32.4 g/fish (0.07 lb/fish) (from 1976 impingement at the JAF plant)[1] is assumed, a total of 633,487 fish were

harvested. The average Unit 1 impingement during the period 1973 through 1981 amounted to 6,666 fish. Thus, impingement was 1.0 percent of commercial fishing. The Unit 2 mortality rate is projected to be 0.12 percent of the commercial catch in 1976. The available data indicate that impingement cropping is minimal when compared with available fish in the area or commercial fishing pressure.

Yellow Perch

An exploitation rate was calculated based on the number of tagged fish recovered in impingement collections compared to the number of tagged fish available in the lake. Although yellow perch tagging began in 1972, no tagged yellow perch were recovered in impingement collections at either the JAF plant or Unit 1 prior to 1976. During 1976, two tagged fish were recovered at Unit 1 and one at the JAF plant. Since sampling at both plants took place on 43 percent of the days during 1976, the total estimated number of returns is calculated to be five fish and two fish at Unit 1 and the JAF plant, respectively.

An estimated 1,232 tagged yellow perch were available in 1976. The seven fish impingement estimate for Unit 1 and the JAF plant combined then represents an exploitation rate of 0.57 percent of the available tagged yellow perch. When compared to an average exploitation rate of 7.41 percent[14], based on other fishing efforts (total tag returns), the impact of impingement is negligible. Based on the total number of yellow perch impinged during 1976 (3,695) and the New York State commercial catch of 23,841 kg (52,560 lb)[15], which represents 478,000 fish based on an average weight of 49.8 g/fish (0.11 lb/fish), impingement at Unit 1 and the JAF plant during 1976 represented 0.77 percent of the commercial harvest. Compared to other sources of mortality, impingement at Unit 1 and the JAF plant is insignificant. The Unit 2 impingement based on 1976 statistics would represent less than 0.01 percent of the commercial harvest.

Smallmouth Bass

Storr[14] has tagged 126 smallmouth bass since 1972, but none have been collected from the traveling screens at Unit 1 or the JAF plant through December 1981. Since the majority of these fish were tagged and released in the immediate vicinity of the two intakes, the lack of any recoveries in impingement collections would indicate that the plants do not have a significant effect on the local smallmouth bass population.

No commercial catch statistics are available for smallmouth bass, so comparisons to commercial harvest were not possible; however, Storr has had 19 tags returned of the total of 126 smallmouth bass tagged. These tags, for the most part, were returned by commercial and sport fishermen, and an exploitation rate of 15.1 percent can thus be attributed to commercial and sport fishing combined. Therefore, based on the lack of any tag returns in impingement collections, cropping by the power plants would be at least an order of magnitude less than that by fishing mortality.

Coho Salmon

Coho salmon do not occur naturally in Lake Ontario, but are stocked by various state and federal agencies. Thus, the only population size data available are from stocking statistics. Impingement at Unit 1 and the JAF plant and estimated impingement at Unit 2 are therefore compared to stocking conducted by NYSDEC.

The estimated total impingement of coho salmon from 1976 through 1981 at Unit 1 and the JAF plant was 10 fish[3]. NYSDEC stocked approximately 1,753,000 coho from 1975 through 1980[3]. The 10 fish impinged at the two plants represent an insignificant portion of the fish stocked during this period and the fish return system on Unit 2 will return any salmon inadvertantly entrapped in its cooling water flow.

Threespine Stickleback

Since no standing stock or tagging data are available for the threespine stickleback, impingement cropping rates cannot be calculated. However, the large cycles of population abundances exhibited by this species noted in Section 2.4.2 and indicated in the impingement data demonstrate that the population is regulated by other factors (weather, predation, fecundity, or inherent behavior) which far override the localized effect of impingement cropping.

Brown Trout

The brown trout is not native to North America but was introduced into New York during the 19th century. Recently, Lake Ontario stocks have been maintained by New York and Canadian stocking programs. Therefore, cropping at Unit 1, the JAF plant, and Unit 2 is compared to New York State stocking statistics.

An estimated 256 brown trout were impinged from 1976 through 1981 at Unit 1 and the JAF plant[3]. NYSDEC stocked 1,881,000 brown trout from 1975 through 1980[3], and impingement cropping therefore represents less than 0.02 percent of the stocked fish. Unit 2 represents a small addition to this estimated cropping.

Endangered Species

Only two species, longjaw cisco (Coregonus alpenae) and blue pike (Stizostedion vitreum glaucum), at one time common to Lake Ontario, are currently listed by the U.S. Fish and Wildlife Service and New York State as endangered and threatened. Neither species has been collected in impingement at Unit 1 or the JAF plant nor is anticipated to be collected at Unit 2.

Summary of Impingement Impact

The preceding analyses indicate that the total annual mortality at Unit 2 is expected to be very low for all species. This mortality relative to various measures of abundance in the vicinity of Nine Mile Point indicates that plant effects will be insignificant at the population level. Previous analyses[1,16,17] have indicated that the impingement cropping due to the operation of three major power plants at the eastern end of Lake Ontario has a minimal effect on fish populations. Because the cropping at Unit 2 is an extremely small increment of mortality, the conclusions of the previous analyses are not changed when Unit 2 mortality is added to the existing effect. This is also true for the conclusions of an analysis of the lakewide effects of cropping which included all operating power plants on Lake Ontario[1].

5.3.2 Discharge System

5.3.2.1 Thermal Description and Physical Impacts

5.3.2.1.1 Hydrothermal Description of Affected Area

The Unit 2 discharge consists of cooling tower blowdown flow, service water bypass flow, and waste treatment system and liquid radwaste discharge flow which pass through a 1.4-m (4.5-ft) diameter pipe within one of the Unit 2 intake tunnels. The pipe emerges from the lake bed at a point approximately 450 m (1,500 ft) from the existing shoreline, where the discharge flow enters a 1.4-m (4.5-ft) diameter steel riser leading to a two-port diffuser located on the lake bottom. Section 3.4 provides a complete description of

the cooling system and its expected flow rate and associated temperature rises for different operating conditions.

The discharge consists of a two-port diffuser, each 0.5 m (1.5 ft) in diameter, off a common header with a horizontal angle of 120 deg between the ports (Figure 5.3-4). Each port is located 1.1 m (3.8 ft) above the lake bottom and angled 5 deg up to reduce jet contact with the bottom, which could result in local scour. The centerline submergence of the ports at the point of discharge is 10.7 m (35.2 ft), relative to the minimum controlled lake level (el 74.4 m [244.0 ft]).

To evaluate the performance of the discharge system, maximum surface temperatures and associated dilution factors were computed for a range of total discharge flows and associated temperature rises. The range was selected to include normal seasonal operating modes as well as low probability extreme conditions.

5.3.2.1.2 Theoretical Framework of Mathematical Model

The theory of submerged discharges indicates that effluent dilution is dependent on the exit densimetric Froude number, relative port spacing, and relative submergence of the discharge when momentum and buoyancy forces dominate the plume dynamics. The Froude number represents the ratio between the discharge inertial force and buoyancy and is given by:

$$F = \frac{V}{\sqrt{g \frac{\Delta\rho}{\rho} D}}$$

Where:

V = Exit velocity

D = Port diameter

G = Gravitational acceleration

$\frac{\Delta\rho}{\rho}$ = Density difference of the effluent relative to the ambient water

Relative port spacing is the ratio of the port centerline spacing to the port diameter; relative submergence is the ratio of the port centerline submergence to the port diameter.

A complete analysis of the trajectory, the extent (length, width, area), and the temperature distribution of the jet plume system must consider all of the following factors:

1. Hydrodynamics of the lake (velocity field and ambient turbulence).

2. Lake geometry (depth, bottom roughness, and local topography).

3. Ambient temperature distribution in the vicinity of the discharge.

4. Effluent characteristics (flow rate, density differences from ambient lake water, and discharge velocity).

5. Discharge port characteristics (location, orientation, submergence, size and shape of outlets, number and spacing of ports).

Koh and Fan applied an integral method in solving the differential equations of mass, momentum, and energy conservation under various assumptions encompassing the preceding factors[18]. The mathematical model developed by these investigators for a row of equally spaced round jets discharging at an arbitrary angle of inclination to the horizontal has subsequently been used to generate standard nomograms published by EPA[19]. The nomograms can be used to predict the surface temperature rises and nearfield temperature distributions resulting from either single or multiple submerged discharge jets. The temperature rise distribution between the discharge and the point of jet surfacing is determined by the densimetric Froude number, the relative submergence, and the relative port spacing of the discharge system.

Robideau introduced the concept of the effective depth of dilution to the theory of submerged jets[20]. Briefly, Robideau's analysis indicates that, depending on the relative submergence and the exit Froude number, dilution of the jet occurs over only some portion of the full depth of submergence since the overlying surface plume precludes dilution of the effluent in the surface layer. Thus, Robideau's effective submergence leads to more realistic predictions than those of Koh and Fan.

The main thrust of Robideau's formulation is the consideration of the finite water depth in limiting the available supply of ambient water for dilution.

> "The jet is deflected upward, or toward any boundary, because the water available for jet entrainment is not unlimited. This results in the creation of vortices in the ambient fluid and an associated decrease in pressure."[20]

Therefore, Robideau's approach was to assume a surface impingement, or surface mixing region, in which there is no further dilution of the jet. In order to present a synopsis of his analysis, the two primary zones of jet flow are defined. The region in the immediate vicinity of the discharge is called the zone of flow establishment and extends from point o to point e (Figure 5.3-5). In this region, the velocity and temperature distributions undergo a transition from the profile of turbulent flow through a port to the Gaussian distribution which characterizes a free jet. In the zone of established flow, which begins at point e, the jet is unaffected by boundaries and is treated as if it were in an infinite environment until it enters the surface mixed region at point c. This mixing region constitutes a control volume over which the equations for the conservation of mass, momentum, and energy are written in integral form. These equations are combined with the description of the jet in the zone of established flow to give the maximum surface temperature resulting from a submerged jet with various discharge conditions and water depth.

One of the basic assumptions in the analysis is that no further dilution of the jet by ambient water occurs in the surface mixed region. Because the control volume is a mixing region, the surface temperature there is necessarily higher than the average temperature of the incoming plume flow, but less than the maximum temperature. To ensure conservative results in the analysis presented here, this mixing was not considered. It was assumed that the maximum surface temperature is the same as that on the jet centerline as it enters the control volume at point c. From Figure 5.3-5 it can be seen that point c is a relative distance y_c above the discharge. The jet is diluted as it rises to y_c, but the remaining distance, $h-y_c$ (where h is the dimensionless water depth), provides no further reduction in the jet temperature.

The algorithm developed by Robideau departs from the classical formulations of jet plume dilution by substituting a polynomial distribution for the assumed Gaussian velocity distribution of velocity in the plume.

$$\text{Gaussian} : \bar{u} = ue^{-(r/b)^2}$$

Polynomial: $\bar{u}' = u' [1-(r/r_m)^2]^2$

Where:

$\bar{u}$ and $\bar{u}'$ = Centerline velocity for Gaussian and polynomial distributions

r = Coordinate normal to the round jet centerline

r_m = Maximum radius of the round jet with polynomial distribution

b = Local round jet nominal radius Gaussian distribution

The polynomial expression is a very close approximation of the Gaussian and, in fact, agrees with the experimental data just as well, or better, than the Gaussian form. This key mathematical substitution enables a numerical solution of the velocity and temperature over depth based on the discharge characterized according to its Froude number. The plots of the ratio of the effective depth for dilution, y_c, to the actual depth, h, versus the discharge Froude number, F_o, for various dimensionless depths, h, have been verified by comparison among the dilutions 1) measured in hydraulic model studies[21] and in recent thermal surveys[2], 2) predicted according to Robideau's effective depth of dilution, and 3) predicted with the use of the total submergence rather than its effective submergence. When the depth correction is not included, predicted dilutions are greater than those actually measured.

Because these experimental data agreed with Robideau's findings and a conservative design was desired to ensure compliance with standards, the depth correction presented by Robideau was used to predict the temperature distributions resulting from the Unit 2 discharge.

5.3.2.1.3 Isotherms and Velocity Vector Data

Maximum surface temperature rises for a range of plant operating conditions and temperature distributions in the nearfield submerged plume were predicted for the most severe operating conditions. Given the low potential impact of the small volume Unit 2 discharge and the high dilution achieved by the diffuser in the nearfield region, complex modeling of temperature distributions beyond the nearfield is not necessary. This is consistent with the NRC guidelines, which state: "Where the thermally affected discharge will

be relatively small and have low ecological impacts, only simple methods of analysis using conservative assumptions need be applied."

The results of the surface temperature rise predictions are given in Table 5.3-8, along with the associated discharge conditions and plant operating conditions. The detailed description of worst-case conditions is provided in Section 3.4. Worst-case discharge conditions were based on the maximum cooling tower evaporation and the maximum cooling tower blowdown temperature differential during summer and winter conditions. An annual average condition was also modeled.

Two worst-case conditions were modeled because discharge parameters and factors affecting dilutions vary. The winter case (March) has the worst discharge conditions of highest temperature rise and lowest exit velocity; however, the cold ambient temperatures allow for a less buoyant plume. The summer case (July) has the highest temperature rise during the summer months when the ambient temperature is 21°C (70°F) or higher and near lowest flow (August worst flow was 1.635 cu m/s [25,954 gpm] vs July's 1.637 cu m/s [25,984 gpm]). The summer ambient temperatures will have a more buoyant plume which should surface quicker with less dilution.

The use of Robideau's findings to predict the surface temperature rises required a slight alteration of his procedures. Because of the Unit 2 discharge design and flow rates, the modeled conditions had Froude numbers of 68.4 (annual), 42.2 (summer), and 60.6 (winter), which were significantly higher than the maximum Froude number (30) used in his study. Since the dilution increases with an increasing Froude number, a conservative alternative procedure was selected; i.e., use a Froude number of 30 for all conditions with higher Froude numbers. The result of this alternative procedure is that the predicted dilution of the discharges with higher Froude numbers (annual and winter) are lower than may actually occur. Even with these conservative estimates, the predicted maximum difference in the surface temperature is only 1.3°C (2.3°F).

The impact of the alternative procedure on effective depth is not as clear as with dilution. According to Robideau, increasing Froude numbers (in the range of 0 to 30) will decrease the effective depth. However, it is unlikely that this relationship would continue with Froude numbers higher than 30; most likely the curve will level off at a set effective depth. The changes in effective depth have no im-

pact on the dilution calculations and may be noticeable only in the predicted temperature distributions.

As indicated in Table 5.3-8, the initial discharge temperature rise is diluted in excess of 10:1 for all discharge conditions, and surface temperature rises are thus all less than 1.3°C (2.3°F). The dilution is achieved in the nearfield and thus will not vary with meteorological conditions.

Since maximum surface temperature rises are less than 1.3°C (2.3°F) under all operating conditions, the discharge is in full compliance with New York State surface temperature criteria governing Lake Ontario as described in Sections 704.2 and 704.3 of the New York Codes, Rules, and Regulations and does not require the allowance of a surface mixing zone.

The effects of the worst-case discharge conditions on lake temperatures were further evaluated by predicting the distribution of temperature rises in a vertical section through the centerline of each discharge jet. The computational method for determining the temperature distribution in the nearfield is based on various relationships described in the literature. Previous studies[4] have indicated that the dilution of temperature along the centerline of the plume outside the zone of flow establishment is proportional to the centerline distance raised to some power, a.

$$\frac{T(S)}{T_o} = \frac{k}{S^a}$$

Where:

$T(S)$ = Surface temperature

T_o = Discharge temperature

S = Centerline distance

k = Constant

a = Constant

The solution of this equation yields the temperature rise with distance along the centerline of the plume. To determine the shape of the isotherms in the vertical plane, the nomograms developed by Shirazi and Davis[19] have been employed since the Robideau analysis does not explicitly

describe the plume shape. The Shirazi and Davis analysis is based on a normal or Gaussian distribution of temperature with perpendicular distance from the centerline. Figures 5.3-6 through 5.3-8 show the cross-sectional distribution of temperature rises in a typical jet under the three modeled conditions with no ambient lake current. The rapid dilution of the discharge in the submerged nearfield zone of the plume and the small size of the zones affected by the higher temperature rises are evident. Based on the predictions in Figure 5.3-8, the winter worst-case initial discharge temperature rise of 15.6°C (28.0°F) will be diluted by 2.8:1 to 5.5°C (10°F) within 3.7 m (12 ft) of each discharge port, and by 5.6:1 to 2.8°C (5.0°F) within 11 m (36 ft). Under other, less critical discharge conditions with higher velocities and lower discharge temperature rises, dilution in the submerged jet will be increased, reducing the zones bounded by the higher isotherms.

It should be noted that this temperature distribution plot shows dilution over the entire water column, whereas the Robideau approach does not credit any dilution in the upper mixing region. A more detailed submerged plume prediction following Robideau's type of analysis would predict broader (less elongated) isotherms with more rapid centerline dilution. The volume of water entrained by the plume in either model is comparable. Consequently, the model used does not substantially alter the cross-sectional area encompassed by the isotherms, as illustrated on Figures 5.3-6 through 5.3-8.

Abramovitch has shown that velocity in the nearfield plume must decay along the centerline at least as rapidly as temperature[22]. If velocity and temperature in the nearfield plume are assumed to decline at approximately the same rate, velocities and turbulence would both be greatest when the temperature rise is greatest in the nearfield. Table 5.3-9 lists the predicted plume velocities for selected isotherms.

In summary, the temperature distribution resulting from the Unit 2 discharge complies with applicable Lake Ontario water quality standards, and temperature rises in excess of 1.7°C (3.0°F) are predicted to be confined to a small submerged region in the immediate vicinity of the discharge structure. The submerged nearfield regions subjected to higher temperature rises are also associated with high velocity and turbulence levels. The thermal effects of the discharge beyond the immediate discharge vicinity are minimal because of the low temperature rises

(0.5°C and 1.0°C [1.0°F and 2.0°F]) and relatively low volume of discharge.

The minimal farfield surface temperature effects, combined with the offshore orientation of the discharge, serve to minimize the potential for recirculation of any measurable portion of the plume through either of the inshore submerged intake structures. The buoyancy of the plume tends to restrict it to the upper levels of the water column, whereas the intakes draw from the lower levels.

The high velocities of the initial discharge jet may cause some local benthic scouring of fine sediment where the bottom of the jet contacts the lake bottom. However, the upward orientation of the discharge ports and the relatively low discharge flow serve to minimize the extent of bottom scour. Based on the prediction of submerged plume size, the scoured area will extend, at most, approximately 45 m (150 ft) from the discharge structure with deposition occurring on the periphery. Although the benthic community in the scoured area would be disrupted, the small area involved would not have a significant adverse impact on the benthic community as a whole.

5.3.2.1.4 Interaction With Other Discharges

As described in Section 3.4, the Unit 2 discharge is located between the two existing thermal discharges of Unit 1 and the JAF plant.

While the initial discharge temperature rise for the three discharges is similar, the Unit 2 discharge flow rate is between 6 and 13 percent of the flow rate of either Unit 1 or the JAF plant.

Because of its extremely low volume of discharge (compared with that of Unit 1 and JAF plant discharges) and the submerged high velocity mode of discharge, the Unit 2 discharge will have little thermal effect beyond its immediate discharge area. The Unit 1 and JAF plant discharges, however, can exert a thermal effect at greater distances from their respective discharges, and therefore may affect temperatures at the lake surface in the vicinity of the Unit 2 discharge. Thus, the greatest effect of plume interactions would occur in the immediate vicinity of the Unit 2 discharge when natural lake conditions cause the plume from either the Unit 1 or the JAF plant discharge to be in the vicinity of the Unit 2 discharge. Since the predominant currents in the area are alongshore in either an easterly or westerly direction and the Unit 2 discharge is between the Unit 1 and the

JAF plant discharges, it is improbable that both discharges would interact simultaneously with the Unit 2 plume.

Section 2.3.1.1.6 describes the Unit 1 and JAF plant plumes. Temperature elevations associated with the Unit 1 plume have not exceeded 6.0°C (11.0°F) at the surface. The JAF plant plume is even more diluted than that of Unit 1 and has a lower temperature elevation.

When either the Unit 1 or JAF plant plume is in the vicinity of the Unit 2 discharge, it will be confined by its buoyancy to the upper half of the water column, usually the upper 2.1 m (7 ft). The method used to predict the surface temperature rises from the Unit 2 discharge alone includes dilution of the jet only in the lower half of the water column and assumes no dilution from mixing with upper layers. Therefore, the presence of a surface plume in the vicinity of the Unit 2 discharge will not alter the conservatively predicted surface temperature rises at the point of plume surfacing.

Any interaction between the Unit 2 plume and either the Unit 1 or the JAF plant plume will involve the mixing of the Unit 2 surface plume, after jet surfacing, with the surrounding surface plume. The temperature rises resulting from the mixing of the two plumes must necessarily be between the temperature rises in the separate plumes prior to mixing.

When the surface temperature rises resulting from the Unit 2 discharge are less than or equal to the temperature rises in the surrounding plume, the result of the interaction of the plumes will be to reduce the higher temperature rises in the plume of the existing station. This results from mixing with the cooler Unit 2 plume and increased mixing with underlying ambient waters caused by turbulence in the combined plume. The Unit 2 discharge will contribute to the volume of the combined plume contained within the lower temperature rise isotherms; however, the contribution based on the relative discharge flow between Unit 2 and the JAF plant or Unit 1 will be less than 10 percent.

When the portion of the Unit 1 or JAF plant plume that interacts with the Unit 2 plume has temperature rises less than the Unit 2 surface temperature rise, the result will be an area of slightly increased temperature rises within the combined plume. Even with the increase, however, the surface temperature rise will not exceed the maximum previously described for Unit 2 alone, since the required dilution will occur in the lower portion of the water column.

In general, the local effect of interactions between the Unit 2 and either the Unit 1 or JAF plant plumes will be to increase local mixing and produce temperature elevations no greater than those from the existing plumes or the predicted maximum temperature effect of Unit 2 alone, whichever is greater. Given the variations present in plume sizes that occur from naturally variable meteorological and ambient lake conditions and the relatively small contribution of the Unit 2 discharge, the overall effects of plume interaction will be negligible and most probably undetectable.

5.3.2.2 Aquatic Impacts of the Discharge

5.3.2.2.1 Benthos

Potential sources for discharge impacts on benthic communities include temperature-induced mortality of sessile organisms, plume entrainment of semiplanktonic forms, and scouring of the bottom habitat. For the most part, benthic organisms remain closely associated with the lake substrate and are not usually subjected to thermal elevations because the plume is buoyant. After initial mixing, a neutrally buoyant or sinking plume may develop during the winter. In addition, many benthic species burrow into and live in the sediments, which further protect them against plume-related thermal effects. Studies at other power plants have shown that plume-induced elevations in water temperature near the substrate are not transmitted through the sediments[23].

Local scour and subsequent deposition will be limited to the nearfield. As described in Section 5.3.2.1, the scour area is projected to be within 45 m (150 ft) of the outfall. Any impacts of scouring to benthos will be limited to this area.

Based on the analysis of 6 yr of benthic data collected near the Unit 1 discharge and at a control transect, as well as a year of collection at the JAF plant, no measurable effect was demonstrated on either species assemblages or abundances as a result of operations[2,3,5]. None would be expected at Unit 2 which, because of its smaller volume, has a lower potential for causing impact.

5.3.2.2.2 Plankton

Plankton generally exhibit limited mobility and will become entrained into the thermal plume. Entrainment can affect the organisms in several ways. Thermal effects include inhibition or stimulation of metabolic processes and mortality. Effects caused by increased turbulence can include physical damage and redistribution of planktonic or-

ganisms within the water column. Effects resulting from chemical composition include acute and sublethal toxic actions and synergistic effects of the chemicals with temperature.

Because Unit 2 has a closed-cycle cooling system, the discharge waters will be devoid (or nearly so) of live plankton. The consequences of this may be a reduction in plankton standing stocks in the immediate vicinity of the discharge; however, as a result of mixing of discharge waters with lake water and the patchy nature of planktonic communities, this localized reduction is not expected to be observable. This potential effect applies to all types of plankton; the remainder of this discussion will focus on phyto-, zoo-, and ichthyoplankton separately.

The effect on plume-entrained phytoplankton will most likely result in an alteration of metabolic processes observable as a change in primary productivity. Depending upon season or ambient temperatures, individual species may be either stimulated or inhibited, but the overall effect will be small. Studies to determine the effect of plume entrainment on phytoplankton conducted at JAF from 1976 through 1979 confirmed this[5,7,8,24]. The results of these studies are presented in a summary report prepared by LMS[3].

Studies conducted by LMS and Texas Instruments, Inc. (TI) at JAF to determine the effects of plume entrainment on zooplankton survival also indicated little or no effect[5-8,24]. In general, the survival of zooplankton collected in the intake and subjected to plume simulation studies in the laboratory and those collected at the 1.1°C and 1.6°C (2°F and 3°F) isotherms in the lake was within the range observed for intake organisms, indicating that the greatest mortality was probably a result of collection and handling procedures.

LMS reviewed the literature regarding plume entrainment of zooplankton[3]. The general conclusion was that there was no lasting or permanent effect of entrainment on resident zooplankton communities. The thermal tolerance of <u>Gammarus</u> sp. was also reviewed, and, based on the available data, their survival is expected to be high even if <u>Gammarus</u> is entrained near the discharge ports and exposed to the full effects of the discharge plume[3].

The effects of plume entrainment on ichthyoplankton were studied at the JAF plant during 1976, 1977, and 1978[5,7,8]. Live larvae were obtained and survived the simulation

process, demonstrating that fish larvae can survive the plume temperatures expected from the Unit 2 discharge.

In order to further evaluate the impact of the Unit 2 plume on ichthyoplankton, the available literature on thermal effects was reviewed[3]. In general, these studies provided conservative estimates. Eggs and larvae were exposed to temperature increases for a minimum of 30 min. At the JAF plant, an organism entrained exactly at the point of discharge is exposed to temperatures 5°C (9°F) above ambient for less than 2 sec for the worst-case condition, and the time is less at Unit 2. In general, the cited studies found that a 10°C (18°F) increase did not affect survival, while a 15°C (27°F) increase resulted in less than 50 percent mortality. Since these studies were done for exposure periods that were substantially longer than expected at Unit 2, it is anticipated that plume entrainment at Unit 2 will have a minimal effect on survival of eggs and larvae.

In summary, discharge impacts of Unit 2 on plankton communities are expected to be minimal. These conclusions are further supported by the aquatic ecology studies conducted for Unit 1 and the JAF plant from 1972 to 1978, which showed no measurable reductions in plankton numbers nor alterations in temporal patterns in the thermally influenced area as compared to the control areas. Based on this 6-yr data base and the relatively small flow rate being discharged by Unit 2 as compared to Unit 1 and the JAF plant, the thermal discharge is expected to have a minimal impact on the plankton communities.

5.3.2.2.3 Nekton

Thermal discharges can affect populations both directly, through individual contact, and indirectly. Indirect effects result from an interaction of the discharge with other potentially stressful conditions or from an ecosystem imbalance initiated through direct effects.

Fish can voluntarily swim into the plume or be entrained into it. The temperature distributions in the plume indicate a sharp temperature gradient caused by the rapid dilution produced by the high velocity discharge[3]. Therefore, the likelihood of a fish intentionally experiencing the full ΔT by swimming into the plume is very remote. Only those few fish entrained near the discharge ports will experience the highest temperatures, and the exposure period will be on the order of only a few seconds. Analysis of laboratory-derived critical thermal maxima (CTM) indicates that some mortality could occur at the highest acclimation

temperatures (20°C-25°C [68°F-77°F]) for fish that experience the full 15.6°C (28°F) $\Delta T^{(3)}$. However, as discussed in a summary report prepared by LMS, CTMs are determined by raising temperature until equilibrium loss occurs[(3)]. Fish entrained into the thermal plume experience a brief exposure to a high temperature followed by a rapid decline as the plume mixes with lake water. During the brief exposure, the fish's body temperature will not reach equilibrium with ambient, and it can be postulated that the temperature at which adverse effects will occur is higher than the laboratory CTM.

LMS analyzed the available data on swimming speeds in fish and on predicted plume velocities and determined that most species could voluntarily maintain themselves in the area of 30 cm/s (0.98 fps) water velocity during the summer months when their swimming ability is at a maximum[(2)]. Temperature increases of 1.5°C (2.7°F) above ambient are expected in this area. Upper incipient lethal levels for all species of concern at low to moderate ambient lake temperatures are well above temperatures in the 30 cm/s (0.98 fps) area of the plume[(3)]. Summer lethal thresholds for smallmouth bass, yellow perch, white perch, spottail shiner, threespine stickleback, and young-of-the-year alewife are also above the plume temperatures under consideration.

Behavioral characteristics of other selected species will tend to keep them away from the discharge area during the period of warm ambient temperatures. Brown trout, coho salmon, and rainbow smelt are cold-water species that normally reside in the cool waters of the lake depths during the summer months. Adult alewives, which are less tolerant of high temperatures than young-of-the-year alewives, also move to the cool waters[(2)].

Sublethal effects that could result from a thermal discharge include alterations in the reproductive cycle, changes in growth, and changes in feeding patterns. Alterations to the reproductive cycle could be manifested as delays in spawning or reduced numbers of eggs. Changes in growth and feeding could affect one another and both could precipitate changes in the reproductive cycle. No alterations attributable to operation of the existing plants have been detected in the fish community (Section 5.3.1.2).

In conclusion, the data indicate that operation of existing plants has not measurably affected the fish populations of Lake Ontario, and the relatively small addition of heat of Unit 2 is not expected to have a significant impact.

5.3.2.3 Plant Shutdown

Mortality of aquatic life due to cold shock, i.e., abrupt exposure of organisms acclimated to a warm effluent to very low ambient temperatures, has occurred at a number of power plants. The small size of the Unit 2 discharge plume limits the potential for residency. However, some fish and benthic species may become acclimated to the discharge plume outside the high velocity (and turbulent) area. In the event of a Unit 2 shutdown, the temperature at the Unit 2 outfall would return to the slightly elevated temperatures (0.5°C-1.0°C [1°F-2°F]) produced by the Unit 1 or the JAF plant plume. Fish would then seek out their preferred temperature within the existing plumes. Because of the dynamic nature of the plume (constantly moving due to changing wind and current), fish residing within the plume must regularly change position to remain at their preferred temperature. Benthic organisms experience elevated temperatures only in the near-field where the plume contacts the substrate. In this area, the organisms would either acclimate to the changing temperatures or burrow into the substrate.

Simultaneous shutdown of all three units is very unlikely. A minimum of one plant would be operating and provide a zone of elevated temperature throughout the winter months for any acclimated residents to the discharge area. Therefore, the potential for mortality due to cold shock resulting from a Unit 2 shutdown is minimal.

5.3.3 Heat Dissipation System

5.3.3.1 Heat Dissipation to the Atmosphere

The natural-draft cooling tower is the only significant source of plant effluent capable of affecting local meteorology and terrestrial ecology. The following sections present a discussion of fogging, icing, drift, humidity, and their impact on local weather and ecology. These impacts are also addressed in an NRC report on the cooling tower at Unit 2[25].

5.3.3.1.1 Predictions of the Following Impacts for the Affected Site and Vicinity Locations

5.3.3.1.1.1 Additional Amounts of Ground-Level Fogging and Icing and Transportation Impact

Ambient air becomes heated and moisture-laden when induced through the natural-draft cooling tower. This air is discharged from the tower as a plume which may be occasionally

visible. The frequency of visible plume occurrence and its extent depend on the meteorological conditions existing at the time and the design and physical parameters of the tower.

A mathematical model, using as input simultaneous observations of wind speed, wind direction, ambient dry-bulb temperature, ambient wet-bulb temperature, and relative humidity, is used to determine the configuration and extent of visible plumes from the natural-draft cooling tower at Unit 2. Onsite meteorological data for the period January 1, 1974, through December 31, 1976, are used for the visible plume predictions. The mathematical model used in this analysis is described in detail in FSAR Appendix 2C.

The results of these model predictions are illustrated on FSAR Figures 2.3-1 through 2.3-25, which depict the frequency of occurrence of various plume extents in each of the four primary wind direction quadrants for each season of the year and for the entire 3-yr period. These contours do not represent individual plume outlines but the combination of many individual plumes, to show the maximum horizontal and vertical extent of the visible plume for each given frequency of occurrence. The visible plume rarely (<0.2 percent) descends below heights of 91 m (300 ft) above ground, as can be seen on FSAR Figures 2.3-1 through 2.3-25. In addition, more than 90 percent of the time, the plumes do not extend beyond 1,370 m (4,500 ft). The plume remains aloft because it is initially injected into the atmosphere at a height of 165 m (541 ft) with an exit velocity of 3-6 m/s (10-20 fps) and is buoyant because its temperature exceeds that of the ambient air. Occurrences of visible plumes below the height of the tower are due to strong winds and the associated tower-induced turbulence in the wind field. As can be seen on FSAR Figure 2.3-25, less than 1 percent of the visible plumes fall below the tower height at a distance of 762 m (2,500 ft) or greater.

Based on the modeling results and the fact that the nearest airport is over 16 km (10 mi) from the Unit 2 site, it is expected that air traffic will be unimpeded by the cooling tower plumes. Furthermore, in a comprehensive study conducted at the Chalk Point Generating Station, it was concluded that the natural-draft cooling tower plume posed no hazard to aircraft in terms of flight visibility, turbulence, or icing to structures and engines[26].

Since the visible plume rarely descends below heights of 91 m (300 ft) above ground and does not impinge the ground surface, it will not contribute to ground fogging or icing.

In addition, ground icing due to cooling tower drift was assessed and found to be of little consequence. This conclusion was based on the results of the modeling analysis presented in Section 5.3.3.1.1.2, in which a maximum annual surface accumulation of water due to drift was estimated to be 0.08 mm (0.003 in). Assuming that this entire accumulation of water occurred during freezing conditions, it is still an insignificant amount compared with a light ice storm, which is defined as one that deposits less than 2.5 mm (0.1 in) of ice per hour[27]. Therefore, impacts to highway or lake traffic are not expected.

5.3.3.1.1.2 Annual and/or Monthly Amount of Drift Deposition in g/sq m or Drift Concentration in mg/cu m

A mathematical model is developed to determine the downwind distribution of salt, the water deposition, and the concentration of airborne salt resulting from cooling tower operation. A detailed description of the model and results are contained in FSAR Appendix 2D. The model takes the following into account:

1. Configuration and performance of the tower.
2. Drift rate.
3. Exit velocity.
4. Total dissolved solids (TDS) level.
5. Droplet size distribution.
6. Evaporation rate.
7. Plume buoyancy.
8. Wind speed.
9. Wind direction.
10. Wet-bulb temperature.
11. Relative humidity.

The amount of drift leaving the cooling tower is assumed to be 0.002 percent of the circulating water flow through the tower. This number is less than that guaranteed by the cooling tower manufacturer, and in fact even lower drift rate percentages may be achieved. Monthly average TDS

concentrations in the blowdown and 3 yr of onsite, hourly average meteorological data (January 1, 1974, through December 31, 1976) are used as input to the salt drift model.

The meteorological input data used in the model consist of wind speed, wind direction, dry-bulb temperature, wet-bulb temperature, and relative humidity at the 61-m (200-ft) level. The difference between the dry-bulb temperatures at 61 m (200 ft) and at 8 m (27 ft) (ΔT) is also used. Normally, the low level relative humidity would be used to determine tower performance, but due to the large amount of missing data for this parameter, the upper level relative humidity is chosen. A comparison of the relative humidities at these two levels shows an average difference of only 4.6 percent, which has little effect on the salt drift model results. The results of a sensitivity test of the drift model to relative humidity, using 1 month (December 1974) of meteorological data, show an 11-percent decrease in the maximum salt deposition rate and an 8.7-percent decrease in the maximum water deposition rate by using the 61-m (200-ft) relative humidity in place of the 9.1-m (30-ft) relative humidity.

There is also a substitution of the 31-m (100-ft) wind direction when the 61-m (200-ft) wind direction is missing to ensure that a high percentage of data is used. This practice does not significantly affect the salt drift results because of the very small changes in wind direction with height between these levels.

Predicted average annual salt deposition rates in lb/acre/yr are shown on FSAR Figure 2.3-26. The maximum salt deposition rate is predicted to be 0.03 g/sq m/yr (0.27 lb/acre/yr), occurring approximately 2,000 m (6,562 ft) northwest of the tower. FSAR Figure 2.3-27 presents annual water deposition rates in lb/acre/yr, with a maximum value of 77.4 g/sq m/yr (690.6 lb/acre/yr) occurring 2,000 m (6,562 ft) northwest of the tower. This amount corresponds to 0.08 mm (0.003 in) of water per year. Predicted average monthly salt deposition rates in lb/acre/yr are shown on FSAR Figures 2.3-28 through 2.3-39. Monthly and seasonal water deposition rates are not shown because the maximum annual amount of 0.08 mm (0.003 in) is insignificant compared to annual precipitation at the site of over 76 cm (30 in).

In addition to the drift deposition rates, airborne salt concentrations at ground level are calculated. The maximum annual average airborne salt concentration is predicted to be 0.83×10^{-6} mg/cu m (5.18×10^{-14} lb/cu ft) at a distance of 2,400 m (7,874 ft) northwest of the tower. The highest value over land is predicted to be 5.6×10^{-7} mg/cu m (350×10^{-14} lb/cu ft) at 1,067 m (3,500 ft) south of the tower. A value of 1.22×10^{-3} mg/cu m (7.62×10^{-11} lb/cu ft) is predicted for the maximum hourly airborne salt concentration which occurs at a distance of 500 m (1,640 ft) west-northwest from the tower. The maximum hourly airborne salt concentration over land is predicted to be 1.19×10^{-3} mg/cu m (7.43×10^{-11} lb/cu ft) at a distance of 1,067 m (3,500 ft) west-southwest of the tower.

5.3.3.1.1.3 Cloud Development and Cloud Shadowing

The extent to which natural-draft cooling tower plumes contribute to cloud formation can be qualitatively assessed based on observational studies conducted at three operating, natural-draft cooling tower sites[28]. At each of these sites, cooling tower plumes were observed to occasionally cause broken cloud decks to become overcast and to make thin clouds thicker. Separate cloud formations were sometimes observed to result from visible plume formation from the cooling towers but usually at altitudes of several thousand feet above ground. Therefore, the potential for increased cloud development due to cooling tower operation appears to be minimal compared to the potential for development due to natural causes.

The impact of plume shadowing depends highly on the extent and duration of visible plume formation. The results of the analysis presented in Section 5.3.3.1.1.1 provide a quantitative assessment of the configuration and frequency of occurrence of visible plumes resulting from the operation of the Unit 2 tower. FSAR Figure 2.3-25 indicates that any shadowing effects of the visible plumes on the region would be very localized, since less than 10 percent of the plumes extend beyond 1.6 km (1 mi) from the tower. Likewise, the infrequent occurrence of plumes longer than 1.6 km (1 mi) would most likely be on naturally cloudy days, which would not contribute to shadowing. Therefore, it is highly unlikely that cooling tower plume shadowing would have an adverse impact on any offsite locations.

5.3.3.1.1.4 Weather Modification in Terms of Increased Precipitation

The natural-draft cooling tower at Nine Mile Point could create an insignificantly small increase in precipitation, primarily during the winter months. Sufficient research and field data are now available to rule out the triggering of violent storms such as thunderstorms or squalls.

Observations of precipitation falling from natural-draft plumes are very limited. Kramer and Seymour have documented one observation of light rain falling from a natural-draft cooling tower plume and several observations of light snowfall[29]. Though it may be possible for a cooling tower to modify the precipitation pattern immediately downwind of the tower, it will not alter the total precipitation in the region, as the water vapor emissions from the tower are small compared to natural fluxes[30].

During the winter of 1975-1976, Kramer et al observed light snow from several different cooling tower plumes on 10 separate days[31]. Furthermore, only light, fluffy snowfall has been observed in studies of natural-draft cooling tower plumes associated with power plants of a size similar to Unit 2. These events have been of short duration, and the area affected by the precipitation has been confined to the region under the visible plume. None of these occurrences took place during the agricultural season.

Though little is known about the actual precipitation mechanisms causing the snowfall, it was found to occur only during stable atmospheric conditions with temperatures below -12°C (10°F) at the height of the plume centerline. These observations have been theoretically substantiated by Koenig[32].

While studies of actual natural-draft cooling tower plumes have not documented any cases of the plumes triggering a thunderstorm or squall, the potential for a cooling tower plume to trigger such an event has been analytically considered. Hanna has compared the energy produced by natural phenomena such as thunderstorms and Great Lakes snowsqualls and found that the energy produced by these phenomena is 10 to 10,000 times the energy released by a wet cooling tower at a 1,000-MW generating station[33]. Such effects require concentrated heat releases in a small area, substantially larger than those from the Unit 2 cooling tower.

Since Lake Ontario is a large source of local weather modifications along its shores, the effect of the cooling tower is minuscule in comparison. The lake creates very large variations in the amounts and frequency of precipitation so that changes associated with the tower plume should be impossible to measure.

5.3.3.1.1.5 Humidity Increase

The amounts of moisture emitted from cooling towers not only contribute to visible plume formation but also may increase ambient ground-level relative humidities, even if the plume remains aloft. In order to evaluate the potential augmentation of ambient relative humidities due to cooling tower operation, a mathematical diffusion model, which incorporates tower-specific information and onsite meteorological data, is developed. A detailed description of this model is provided in FSAR Appendix 2E.

The model described in FSAR Appendix 2E is utilized to determine relative humidity increases due to the operation of the Unit 2 natural-draft cooling tower. Using tower-specific information on evaporation rate and other performance characteristics, along with local topographic information, the model is run with a 3-yr onsite meteorological data base (1974-1976) to arrive at long- and short-term increases in relative humidity as a function of distance and direction from the tower. The results of this model run are presented in Table 5.3-10, which contains maximum hourly, daily, monthly, and annual average increases in ground-level relative humidity for each 22.5-deg sector from the tower. This table also includes the average ambient diurnal changes in relative humidity at the site as a basis for comparison. The maximum 1-hr relative humidity increase of 3.3 percent points out the insignificant impact of the cooling tower when compared with the diurnal fluctuations of relative humidity, as shown in FSAR Appendix 2B. The reason for such a small increase can be related to the large discharge height of the cooling tower (165 m [541 ft]), which allows the moisture to effectively disperse before reaching the ground. Therefore, no significant humidity changes are expected from this cooling tower.

5.3.3.1.1.6 Interaction of the Heat Dissipation System Plume With Existing Pollutants

The chemical interaction of the natural-draft cooling tower plume with any local industrial pollutant plumes in the vicinity of Nine Mile Point should have a negligible impact on the environment. Both research and literature indicate

that the merging of natural-draft cooling tower plumes with nearby fossil or industrial plant plumes produces no detrimental effects.

Quantitative field studies performed by Pennsylvania State University at Keystone and Bowen Power Plants and by the Chalk Point Cooling Tower Project support this conclusion, as do qualitative studies sponsored by American Electric Power Service Corporation at five fossil-fuel power plant sites (Amos, Gavin, Muskingum, Big Sandy, and Mitchell)[34-37]. The absence of any published reports on adverse effects in Cooling Tower Environment (1974 and 1978) indicates that as of 1978, there were no known or measured impacts from the merging of natural-draft cooling tower plumes with associated fossil or industrial plumes[38,39]. Furthermore, a summary by Argonne National Laboratory of the atmospheric impacts of evaporative cooling systems concludes that the lack of reported significant adverse impacts caused by the merging of stack and cooling tower plumes suggests that the effects of merging are of minor importance[30].

All sources of chemical plumes are located more than 2.0 km (1.3 mi) from the natural-draft cooling tower, including the nearest fossil-fuel plant, which is 11 km (7 mi) away. Merging of these plumes or entrainment of an industrial or fossil-fuel plant plume into the cooling tower plume is a remote possibility. Since plume merging requires that one source be directly downwind of the other and that the plumes be at the same altitude, and since the predicted frequency of cooling tower plumes greater than 1.6 km (1.0 mi) in length is less than 10 percent of the time annually, the merging of plumes should be extremely infrequent.

5.3.3.1.2 Unusual Heat Dissipation System Impacts

There are no anticipated heat dissipation system impacts other than those described in Sections 5.1.1, 5.1.3, 5.3.3.2, and 5.8.1. Unusual impacts of drift emissions and blowthrough, such as discoloring or corrosion of plant structures, transmission line interruption or station outage due to salt buildup on switchyards or transmission line insulators, or damage due to ice buildup on transmission lines or structures, are very unlikely. The use of freshwater (solids concentration of about 400 ppm) as makeup to the cooling tower and the significant emission height (165 m [541 ft]) of drift and water vapor result in very low solids deposition rates and water vapor concentrations at ground level (Section 5.3.3.1.1), precluding the occurrence of such impacts. In addition, operating experience with freshwater

natural-draft cooling towers has not shown any of the unusual impacts previously described.

5.3.3.1.3 Mitigating Actions

Due to the extremely minor nature of the atmospheric impacts associated with the heat dissipation system, as described in Section 5.3.3.1.1, no mitigating actions are required for this system.

5.3.3.1.4 Summary of Unavoidable Adverse Impacts

The results of the atmospheric impact analyses of the heat dissipation system, as described in Section 5.3.3.1.1, indicate that there are no significant unavoidable adverse impacts associated with this system.

5.3.3.2 Impacts to Terrestrial Ecosystems

5.3.3.2.1 Induced Icing on Vegetation

Vegetation in the Nine Mile Point region is commonly subjected to natural icing (FSAR Section 2.3.1). It is expected that the cooling tower will not induce icing (Section 5.3.3.1.1.1), and no significant damage to local vegetation is expected.

5.3.3.2.2 Effects of Chemical Discharges on Vegetation

Operation of the natural-draft cooling tower at the site will result in the release of water droplets containing dissolved solids, including concentrations of sodium (9 percent), calcium (17 percent), chloride (19 percent), and sulfate (44 percent) ions (Table 3.6-1). The emission of these droplets (i.e., salt drift) represents a source of potential impact to terrestrial ecosystems.

Salt injury of woody plants has been attributed to chloride (Cl^-) and sodium (Na^+) ions[40,41]. The exact mechanism of plant injury due to these ions has yet to be established; however, vegetative shoot content of Cl^- is considered to be a reliable index of the degree of salt injury[42]. In general, the greater the amount of Cl^- in tissue, the more rapid the onset of damage and the more severe the injury[40,43].

Data for the Cl^- levels in tissue of injured plants are often extremely variable because of species specificity, plant part sampled, time of sample collection, and analytical techniques[43]. In addition, plant survival in saline soils

does not automatically imply survival where salt is applied to the foliage[40]. Thus, any assessment of potential salt drift injury must include considerations of the effects due to the accumulation of salts in the soil and the effects due to deposition of airborne salts, either as particulates or in solution, on plant foliage.

Soil Salinization

In the presence of high concentrations of soluble salts in the rooting zone of plants, uptake of water and nutrients by the plants may be restricted. Moreover, in some plants, the absorption of saline constituents may result in a damaging or lethal accumulation of a particular ion. Sublethal accumulation of soluble salts may also inhibit growth and productivity of plants.

Factors that appear to be most important in tolerance of plants to salts in the soil are climate, soil permeability (including various soil chemical and physical parameters), plant genetics, physiology, and pathologic responses[44-52]. High surface runoff or appreciable rainfall and good soil permeability increase the rate at which most salts are carried or leached from the soil. Toxic accumulation is less likely under these conditions.

From the standpoint of soil salinization, no appreciable impact resulting from operation of the natural-draft cooling tower is anticipated either for vegetation at the Unit 2 site or for agricultural crops which may be grown offsite. This assessment is based on the following:

1. The estimated maximum annual average rate of salt deposition resulting from the natural-draft cooling tower is 30.37 kg/sq km/yr (0.27 lb/acre/yr), occurring 2,057 m (6,750 ft) northwest of the cooling tower (Section 5.3.3.1.1.2). Deposition rates over land in vegetated areas are less. The maximum annual deposition rate predicted for vegetated areas (pasture, woods, and agricultural parcels) is 11.08 kg/sq km/yr (0.099 lb/acre/yr) and occurs 991 m (3,250 ft) west-southwest of the cooling tower (in the vicinity of the Visitors Center).

2. The drift is composed primarily of calcium (17 percent) and sulfate (44 percent) ions. Bicarbonate (7 percent) and other trace ions make up another 4 percent. Na^+ and Cl^- ions constitute only 9 and 19 percent of the drift, respectively. Thus, the majority (72 percent) of the constituents

of the salt deposited at the site by operation of the cooling tower are the much less toxic ions of calcium, sulfate, bicarbonate, and others.

3. The potential for salt accumulation in the soil is greatly reduced by the relatively high rate of rainfall of 91 cm (36.41 in)[53] annually (Section 2.7.1) and the high soil permeability.

An estimate of dissolved solids in the water passing through the soil due to cooling tower drift was calculated using the maximum predicted annual drift deposition rate over land of 0.111 kg/ha/yr (0.099 lb/acre/yr) and the rainfall rate of 0.925 m/yr (36.41 in/yr). This estimate is extremely conservative because it assumes that all salt resulting from tower operation and deposited on the soil remains in the soil and is not leached. The average increase in dissolved solids for water passing through the soil 991 m (3,250 ft) west of the tower is estimated at 0.012 ppm annually. Concentrations would be less elsewhere onsite and in offsite areas. Bernstein found that even the most sensitive species were not affected at soil salinities of less than 1,280 ppm[46]. Thus, given this potential incremental increase in soil salinities, it is highly unlikely that even salt-sensitive species would be measurably affected by operation of the Unit 2 cooling tower.

Foliar Salinization

Most of the available literature addressing the effects of salt sprays on vegetation is qualitative in nature[54,55]. Salts from aerosol sprays have been shown to accumulate and cause damage to leaves of many species[50,52,56-67]. Naturally occurring levels of chloride have been shown to accumulate in flowering dogwood (Cornus florida) leaves during much of the growing season and to reach near-toxic levels (3,800 ug/g [1.6625 gr/oz] dry weight) just before leaf abscission[68]. Salts also play an important role in the zonation of beach communities and affect the productivity of many agricultural plants[45-47,51,69-74].

Generally, foliar salinization tends to be more harmful under humid conditions than dry conditions[61,62,74,75].

Other factors that appear to determine the degree of foliar damage include precipitation, wind velocity, temperature, sunlight availability, insect damage, species tolerance, age, growth form, and cumulative dose[72]. In addition, foliar injury may occur in response to extended low levels of aerosol salt concentrations (chronic) or in response to

higher levels of aerosol salt concentrations for relatively short periods of time (acute)[70]. It appears that, in the presence of a corresponding increase in leaf chloride levels, the minimal deposition of salt drift that would cause injury to sensitive species of native perennials is about 10 kg/ha/mo (11 lb/acre/mo)[68]. Based on mathematical model predictions performed, a maximum of 0.19 kg/ha/mo (0.17 lb/acre/mo) of salt would be deposited near the Nine Mile Point site, 2,210 m (7,250 ft) west-northwest of the cooling tower. Deposition rates over land in vegetated areas will be less. The degree of salt damage will also depend on the seasonal distribution and amount of rainfall and the ability of native vegetation to accumulate chloride over the growing season. Thus, little potential for injury to native perennials from salt drift exists.

No adverse impact to native perennials or agricultural crops is anticipated, since predicted deposition rates are far below those levels known to cause injury.

5.3.3.2.3 Effects of Heat Dissipation System Operation on Wildlife

The principal sources of potential impact to wildlife from the operation of the heat dissipation system are fog and salt drift from the cooling tower, tower noise, and bird collisions with the tower during inclement weather.

Any impacts to wildlife resulting from dense fog would probably be limited to a reduction in activity levels, particularly in birds. Ground fog in the area of the Nine Mile Point site occurs, on the average, about 0.02 percent of the time (FSAR Section 2.3.1). Fogging in the vicinity of the cooling tower is not expected to increase significantly due to tower operation (Section 5.3.3.1.1.1). Since wildlife in the area experiences fog under natural conditions, any slight increases of incidence which might occur due to the operation of the tower would have no adverse impact on the fauna of the area.

The major effect of salt drift on wildlife occurs through alteration of habitat (which serves as food, shelter, and breeding cover). It is unlikely that wildlife populations will be affected, because it is anticipated that there will be little or no adverse salt drift effect on vegetation, due to the nature of the constituents of the drift, the low deposition rates, and the dilution provided by rainfall.

Several factors are involved in the reaction of wildlife to the noise generated by cooling tower operation. Animals

generally exhibit an initial fright reaction to elevated noise levels, followed by a period of acclimation, depending on the intensity of the noise level and the degree to which it is monotonous or repetitive[76]. Onsite, this reaction will also be related to the noise levels present prior to the commencement of plant operation, since previous conditions may reduce the period of acclimation.

The predicted maximum noise level at the property boundary during operation of the plant (including Unit 1 and ambient) ranges from about 32 to 40 dBA (Section 5.8.1.3). During operation of the tower, the intensity and quality of the noise will remain more or less constant. In the presence of these monotonous sounds, the animals are expected to adapt to them and resume their normal patterns of behavior. Consequently, the noise produced by station operation should have no permanent adverse impact on the wildlife in the area.

The height and width of the cooling tower present a potential hazard to migratory species of birds. From the base (el 79.3 m [260 ft], 4.3 m [14 ft] above lake level), the tower extends approximately 164.9 m (541 ft) above grade, and its width varies from 136 m (446 ft) at the base to 83.2 m (273 ft) at the top. It will also occasionally produce visible plumes that extend somewhat below the top of the tower (FSAR Figures 2.3-1 through 2.3-25). The assessment of potential impact, discussed in the following paragraphs, is based on considerations of bird migratory patterns, migratory cues, and meteorology in the Oswego area.

Hochbaum states that a bird's eyes are the basic sensory organ from which it receives its initial orientation[77]. In flight, birds must maintain true spatial orientation. On clear days with good visibility, orientation is not a problem. However, at night and/or under adverse weather conditions, such as low ceilings with precipitation and/or fog, nocturnally migrating birds may become spatially disoriented. Herbert states that for birds to maintain a visual horizon under adverse weather conditions, they are forced to migrate at lower elevations[78]. In general, most small birds migrate at elevations above 152.4 m (500 ft)[79]. Shadows and lights, such as aircraft warning lights atop tall buildings, television-radio towers, and ceilometers, may spatially disorient birds that normally utilize natural land and water shadows against the horizon as visual cues[78]. In attempting to orient themselves, birds may seek new visual references and thus orient themselves to a false horizon. Their flight may then become er-

ratic and uncontrolled with the discrepant visual and sensory cues.

Birds may also fly directly into the ground, building, tower guy wires, or other brightly illuminated structures at night because of a complete loss of visual cues[80-87]. This may occur when the light source is constant or is a continually rotating beam and completely obliterates any background, causing birds to lose their visual cues to the horizontal.

Major periods of potential bird mortality would be expected to occur during peak periods of nocturnal migration under unfavorable weather conditions, although losses may occur at any time during the year. Studies have shown that most bird losses coincide with overcast weather conditions, wind shifts due to passing cold fronts, and precipitation and/or fog. Some kills, however, have occurred on clear nights[82,86]. Guy wires associated with radio and TV towers appear to be responsible for a large percentage of bird mortalities[83,86].

Some quantitative information is available on bird kills at TV towers and large buildings. During the 1972 fall season, 561 birds were killed at four TV towers in North Dakota[88]. It also has been reported that 576 birds were killed during 1 night at the Washington Monument in Washington, DC[89].

Bird collisions with cooling towers have been observed and recorded at the Three Mile Island Nuclear Station on the Susquehanna River near Harrisburg, PA; the Davis/Besse Nuclear Power Station on the southeast shore of Lake Erie near Port Clinton, OH; and the Beaver Valley Power Station - Unit 1 on the Ohio River[90-92]. At the Three Mile Island site, 66 bird collisions were reported from July 17, 1973 through May 31, 1975 (predominantly passerines, vireos, kinglets, and warblers). At the Ohio site, 157 bird casualties were reported during the fall of 1972 and spring and fall of 1973 seasons. It was also reported that ducks and gulls readily avoided the Davis/Besse tower. At the Beaver Valley site, 27 bird casualties (only passerines) were observed during 9 seasons of monitoring.

The mortality of birds from a nuclear power plant with cooling towers appears small compared to mortality due to other hazards encountered during migration. For example, migrating game species face an additional hazard during the fall migration period. Throughout New York State, as well as other parts of the country, large numbers of migratory game birds are harvested during annual hunting seasons

(Table 2.4-7). The harvest of game birds has not been detrimental to the survival of these species.

In assessing the potential impact of the natural-draft cooling tower at the Unit 2 site, all of the preceding factors must be taken into consideration.

It is anticipated that the majority of the bird mortalities associated with the cooling tower will occur during the spring and fall migration periods, since the Nine Mile Point Station is located in a major flyway[93,94]. Mortalities will primarily occur when weather conditions are unfavorable, forcing birds to migrate below 152.4 m (500 ft) at night. The potential for mass mortalities at the site is reduced for a number of reasons:

1. The cooling tower associated with the facility is located south of the plant and is lighted in accordance with FAA regulations, using high-intensity white beacons flashing at 40 flashes/minute. The tower will occasionally produce visible plumes that extend below the 152.4-m (500-ft) level (Section 5.3.3.1.1.1). These plumes, by themselves, are not expected to affect overall ambient visibility. Also, the height of the tower (164.9 m [541 ft]) is well below normal migration levels.

2. Along Lake Ontario, the spring and fall migration periods may extend over 2 to 3 months, with peak movements expected over a 6- to 8-week period during the year. The potential for large mortalities of migratory birds within this period is further reduced by the low frequency of occurrence of unfavorable weather conditions. Data provided by the Rochester weather tapes (1949 to 1958) indicate that the total frequency in occurrence of ceilings below 152.4 m (500 ft) with visibility of zero to 1.6 km (1 mi) are 1.3 percent of the time in the spring (March, April, and May) and 0.7 percent of the time in the fall (September, October, and November). During a 17-day study conducted in 1975, only one song sparrow (<u>Melospiza melodia</u>) was killed at the Nine Mile Point meteorological tower and no bird mortalities occurred at the stacks[95].

3. Lake Ontario, in the vicinity of the site, is moderately used by migratory waterfowl and birds for resting and feeding during migration. The potential for mortality from waterfowl and hawks

(Falconiformes) flying into the cooling tower should be reduced because these birds are most active diurnally when orientation is generally not a problem. This conclusion is supported in other studies on bird mortality at towers. These studies indicate that only a small percentage of the birds that are killed are waterfowl or hawks[82,88,96].

When the low frequency of occurrence of ceilings below 152.4 m (500 ft) is combined with the short period of time of moderate bird migrations (6 to 8 weeks/yr), the potential for mass mortalities at the site is greatly reduced. Some losses of passerine species may occur, even during the day, but these are not expected to be appreciable when compared to other sources of bird mortality occurring from natural and manmade hazards during migration.

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TABLE 5.3-1

PROJECTED TOTAL ENTRAINED, TOTAL IN WATER BODY SEGMENT, AND PERCENT CROPPING OF GAMMARUS FASCIATUS NINE MILE POINT UNIT 2

Sampling Period	Projected Volume[1] (m^3) Mean ($x 10^6$)	Projected Volume[1] (m^3) Max ($x 10^6$)	Estimated Entrainment Abundance[2] ($No./m^3$)	Estimated Entrainment (No.) Mean ($x 10^6$)	Estimated Entrainment (No.) Max ($x 10^6$)	Estimated Standing Crop[2] ($x 10^7$)	Estimated Percent Cropping Mean	Estimated Percent Cropping Max
Jan-Feb	16.468	17.825	2.740	45.12	48.84	864.9	0.52	0.56
Mar-Apr	17.490	18.137	0.272	4.76	4.93	269.8	0.18	0.18
May-Jun	18.178	18.178	0.242	4.40	4.40	601.3	0.07	0.07
Jul-Aug	18.178	19.300	0.312	5.67	6.02	1840.5	0.03	0.03
Sep-Oct	18.147	18.147	0.217	3.94	3.94	1459.9	0.03	0.03
Nov-Dec	18.128	18.128	0.276	5.00	5.00	1459.9	0.03	0.03

(1) Section 3.3, Table 3.3-1.
(2) Reference 3.

TABLE 5.3-2

PROJECTED TOTAL ENTRAINED AND PERCENT CROPPING OF ALEWIFE EGGS AT NINE MILE POINT UNIT 2

Sampling Period	Unit 2 Projected Flow[1] ($m^3 \times 10^6$)	1976 Entrainment[2] (No./m^3) Unit 1	JAF	Projected Unit 2 Entrainment ($\times 10^6$) Based on Unit 1	JAF	Estimated Total in Water Segment[3] ($\times 10^6$)	Estimated Percent Cropping Based on Unit 1	JAF
Jun 6-12	2.084	0.0025	0.0	0.005	0.0	9.1	0.06	0.00
Jun 13-19	2.084	0.018	0.009	0.038	0.019	190.8	0.02	0.01
Jun 20-26	2.084	1.026	3.060	2.138	6.377	23,943.9	0.01	0.03
Jun 27-July 3	2.084	34.412	8.057	71.715	16.791	9,100.1	0.79	0.18
Jul 4-10	2.084	4.421	9.807	9.213	20.438	197,257.5	<0.01	0.01
Jul 11-17	2.084	0.791	3.786	1.648	7.890	332,552.4	<0.01	<0.01
Jul 18-24	2.084	1.393	1.435	1.999	2.991	149,800.3	<0.01	<0.01
Jul 25-31	2.084	0.481	0.080	1.002	0.167	62,646.2	<0.01	<0.01
Aug 1-7	2.083	0.270	0.867	0.562	1.806	10,317.8	<0.01	0.02
Aug 8-14	2.083	0.068	0.562	0.142	1.171	443.4	0.03	0.26
Aug 15-21	2.083	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total (Jun 6-Aug 21)				88.462	57.650			
Mean (Jun 6-Aug 21)				8.042	5.241	71,508.3	0.01	0.01

[1] Section 3.3, Table 3.3-1.
[2] Reference 6.
[3] Reference 1.

TABLE 5.3-3

PROJECTED TOTAL ENTRAINED AND PERCENT CROPPING
OF ALEWIFE LARVAE AT NINE MILE POINT UNIT 2

Sampling Period	Unit 2 Projected Flow[1] ($m^3 \times 10^6$)	1976 Entrainment[2] ($No./m^3$) Unit 1	JAF	Projected Unit 2 Entrainment ($\times 10^6$) Based on Unit 1	JAF	Estimated Total in Water Segment[3] ($\times 10^6$)	Estimated Percent Cropping Based on Unit 1	JAF
Jun 13-19	2.084	0.0	0.0	0.0	0.0	0.14	0.0	0.0
Jun 20-26	2.084	0.0	0.006	0.0	0.012	0.85	0.0	1.41
Jun 27-Jul 3	2.084	0.004	0.071	0.008	0.148	3.61	0.22	4.10
Jul 4-10	2.084	0.013	0.015	0.027	0.031	14.54	0.19	0.21
Jul 11-17	2.084	0.054	0.137	0.113	0.286	17.57	0.64	1.63
Jul 18-24	2.084	0.008	0.020	0.017	0.042	32.74	0.05	0.13
Jul 25-31	2.084	0.014	0.300	0.029	0.625	30.38	0.10	2.06
Aug 1-7	2.083	0.481	2.524	1.002	5.257	320.64	3.13	1.64
Aug 8-14	2.083	0.015	0.527	0.031	1.098	133.84	0.02	0.82
Aug 15-21	2.083	0.372	0.612	0.775	1.275	160.90	0.48	0.79
Aug 22-28	2.083	0.135	0.438	0.281	0.912	36.59	0.77	2.49
Aug 29-Sept 4	2.082	0.116	0.032	0.242	0.067	60.77	0.40	0.11
Sep 5-11	2.081	0.004	0.002	0.008	0.004	1.18	0.68	0.34
Sep 12-18	2.081	0.008	0.005	0.017	0.010	7.03	0.22	0.14
Sep 19-25	2.081	0.012	0.0009	0.025	0.019	NS		
Sep 26-Oct 2	2.081	0.006	0.0006	0.012	0.012	NS		
Oct 3-9	2.079	0.001	0.0003	0.002	0.006	NS		
Oct 10-16	2.079	0.001	0.002	0.002	0.004	NS		
Oct 17-23	2.079	0.001	0.002	0.002	0.004	NS		
Total (Jun 13-Oct 23)				2.593	9.812			
Mean (Aug 1-Sep 4)				0.466	1.722	142.55	0.33	1.21

KEY: NS = Not sampled.

(1)Section 3.3, Table 3.3-1.
(2)Reference 6.
(3)Reference 1.

TABLE 5.3-4

PROJECTED TOTAL ENTRAINED AND PERCENT CROPPING
OF RAINBOW SMELT LARVAE AT NINE MILE POINT UNIT 2

Sampling Period	Unit 2 Projected Flow[1] ($m^3 \times 10^6$)	1976 Entrainment[2] (No./m^3)		Projected Unit 2 Entrainment ($\times 10^6$) Based on		Estimated Total in Water Segment[3] ($\times 10^6$)	Estimated Percent Cropping Based on	
		Unit 1	JAF	Unit 1	JAF		Unit 1	JAF
May 2-8	2.083	0.006	0	0.012	0	NS	-	-
May 9-15	2.083	0	0.001	0	0.002	NS	-	-
May 16-22	2.083	0.008	0.006	0.017	0.035	NS	-	-
May 23-29	2.083	0	0.004	0	0.008	NS	-	-
May 30-Jun 5	2.084	0.006	0.006	0.012	0.012	9.46	0.13	0.13
Jun 6-12	2.084	0.002	0.021	0.004	0.044	2.23	0.18	1.97
Jun 13-19	2.084	0.001	0.005	0.002	0.010	3.04	0.07	0.33
Jun 20-26	2.084	0	0	0	0	2.84	0	0
Jun 27-Jul 3	2.084	0	0	0	0	0.35	0	0
Jul 4-10	2.084	0.001	0.001	0.002	0.002	2.30	0.09	0.09
Jul 11-17	2.084	0.004	0.007	0.008	0.015	3.00	0.27	0.50
Jul 18-24	2.084	0	0.002	0	0.004	1.12	0	0.36
Jul 25-31	2.084	0	0	0	0	0.11	0	0
Aug 1-7	2.083	0.001	0	0.002	0	0.97	0.21	0
Aug 8-14	2.083	0.003	0.001	0.006	0.002	0.54	1.11	0.37
Aug 15-21	2.083	0.004	0.001	0.008	0.002	0.45	1.78	0.44
Aug 22-28	2.083	0.020	0.000	0.042	0	0.42	10.0	0
Aug 29-Sep 4	2.082	0	0.001	0	0.002	0.13	0	1.5
Sep 5-11	2.081	0	0	0	0	0	0	0
Sep 12-18	2.081	0	0.001	0	0.002	0.43	0	0.46
Sep 19-25	2.081	0	0.001	0	0.002	NS	-	-
Total (May 2-Sep 25)			0.115		0.142			
Mean (May 30-Jul 17)			0.004		0.012	3.32	0.12	0.36

KEY: NS = Not sampled.

[1]Section 3.3, Table 3.3-1.
[2]Reference 6.
[3]Reference 1.

TABLE 5.3-5

ESTIMATED MEAN MONTHLY* AND TOTAL YEARLY IMPINGEMENT
FOR SELECTED SPECIES
NINE MILE POINT UNIT 1

Species	Yearly Total	Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct	Nov	Dec
Alewife	1,261,910	1,301	284	60,504	631,964	399,278	44,670	28,440	33,618	9,778	20,049	17,050	14,974
Rainbow smelt	79,939	13,988	5,377	6,957	11,981	10,798	1,571	357	536	1,435	962	3,698	22,279
White perch	6,666	1,099	628	1,613	918	221	44	37	166	377	116	583	863
Yellow perch	2,817	579	198	102	128	912	42	113	78	36	77	202	350
Smallmouth bass	223	35	26	11	5	24	30	13	15	7	13	16	28
Coho salmon	<6	<1	0	<1	<1	<1	0	<1	<1	0	0	0	0
Threespine stickleback	45,589	1,253	2,071	4,872	20,044	14,645	1,171	961	2	33	34	95	106
Brown trout	12	2	0	<1	0	<1	1	3	1	<1	0	1	1
Spottail shiner	3,298	300	112	231	260	1,252	268	185	107	84	51	136	312

*Mean estimated impingement based on monthly collection from 1973 through 1981.

TABLE 5.3-6

ESTIMATED TOTAL ENTRAPMENT AND MORTALITY
FOR SELECTED SPECIES
NINE MILE POINT UNIT 2

Species	Annual Total Unit 1	Annual Total Entrapment Unit 2[1]	Annual Total Mortality Unit 2[2]
Alewife	1,261,910	252,382	228,153
Rainbow smelt	79,939	15,988	13,590
White perch	6,666	1,333	785
Yellow perch	2,817	563	28
Smallmouth bass	223	45	2
Coho salmon	6	1	<1
Threespine stickleback	45,589	9,118	456
Brown trout	12	2	<1

(1) Obtained by multiplying Unit 1 total by 0.20, the ratio of design plant flows.
(2) Obtained by multiplying Unit 2 total by the estimated mortality rate in the fish diversion system based on the OSS Unit 6 diversion results.

TABLE 5.3-7

STANDING STOCK ESTIMATES FOR ALEWIFE AND RAINBOW SMELT IN THE NYSDEC OSWEGO SECTOR, ALL OF NEW YORK STATE'S WATER TO 110 M (360 FT), AND THE TOTAL U.S. LAKE AREA[1]

Species	Location	Number Impinged at Unit 1	Estimated Mortality at Unit 2	Standing Stock	Adjusted Standing Stock[2]	Percent Cropped at Unit 1: Standing Stock	Percent Cropped at Unit 1: Adjusted Standing Stock	Percent Cropped at Unit 2: Standing Stock	Percent Cropped at Unit 2: Adjusted Standing Stock
Alewife	Oswego sector	1,261,910	228,153	122,998,300	1,229,983,000	1.03	0.10	0.20	0.019
	N.Y. State waters to 100 m (360 ft)[3]			226,083,000	2,260,830,000	0.56	0.06	0.10	0.010
	Lake-wide (U.S. only)[4]			1,256,021,000	12,560,210,000	0.10	0.01	0.02	0.002
Rainbow smelt	Oswego sector	79,939	13,590	11,703,510	117,035,000	0.68	0.07	0.12	0.012
	N.Y. State waters to 110 m (360 ft)[3]			17,902,650	179,026,500	0.44	0.04	0.08	0.008
	Lake-wide (U.S. only)[4]			99,459,000	994,590,000	0.08	0.01	0.01	0.001

(1)Reference 97.
(2)Standing stock from bottom trawl collections multiplied by 10 for upper water column fish.
(3)Represents 18% of U.S. lake surface area.
(4)Extrapolated to 100% of U.S. lake surface area.

TABLE 5.3-8

PREDICTING SURFACE DILUTION AND ΔT - NINE MILE POINT NUCLEAR STATION UNIT 2

Operating Condition	Lake Elevation[1]		Ambient Temperature		Discharge Flow[2]		Discharge[2] ΔT		Dilution[3]	ΔT_s	
	ft	m	°F	°C	gpm	m^3/s	°F	°C	$\Delta T_s/\Delta T_o$	°F	°C
Annual average	244.0	74.4	50	10.0	28,752	1.81	17.64	9.8	0.084	1.48	0.82
Summer worst	244.0	74.4	70	21.1	25,984	1.64	25.83	14.4	0.084	2.16	1.21
Winter worst	244.0	74.4	32	0.0	23,055	1.45	27.99	15.5	0.084	2.34	1.27

(1) Minimum controlled lake elevation.
(2) See Table 3.3-1.
(3) Includes depth corrections and correction for 5 percent upward orientation.

TABLE 5.3-9

PREDICTED PLUME VELOCITIES AT
NINE MILE POINT NUCLEAR STATION UNIT 2

Operating Condition/ Season	Predicted Velocities in m/s (fps) at Isotherm Levels				
	10.0°F	5.0°F	3.0°F	2.5°F	1.5°F
Annual average	3.1 (10.3)	1.6 (5.2)	0.9 (3.1)	0.8 (2.6)	0.5 (1.6)
Summer worst	1.9 (6.3)	1.0 (3.2)	0.6 (1.9)	0.5 (1.6)	-
Winter worst	1.6 (5.2)	0.8 (2.6)	0.5 (1.6)	0.4 (1.3)	-

TABLE 5.3-10

GROUND-LEVEL INCREASES IN AMBIENT RELATIVE HUMIDITY (RH) DUE TO THE OPERATION OF THE NATURAL-DRAFT COOLING TOWER AT NINE MILE POINT

Downwind Sector	Max Annual RH Increase (%)	Distance ft	Distance m	Max Monthly RH Increase (%)	Distance ft	Distance m	Max Daily RH Increase (%)	Distance ft	Distance m	Max Hourly RH Increase (%)	Distance ft	Distance m
N	0.002	3,250	991	0.010	4,000	1,219	0.22	3,250	991	1.40	3,250	991
NNE	0.001	3,750	1,143	0.013	3,750	1,143	0.10	4,500	1,372	1.60	3,500	1,067
NE	0.001	3,000	914	0.015	3,000	914	0.44	3,000	914	2.00	3,250	991
ENE	0.002	2,750	838	0.020	2,500	762	0.58	2,500	762	1.60	4,000	1,219
E	0.005	2,500	762	0.043	2,500	762	1.70	2,750	838	2.10	2,750	838
ESE	0.012	2,750	838	0.230	2,750	838	1.80	2,750	838	2.80	2,500	762
SE	0.018	3,000	914	0.160	2,750	838	3.30	2,750	838	3.30	3,000	914
SSE	0.014	3,000	914	0.088	3,000	914	1.00	2,750	838	2.20	3,500	1,067
S	0.012	3,250	991	0.053	3,500	1,067	0.52	3,000	914	2.40	3,000	914
SSW	0.005	3,500	1,067	0.070	3,000	914	0.68	3,000	914	2.50	3,250	991
SW	0.003	3,500	1,067	0.039	3,250	991	0.85	3,250	991	2.50	3,250	991
WSW	0.0001	4,750	1,448	0.004	4,250	1,295	0.11	4,250	1,295	1.10	4,000	1,219
W	0.005	4,500	1,372	0.014	4,250	1,295	0.38	4,000	1,219	1.50	3,750	1,143
WNW	0.001	3,500	1,067	0.017	3,500	1,067	0.26	3,750	1,143	1.60	3,750	1,143
NW	0.002	3,500	1,067	0.010	3,250	991	0.29	3,250	991	1.40	4,000	1,219
NNW	0.003	3,250	991	0.013	3,000	914	0.21	3,500	1,067	1.80	3,250	991
Worst sector	0.018	3,000 (SE)	914	0.230	2,750 (ESE)	838	3.30	2,750 (SE)	838	3.30	3,000 (SE)	914

Ambient Diurnal RH Mean Value at Nine Mile Point*

01	07	13	19	(LST)
78%	81%	71%	71%	

*Based on 3 yr (1974-1976) of onsite meteorological data.

KEY: LST = Local standard time

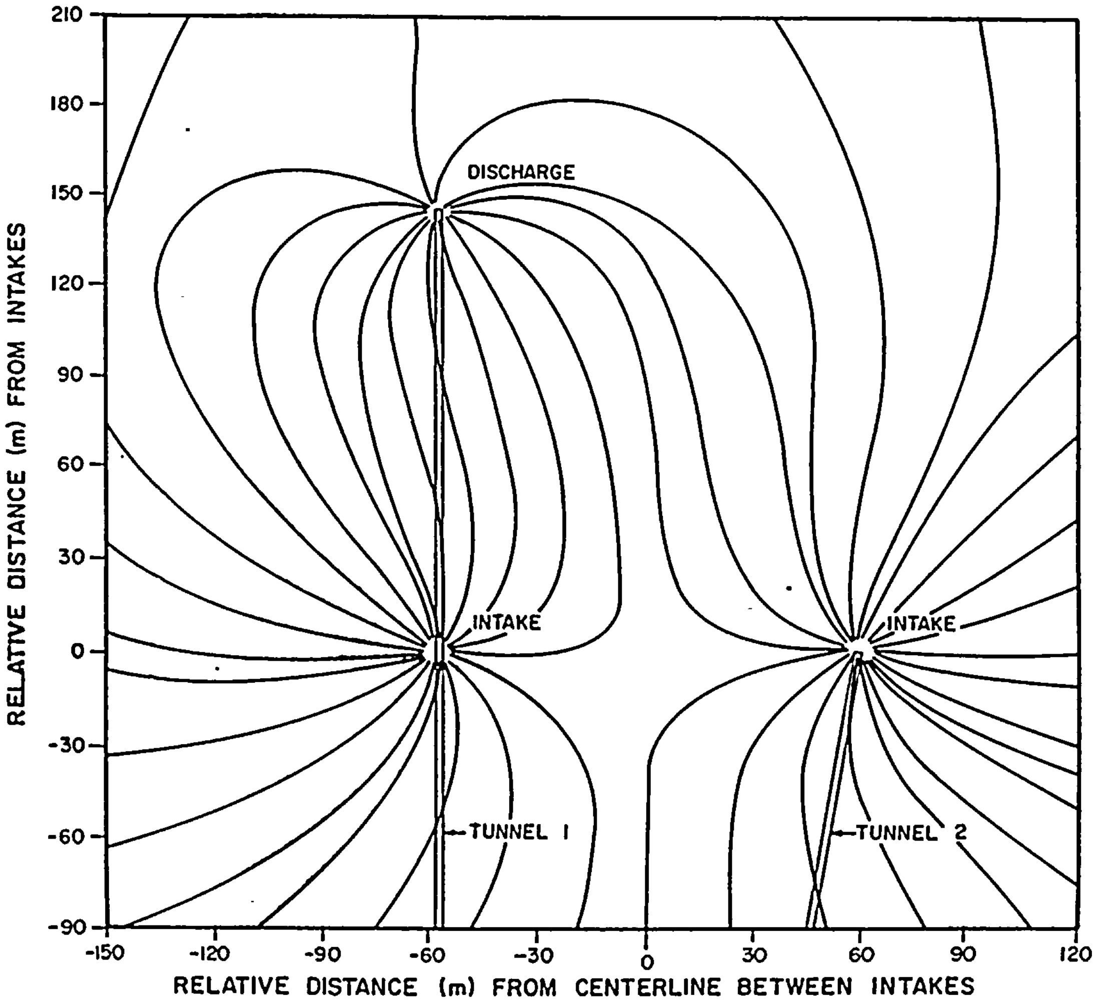


FIGURE 5.3-1

STREAM-LINE PATTERNS BASED ON YEARLY INTAKE-DISCHARGE FLOWS AT NINE MILE POINT NUCLEAR STATION UNIT 2 (NO LAKE CURRENT)

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

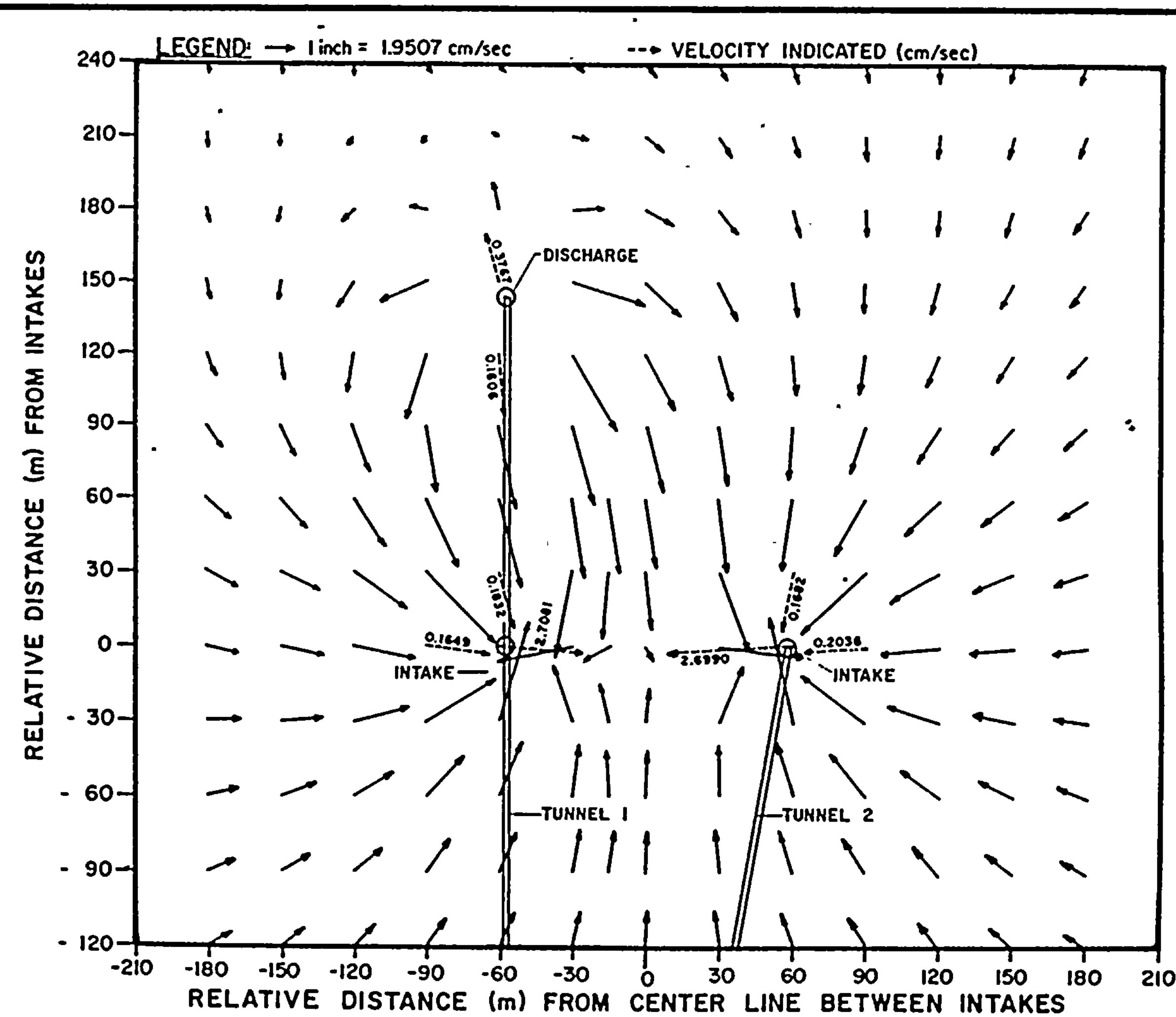


FIGURE 5.3-2

INDUCED VELOCITY PATTERNS AT NINE MILE POINT NUCLEAR STATION UNIT 2 (NO LAKE CURRENT)

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

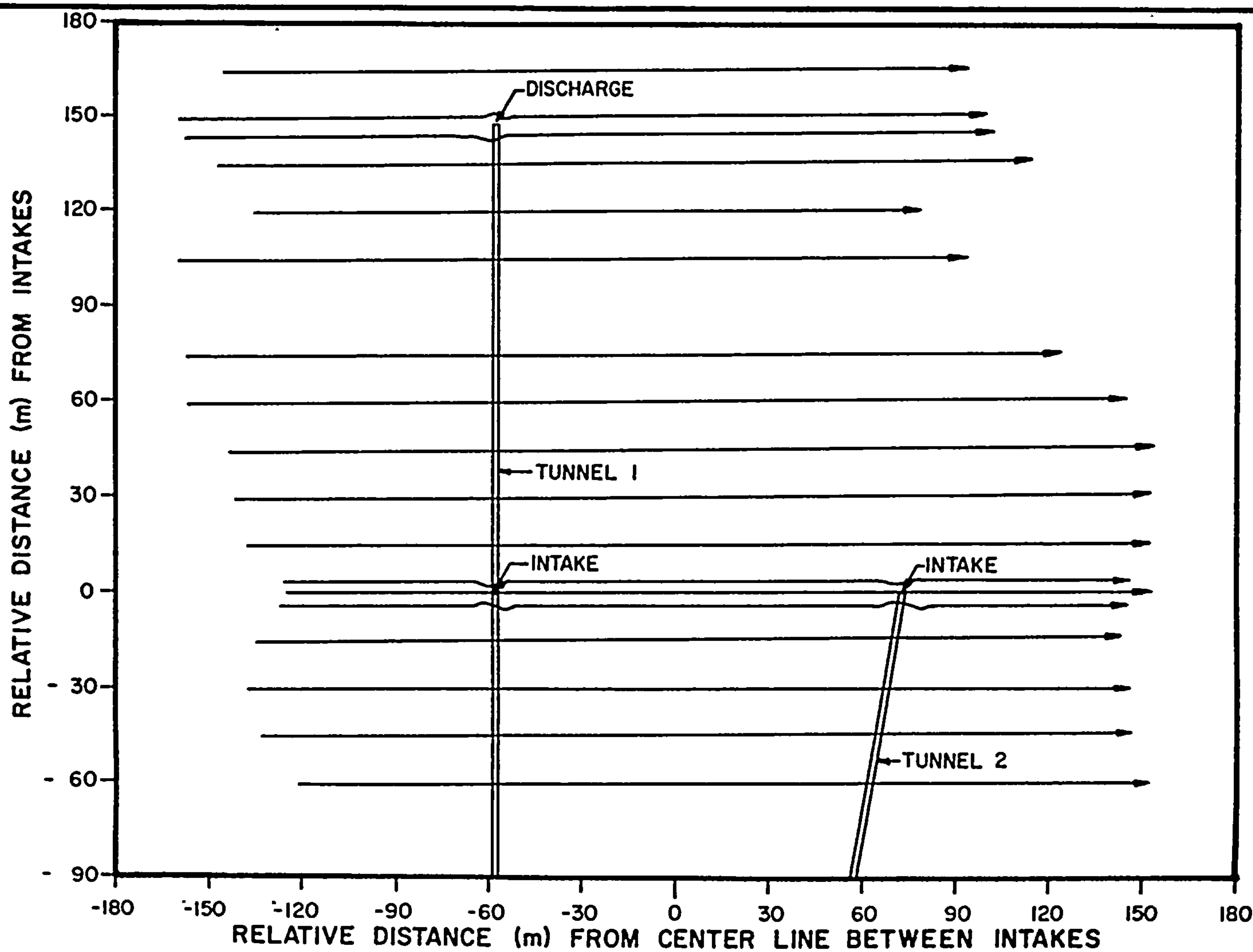


FIGURE 5.3-3

STREAM-LINE PATTERNS BASED ON YEARLY INTAKE-DISCHARGE FLOWS AT NINE MILE POINT NUCLEAR STATION UNIT 2 (WITH A 15 CM/S W-E LAKE CURRENT)

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

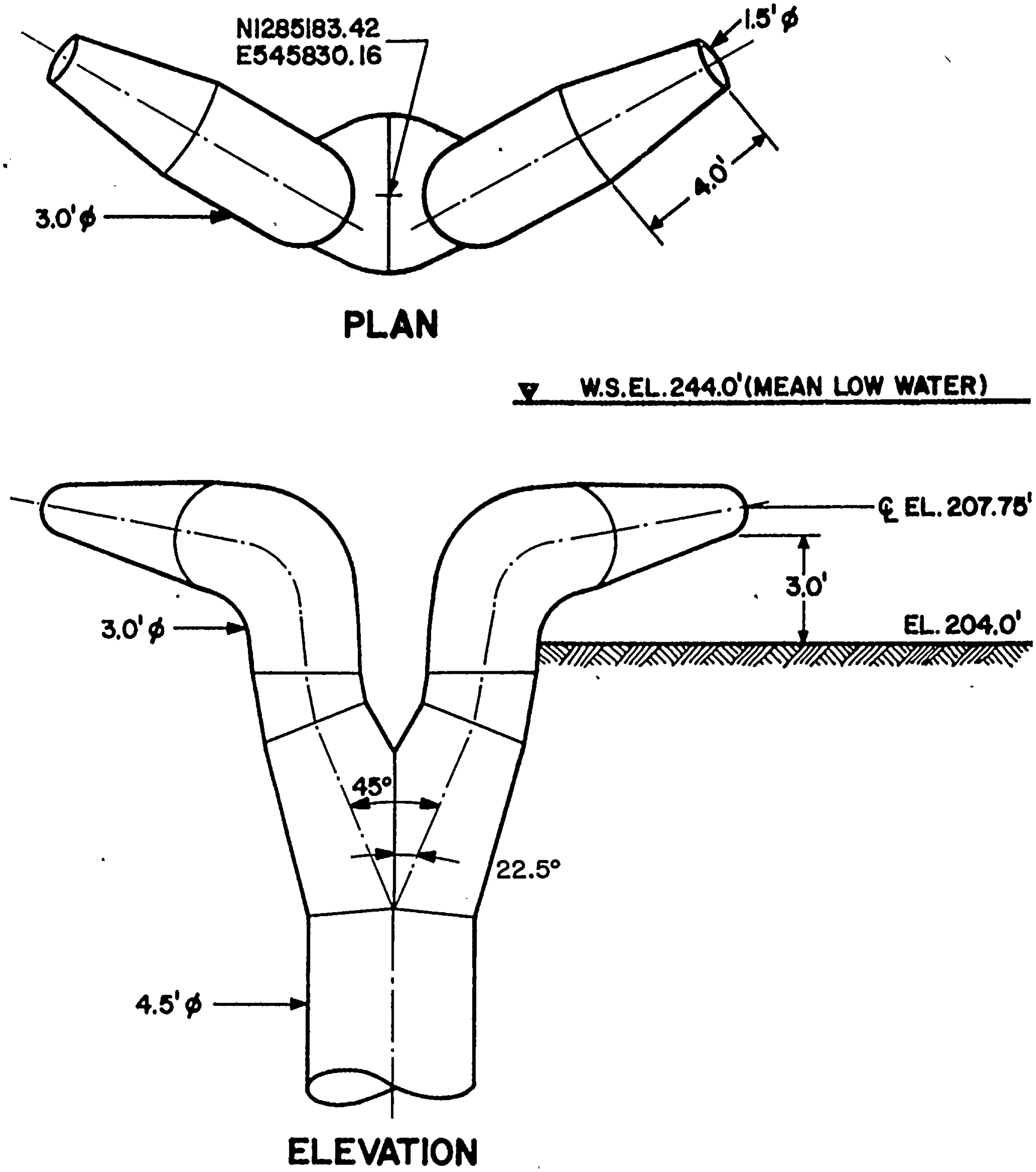


FIGURE 5.3-4

DISCHARGE DIFFUSER

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

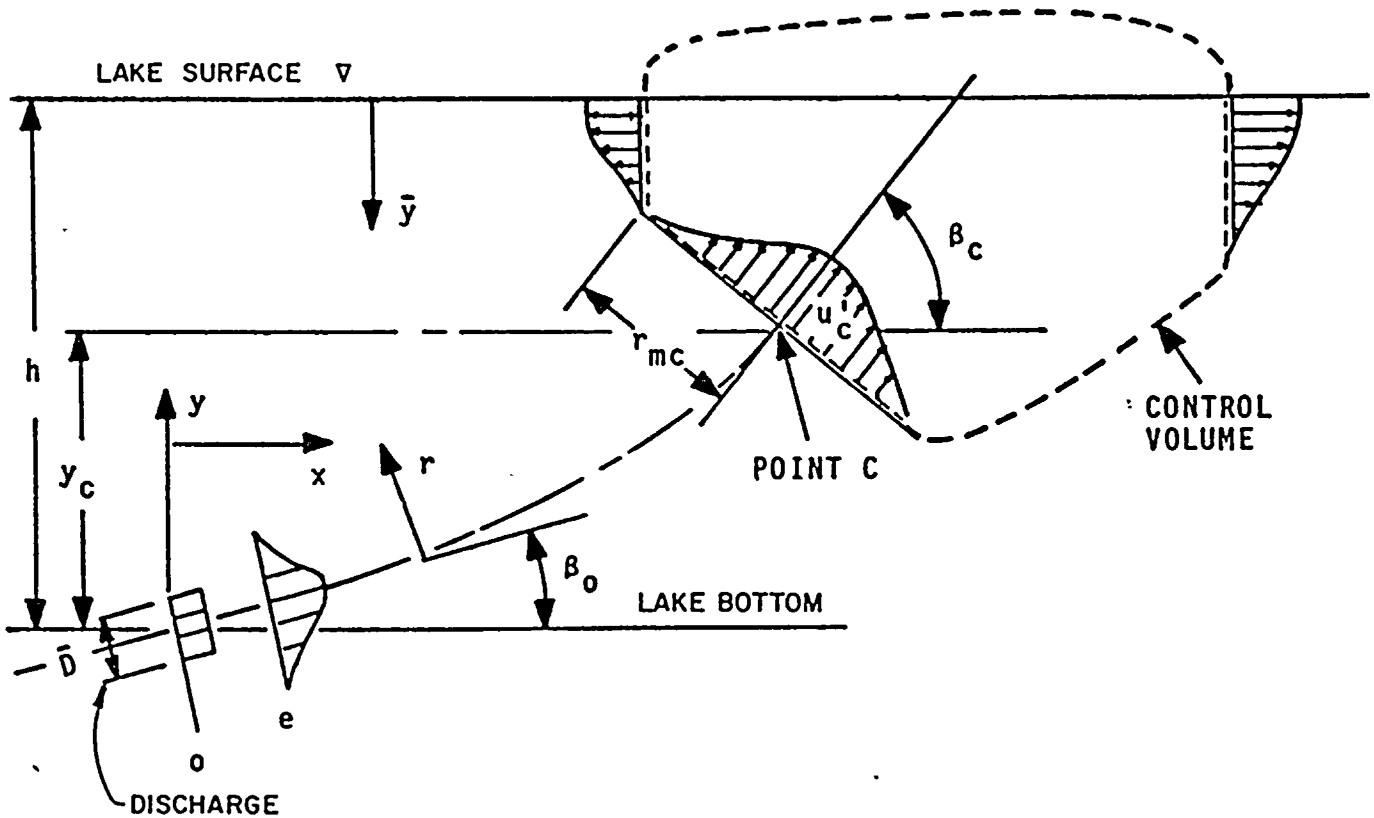
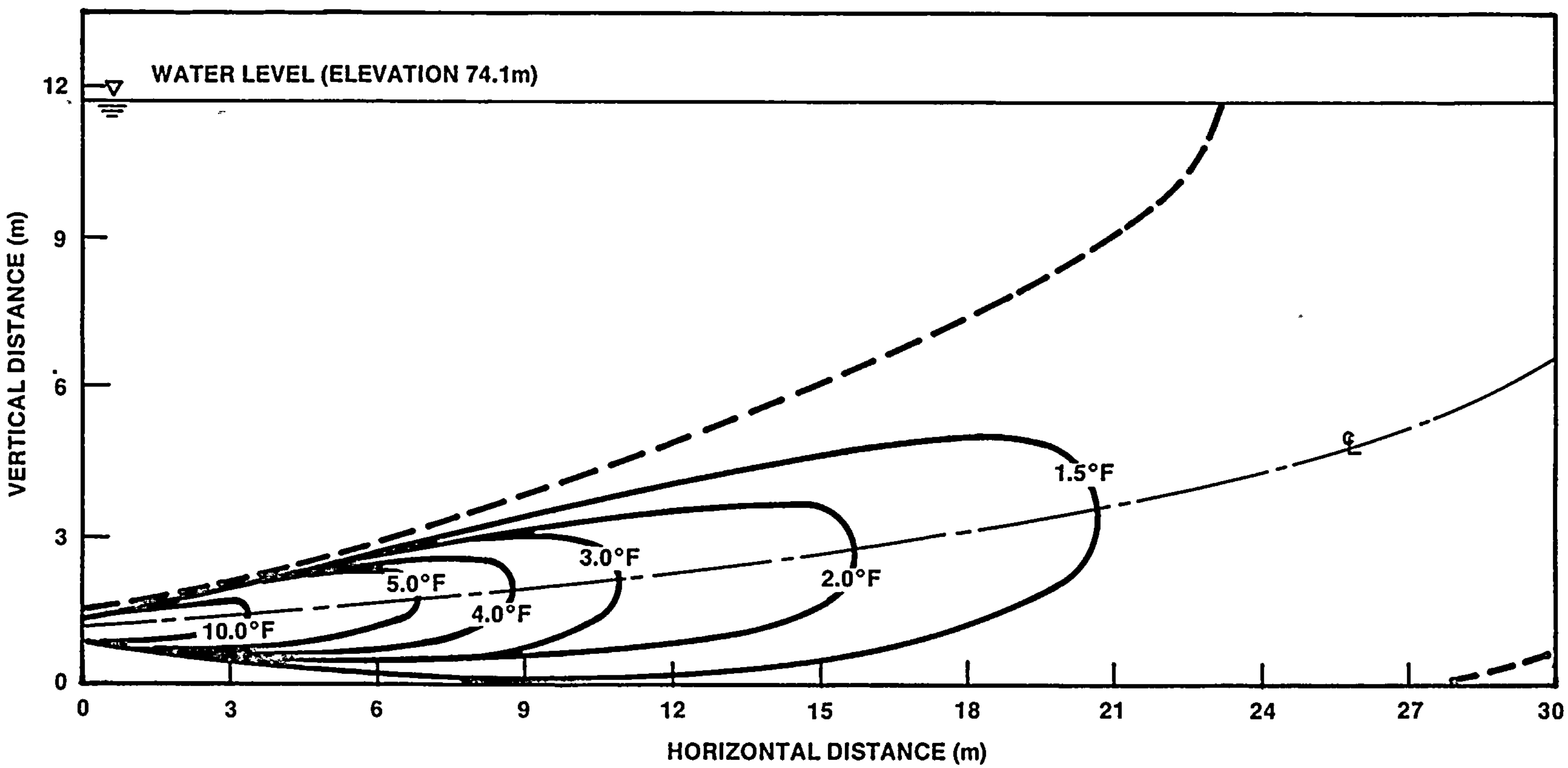


FIGURE 5.3-5

A VIEW OF THE PLANE CONTAINING THE CENTERLINE OF A ROUND BUOYANT JET DISCHARGING INTO WATER OF FINITE DEPTH (SOURCE: ROBIDEAU [3])

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



PARAMETERS

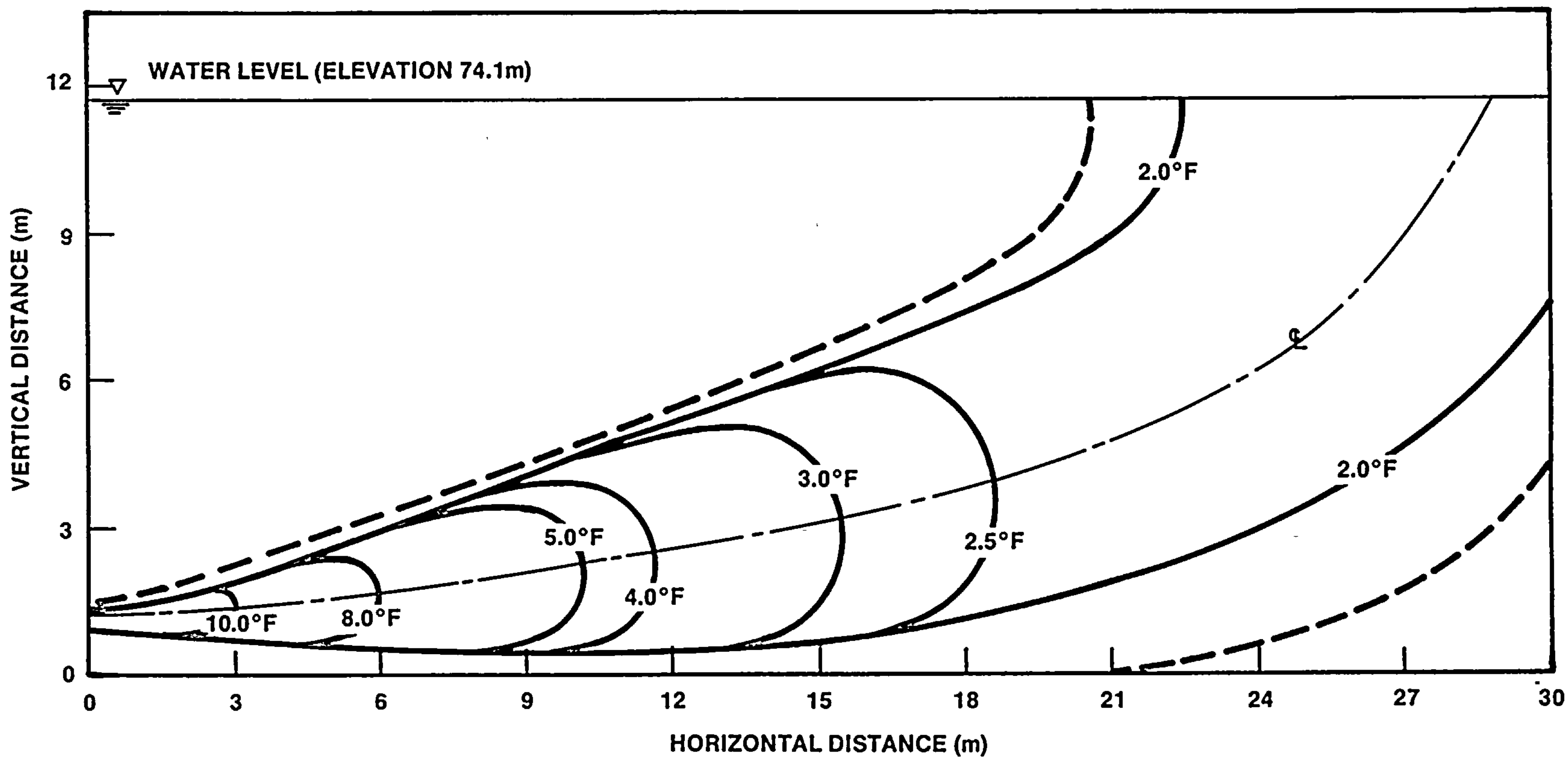
NOZZLE DIAMETER: 0.5m (1.5ft)
NOZZLE ANGLE: 5°up
NUMBER OF NOZZLES: 2

DISCHARGE FLOW: 1.81m 3/s (28,752 gpm)
DISCHARGE AT: 9.8°C (17.64°F)
DISCHARGE VELOCITY: 5.51m/s (18.1 fps)

FIGURE 5.3-6

PREDICTED TEMPERATURE DISTRIBUTION—
VERTICAL SECTION ALONG CENTERLINE
ANNUAL AVERAGE CONDITION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



PARAMETERS

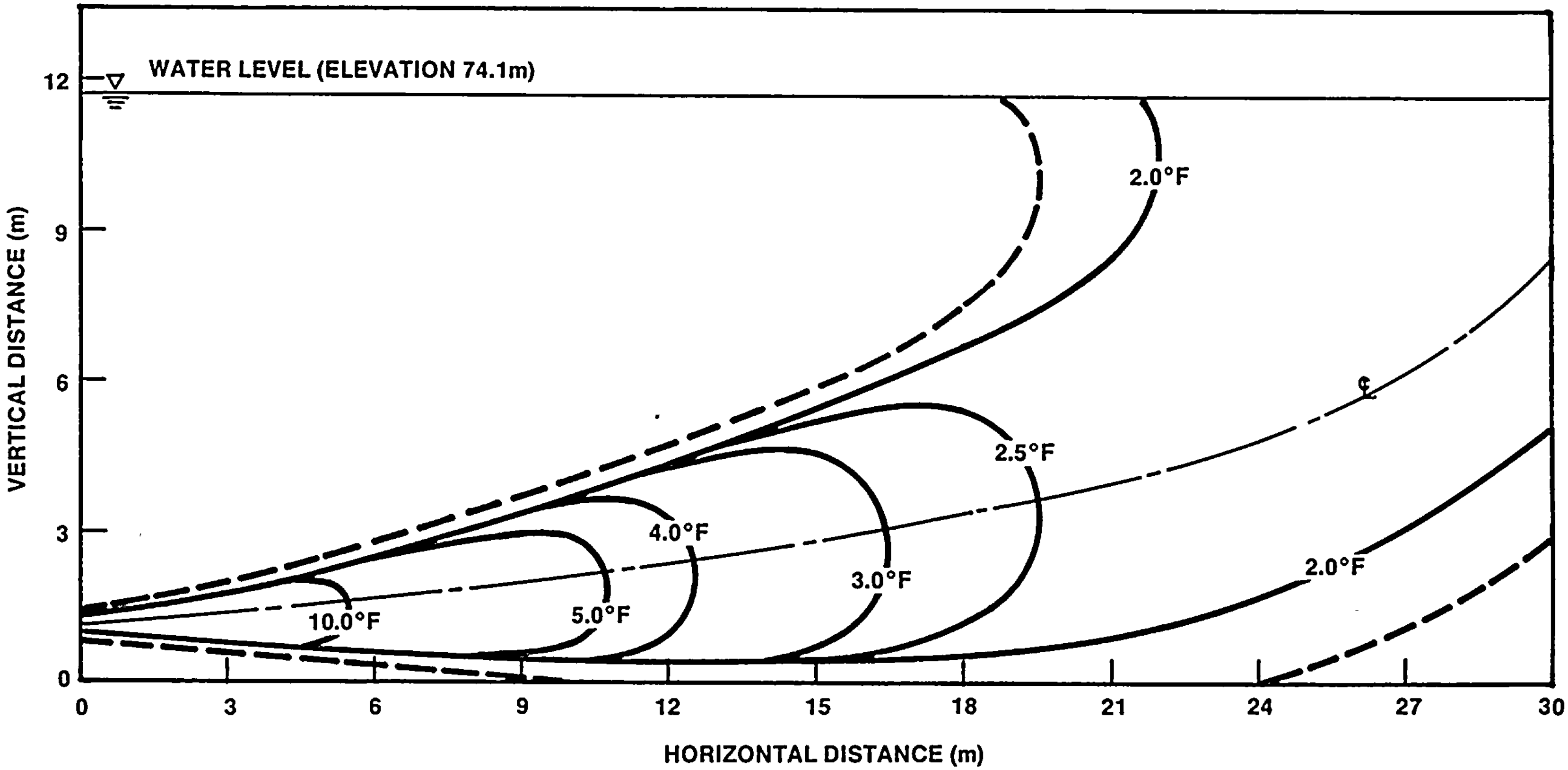
NOZZLE DIAMETER: 0.5m (1.5ft)
NOZZLE ANGLE: 5°up
NUMBER OF NOZZLES: 2

DISCHARGE FLOW: 1.64m 3/s (25,984 gpm)
DISCHARGE AT: 14.4°C (25.83°F)
DISCHARGE VELOCITY: 4.99m/s (16.38 fps)

FIGURE 5.3-7

PREDICTED TEMPERATURE DISTRIBUTION—
VERTICAL SECTION ALONG CENTERLINE
SUMMER WORST CONDITION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



PARAMETERS

NOZZLE DIAMETER: 0.5m (1.5ft)
NOZZLE ANGLE: 5°up
NUMBER OF NOZZLES: 2

DISCHARGE FLOW: 1.45m 3/s (23,055 gpm)
DISCHARGE AT: 15.5°C (27.99°F)
DISCHARGE VELOCITY: 4.42m/s (14.5 fps)

FIGURE 5.3-8

PREDICTED TEMPERATURE DISTRIBUTION—
VERTICAL SECTION ALONG CENTERLINE
WINTER WORST CONDITION

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

5.4 RADIOLOGICAL IMPACT FROM ROUTINE OPERATION

During routine station operation, small quantities of radionuclides are released to the environment. The routine release of radionuclides in the gaseous and liquid effluents from Unit 2 results in doses lower than the design objectives established in Appendix I of 10CFR50, thereby meeting the as-low-as-is-reasonably-achievable philosophy (Table 5.4-1). Environmental transport and radiation dose estimates presented in this section are based on discharge rates projected for the Unit 2 waste treatment systems. These discharge rates and their bases are given in Section 3.5. The following sections discuss the possible pathways of radiation exposure, the distribution of the radioactive effluents in the environment, and the radiological impact on man and on local flora and fauna. The flora and fauna evaluated are those whose terrestrial and/or aquatic habitats provide the highest potential for radiation exposure.

5.4.1 Exposure Pathways

This section discusses the possible pathways of radiation exposure to flora and fauna and to man from routine operation of the station.

5.4.1.1 Exposure of Flora and Fauna

Figure 5.4-1 illustrates the generalized pathways leading to radiation exposure to biota other than man.

5.4.1.1.1 Gaseous Pathways

Plants and animals in the vicinity of the station receive an external exposure from the radioactive gases that are released into the atmosphere and from radioactive iodines and particulates, either released directly or formed as decay products of the effluents, deposited on the ground.

Deposition of radioiodines and particulates on vegetation (foliar deposition) and root uptake of long-lived radionuclides deposited on soil result in internal exposure of plants. These radionuclides can subsequently be consumed by grazing animals. Food chains involving animals that have the highest potential for radiation exposure have been analyzed.

Although the inhalation of radionuclides can result in internal exposure to the body and various organs of animals, some of the available information suggests that the doses

from this pathway are generally insignificant when compared to the doses from the ingestion pathway. Sufficient data are not available to warrant specific consideration of the inhalation pathway[1].

5.4.1.1.2 Liquid Pathways

Aquatic organisms are exposed to radiation emitted by radionuclides in the liquid effluent discharged to the receiving waters. This exposure is not considered significant beyond the immediate vicinity of the station discharge because of the effluent dilution in the water. Some radionuclides may be absorbed by waterborne sediment particles and deposited on the bottom. This process is complex since there are numerous physical, chemical, and biological factors involved. Such sedimentary accumulation can occur for the life of the station. Benthic organisms, which live near the bottom or in the sediment, may be exposed to the radiation emitted. Plants and animals on land can be exposed to the gamma radiation emitted from deposits on shorelines that have little water covering or are exposed during low water level conditions.

Aquatic biota accumulate radionuclides in their body tissues through ingestion or direct absorption from the water. Radionuclides in aquatic organisms are transferred to terrestrial organisms deriving all or part of their diet from the receiving water. Animals, such as ducks, feed on aquatic vegetation and, therefore, are in a position to ingest and accumulate radionuclides. Doses to terrestrial animals result from the consumption of aquatic vegetation as well as from direct ingestion of water. Transfer of nutrients, and thus radionuclides, in the terrestrial food chain is through successive trophic levels.

5.4.1.1.3 Direct Radiation

Direct radiation exposure due to the storage of radioactive materials, including radioactive wastes, and gamma radiation emitted by plant equipment may result in small doses to plants and animals in the site vicinity.

5.4.1.2 Exposure of Man

In providing guidance for implementing Section II of Appendix I to 10CFR50, the NRC staff has made use of the maximum exposed individual approach. In this approach, the numerical design objectives of Section II are compared to the calculated radiation exposures to maximum individuals in each of four age groups.

The population is considered to be made up of infants (0 to 1 yr), children (1 to 11 yr), teenagers (11 to 17 yr), and adults (17 yr and older). For the purpose of evaluating dose commitment, the maximum infant is assumed to be newborn, the maximum child is taken to be 4 yr old, the maximum teenager is taken to be 14 yr old, and the maximum adult is taken to be 17 yr old.

Maximum individuals are characterized as maximum with regard to food consumption, occupancy, and other usage of the region in the vicinity of the plant site and, as such, represent individuals with habits representing reasonable deviations from the average for the population in general. In all physiological and metabolic respects, the maximum exposed individuals are assumed to have those characteristics that represent the averages for their corresponding age group in the general population. Although specific individuals will almost certainly display dietary, recreational, and other living habits considerably different from those suggested here, and actual physiological and metabolic parameters may vary considerably, the NRC staff considers the maximum exposed individual to be a well-defined reference for implementation of Section II of Appendix I.

Figure 5.4-2 illustrates the generalized exposure pathways to man.

5.4.1.2.1 Gaseous Pathways

Radionuclides released in the plant's gaseous effluents include tritium, carbon-14, iodines, particulates, and noble gases (xenon and krypton). The inhalation of these effluents may result in an internal exposure to various body organs.

Immersion in the noble gases results in an external exposure to the whole body and skin.

Radioiodine and particulate deposits on vegetation may result in radioactivity entering food chains to man. The ingestion of vegetation grown in the vicinity of the plant and the ingestion of animals that graze on affected vegetation may result in an internal exposure to man. An example of a food chain that is important to man is the vegetation-cow-milk-infant pathway. Milk cows consuming locally grown feed may contribute to the internal dose to man. An herbivorous game animal near the site that may be a potential source of food to man is the white-tailed deer.

The following possible gaseous pathways to man have been analyzed:

1. Dose from standing on contaminated ground (contamination due to deposition of activity from routine releases of gaseous effluents).

2. Inhalation dose.

3. Ingestion of vegetation.

4. Ingestion of milk (cow) and meat (beef cattle).

5. Doses from immersion in and direct exposure to noble gaseous effluents.

6. Ingestion of deer.

5.4.1.2.2 Liquid Pathways

Radionuclides released in the liquid effluent can reach man through several potential pathways. Internal doses could be received through ingestion of these radionuclides either by direct consumption of the water or indirectly via aquatic animals that reside in the water. Consumption of secondary organisms such as ducks, which obtain all or part of their food from aquatic organisms in the receiving water, is another potential pathway to exposure of man.

In addition to the consumption of aquatic animals and their predators, another potential internal exposure pathway to man is through the consumption of agricultural crops that have been irrigated with receiving water. Although irrigation is not a major pathway for this site, it has been considered, using the assumption that water is withdrawn from the Metropolitan Water Supply of Onondaga County.

In addition to these internal exposure pathways to man, there are several potential external exposure pathways. Swimming and boating are two pathways by which individuals may receive direct exposure from the radionuclides in water. Another potential source of external exposure is from the buildup of activity in sediments along the shoreline of the receiving water.

The following possible liquid pathways to man have been analyzed:

1. Ingestion of potable water.

2. Ingestion of fish.

3. Ingestion of duck.

4. Swimming and boating.

5. Shoreline recreation.

6. Ingestion of vegetables associated with irrigation.

5.4.1.2.3 Direct Exposure

Direct radiation exposure due to normal plant operation, storage of radioactive materials and spent fuel, and gamma radiation emitted from plant equipment may result in doses in the site vicinity.

5.4.2 Radioactivity in the Environment

Section 3.5 presents the expected radionuclide release rates associated with the release of gaseous and liquid effluents from the station. Quantitative estimates of the distribution of these radionuclides in the site environs, and descriptions of the models used to obtain these estimates, are provided in the following sections.

5.4.2.1 Radioactivity in Surface Waters

Concentrations of radioactive effluents in water affected by operation of the plant were calculated according to the methods set forth in Regulatory Guide 1.113. The specific rationale is discussed in FSAR Section 2.4.12.

5.4.2.2 Radioactivity in Air

Atmospheric dispersion factors (X/Q) and deposition factors (D/Q) utilized in evaluating the releases of gaseous effluents were calculated according to the methods set forth in Regulatory Guide 1.111. The specific rationale is discussed in Section 2.7.4.

5.4.2.3 Radionuclide Concentrations

5.4.2.3.1 Liquid Effluents

The radionuclides released with the liquid effluents are rapidly diluted in the receiving water. An assumed annual average liquid effluent flow rate of 116,250 lpm (30,000 gpm) is used for the dose calculations. A dilution factor of 5.9 is used for activities taking place within the

vicinity of the nearfield dilution zone. Table 5.4-2 presents the calculated concentrations of various radionuclides in the discharge, nearfield dilution zone, nearest accessible shoreline, and public water supply with the potential for the highest radionuclide concentrations. These calculated concentrations are based on the assumed annual average discharge rates for one unit.

Table 5.4-3 lists the equilibrium bioaccumulation factors used to determine the doses to the primary organisms (fish, invertebrates, and aquatic plants) and subsequent doses to the secondary predatory animals. The equilibrium bioaccumulation factors are also used in the calculations of doses to man from the consumption of certain primary and secondary organisms.

Although Lake Ontario is not used extensively for irrigation, this pathway was considered for the maximum individual dose estimates. It is conservatively assumed that irrigation water is withdrawn from the Metropolitan Water Supply of Onondaga County and has the radionuclide concentration listed in Table 5.4-2. The maximum individual's garden was assumed to be irrigated each day for a 6-month growing season. Maximum individual consumption rates for vegetables grown in the garden were taken from Regulatory Guide 1.109 and were used to calculate the estimated doses.

5.4.2.3.2 Gaseous Effluents

Radionuclides emitted in the gaseous effluents accumulate on the ground throughout the life of the plant. Table 5.4-4 lists the ground plane concentrations of radionuclides at a point 4,106 m (13,471 ft) east of the plant. The concentrations at this point represent the maximum calculated offsite deposition occurring at an occupied residence. These concentrations were calculated using the approach outlined in Regulatory Guide 1.109, along with the assumption of a 40-yr plant life. Relative deposition rates were calculated using the methodology in Regulatory Guide 1.111.

Concentrations of radionuclides can accumulate in vegetation growing in the vicinity of the site. The model used for estimating the transfer of radionuclides from the atmosphere to vegetation considers deposition on foliage and uptake from soil for all radioiodines and particulates, except tritium and carbon-14. The concentration of carbon-14 in vegetation is estimated by assuming that its ratio to the natural carbon in the vegetation is the same as the ratio of

carbon-14 to natural carbon in the atmosphere surrounding the vegetation. The concentration of tritium in vegetation is calculated from its concentration in water vapor surrounding the vegetation. Vegetation is assumed to be exposed to contamination for 60 days and have an agricultural productivity yield of 2 kg/sq m (0.41 lb/sq ft). The soil is assumed to have a surface density of 240 kg/sq m (49 lb/sq ft), and buildup on the soil is assumed to occur over 20 yr (midpoint of plant life). Table 5.4-5 lists the concentration of radionuclides in vegetation grown at the location of the maximum individual's garden. Foliage retention factors of 0.2 for particulates and 1.0 for elemental radioiodines from airborne deposition are used as recommended in Regulatory Guide 1.109.

5.4.3 Dose Rate Estimates for Biota Other than Man

The exposure pathways and the concentrations of radionuclides in the environment are discussed in previous sections. The doses to terrestrial and aquatic organisms other than man, resulting from these radionuclides, are presented in the following sections and tables. Calculated internal and external dose rates to biota are based on the models and assumptions presented in Appendix 5A.

5.4.3.1 Doses through Gaseous Pathways

Tables 5.4-6 and 5.4-7 list the calculated doses to biota other than man from gaseous pathways. These doses are calculated for terrestrial animals residing within the vicinity of the gaseous effluent release points. The external dose rates are based on external dose rates calculated for man.

5.4.3.2 Doses through Liquid Pathways

Table 5.4-6 also lists the calculated external doses to biota other than man from submersion in water at the edge of the nearfield dilution zone and exposure to shoreline sediments. Table 5.4-7 lists the calculated internal doses to these animals due to the bioaccumulation process.

5.4.3.3 Direct Radiation Doses

This external exposure rate is independent of the biotic type and is assumed to be the same for biota as for man. Section 5.4.4.3 describes the calculational techniques used and the calculated doses.

5.4.4 Dose Rate Estimates for Man

Calculated doses to the maximum offsite individual and the 80-km (50-mi) radius 2010 population are based on the gaseous and liquid releases discussed in Section 3.5. The mathematical models and assumptions used to calculate these doses are given in Appendix 5A.

5.4.4.1 Liquid Pathways

Tables 5.4-8 through 5.4-11 present the calculated doses to the maximum individual from liquid pathways. These tables present the calculated total-body and organ doses for the four age groups: adult, teen, child, and infant.

Table 5.4-1 presents a comparison of the maximum individual calculated doses from liquid effluents to the design objectives of 10CFR50 Appendix I limits.

5.4.4.2 Gaseous Pathways

Tables 5.4-12 through 5.4-23 present the calculated doses to the maximum individual from gaseous pathways. These tables present the calculated total-body and organ doses for the four age groups: adult, teen, child, and infant.

The analysis was performed for the maximum location where a resident, milk cow, and beef animal actually exist. Each analysis case considers exposure pathways that exist at the specified location. For example, if a milk cow and a beef animal existed at the same farm, the maximum individuals residing at that farm were analyzed for immersion, inhalation, ground deposition, ingestion of vegetation, and consumption of cow milk and beef meat pathways. It was assumed that a vegetable garden could exist at each location analyzed. In addition, the consumption of deer was analyzed.

Tables 5.4-12 through 5.4-15 present the calculated doses to the maximum individuals living at the residence location. Tables 5.4-16 through 5.4-19 present the doses to the maximum individuals living at the highest milk cow location. Tables 5.4-20 through 5.4-23 present the doses to the maximum individuals living at the highest beef animal location.

Table 5.4-1 presents the comparison of the maximum individual calculated doses from gaseous effluents to the design objectives of 10CFR50 Appendix I.

Annual gamma air dose and beta air dose values were calculated and are compared to the 10CFR50 Appendix I design objective values in Table 5.4-1.

5.4.4.3 Direct Radiation from Facility

Direct radiation exposure rates at the site boundary will be provided in a future amendment.

5.4.4.4 Annual Population Doses

5.4.4.4.1 Eighty-Kilometer (Fifty-Mile) Radius Population Doses

Population dose commitments were calculated for all individuals living within 80 km (50 mi) of the facility employing the same models used for individual doses (Regulatory Guide 1.109).

Table 5.4-24 presents the calculated annual total-body and thyroid doses from gaseous and liquid pathways to the population projected to reside within an 80-km (50-mi) radius of the site in the year 2010.

5.4.4.4.2 Contiguous U.S. Population Doses

In addition to the 80-km (50-mi) radius population doses, population doses associated with the export of food crops produced within the 80-km (50-mi) region and the atmospheric and hydrospheric transport of the more mobile effluent species, such as noble gases, tritium, and carbon-14, were calculated.

Table 5.4-25 presents the calculated annual total-body and thyroid doses to the contiguous U.S. population.

5.4.5 Summary of Annual Radiation Doses

The calculated annual radiation doses to the maximum individual from liquid and gaseous pathways are presented in Tables 5.4-8 through 5.4-23. As these tables and Table 5.4-1 indicate, the calculated annual radiation doses are below the design objectives of 10CFR50 Appendix I for the site. The maximum calculated dose was 1.7+00 mRem/yr* to an infant thyroid. It represents an infant who resides at a location 2,350 m (7,710 ft) east-southeast of the

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*1.7+00 = 1.7×10^0

facility and who obtains all of his or her milk from a cow located at the same location. The highest calculated external exposure rates to the whole body and skin from immersion in noble gases at an occupied location were 0.03 and 0.06 mRem/yr, respectively. These occurred at the residence location 1,693 m (5,555 ft) east of the site.

The highest calculated beta and gamma air doses at an unoccupied location from noble gas releases were 0.04 and 0.06 mrad/yr, respectively. These occurred at the exclusion area boundary 1,603 m (5,259 ft) east of the site.

For the liquid releases, it was assumed that the maximum individual obtains drinking water from the Metropolitan Water Supply of Onondaga County, located 12.87 km (8 mi) from the facility. The maximum individual was assumed to consume fish and ducks caught at the edge of the nearfield dilution zone. This assumption leads to an overestimation of accumulation of radioactive material in fish, since fish do not permanently occupy this zone. This location was also used in calculating doses from swimming and boating. Food products assumed to be irrigated were irrigated with water taken from the Metropolitan Water Supply of Onondaga County. The calculated doses from shoreline recreation also were performed at the nearest occupied beach.

The calculated dose to the maximum individual from liquid pathways is 7.9-01 mRem/yr to a child's bone. This dose is primarily a result of fish consumption.

The calculated annual doses for the population residing within an 80-km (50-mi) radius of the site are presented in Table 5.4-24. For liquid effluents, the calculated whole-body and thyroid doses are 6.5-01 man-Rem/yr and 1.3-01 man-Rem/yr, respectively. The calculated doses from gaseous pathways are 6.3-01 man-Rem/yr whole body and 2.2+00 man-Rem/yr thyroid. These doses were calculated for a projected population in the year 2010 of 1.2+06 people within 80 km (50 mi) of the site. The milk, meat, and vegetation 80-km (50-mi) radius crop yield, as well as the 80-km (50-mi) radius sport and commercial fish harvest, are presented in Appendix 5A.

The calculated doses to the contiguous U.S. population are presented in Table 5.4-25. The total annual doses were calculated to be 2.1+01 man-Rem to the whole body and 2.4+01 man-Rem to the thyroid.

5.4.6 Reference

1. Environmental Analysts, Incorporated. Standard Methodology for Calculating Radiation Dose to Lower Form of Biota. Prepared for the Atomic Industrial Forum and the National Environmental Studies Project, AIF/NESP-006, February 1975, p 33.

TABLE 5.4-1

COMPARISON OF MAXIMUM CALCULATED DOSES FROM UNIT 2
WITH APPENDIX I DESIGN OBJECTIVES

Criterion	Appendix I Design Objective[1]	Unit 2 Calculated Dose
Gaseous effluents		
Gamma air dose[2], mRad/yr	10	5.8-02
Beta air dose[2], mRad/yr	20	4.2-02
Noble gas - total body[3], mRem/yr	5	2.98-02
Noble gas - skin[3], mRem/yr	15	6.10-02
Iodines and particulates[4]		
Any organ (thyroid), mRem/yr	15	1.7+00
Liquid effluents		
Total body, mRem/yr	3	1.4-01
Any organ[5], mRem/yr	10	7.9+00

NOTE: 5.8-02 = 5.8×10^{-2}

[1]Per reactor.
[2]Calculated at exclusion area boundary 1,603 m (5,259 ft) east.
[3]Calculated at 1,693 m (5,554 ft) east.
[4]Infant thyroid dose from cow milk 2,350 m (7,710 ft) east-southeast.
[5]Child bone dose is calculated to be the highest organ dose.

TABLE 5.4-2

ESTIMATED RADIONUCLIDE CONCENTRATIONS
IN EFFLUENT AND RECEIVING WATER

Final Effluent Flow Rate = 66.80 cfs

(pCi/l)

Isotope	Discharge Concentration	Edge of Nearfield Dilution Zone(1)	Nearest Accessible Shoreline(2)	Metropolitan Water Board Onondaga County(3)
H-3	8.56+02	1.45+02	2.78+00	1.85+00
Na-24	1.81-01	3.07-02	7.17-05	3.72-05
P-32	6.92-03	1.17-03	2.05-05	1.35-05
Cr-51	2.14-01	3.63-02	6.65-04	4.39-04
Mn-54	2.47-03	4.19-04	8.00-06	5.30-06
Mn-56	3.29-02	5.58-03	4.78-10	7.61-11
Fe-55	3.62-02	6.14-03	1.18-04	7.80-05
Fe-59	1.09-03	1.84-04	3.43-06	2.27-06
Co-58	7.08-03	1.20-03	2.26-05	1.50-05
Co-60	1.48-02	2.51-03	4.82-05	3.19-05
Ni-63	3.62-05	6.14-06	1.18-07	7.81-08
Ni-65	1.81-04	3.07-05	2.29-12	3.59-13
Cu-64	4.45-01	7.54-02	1.22-04	6.07-05
Zn-65	7.25-03	1.23-03	2.34-05	1.55-05
Br-83	3.46-03	5.86-04	2.01-11	2.88-12
Br-84	9.06-09	1.54-09	1.64-37	9.92-41
Sr-89	3.79-03	6.42-04	1.20-05	7.93-06
SR-90	2.47-04	4.19-05	8.03-07	5.32-07
Sr-91	4.61-02	7.81-03	5.27-06	2.37-06
Sr-92	7.90-03	1.34-03	2.08-10	3.55-11
Y-91	1.81-03	3.07-04	5.76-06	3.81-06
Y-92	4.78-02	8.09-03	1.96-08	4.60-09
Y-93	5.10-02	8.65-03	7.37-06	3.41-06
Zr-95	2.80-04	4.74-05	8.92-07	5.90-07
Zr-97	1.10-04	1.87-05	5.39-08	2.87-08
Nb-95	2.80-04	4.74-05	8.77-07	5.79-07
Mo-99	6.09-02	1.03-02	1.23-04	7.68-05
Tc-99m	1.22-01	2.07-02	2.05-06	7.37-07
Ru-103	7.08-04	1.20-04	2.23-06	1.47-06
Ru-105	6.59-03	1.12-03	1.69-08	4.90-09
Ru-106	1.10-04	1.87-05	3.58-07	2.37-07
Ag-110m	3.62-05	6.14-06	1.17-07	7.77-08
Te-129m	1.45-03	2.46-04	4.53-06	2.99-06
Te-131m	2.47-03	4.19-04	2.79-06	1.64-06
Te-132	3.13-04	5.30-05	6.77-07	4.28-07
I-131	1.50-01	2.54-02	4.14-04	2.69-04

TABLE 5.4-2 (Cont)

Isotope	Discharge Concentration	Edge of Nearfield Dilution Zone[1]	Nearest Accessible Shoreline[2]	Metropolitan Water Board Onondaga County[3]
I-132	2.63-02	4.47-03	8.06-11	1.07-11
I-133	1.22+00	2.07-01	8.63-04	4.79-04
I-134	7.57-05	1.28-05	4.35-23	4.33-25
I-135	3.95-01	6.70-02	1.05-05	3.98-06
Cs-134	5.10-02	8.65-03	1.66-04	1.10-04
Cs-136	3.46-02	5.86-03	1.02-04	6.66-05
Cs-137	1.43-01	2.43-02	4.66-04	3.09-04
Cs-138	8.73-07	1.48-07	6.23-35	4.43-38
Ba-139	2.96-04	5.02-05	1.14-16	5.39-18
Ba-140	1.42-02	2.40-03	4.15-05	2.72-05
La-142	3.29-04	5.58-05	1.20-15	7.32-17
Ce-141	1.09-03	1.84-04	3.39-06	2.24-06
Ce-143	7.74-04	1.31-04	9.62-07	5.71-07
Ce-144	1.10-04	1.87-05	3.57-07	2.37-07
Pr-143	1.45-03	2.46-04	4.28-06	2.80-06
Nd-147	1.05-04	1.79-05	3.04-07	1.99-07
W-187	6.75-03	1.14-03	5.82-06	3.31-06
Np-239	2.31-01	3.91-02	4.29-04	2.66-04

NOTE: 8.56+02 = 8.56×10^2

[1]Dilution factor = 5.9
Travel time = 0.0 hr
[2]Dilution factor = 307.4
Travel time = 45.8 hr
[3]Dilution factor = 463.8
Travel time = 51.1 hr

TABLE 5.4-3

EQUILIBRIUM BIOACCUMULATION FACTORS
FOR AQUATIC BIOTA IN FRESHWATER

Element	Fish[1]	Crustaceans[1]	Mollusks[1]	Algae[2]
H	0.9	0.9	0.9	0.9
Cr	200.0	2,000.0	2,000.0	4,000.0
Mn	400.0	90,000.0	90,000.0	10,000.0
Fe	100.0	3,200.0	3,200.0	1,000.0
Co	50.0	200.0	200.0	200.0
Br	420.0	330.0	330.0	50.0
Rb	2,000.0	1,000.0	1,000.0	1,000.0
Sr	30.0	100.0	100.0	500.0
Y	25.0	1,000.0	1,000.0	5,000.0
Zr	3.3	6.7	6.7	1,000.0
Nb	30,000.0	100.0	100.0	800.0
Mo	10.0	10.0	10.0	1,000.0
Tc	15.0	5.0	5.0	40.0
Ru	10.0	300.0	300.0	2,000.0
Te	400.0	6,100.0	6,100.0	100.0
I	15.0	5.0	5.0	40.0
Cs	2,000.0	1,000.0	1,000.0	500.0
Ba	4.0	200.0	200.0	500.0
La	25.0	1,000.0	1,000.0	5,000.0
Ce	1.0	1,000.0	1,000.0	4,000.0
Pr	25.0	1,000.0	1,000.0	5,000.0
Np	10.0	400.0	400.0	300.0

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(1) Regulatory Guide 1.109, Revision 1, October 1977.
(2) Regulatory Guide 1.109, Revision 0, March 1976. Values for algae were eliminated from Revision 1; therefore, values published in Revision 0 were utilized.

TABLE 5.4-4

DEPOSITION OF RADIONUCLIDES ON SOIL*

Isotope	Deposition (pCi/m^2)
H-3	0.0
C-14	0.0
Cr-51	1.6-01
Mn-54	1.8+00
Fe-59	6.6-02
Co-58	2.5-01
Co-60	3.7+01
Zn-65	7.2+00
Sr-89	8.0-01
Sr-90	3.1-01
Zr-95	1.5-01
Nb-95	1.3+00
Mo-99	6.2-01
Ru-103	8.6-02
Ag-110m	2.3-03
Sb-124	2.0-02
I-131	3.1+00
I-132	6.3-01
I-133	4.6+00
I-134	5.6-01
I-135	1.5+00
Cs-134	1.2+01
Cs-136	2.5-02
Cs-137	9.1+01
Ba-140	9.5-01
Ce-141	9.2-01

NOTE: 1.6-01 = 1.6×10^{-1}

*Location is 4,106 m (13,471 ft) east of the main stack - annual average.
D/Q1 = 6.5-10 $1/m^2$
D/Q2 = 2.2-09 $1/m^2$
D/Q3 = 8.8-10 $1/m^2$

TABLE 5.4-5

CONCENTRATION OF RADIONUCLIDES IN VEGETATION

Isotope	Stored Vegetation Concentration (pCi/kg)	Fresh Vegetation Concentration (pCi/kg)
H-3	3.1+00	3.1+00
C-14	4.0+00	4.0+00
Cr-51	1.2-03	4.9-03
Mn-54	6.5-03	7.4-03
Fe-59	5.7-04	1.4-03
Co-58	2.2-03	3.9-03
Co-60	2.6-02	2.7-02
Zn-65	4.0-02	4.7-02
Sr-89	7.3-03	1.6-02
Sr-90	1.2-04	1.2-04
Zr-95	1.3-03	2.4-03
Nb-95	1.1-02	3.4-02
Mo-99	1.3-08	3.8-02
Ru-103	7.2-04	2.0-03
Ag-110m	1.0-05	1.2-05
Sb-124	1.8-04	3.5-04
I-131	5.4-03	8.6-01
I-132	0.0	2.1-04
I-133	3.2-21	9.5-01
I-134	0.0	1.5-09
I-135	1.6-66	5.8-02
Cs-134	1.8-02	1.9-02
Cs-136	5.1-05	1.2-03
Cs-137	3.1-02	3.1-02
Ba-140	1.8-03	4.4-02
Ce-141	7.4-03	2.6-02

NOTE: 3.1+00 = 3.1×10^{0}

*Location is 4,106 m (13,471 ft) east of the main stack - grazing season.
X/Q1 = 1.9-08 sec/m^3
D/Q1 = 6.6-10 1/m^2
X/Q2 = 1.1-07 sec/m^3
D/Q2 = 2.2-09 1/m^2
X/Q3 = 8.3-08 sec/m^3
D/Q3 = 8.6-10 1/m^2

TABLE 5.4-6

ANNUAL CALCULATED EXTERNAL DOSE RATES TO BIOTA OTHER THAN MAN FROM ROUTINE REACTOR OPERATIONS

	External Dose Rate (mrad/yr)				
Biotic Type	Air Immersion*	Standing on Contaminated Ground*	Shoreline Exposure	Water Immersion	Water Surface
Muskrat	4.45-02	4.1-02	7.52-02	2.63-03	NA
Raccoon	4.45-02	4.1-02	5.64-02	NA	NA
Heron	4.45-02	4.1-02	7.52-02	NA	1.31-03
Duck	4.45-02	4.1-02	1.13-01	NA	1.97-03
Deer	4.45-02	4.1-02	NA	NA	NA

NOTE: 4.45-02 = 4.45x10n²

*Location of dose receiver analysis is 1,603 m (5,259 ft) east of the main stack.

TABLE 5.4-7

ANNUAL CALCULATED INTERNAL DOSE RATES TO BIOTA OTHER THAN MAN FROM ROUTINE REACTOR OPERATIONS

Biotic Type	Internal Dose Rate (mrad/yr)
Primary Organisms[1,2]	
Fish	2.1+00
Crustaceans	1.0+01
Mollusks	1.0+01
Algae	1.2+01
Secondary Organisms[2,3]	
Muskrat	1.3+01
Raccoon	0.7+00
Heron	1.3+01
Duck	1.3+01
Terrestrial Animals	
Deer[4]	2.1-01

NOTE: 2.1+00 = 2.1×10^0

[1] Primary organisms are defined as those exposed by interaction with radionuclides in the water.
[2] Location of dose receiver analysis is assumed to be at the edge of the nearfield dilution zone.
[3] Secondary organisms are defined as those which consume primary organisms.
[4] Location of dose receiver analysis is 1,603 m (5,259 ft) east of the main stack.

TABLE 5.4-8

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE ADULT GROUP FROM LIQUID EFFLUENTS

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	1.7-04	0.0	3.2-05	1.8-04	6.5-04	1.6-04	1.5-04	2.8-04
Fish consumption	1.4-01	0.0	5.6-01	2.0-01	2.5-02	6.0-02	1.9-02	6.5-02
Shoreline recreation	4.0-06	4.6-06	4.0-06	4.0-06	4.0-06	4.0-06	4.0-06	4.0-06
Fresh vegetation	1.9-05	0.0	7.5-06	2.2-05	4.7-05	1.6-05	1.3-05	4.0-05
Stored vegetation	1.4-04	0.0	4.9-05	1.5-04	9.0-05	1.1-04	9.6-05	1.9-04
Duck consumption	1.9-04	0.0	4.7-03	3.1-04	9.3-06	1.3-05	1.8-06	8.6-04
Swimming exposure	8.9-05	1.2-04	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05
Boating exposure	8.9-05	1.2-04	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05
Total dose	1.4-01	2.4-04	5.6-01	2.0-01	2.6-02	6.0-02	1.9-02	6.7-02

NOTE: 1.7-04 = 1.7×10^{-4}

TABLE 5.4-9

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE
TEEN GROUP FROM LIQUID EFFLUENTS

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	1.2-04	0.0	3.1-05	1.4-04	5.4-04	1.5-04	1.0-04	1.1-04
Fish consumption	9.0-02	0.0	6.1-01	2.1-01	2.4-02	6.1-02	2.3-02	4.7-02
Shoreline recreation	2.2-05	2.6-05	2.2-05	2.2-05	2.2-05	2.2-05	2.2-05	2.2-05
Fresh vegetation	1.2-05	0.0	6.7-06	1.7-05	3.6-05	1.7-05	9.3-06	8.9-06
Stored vegetation	1.6-04	0.0	8.6-05	2.3-04	1.2-04	2.0-04	1.3-04	1.2-04
Duck consumption	1.6-04	0.0	4.0-03	2.7-04	7.0-06	1.0-04	1.6-06	3.5-04
Swimming exposure	8.9-05	1.2-04	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05
Boating exposure	8.9-05	1.2-04	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05	8.9-05
Total dose	9.1-02	2.7-04	6.1-01	2.1-01	2.5-02	6.2-02	2.3-02	4.8-02

NOTE: 1.2-04 = 1.2×10^{-4}

TABLE 5.4-10

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE CHILD GROUP FROM LIQUID EFFLUENTS

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	2.1-04	0.0	8.7-05	2.7-03	1.3-03	2.2-04	2.0-04	2.0-04
Fish consumption	5.4-02	0.0	7.8-01	1.9-01	2.7-02	5.2-02	1.8-02	2.0-02
Shoreline recreation	4.6-06	5.4-06	4.6-06	4.6-06	4.6-06	4.6-06	4.6-06	4.6-06
Fresh vegetation	1.2-05	0.0	1.2-05	2.1-05	5.1-05	1.4-05	1.1-05	1.0-05
Stored vegetation	2.2-04	0.0	2.0-04	3.8-04	1.9-04	2.5-04	2.1-04	1.9-04
Duck consumption	3.0-04	0.0	7.5-03	3.7-04	1.1-05	1.1-05	1.9-06	2.2-04
Swimming exposure	5.0-05	6.7-05	5.0-05	5.0-05	5.0-05	5.0-05	5.0-05	5.0-05
Boating exposure	5.1-05	6.8-05	5.1-05	5.1-05	5.1-05	5.1-05	5.1-05	5.1-05
Total dose	5.5-02	1.4-04	7.9-01	1.9-01	2.9-02	5.3-02	1.9-02	2.1-02

NOTE: 2.1-04 = 2.1×10^{-4}

TABLE 5.4-11

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE INFANT GROUP FROM LIQUID EFFLUENTS

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Potable water	2.0-04	0.0	9.3-05	2.9-04	1.9-03	2.2-04	2.0-04	1.9-04
Total dose	2.0-04	0.0	9.3-05	2.9-04	1.9-03	2.2-04	2.0-04	1.9-04

NOTE: $2.0\text{-}04 = 2.0 \times 10^{-4}$

TABLE 5.4-12

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE ADULT GROUP FROM GASEOUS EFFLUENTS*

At Maximum Residence Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	7.9-03	9.2-03	7.9-03	7.9-03	7.9-03	7.9-03	7.9-03	7.9-03
Inhalation	1.6-04	0.0	1.6-04	2.4-04	1.3-02	3.0-04	2.8-04	2.1-04
Fresh vegetation	7.5-04	0.0	1.7-03	1.1-03	1.3-01	1.2-03	2.1-04	8.0-04
Stored vegetation	2.7-03	0.0	6.3-03	3.2-03	4.5-03	1.8-03	1.1-03	1.8-03
Deer 1,603 m east	1.4-04	0.0	1.7-04	1.9-04	3.2-04	9.2-05	3.1-05	3.3-04
Total dose	1.2-02	9.2-03	1.6-02	1.3-02	1.6-01	1.1-02	9.5-03	1.1-02

*Analysis performed at maximum residence location is 4,106 m (13,471 ft) east.

NOTE: 7.9-03 = 7.9×10^{-3}

TABLE 5.4-13

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE
TEEN GROUP FROM GASEOUS EFFLUENTS*

At Maximum Residence Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	7.9-03	9.2-03	7.9-03	7.9-03	7.9-03	7.9-03	7.9-03	7.9-03
Inhalation	1.8-04	0.0	2.2-04	2.9-04	1.7-02	3.8-04	3.8-04	2.3-04
Fresh vegetation	5.4-04	0.0	1.6-03	1.0-03	1.1-01	1.1-02	1.9-04	5.8-04
Stored vegetation	3.5-03	0.0	1.1-02	5.7-03	7.3-03	6.0-02	2.0-03	2.7-03
Deer 1,603 m east	7.8-05	0.0	1.4-04	1.5-04	2.4-04	7.6-03	2.7-05	1.9-04
Total dose	1.2-02	9.2-03	2.1-02	1.5-02	1.4-01	8.7-02	1.0-02	1.2-02

*Analysis performed at maximum residence location is 4,106 m (13, 471 ft) east.

NOTE: 7.9-03 = 7.9×10^{-3}

TABLE 5.4-14

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE CHILD GROUP FROM GASEOUS EFFLUENTS*

At Maximum Residence Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	7.9-03	9.2-03	7.9-03	7.9-03	7.9-03	7.9-03	7.0-03	7.0-03
Inhalation	1.8-04	0.0	3.0-04	2.8-04	2.1-02	3.6-04	3.3-04	1.9-04
Fresh vegetation	7.1-04	0.0	2.9-03	1.4-03	1.6-01	1.4-03	3.2-04	5.3-04
Stored vegetation	5.7-03	0.0	2.8-02	1.1-02	1.5-02	6.2-03	4.5-03	4.6-03
Deer 1,603 m east	8.6-05	0.0	2.5-04	2.0-04	3.6-04	9.5-05	4.0-05	1.2-04
Total dose	1.5-02	9.2-03	3.9-02	2.1-02	2.0-01	1.6-02	1.3-02	1.3-02

*Analysis performed at maximum residence location is 4,106 m (13,471 ft) east.

NOTE: 7.9-03 = 7.9×10^{-3}

TABLE 5.4-15

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE INFANT GROUP FROM GASEOUS EFFLUENTS*

At Maximum Residence Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	7.9-03	9.2-03	7.9-03	7.9-03	7.9-03	7.9-03	7.9-03	7.9-03
Inhalation	1.2-04	0.0	2.2-04	2.2-04	1.9-02	2.3-04	2.4-04	1.1-04
Total dose	8.0-03	9.2-03	8.1-03	8.1-03	2.7-02	8.1-03	8.1-03	8.0-03

*Analysis performed at maximum residence location is 4,106 m (13,471 ft) east.

NOTE: 7.9-03 = 7.9×10^{-3}

TABLE 5.4-16

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE ADULT GROUP FROM GASEOUS EFFLUENTS*

At Maximum Cow Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	1.3-02	1.6-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02
Inhalation	1.4-04	0.0	1.1-04	2.0-04	9.7-03	2.5-04	2.7-04	1.9-04
Fresh vegetation	7.0-04	0.0	1.3-03	1.1-03	1.3-01	1.1-03	1.3-04	7.3-04
Stored vegetation	2.4-03	0.0	4.3-03	3.0-03	4.1-03	1.4-03	6.9-04	1.4-03
Cow milk	2.4-03	0.0	3.0-03	3.7-03	2.2-01	2.7-03	4.5-04	1.1-03
Deer 1,603 m east	1.4-04	0.0	1.7-04	1.9-04	3.2-04	9.2-05	3.1-05	3.3-04
Total dose	1.9-02	1.6-02	2.2-02	2.1-02	3.8-01	1.9-02	1.5-02	1.7-02

*Analysis performed at maximum cow location is 2,350 m (7,710 ft) east-southeast.

NOTE: 1.3-02 = 1.3×10^{-2}

TABLE 5.4-17

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE
TEEN GROUP FROM GASEOUS EFFLUENTS*

At Maximum Cow Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	1.3-02	1.6-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02
Inhalation	1.5-04	0.0	1.5-04	2.4-04	1.3-02	3.1-04	3.6-04	2.1-04
Fresh vegetation	4.8-04	0.0	1.2-03	9.5-04	1.1-01	1.2-02	1.2-04	5.1-04
Stored vegetation	2.8-03	0.0	7.7-03	5.2-03	6.5-03	6.5-02	1.3-03	1.9-03
Cow milk	3.0-03	0.0	5.3-03	6.4-03	3.5-01	4.7-03	8.5-04	1.5-03
Deer 1,603 m east	7.8-05	0.0	1.4-04	1.5-04	2.4-04	7.6-03	2.7-05	1.9-04
Total dose	2.0-02	1.6-02	2.7-02	2.6-02	4.9-02	1.0-01	1.6-02	1.7-02

*Analysis performed at maximum cow location is 2,350 m (7,710 ft) east-southeast.

NOTE: 1.3-02 = $1.3x10^{-2}$

TABLE 5.4-18

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE CHILD GROUP FROM GASEOUS EFFLUENTS*

At Maximum Cow Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	1.3-02	1.6-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02
Inhalation	1.5-04	0.0	2.1-04	2.3-04	1.6-02	2.9-04	3.1-04	1.7-04
Fresh vegetation	5.8-04	0.0	2.2-03	1.3-03	1.6-01	1.3-03	1.8-04	3.9-04
Stored vegetation	3.8-03	0.0	1.9-02	9.3-03	1.3-02	4.4-03	2.6-03	2.6-03
Cow milk	4.3-03	0.0	1.3-02	1.1-02	7.1-01	7.9-03	1.6-03	1.8-03
Deer 1,603 m east	8.6-05	0.0	2.5-04	2.0-04	3.6-04	9.5-05	4.0-05	1.2-04
Total dose	2.2-02	1.6-02	4.8-02	3.5-02	9.1-01	2.7-02	1.8-02	1.8-02

*Analysis performed at maximum cow location is 2,350 m (7,710 ft) east-southeast.

NOTE: 1.3-02 = 1.3×10^{-2}

TABLE 5.4-19

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE INFANT GROUP FROM GASEOUS EFFLUENTS*

At Maximum Cow Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	1.3-02	1.6-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02	1.3-02
Inhalation	9.6-05	0.0	1.5-04	1.8-04	1.5-02	1.8-04	2.3-04	9.5-05
Cow milk	6.6-03	0.0	2.3-02	2.2-02	1.7+00	1.3-02	3.2-03	4.7-03
Total dose	2.0-02	1.6-02	3.6-02	3.5-02	1.7+00	2.6-02	1.6-02	1.8-02

*Analysis performed at maximum cow location is 2,350 m (7,710 ft) east-southeast.

NOTE: 1.3-02 = 1.3×10^{-2}

TABLE 5.4-20

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE ADULT GROUP FROM GASEOUS EFFLUENTS*

At Maximum Beef Animal Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	2.4-02	2.8-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02
Inhalation	2.3-04	0.0	1.3-04	3.1-04	1.2-02	3.6-04	4.9-04	3.2-04
Fresh vegetation	1.6-03	0.0	2.7-03	2.4-03	2.6-01	2.3-03	2.4-04	1.7-03
Stored vegetation	5.7-03	0.0	8.4-03	7.4-03	7.9-03	3.1-03	1.3-03	3.0-03
Beef	9.7-04	0.0	1.7-03	1.4-03	1.5-02	8.1-04	3.2-04	4.4-03
Deer 1,603 m east	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total dose	3.2-02	2.8-02	3.7-02	3.6-02	3.2-01	3.1-02	2.6-02	3.3-02

*Analysis performed at maximum beef animal location is 1,693 m (5,555 ft) east.

NOTE: 2.4-02 = 2.4×10^{-2}

TABLE 5.4-21

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE TEEN GROUP FROM GASEOUS EFFLUENTS*

At Maximum Beef Animal Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	2.4-02	2.8-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02
Inhalation	2.4-04	0.0	1.8-04	3.6-04	1.6-02	4.3-04	6.6-04	3.4-04
Fresh vegetation	1.1-03	0.0	2.5-03	2.2-03	2.1-01	3.2-02	2.3-04	1.2-03
Stored vegetation	6.3-03	0.0	1.5-02	1.3-02	1.3-02	1.7-01	2.4-03	4.0-03
Beef	6.1-04	0.0	1.4-03	1.1-03	1.1-02	9.2-02	2.6-04	2.5-03
Deer 1,603 m east	1.4-04	0.0	1.7-04	1.9-04	3.2-04	9.2-05	3.1-05	3.3-04
Total dose	3.2-02	2.8-02	4.3-02	4.1-02	2.7-01	3.2-01	2.8-02	3.2-02

*Analysis performed at maximum beef animal location is 1,693 m (5,555 ft) east.

NOTE: 2.4-02 = 2.4×10^{-2}

TABLE 5.4-22

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE CHILD GROUP FROM GASEOUS EFFLUENTS*

At Maximum Beef Animal Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract
Contaminated ground	2.4-02	2.8-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02
Inhalation	2.3-04	0.0	2.4-04	3.4-04	2.0-02	4.0-04	5.6-04	2.6-04
Fresh vegetation	1.2-03	0.0	4.5-03	2.8-03	3.3-01	2.6-03	3.1-04	7.8-04
Stored vegetation	7.6-03	0.0	3.6-02	2.2-02	2.6-02	9.2-03	4.4-03	4.4-03
Beef	7.9-04	0.0	2.5-03	1.4-03	1.7-02	8.8-04	4.4-04	1.6-03
Deer 1,603 m east	7.8-05	0.0	1.4-04	1.5-04	2.4-04	7.6-03	2.7-05	1.9-04
Total dose	3.4-02	2.8-02	6.7-02	5.1-02	4.2-01	4.5-02	3.0-02	3.1-02

*Analysis performed at maximum beef animal location is 1,693 m (5,555 ft) east.

NOTE: 2.4-02 = 2.4×10^{-2}

TABLE 5.4-23

ANNUAL DOSES TO MAXIMUM INDIVIDUAL IN THE INFANT GROUP FROM GASEOUS EFFLUENTS*

At Maximum Beef Animal Location

(Annual Dose in mRem/yr)

Pathway	Total Body	Skin	Bone	Liver	Thyroid	Kidney	Lung	GI-Tract	
Contaminated ground	2.4-02	2.8-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02	2.4-02	1.30
Inhalation	1.4-04	0.0	1.8-04	2.5-04	1.8-02	2.5-04	4.1-04	1.4-04	1.32
Total dose	2.4-02	2.8-02	2.4-02	2.4-02	4.2-02	2.4-02	2.4-02	2.4-02	1.34

*Analysis performed at maximum beef animal location is 1,693 m (5,555 ft) east.

NOTE: 2.4-02 = 2.4×10^{-2}

TABLE 5.4-24

CALCULATED ANNUAL DOSES FOR
POPULATION WITHIN 80-KM (50-MI) RADIUS

	Whole Body (man-Rem)	Thyroid (man-Rem)
Liquid Effluents		
Ingestion of potable water	2.2-02	7.0-02
Ingestion of fish	6.2-01	5.3-02
Shoreline recreation	4.2-03	4.2-03
Swimming	1.9-05	1.9-05
Boating	7.8-06	7.8-06
Total	6.5-01	1.3-01
Gaseous Effluents		
Submersion	3.3-01	3.3-01
Inhalation	1.4-02	9.6-01
Standing on contaminated ground	7.2-02	7.2-02
Ingestion of fruits, grains, and vegetation	1.6-01	1.5-01
Ingestion of cow milk	4.8-02	6.4-01
Ingestion of meat	3.8-03	6.9-03
Total	6.3-01	2.2+00

NOTES: 1. Based upon a projected 80-km (50-mi) population of 1.2+06 for the year 2010.

2. 2.2-02 = 2.2x10^{2}

TABLE 5.4-25

CALCULATED POPULATION DOSE COMMITMENT

(Contiguous U.S. Population Dose)

	Annual Dose Per Site	
	Total Body (man-Rem)	Thyroid (man-Rem)
Liquid effluents	6.5-01	1.3-01
Noble gas effluents	1.2+00	1.4+00
Radioiodines and particulates*	1.9+01	2.2+01
Total	2.1+01	2.41+01

NOTE: 6.5-01 = 6.5×10^{-1}

*Carbon-14 and tritium have been added to this category.

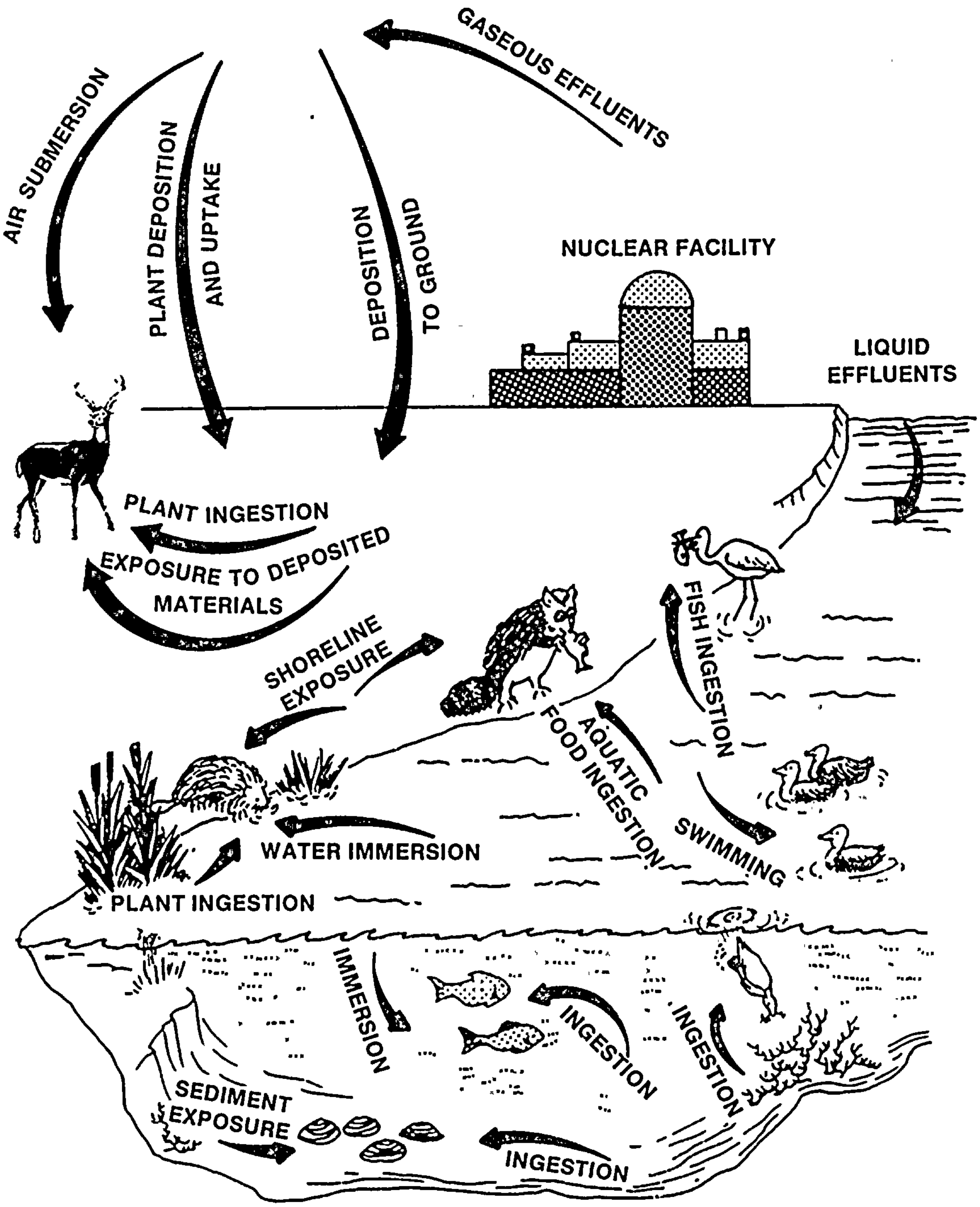

FIGURE 5.4-1

EXPOSURE PATHWAYS TO ORGANISMS OTHER THAN MAN

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

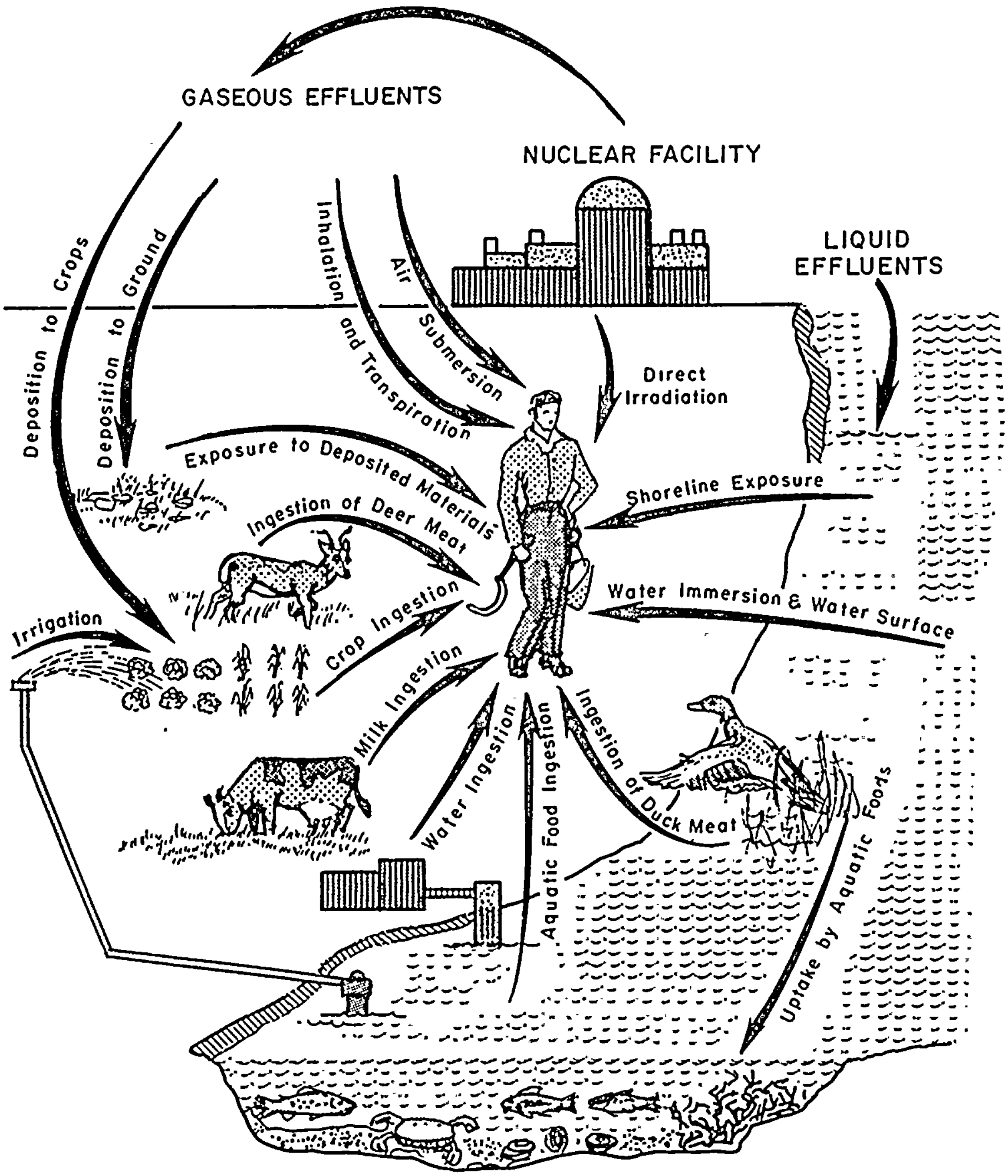

FIGURE 5.4-2

EXPOSURE PATHWAYS TO MAN

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

5.5 NONRADIOLOGICAL WASTE SYSTEM IMPACTS

5.5.1 Identification of Nonradiological Effluent Discharges

Unit 2 operation will result in effluent releases to air and water and solid waste disposal on land. Nonradiological effluents released to water are discussed in detail in Sections 3.6.1, 3.6.2, and 3.6.3.

Solid wastes that are disposed of on land are discussed in Sections 3.6.2 and 3.6.3 and consist of cooling tower sludge and sanitary waste treatment sludge.

Sources of nonradiological effluent discharges to the atmosphere include combustion products (SO_2, NO_X, and particulates) from the operation of two standby diesel generators, one high-pressure core spray (HPCS) diesel generator, and the diesel-driven fire protection pump. Diesel generator operation, specifications, and flue gas parameters are discussed in Section 3.6.3.4.

Other nonradiological effluents discharged to the atmosphere include drift and water vapor emissions from the natural-draft cooling tower. Drift refers to droplets of circulating water entrained in the cooling tower airflow and discharged in the exhaust flow from the top of the tower. The drift contains dissolved solids that are present in the circulating water system. Water vapor is emitted from the cooling tower as a result of the evaporative cooling process in the tower and may form a visible plume upon discharge to the atmosphere. These effluents are described in detail in Section 3.6.1.3.

5.5.2 Compliance With Effluent Standards

5.5.2.1 Discharges to Water

Discharges are subject to two types of restrictions: effluent limitations and receiving water body quality standards (and criteria). The effluent limitations limit concentrations at the waste stream. Discharge water quality standards apply to the receiving waters after allowance for initial dilution, i.e., mixing zone near the outfall.

Effluents discharged to Lake Ontario must conform to the federal effluent limitations guidelines and standards for the steam electric power generating category (40CFR423)[1]. The numerical values of the applicable limitations are listed in Table 3.6-1. In addition to these regulations, New York State water pollution control laws (Article 17,

Titles 1-11)[2] include regulations for the State Pollutant Discharge Elimination System (SPDES) permit under 6NYCRR750-757, which can require more stringent effluent limits than the federal standards. A copy of the Nine Mile Point Station SPDES permit is included in Chapter 1. Water quality standards for Lake Ontario are specified in 6NYCRR702.1[3] based on the lake's classification, Class A - Special Waters, and are summarized in Table 3.6-1. In addition to the pertinent state water quality standards for pH, total dissolved solids, and iron, guidelines for selected metals have been established.

The International Joint Commission (IJC)[4] makes recommendations to regulatory agencies and sets objectives or goals, but these objectives do not constitute standards unless they become incorporated into the New York State standards.

5.5.2.1.1 Cooling System Discharge

The cooling system discharge, including various small-volume waste streams, is mixed with service water in a combined plant discharge. The predicted chemical composition of this waste stream is described in Section 3.6.1 and summarized in Table 3.6-1. The maximum and average predicted concentrations at the discharge point and the previously discussed effluent limitations are also summarized in Table 3.6-1. With the exception of the following parameters, all effluent standards and water quality criteria will be met at the point of discharge prior to mixing.

As shown in Table 3.6-1, average ambient total dissolved solids concentrations are above the lake water quality standard. As a result of solids concentration by the cooling tower, effluent concentrations are also predicted to be higher than the lake water quality standard. In general, the Unit 2 discharge will create a nearfield increase in total dissolved solids that will be indistinguishable from ambient concentrations after the 10:1 dilution which occurs within the zone of active mixing induced by the turbulence of the discharge (Table 3.6-1).

The maximum effluent zinc concentration is greater than the guideline. However, after mixing induced by the discharge, the lake concentration for zinc will be within the guideline value.

The discharge has been designed as a high-velocity submerged jet to minimize the area affected and achieve the most rapid dilution possible. The description of the mixing zone in

the vicinity of the outfall is described in quantitative terms in Section 5.3.2.1. The design of the outfall will minimize the area influenced by the discharge. The proposed discharge complies with New York State's best usage classifications for Lake Ontario.

5.5.2.1.2 Treated Sanitary Effluent

The sanitary waste effluent from Unit 2 will be combined with effluent from Unit 1 and treated prior to discharge to the lake. The combined flow (Section 3.6.2) is estimated to total 74,943 cu m/day (19,800 gpd) during normal operation and 374,715 cu m/day (99,000 gpd) during refueling/maintenance. The Unit 2 contribution to this flow under normal conditions is 37,472 cu m/day (9,900 gpd) and 187,358 cu m/day (49,500 gpd) during an outage.

Federal regulations 40CFR133[5] describe secondary treatment effluent standards. Sanitary effluent from the wastewater treatment system for Units 1 and 2 will be restricted to limits specified in the SPDES permit pursuant to the 40CFR133 regulations and receiving water quality standards. The treated effluent will meet the SPDES permit limitations for this discharge.

5.5.2.1.3 Storm Water, Roof, and Yard Drainage

Storm water and roof drains are effluent streams generated by precipitation events. It is anticipated that these discharges will be exempted from SPDES limitations under 6NYCRR751. No treatment is planned for this discharge.

Drainage or oil spills from the main and reserve station transformer area are directed through oil/water separators to remove oil prior to discharge to the storm drain system.

5.5.2.1.4 Floor Drainage

Drainage or oil spills from the diesel generator building are directed through an oil/water separator to remove oil prior to discharge. The 40CFR423 standards for low-volume wastes are applicable to the diesel generator building drainage and other nonradiological floor drainage. These standards specify maximum daily total suspended solids (TSS) concentrations of 100 mg/l and maximum daily oil and grease concentrations of 20 mg/l. The average daily concentration limits for 30 consecutive days are 30 mg/l for TSS and 15 mg/l for oil and grease. It is anticipated that nonradiological floor drainage will meet the preceding requirements through proper isolation and containment of

material spills to floors served by the nonradiological floor drains.

5.5.2.2 Discharges to Air

There are no federal new-source performance standards (NSPS) or state emission standards applicable to the standby diesel generators and diesel-driven fire pump, except for the New York State limit for a stationary combustion installation to 40 percent opacity for any time period or 20 percent opacity for a period of 3 min or more during any continuous 60-min period (Section 3.6.3.4). Through proper operation and maintenance of the standby diesel generators, compliance with these opacity limits will be achieved.

The suspended portion of the drift emissions from the natural-draft cooling tower will contribute to the ambient suspended particulate concentration levels. The magnitude of this contribution was determined based on the results of the modeling analysis presented in Section 5.3.3.1.1. Maximum annual average and maximum 24-hr average ground-level concentrations of suspended particulates due to cooling tower operation were predicted to be 0.0004 ug/cu m and 0.026 ug/cu m, respectively. The national primary air quality standards for particulates are 75 ug/cu m (annual) and 260 ug/cu m (24 hr). The secondary standards for the annual and 24-hr periods are 60 ug/cu m and 150 ug/cu m, respectively. The corresponding applicable New York State ambient air quality standards (6NYCRR257) are 45 ug/cu m (annual) and 250 ug/cu m (24 hr). The predicted particulate concentrations due to cooling tower drift emissions are several orders of magnitude below the federal and state standards. Therefore, the cooling tower emissions will neither cause nor exacerbate any violation of air quality standards.

Prevention of significant deterioration (PSD) requirements does not apply to the cooling tower since the estimated emission rate of particulates (8,980 kg/yr [9.9 ton/yr]) is well below the 226,800 kg/yr (250 ton/yr) emission criterion.

5.5.2.3 Discharges to Land

Unit 2 operation will result in the production of sludges generated from cooling tower operation and sanitary wastewater treatment (Sections 3.6.2 and 3.6.3). Prior to disposal, the quality of the cooling tower sludge will be determined, and a disposal method providing the necessary level of environmental protection in accordance with

regulations pursuant to PL94-580 (the Resource, Conservation, and Recovery Act) and New York State solid waste management laws, Article 27 (collection, treatment, and disposal of refuse and other solid waste), will be selected. The sanitary waste sludge will be disposed of by a contractor (Section 3.6.2) in accordance with NYCRR Title 6, Chapter 360 (solid waste management facilities).

5.5.3 Impacts Associated With Nonradiological Effluent Discharges

5.5.3.1 Discharges to Water

As discussed in Section 3.6, there are several sources of liquid effluent from Unit 2. The impact to biota resulting from the thermal component of these discharges is discussed in Section 5.3. The potential impact of the chemical constituents of the discharges to aquatic life is discussed in this section.

The combined plant effluent, including the circulating water blowdown stream, discharges into Lake Ontario 457 m (1,500 ft) from the shoreline in approximately 10.7 m (35 ft) of water. The chemical makeup of this stream is determined principally by the ambient lake water quality, as concentrated (average 1.67 times) and treated in the closed-cycle cooling system. Additions of other effluent streams resulting from station operation, which provide small quantities of various constituents on a variable schedule, are discussed in Section 3.6.1.

Table 5.5-1 lists the expected composition of the wastewater stream at the point of discharge, along with laboratory-determined acute toxicity levels for each of the constituents. Toxicity data for Lake Ontario species were used whenever possible. In cases where tests were conducted under a variety of conditions, the data chosen showed water quality most similar to Lake Ontario. Table 5.5-2 shows proposed EPA water quality criteria for protection of aquatic life. The 24-hr average values as well as peak levels are included. In those cases where the level must be calculated using ambient hardness, a level of 90 mg/l as $CaCO_3$ was used as representative of Lake Ontario waters in the Nine Mile Point vicinity (Section 2.3.3).

For most constituents, maximum effluent concentrations at the point of discharge are well below levels that have been reported to be acutely toxic to aquatic life (Table 5.5-1). These levels would be further diluted as the discharge rapidly mixes with lake water.

The calculated effluent concentrations for chlorine, at the point of discharge, copper, and zinc could exceed toxic levels based on continuous exposures for 48 to 96 hr. However, this is considerably longer than the exposure expected at Unit 2, even if organisms are entrained near the discharge ports (Section 5.3.2.2). Because of the rapid dilution of the plume with lake water and the high water velocities near the discharge ports, organisms will only be exposed to potentially harmful concentrations for periods of less than a few minutes. Dilution is projected to be approximately 3:1 in the first 4 m (13 ft) and 6:1 in 11 m (35 ft) (Section 5.3.2.1). For example, LC values for 30-min exposures to chlorine, which are still far in excess of anticipated exposures at Unit 2, are higher than the maximum concentrations expected at the discharge ports (Table 5.5-1). Thus, the exposure duration will be short and is not expected to have a significant impact on Lake Ontario biota.

The effluent from the sewage treatment plant will contain phosphates and nitrogen that could contribute to an increase in algal biomass near the discharge[6]. However, this small nutrient addition is expected to have no detectable effect on the biota of Lake Ontario beyond the immediate discharge area. Chlorine will be added to the sanitary waste treatment effluent as required by the SPDES permit to control pathogenic organisms.

No impact on aquatic life is anticipated from the remaining effluent sources, i.e., storm water, roof, yard, and floor drainage.

5.5.3.2 Discharges to Air

The emissions of combustion products from the diesel generators and fire pump will not adversely affect air quality. Likewise, particulate emissions from the cooling tower (Section 5.5.2.2) resulting in ambient concentrations far below federal and state air quality standards will not create an adverse impact on air quality. Other atmospheric considerations associated with cooling tower emissions are discussed in Section 5.3.3.1.1. Analytical results demonstrate that there are no significant adverse atmospheric impacts associated with cooling tower operation.

5.5.3.3 Solid Waste Land Impacts

Cooling tower sludge will be disposed of in a licensed sanitary landfill. Through proper operation and maintenance

of a licensed disposal facility, impacts from land disposal can be minimized.

Sludge generated from the combined sanitary waste treatment plant, treating wastes from Units 1 and 2, will be disposed of by a licensed contractor whose disposal practices will meet the requirements of New York State solid waste management facilities (NYCRR Title 6, Chapter 360). Compliance with these regulations will assure mitigation of impacts.

5.5.4 Unavoidable Adverse Impacts

Any impacts associated with nonradiological waste systems are addressed in Sections 5.5.2 and 5.5.3.

5.5.5 Irreversible and Irretrievable Commitment of Resources

The nonradiological waste resulting from the operation of Unit 2 will cause no irreversible and irretrievable commitment of land, water, or air resources.

5.5.6 References

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TABLE 5.5-1

COMPARISON OF UNIT 2 COMBINED PLANT EFFLUENT,
LAKE ONTARIO WATER QUALITY AT NINE MILE POINT,
AND BIOLOGICAL EFFECTS FOR SELECTED CHEMICAL CONSTITUENTS

Constituent	Lake Concentration[1] Mean (mg/l)	Lake Concentration[1] Maximum (mg/l)	Effluent Concentration[1] Mean (mg/l)	Effluent Concentration[1] Maximum (mg/l)	Biological Effects[2] Concentration (mg/l)	Biological Effects[2] Hardness (mg/l as $CaCO_3$)	Biological Effects[2] Criterion	Source[3]
Sodium	16	26	23	42	1,640		48-hr LC50 <u>Daphnia magna</u>	Becker and Thatcher[7]
Calcium	42	47	56	73	160		96-hr LC50 <u>Gambusia affinis</u>	Ellis et al[8]
Chloride	35	53	48	82	5,000		96-hr LC50 <u>Morone saxatilis</u> juveniles	Hughes[9]
					1,000		<u>M. saxatilis</u> larvae	Hughes[9]
Magnesium	8	9	11	14	16,500		96-hr LC50 <u>Gambusia affinis</u>	Mackee and Wolf[10]
Sulfate	31	40	99	147	12,500 (as Na_2SO_4)		96-hr LC50 <u>Lepomis macrochirus</u>	Becker and Thatcher[7]
					3,500		<u>M. saxatilis</u> juveniles	Hughes[9]
					250		<u>M. saxatilis</u> larvae	Hughes[9]
Nitrate	<0.18	0.32	<0.24	0.50	10,000 (as $NaNO_3$)		96-hr LC50 <u>L. macrochirus</u>	Becker and Thatcher[7]
Chromium	<0.001	0.002	<0.001	0.003			96-hr LC50	
					0.067 (as K_2CrO_4)	45	<u>Gammarus pseudolimnaeus</u>	EPA[11]
					6.4		<u>Daphnia magna</u>	Dowden and Bennett[12]
					69.0 (as		<u>Salmo gairdneri</u>	Benoit[13]
					59.0 $K_2Cr_3O_7$)		<u>S. fontinalis</u>	Benoit[13]
					110.0-213.0		<u>L. macrochirus</u>	EPA[11]
Copper	<0.019	<0.066	<0.027	<0.105			96-hr LC50	
					0.1 (as $CuSO_4$)	100	<u>Limnodrilus hoffmeister</u>	Wurtz and Bridges[14]
					0.02 (as $CuSO_4$)	35-55	<u>Gammarus pseudolimnaeus</u>	Arthur and Leonard[15]
					0.91	50	<u>Gammarus sp.</u>	Rehwoldt el al[16]
					0.007-0.027	44-245	<u>Daphnis pulicaria</u>	EPA[17]
					60-74 (as $CuCl_2$)	89-99	<u>Oncorhynchus kisutch</u>	EPA[17]
					6.2-6.4 ($CuNO_3$)	53-55	<u>Morone americana</u>	Rehwoldt et al[18,19]
					6.97	100	<u>Micropteros salmoides</u>	Birge and Black[20]
Iron	0.091	0.172	0.122	0.267	6.0		96-hr LC50 <u>Morone saxatilis</u>	Hughes[9]

TABLE 5.5-1 (Cont)

Constituent	Lake Concentration[1]		Effluent Concentration[1]		Biological Effects[2]			
	Mean (mg/l)	Maximum (mg/l)	Mean (mg/l)	Maximum (mg/l)	Concentration (mg/l)	Hardness (mg/l as $CaCO_3$)	Criterion	Source[3]
Manganese	0.018	0.039	0.024	0.061	16		*Salmo gairdneri* 96-hr LC50	Thurson et al[21]
					0.37-4.0 (as $MnSO_4$)		5-23% increase in mortality of *S. gairdneri* eggs during 29-day exposure	Lewis[22]
							Pimephales promelas	
					33.8		96-hr LC50	Kimball[23]
					19.7		28-day survival in embryo larval test was 48%	Kimball[23]
							D. magna	
					13.5		96-hr LC50	Kimball[23]
					8.99		28-day LC50	Kimball[23]
Nickel	<0.004	0.009	<0.005	0.014			96-hr LC50	
					13 (as $NiNO_3$)	50	*Gammarus* sp.	Rehwoldt et al[16]
					1.9-2.3 (as $NiCl_2$)	100-104	*D. magna*	EPA[24]
					35.5 (as $NiNO_3$)		*S. gairdneri*	Hale[25]
					13.6-13.7	53-55	*M. americana*	Rehwoldt et al[18,19]
					5.2-5.4	20	*L. macrochirus*	Pickering and Henderson[26]
					39.6	360	*L. macrochirus*	
Zinc	<0.048	0.281	<0.065	0.437			96-hr LC50	
					8.1	50	*Gammarus* sp.	Rehwoldt et al[16]
					0.525 (as $ZnCl_2$)	105	*D. magna*	EPA[27]
					4.6 (as $ZnCl_2$)	94	*O. kisutch*	EPA[27]
					1.76 (as $ZnCl_2$)	83	*S. gairdneri*	Chapman and Stevens[28]
					14.3-14.4 (as $ZnNO_3$)	53-55	*M. americana*	Rehwoldt et al[18,19]
					0.41	20-52	12-day LC50 *S. gairdneri*	Spehan et al[29]
Chlorine-(Total residual-TRC)	0	0	<0.092	<0.27			96-hr LC50	
					0.22 (as total chloramine)		*G. pseudolimnaeus*	Arthur and Eaton[30]
					0.017 (as TRC)		*D. magna*	Ward and DeGraeve[31]
					0.037		*S. gairdneri*	Ward and DeGraeve[32]
					0.071		*Salvelinus* sp.	Ward and DeGraeve[32]
							48-hr LC50	
					1.102		*Gammarus* sp.	Ward and DeGraeve[32]
							S. trutta	Ward and DeGraeve[32]

TABLE 5.5-1 (Cont)

Constituent	Lake Concentration[1] Mean (mg/l)	Lake Concentration[1] Maximum (mg/l)	Effluent Concentration[1] Mean (mg/l)	Effluent Concentration[1] Maximum (mg/l)	Biological Effects[2] Concentration (mg/l)	Biological Effects[2] Hardness (mg/l as $CaCO_3$)	Biological Effects[2] Criterion	Source[3]
Chlorine (Cont)					1.19 (17°C)		96-hr LC50 after	Basch and Truchan[33]
					0.56 (21°C)		30-min exposure	
							30-min LC50	Brooks and Seegert[34]
					8.0 (10°C)		*M. americana*	Brooks and Seegert[34]
					1.1 (20°C)		*M. americana*	Brooks and Seegert[34]
					0.7 (30°C)		*M. americana*	Brooks and Seegert[34]
					2.15 (10°C)		*Alosa pseudoharangus*	Brooks and Seegert[34]
					1.70 (20°C)		*Alosa pseudoharangus*	Brooks and Seegert[34]
					0.30 (30°C)		*Alosa pseudoharangus*	Brooks and Seegert[34]
					1.26 (10°C)		*O. kisutch*	Brooks and Seegert[34]
					1.38 (15°C)		*O. kisutch*	Brooks and Seegert[34]
					0.9 (20°C)		*O. kisutch*	Brooks and Seegert[34]

[1] From Table 3.6-1

[2] Based on a survey of available literature and selection of most appropriate data as an indicator of potential effects on Lake Ontario organisms.

[3] See Section 5.5.6 (References).

TABLE 5.5-2

PROPOSED WATER QUALITY CRITERIA
TO PROTECT FRESHWATER AQUATIC LIFE

Constituent[1]	24-hr Average Concentration (ug/l)	Level Never To Be Exceeded (ug/l) Criterion	Level Never To Be Exceeded (ug/l) Value at Hardness of 90 mg/l as $CaCO_3$	Source[2]
Chromium hexavalent	0.29	21	21	EPA[11]
Chromium trivalent	-	$e^{(1.08[\ln(\text{hardness})] + 3.48)}$	4,187.2	EPA[11]
Copper	5.6	$e^{(0.94[\ln(\text{hardness})] - 1.23)}$	20.1	EPA[17]
Nickel	$e^{(0.76[\ln(\text{hardness})] + 1.06)}$ (equals 88.2 ug/l at a hardness of 90 mg/l as $CaCO_3$)	$e^{(0.76[\ln(\text{hardness})] + 4.02)}$	1,701.5	EPA[24]
Zinc	47	$e^{(0.83[\ln(\text{hardness})] + 1.95)}$	294.4	EPA[27]

[1] Measured as total recoverable.
[2] See Section 5.5.6 (References).

5.6 TRANSMISSION SYSTEM IMPACTS

5.6.1 Terrestrial

Consideration has been given to the potential for ecological impacts resulting from both the presence of transmission facilities in the ecosystem and the need to maintain the right-of-way (ROW). The existence and magnitude of any impacts are a function of the transmission line design, the characteristics of the areas crossed by the ROW corridor, and the maintenance practices employed.

5.6.1.1 Impact on Flora

Operation of the Nine Mile 2-Volney 345-kV transmission line is not expected to have any significant negative impact on the flora within or adjacent to the corridor. Although herbicides will be used during maintenance of the ROW (Section 5.6.1.3), only properly licensed chemicals will be used in an approved manner. Herbicides will only be used on undesirable species that could interfere with the transmission lines. It is expected that in time low-growing vegetative communities will become established within the corridor, thereby reducing the amount of vegetative maintenance required.

No rare or threatened plant species listed by the U.S. Fish and Wildlife Service or the New York State Department of Environmental Conservation (NYSDEC) are known to be present within or adjacent to the corridor (Section 2.4.1.1.2); thus, no adverse impact to such species is possible.

5.6.1.2 Impact on Fauna

Little or no impact from operation and maintenance of the transmission lines and ROW is expected on fauna. During the initial maintenance period, any fauna reestablished after construction may be disturbed occasionally by crews clearing and/or treating undesirable tree species, but even this will occur less frequently with time.

Operation or maintenance of the Nine Mile 2-Volney 345-kV transmission line or corridor will not have a significant impact on important species of fauna. Species classified as endangered or threatened by the U.S. Fish and Wildlife Service use the vicinity only occasionally in the spring, summer, or fall. Except for the possibility of bird collisions as discussed in the following paragraph, the operation and maintenance of the transmission line and corridor are not expected to have an impact on these species.

Commercially important species have adequate habitat in the area. Therefore, operation and maintenance of the transmission line and corridor will not have a significant impact on these species (Section 2.4.1.1.3).

Some potential exists for the loss of birds that collide with transmission lines, particularly during adverse weather conditions. The extent of such losses, however, is difficult to determine. Most incidences of birds striking wires go unnoticed for the following reasons:

1. Limited human activity in areas where strikes are most frequent.

2. Dead birds lying beneath wires often are concealed by dense vegetation.

3. Injured or dead birds are removed by predators and scavengers.

4. Inclement weather conditions reduce the chance for recovery.

In general, reported bird mortalities due to collisions with transmission lines are low in comparison to those caused by other obstacles such as television transmitting towers[1]. Mortality caused by collision with power lines appears to be more prevalent among large-sized birds such as waterfowl and wading birds[2]. Collisions are more common where transmission lines are perpendicular to the flight paths along migratory corridors or in areas where birds are involved in frequent local movements. Birds flying at high speeds and at low altitudes are more susceptible in these areas. Two recent bibliographies address avian mortality at manmade structures including transmission lines[2,3].

The proposed Nine Mile 2-Volney corridor does not cross large open wetlands, where the potential for strikes by low-flying birds is high. Brushland and agriculture are the primary land uses in open areas along the ROW. Most bird flight activity there will be close to the ground and of short duration. The line also follows an existing transmission corridor and thus would provide only a slight increase in potential impact. During long-distance migration, birds will usually be flying at higher altitudes and thus will not encounter any transmission lines. However, since the lines are in the airspace, there is potential for a few bird strikes.

5.6.1.3 Right-of-Way Management

The potential for ecological impacts resulting from maintaining the transmission corridor will be minimized by following an ecologically sound management program.

As part of the Environmental Management and Construction Plan (EM&CP) that will be prepared by NMPC and submitted to the New York State Public Service Commission (PSC) prior to construction of the transmission line, surveys will be conducted to provide the information necessary to formulate a ROW management program. This information will be documented on a site-by-site basis using analysis forms (Site Analysis Survey) and aerial mosaic maps. Items of importance relating to the selection of clearing methods and ROW management techniques include the location and areal extent of woodland; the location of sensitive areas such as streams, wetlands, croplands, and highway crossings; and the proportions and densities of desirable and undesirable species[4,5]. The primary objective of the ROW management program, as part of the EM&CP, is the elimination of vegetation that could obstruct or damage the transmission lines or which could hinder access required for routine or emergency activities. This objective is accomplished through the utilization of proven, sound vegetation management and control techniques, including the Site Analysis Survey (geographic, topographic, and vegetative characterization of the ROW); selective clearing and slash disposal techniques based on the Site Analysis Survey; protective measures for stream crossings, wetlands, and agricultural lands; limitations on the construction and location of access roads; and the controlled (stump, basal, or foliar spray) application of approved herbicides. The method and pattern of vegetation management is planned to retain desirable growth to the extent practical, while effectively eradicating only undesirable species. New and improved techniques are evaluated and incorporated into the ROW management program when warranted.

Selectively retaining compatible, low-growing tree and shrub species is another objective of the ROW management program. This practice fosters the natural development of dense old field shrub (low-growing) communities, which provide competition to invading undesirable species. This community frequently differs from vegetative communities adjacent to the ROW, resulting in the creation of greater vegetative diversity and improved wildlife habitat.

The ROW will also be managed to maximize compatibility with environmentally and visually sensitive areas. Where

required, this will be accomplished through the retention of vegetative buffer zones at significant streams, other sensitive water bodies, and road crossings, and through the application of selective management techniques to eventually convert these buffers to naturally invading low-growing species that are compatible with both the transmission line facility and aesthetic or other environmental considerations.

Other objectives of the ROW program include management of the ROW for compatibility with the agricultural, recreational, and other multiple-use activities.

During preparation of the EM&CP, the ROW is divided into individual areas or sites (Section 2.4.1.2.2). Information is developed on a site-by-site basis during each survey. Forms used during the EM&CP and during each successive assessment are kept on file, serve as documentation of changes in vegetation and ROW conditions, and serve as information concerning the environmental impact of construction, restoration, and management of the transmission facility.

NMPC keeps ROW clearing to the minimum width necessary for construction, operation, and maintenance of the transmission facility. A cleared ROW width of 23 m (75 ft) on each side of the centerline has been established by NMPC as a standard for 345-kV lines. NMPC-established procedures for selective clearing and slash disposal, access route layout, structure laydown site designation, and restoration measures protect undisturbed vegetation and topsoil to the extent practical. NMPC utilizes a variety of selective clearing and slash disposal methods that are environmentally compatible with each site; consideration also is given to soil stability, protection of desirable vegetation, and protection of adjacent resources. These concerns are addressed in detail in the EM&CP.

NMPC cleanup and restoration plans include grading, seeding, and fertilizing when required on exposed mineral soil resulting from construction activities. Necessary erosion control measures such as ditching and water barriers installed during construction will not exceed 8 workdays after initial disturbance. Where initial disturbance occurs in snow or frozen soil conditions, temporary control measures will be installed such as cross ditching and mulching. Seeding will be initiated as soon as soil conditions are conducive.

NMPC-established procedures for stream protection, which include no equipment access areas, restricted activities

areas, clearing and slash disposal methods, stream-crossing devices, erosion control and restoration measures, and consultation with NYSDEC protect streams crossed by the transmission line.

NMPC utilizes herbicides in both construction and maintenance of the transmission facility. During construction, while clearing operations are progressing, it is anticipated that a stump herbicide treatment and/or basal treatment prior to cutting will be applied. It is further anticipated that a second herbicide treatment will be applied to vegetation of the ROW sometime between its second and fourth full-growing seasons. The actual time and method for this second treatment will be determined following a ROW inventory, whereby vegetative and physical conditions of the ROW will be considered in preparing the treatment plan. It is anticipated that methods for the second treatment will include stem foliar, basal, and cut and stump treatments. However, changing technology could alter application methods of both treatments. Therefore, more definite plans will be discussed in the EM&CP. Only those herbicides approved by the EPA and NYSDEC will be used. It is anticipated that picloram, triclopyr, and 2, 4-D herbicides will be utilized; however, at the time of treatment the use of other EPA- and NYSDEC-approved herbicides may be more prudent. Mixtures, rates, and volumes applied will be in accordance with label instructions.

In the maintenance phase, after construction is complete, the transmission line is included in the ROW management program for existing lines. In accordance with the PSC-approved system-wide Transmission Right-of-Way Management Program prepared by NMPC, an assessment is conducted within 4 yr after the last treatment. The purpose of this assessment is to: 1) document vegetation and ROW conditions, 2) determine whether to treat the area, and 3) specify maintenance techniques and materials. The maintenance treatment will occur the year following the ROW inventory. Assessments, ROW inventories, and treatments will continue throughout the life of the facility. Subsequently, at intervals of 5 to 8 or more years, vegetation management techniques described in the PSC-approved system-wide NMPC Transmission Right-of-Way Management Program, and/or in accordance with future PSC-approved ROW management programs, will be utilized as necessary to maintain system reliability. Only approved herbicides will be utilized at mixture rates and volumes in accordance with label instructions.

5.6.2 Aquatic

5.6.2.1 Identification of Operational and Maintenance Activities Associated With Transmission Facilities

As discussed in Section 2.4.2.2, there are few aquatic habitats crossed by the transmission route. None of these are unique environments, and no threatened or endangered fish or aquatic invertebrates are present.

The actual operation of the transmission electrical system and ROW, as described in Section 3.7 and the New York State Article VII Application filed in April 1982, has very little potential for adverse impact on aquatic ecosystems[5]. Activities necessary to maintain the transmission lines and the corridor are sufficiently planned and controlled to protect aquatic communities along the route.

Care was taken during initial clearing to restrict activity in stream and wetland areas. In the year prior to conducting ROW maintenance, a site-by-site inventory will be performed to document vegetative conditions and to prescribe vegetative control measures. Stream and wetland areas will be identified, and vegetative control methods suitable to those areas will be prescribed. Where it is necessary to use herbicides, they will be applied, as appropriate, on a site-by-site basis. The most effective, approved herbicide available at the time of application will be used. The use of herbicides will be restricted in stream and wetland areas. Application (if any) in these sensitive areas will follow techniques and use amounts directed by the herbicide label, and will be in compliance with all applicable permits and regulations. Any vehicular access required during maintenance activities in these sensitive areas will be limited to existing access roads and stream crossings to avoid damage or erosion to these areas.

In summary, there is little potential for impact on aquatic habitats due to transmission line maintenance and operation.

5.6.3 Transmission System Impacts to Man

5.6.3.1 Land Use Impact

Construction of the new transmission line is discussed in detail in the Article VII application[5]. Land use changes resulting from line construction will be limited because the new transmission line will be located within an existing transmission corridor. No land use changes are expected from the operation of the new transmission facility. No

areas within the ROW will be taken from designated public use. A relatively small area (approximately 6 percent) in the corridor supports active farming. Transmission structures will not preclude agricultural activities in the ROW. The transmission line corridor is shown on Figure 2.4-4.

Highway and rail transportation routes have not been affected by existing transmission lines and, therefore, are not expected to be affected by operation and maintenance of the new transmission line.

Operation of the transmission line will comply with all applicable local, state, and federal regulations and standards.

5.6.3.2 Audible Noise from Transmission Lines

Noise can be generated from transmission line corona discharges resulting from moisture on the high-voltage conductors. Corona discharge noise levels generated by a 345-kV transmission line during heavy rain conditions have been measured to be about 51 dBA at a distance of 38 m (125 ft). As the distance from the transmission line increases, the noise level decreases to approximately 43 dBA at 152 m (500 ft) and 36 dBA at 305 m (1,000 ft)[6]. During light rain or dense fog conditions, these noise levels would be approximately 5-8 dBA lower. Installation of the Unit 2 transmission lines within the existing transmission line corridor can result in an intermittent noise level increase of approximately 3 dBA for a total of 54 dBA at a distance of 38 m (125 ft) from the transmission lines. Since the Unit 2 transmission line will be located within the existing transmission line corridor and since very few residences are located adjacent to the transmission line, audible noise from the 345-kV transmission lines is not expected to constitute a major new noise impact in the area.

5.6.3.3 Means to Reduce Impacts of Transmission Systems

NMPC has experienced no significant environmental problems associated with the electromagnetic and electrostatic effects of 115-kV and 345-kV transmission systems. The audible and visible effects of corona discharge are intermittent, depending on atmospheric conditions, and are substantially reduced by present-day, high-voltage equipment. In addition, these effects, when detectable, are usually of low intensity and are unnoticeable. NMPC has also experienced no significant problem with electromagnetic noise or radio interference.

Electrical field strength for the Unit 2 transmission system is discussed in Section 3.7. To date, Electric Power Research Institute (EPRI) sponsored research and research from other sources have demonstrated that the electric fields emanating from 115-kV and 345-kV transmission lines do not have adverse biological effects on humans.

Ozone production is associated almost exclusively with corona discharge. In the design of the 345-kV transmission lines, this phenomenon has been compensated for by avoiding the use of a single conductor per phase. Instead of a single conductor, critical spacing and two conductors per phase are used, breaking up the concentrated electrical field around a single conductor and thereby mitigating corona and ozone production.

NMPC has not included any new or unusual designs in any of the routes, towers, distances and dimensions, or any other engineering variables that may present new or adverse environmental impacts. Based upon the success of present designs, NMPC expects no significant effects to the environment or the public from the operation of Unit 2 transmission lines.

5.6.3.4 Maintenance Practices to Reduce Visual Impacts

Visual impact of the 345-kV line from Unit 2 to the Volney Substation is expected to be minimal, because it is located within an existing transmission line corridor and because of the remote location and limited use of lands and roads surrounding the combined ROWs. One state road and two county roads cross the 14.4-km (9-mi) line. Traffic volumes on roads in the area are low (Section 2.2.1). Views from roads crossing the line will be partially screened by vegetation and topography.

Existing roads will be utilized to a large extent for transmission line construction. New access roads will be constructed as required. Selective cutting at road crossings will reduce visual impact for persons using roads that cross the transmission line corridor. Selective clearing will be employed in woodland and brushland areas. Complete clearing will take place only at construction sites and access roads.

Land cover in the vicinity of the transmission line is primarily woodland (Section 2.4). There are actively farmed areas in the vicinity of O'Connor and Hall Roads. Significant views of structures and the ROW from most of the scattered residential properties along the ROW and from sight lines of travelers driving through the area will be

largely screened by intervening vegetation or structures. Some individual residences on County Route 1, Lily Marsh Road, County Route 29, and Hall Road will have views of the new transmission line[5]. Naturally growing shrubs and certain low-growing trees will be maintained at road crossings to provide partial screening of the facility. Private property ownership along the ROW will limit public access to the corridor.

5.6.4 References

1. Lee, J. M., Jr. Effects of Transmission Lines on Bird Flights: Studies of Bonneville Power Administration Lines. Paper presented at the Workshop on Impact of Transmission Lines on Migratory Birds, Oak Ridge, TN, 1978.

2. Weir, R.D. Annotated Bibliography of Bird Kills at Man-Made Obstacles: A Review of the State of the Art and Solutions. Department of Fisheries and the Environment, Canadian Wildlife Service, Ontario Region, Ottawa, Canada, 1976.

3. Avery, M.L.; Springer, P.F.; and Dailey, N.S. Avian Mortality at Man-Made Structures: An Annotated Bibliography. United States Fish and Wildlife Service, Office of Biological Services, 1978.

4. Niagara Mohawk Power Corporation. Article VII Application: Nine Mile 2-Volney 765-KV Transmission Facility, 1978.

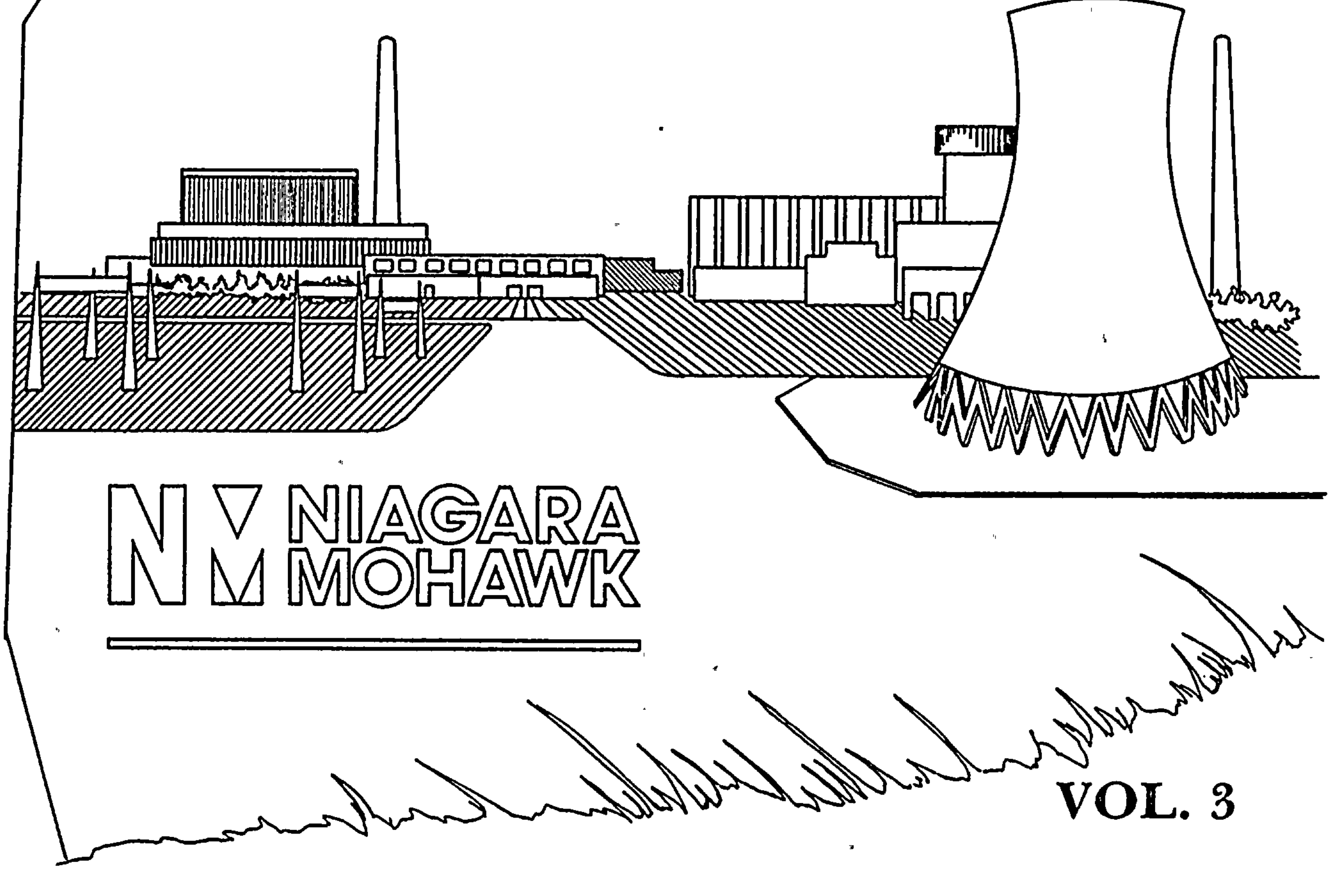
5. Niagara Mohawk Power Corporation. Article VII Application: Nine Mile 2-Volney 345-KV Transmission Facility, 1982.

6. Electric Power Research Institute (EPRI). Transmission Line Reference Book for 345 KV and Above. Chapter 6, Audible Noise. 1975.

ENVIRONMENTAL REPORT

OPERATING LICENSE STAGE

NINE MILE POINT NUCLEAR STATION — UNIT 2



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5.7 URANIUM FUEL CYCLE IMPACTS

The environmental effects of the uranium fuel cycle, including uranium mining and milling, the production of uranium hexafluoride, isotopic enrichments, fuel fabrication, reprocessing of irradiated fuel, transportation of radioactive materials, and management of low-level and high-level wastes, are set forth in Table S-3 of paragraph (e) of 10CFR51.20, which is provided as Exhibit 5.7-1. Rn-222 and Tc-99 (the values of which are not provided in Table S-3) are under consideration by the NRC.

Chapter 10 provides a comparison of the environmental effects of Unit 2 versus the benefits of the plant.

Table S-3.—*Table of Uranium Fuel Cycle Environmental Data*[1]

[Normalized to model LWR annual fuel requirement [WASH-1248] or reference reactor year [NUREG-0116]]

Environmental considerations	Total	Maximum effect per annual fuel requirement or reference reactor year of model 1,000 MWe LWR
NATURAL RESOURCES USE		
Land (acres):		
Temporarily committed [2]	100	
Undisturbed area	79	
Disturbed area	22	Equivalent to a 110 MWe coal-fired power plant.
Permanently committed	13	
Overburden moved (millions of MT)	2.8	Equivalent to 95 MWe coal-fired power plant.
Water (millions of gallons):		
Discharged to air	160	=2 percent of model 1,000 MWe LWR with cooling tower.
Discharged to water bodies	11,090	
Discharged to ground	127	
Total	11,377	<4 percent of model 1,000 MWe LWR with once-through cooling.
Fossil fuel:		
Electrical energy (thousands of MW-hour)	323	<5 percent of model 1,000 MWe LWR output.
Equivalent coal (thousands of MT)	118	Equivalent to the consumption of a 45 MWe coal-fired power plant.
Natural gas (millions of scf)	135	<0.4 percent of model 1,000 MWe energy output.
EFFLUENTS—CHEMICAL (MT)		
Gases (including entrainment): [3]		
SO_x	4,400	
NO_x [4]	1,190	Equivalent to emissions from 45 MWe coal-fired plant for a year.
Hydrocarbons	14	
CO	29.6	
Particulates	1,154	
Other gases:		
F	67	Principally from UF_6 production, enrichment, and reprocessing. Concentration within range of state standards—below level that has effects on human health.
HCl	.014	
Liquids:		
SO_4^-	9.9	From enrichment, fuel fabrication, and reprocessing steps. Components that constitute a potential for adverse environmental effect are present in dilute concentrations and receive additional dilution by receiving bodies of water to levels below permissible standards. The constituents that require dilution and the flow of dilution water are: NH_3—600 cfs. NO_3—20 cfs. Fluoride—70 cfs.
NO_3^-	25.8	
Fluoride	12.9	
Ca^{++}	5.4	
Cl^-	8.5	
Na^+	12.1	
NH_3	10.0	
Fe	.4	
Tailings solutions (thousands of MT)	240	From mills only—no significant effluents to environment.
Solids	91,000	Principally from mills—no significant effluents to environment.
EFFLUENTS—RADIOLOGICAL (CURIES)		
Gases (including entrainment):		
Rn-222		Presently under reconsideration by the Commission.
Ra-226	.02	
Th-230	.02	
Uranium	.034	
Tritium (thousands)	18.1	
C-14	24	
Kr-85 (thousands)	400	
Ru-106	.14	Principally from fuel reprocessing plants.
I-129	1.3	
I-131	.83	
Tc-99		Presently under consideration by the Commission.
Fission products and transuranics	.203	
Liquids:		
Uranium and daughters	2.1	Principally from milling—included tailings liquor and returned to ground—no effluents, therefore, no effect on environment.
Ra-226	.0034	From UF_6 production.
Th-230	.0015	
Th-234	.01	From fuel fabrication plants—concentration 10 percent of 10 CFR 20 for total processing 26 annual fuel requirements for model LWR.
Fission and activation products	5.9×10^{-6}	
Solids (buried on site):		
Other than high level (shallow)	11,300	9,100 Ci comes from low level reactor wastes and 1,500 Ci comes from reactor decontamination and decommissioning—buried at land burial facilities. 600 Ci comes from mills—included in tailings returned to ground. Approximately 60 Ci comes from conversion and spent fuel storage. No significant effluent to the environment.
TRU and HLW (deep)	1.1×10^{7}	Buried at Federal Repository.
Effluents—thermal (billions of British thermal units)	4,063	<5 percent of model 1,000 MWe LWR.
Transportation (person-rem):		
Exposure of workers and general public	2.5	
Occupational exposure (person-rem)	22.6	From reprocessing and waste management.

[1] In some cases where no entry appears it is clear from the background documents that the matter was addressed and that, in effect, the Table should be read as if a specific zero entry had been made. However, there are other areas that are not addressed at all in the Table. Table S-3 does not include health effects from the effluents described in the Table, or estimates of releases of Radon-222 from the uranium fuel cycle or estimates of Technetium-99 released from waste management or reprocessing activities. These issues may be the subject of litigation in the individual licensing proceedings.

Data supporting this table are given in the "Environmental Survey of the Uranium Fuel Cycle," WASH-1248, April 1974, the "Environmental Survey of the Reprocessing and Waste Management Portion of the LWR Fuel Cycle," NUREG-0116 (Supp. 1 to WASH-1248); the "Public Comments and Task Force Responses Regarding the Environmental Survey of the Reprocessing and Waste Management Portions of the LWR Fuel Cycle," NUREG-0216 (Supp. 2 to WASH-1248); and in the record of the final rulemaking pertaining to Uranium Fuel Cycle Impacts from Spent Fuel Reprocessing and Radioactive Waste Management, Docket RM-50-3. The contributions from reprocessing, waste management and transportation of wastes are maximized for either of the two fuel cycles (uranium only and no recycle). The contribution from transportation excludes transportation of cold fuel to a reactor and of irradiated fuel and radioactive wastes from a reactor which are considered in Table S-4 of § 51.20(g). The contributions from the other steps of the fuel cycle are given in columns A-E of Table S-3A of WASH-1248.

[2] The contributions to temporarily committed land from reprocessing are not prorated over 30 years, since the complete temporary impact accrues regardless of whether the plant services one reactor for one year or 57 reactors for 30 years.

[3] Estimated effluents based upon combustion of equivalent coal for power generation.

[4] 1.2 percent from natural gas use and process.

SOURCE: Office of the Federal Register, Code of Federal Regulations, 10CFR51.20(e). General Services Administration, Washington, DC, January 1, 1980.

5.8 SOCIOECONOMIC IMPACTS

5.8.1 Physical Impacts

5.8.1.1 Land Use Impacts

Of the 364-ha (900-acre) site owned by NMPC, approximately 13.5 ha (33.4 acres), or 3.7 percent of the total area, will be affected by Unit 2 operation. Unit 2 facilities account for 5.9 ha (14.5 acres), while parking, roads, and railroad spurs account for the balance of 7.6 ha (18.9 acres). The remaining site land will be generally unaffected by operations, except for providing access to the plant buildings and laydown storage space. Specific land uses and roadways are identified in Section 2.2.1.1.

A private east-west road, connecting county Route 1A and NYS Route 29, is located on NMPC property. This road will be used for site access by the operation work force for the delivery and pickup of maintenance and refuse materials and, to some extent, by Scriba town residents.

In addition, a rail spur that was built onsite, from the Consolidated Railroad's Oswego-Mexico branch line, will be used occasionally during plant operation to transport materials that are used for maintenance and operation. However, shipments will be delivered more regularly by truck via Lake Road, NYS Route 29, and US Route 104 during working hours, 7:00 am to 5:30 pm. The frequency of operation materials deliveries is limited, generally less than that associated with construction materials. Further, the area within 3 km (1.9 mi) of the site is sparsely populated. Therefore, deliveries of operation and maintenance materials are expected to have a minimal effect on the local area.

Unit 2 operation will have no impact on historic or recreational sites in the area. Section 3.1.2 discusses the visual impact of Unit 2.

5.8.1.2 Nonradioactive Gaseous Emissions

Economic and social effects of plant operation resulting from nonradioactive gaseous emissions will be negligible, since the auxiliary boilers will be electrically operated (i.e., no emissions) and the fossil-fired diesel generators and fire pumps will be operated infrequently. Section 3.6.3.4 discusses emissions in more detail.

Plant operation is not expected to create any adverse meteorological conditions outside the plant boundary that

would result in economic or financial loss to the area. This aspect of plant operation is discussed in Section 5.3.3.1.4.

5.8.1.3 Potential Adverse Impacts Due to Noise

This section discusses several potential noise sources, predicts their noise level impact in the surrounding community, and compares these estimated levels with the measured ambient sound levels discussed in Section 2.10 and listed in Table 2.10-2.

The Community Sound Level computer model (COMSOL EN-055), developed by Stone & Webster Engineering Corporation (SWEC), was used to predict the noise impact due to Unit 2 operation. This computer program models each of the power plant noise sources with respect to their generated noise characteristics and their onsite location relative to a fixed reference point (the center of the reactor building). The sound levels for each noise source are then extrapolated to each of the receiver locations, which, for the purposes of this analysis, are the nine measurement locations selected for the ambient sound level survey (Figure 2.10-1). The COMSOL sound propagation model calculates the effects of hemispherical divergence, atmospheric absorption, source directivity and reflectivity, and barrier attenuation due to the surrounding power plant structures. No corrections are made for the attenuation effects of trees, topography, or meteorological conditions. The predicted noise levels from Unit 2 are, therefore, conservative; i.e., the actual plant noise levels in the community during operation will frequently be less than indicated. At each receiver location, the sound level contribution from each noise source is determined and the overall predicted impact is calculated (the logarithmic sum of the noise sources).

To predict the noise impact expected from the operation of Unit 2, the following primary noise sources were modeled for the COMSOL computer input:

1. Natural-draft cooling tower.
2. Four main transformers (three of four operating).
3. Two reserve transformers.
4. Two auxiliary transformers.
5. Normal station transformer.

6. Turbine building (estimates of interior noise levels propagating through the turbine building walls).

7. Large ventilation supply and exhaust fans for the turbine, reactor, and radwaste buildings.

Unit 2 operational noise levels for each of the preceding noise sources were calculated at the ambient measurement locations shown on Figure 2.10-1. The predicted Unit 2 noise levels are given in Table 5.8-1, which also includes the measured ambient noise levels (including the operating noise levels from Unit 1 and the JAF plant) for comparison.

At all offsite locations, Unit 2 noise levels are predicted to be less than 40 dBA. Predicted noise levels along the southwest boundary of the power plant (Lakeview Road) range from 33 dBA at location 2 to 37 dBA at location 1. Predicted noise levels along Miner Road, south of the plant, range from 28 dBA at location 3 to 32 dBA at location 9. Along the southeast boundary of the power plant (Route 29), predicted noise levels range from 28 dBA at location 3 to 39 dBA at location 6.

An analysis of the predicted noise levels from each of the primary noise sources indicates that, in areas east of the power plant (locations 4, 5, and 6), the reactor building ventilation system supply fans located at the rear of the standby gas treatment building are the dominant noise source (above 30 dBA), with a level of 37 dBA at location 6. At all other locations, the noise levels from each of the individual noise sources were less than 30 dBA. However, the total noise level obtained by logarithmically adding these noise sources generally produced noise levels in the range of 25-39 dBA, depending on the distance of each location from Unit 2. Also, because of the distance of the natural-draft cooling tower from the nearest property line (approximately 1.6 km [1 mi] to locations 1 and 6), predicted noise levels from this source are expected to be less than 29 dBA.

Combining (logarithmically adding) the predicted Unit 2 operational noise levels (Table 5.8-1, column 7) and the measured ambient noise levels (Table 5.8-1, column 5, without crickets) results in the expected overall noise levels listed in Table 5.8-1, column 8. These results indicate that, with Unit 2 operating, the expected noise levels at each of the measurement locations will increase between 1 and 4 dBA, except at location 6 where the increase will be approximately 7-8 dBA. This increase at location 6

is primarily due to the expected impact from the reactor building ventilation supply fans. Although the addition of Unit 2 will result in a general increase in ambient sound levels, these levels are in compliance with both HUD (45 dBA) and EPA (49 dBA) noise guidelines, discussed in Section 2.10.3, which are used to define community noise acceptability.

5.8.2 Social and Economic

5.8.2.1 Direct Impact of Station Operation

Ad valorem taxes for Unit 2 have been estimated for the first 10 yr of plant operation. The estimated payments are listed in Table 5.8-2 and apply only to Unit 2. Estimated tax payments range from $15,147,586 in the first year of station operation to $29,149,859 in the tenth year (1982 dollars).

Effects of these revenues on the town of Scriba and Oswego County depend on local planning of capital expenditures. The potential exists for the town of Scriba and the county of Oswego to gain significant benefits from the taxes generated by Unit 2.

5.8.2.2 Impacts Associated With Operating Staff

The operating staff for Unit 2 is expected to number approximately 300. To the extent possible, operating personnel will be drawn from the local area. Other personnel are expected to settle in communities surrounding Unit 2 throughout the county.

Some operating personnel and their families will probably settle in the town of Scriba, but no significant impacts are anticipated from their relocation. In the town of Scriba and Oswego County, existing public services, including police, fire, school, and medical, are able to absorb some growth. In addition, as discussed in Section 2.5.2, recreational opportunities are available throughout the county and throughout the region surrounding Unit 2.

Because a portion of the construction work force of as many as 5,000 has been accommodated in the region without a significant impact, it is expected that the operation staff will disperse throughout the region and not impact any community.

Scheduled station outages are expected every 12 to 24 months. The additional workers required during these

periods are expected to seek temporary lodging within the local area. This would not impact any community. However, it will result in increased revenue to local businesses in the area.

TABLE 5.8-1

COMPARISON OF MEASURED AMBIENT NOISE LEVELS WITH PREDICTED UNIT 2 NOISE LEVELS

Location	Measurement Period (hr)	dBA Levels for: L_{90} Community Noise Analyzer*	dBA Levels for: L_{90} Hand-Held Statistical Data*	dBA Levels Calculated from Residual Octave Band Data: With Crickets	dBA Levels Calculated from Residual Octave Band Data: Without Crickets	Predicted Unit 2 Noise Levels (COMSOL)	Predicted Unit 2 Levels + Measured Ambient Levels
1	Day 0700-2200	37-43	38-44	39-44	35-36	37	39-40
	Night 2200-0700	34-42	34-40	34-40	33-36		34-40
2	Day 0700-2200	32-36	34-40	35-42	27-33	33	34-36
	Night 2200-0700	35-36	30-34	32-35	31-32		35-36
3	Day 0700-2200	40-48	46-48	48-49	29-32	28	32-34
	Night 2200-0700	45-47	44-50	45-49	32-36		34-36
4	Day 0700-2200	31-38	38-44	38-46	35-37	35	38-39
	Night 2200-0700	30-32	32-40	34-40	27-35		35-38
5	Day 0700-2200	-	40-46	41-48	37	32	38
	Night 2200-0700	-	31-40	31-40	28-37		34-38
6	Day 0700-2200	-	36-46	37-44	32-33	39	39-40
	Night 2200-0700	-	38-40	38-41	29-31		39
7	Day 0700-2200	-	42	41	29	25	31
	Night 2200-0700	-	42	42	34		34
8	Day 0700-2200	-	44-46	44-49	35-38	33	37-39
	Night 2200-0700	-	38	42	31		35
9	Day 0700-2200	-	44-48	44-50	31-36	32	35-38
	Night 2200-0700	-	32-42	34-41	31-38		35-39

*Noise dBA level exceeded 90 percent of the time.

TABLE 5.8-2

ESTIMATED REAL ESTATE AND PERSONAL PROPERTY TAXES
TO BE PAID ON UNIT 2
(In Millions of Dollars)[1]

Year	NMPC Portion[2]	Co-Owner Portion	Total Tax
1986	6,210,510	8,937,076	15,147,586
1987	6,791,645	9,773,344	16,564,989
1988	7,288,794	10,488,752	17,777,546
1989	7,822,333	11,256,529	19,078,862
1990	8,394,928	12,080,507	20,475,435
1991	9,009,437	12,964,800	21,974,237
1992	9,668,928	13,913,823	23,582,751
1993	10,376,693	14,932,316	25,309,009
1994	11,136,267	16,025,361	27,161,628
1995	11,951,442	17,198,417	29,149,859

(1) 1982 dollars.
(2) NMPC retains 41 percent ownership of Unit 2.

5.9 DECOMMISSIONING AND DISMANTLING

The potential environmental impacts associated with decommissioning and dismantling Unit 2 at the end of its useful life are assessed in this section, including current plans and policies.

5.9.1 Plans and Policies for Action to be Taken at the End of the Plant's Useful Life

Unit 2 is designed for an operating life of approximately 40 yr. Therefore, its decommissioning activities are expected to commence about 2026. The current NMPC policies for decommissioning and dismantling Unit 2 are to use the most economical approach based on then-demonstrated technologies, as well as one that is consistent with regulatory requirements to ensure the health and safety of the decommissioning workers and the public.

Current NMPC plans for decommissioning and dismantling Unit 2 are based on the immediate removal and disposal of all materials and structures, radioactive or not, and restoring the site to essentially preconscruction condition.

5.9.2 Decommissioning Plans as Described in Regulatory Guide 1.86

Regulatory Guide 1.86 identifies three basic options for the decomissioning of nuclear power plants at the end of their useful life. However, based on analyses that are a part of the NRC's ongoing Rulemaking on Decommissioning, the NRC has indicated that options not involving removal will be unacceptable and that prompt removal decommissioning is the preferred method. Based on this NRC position, plus economic assessments indicating that prompt removal is comparable to, or less expensive than, other options that involve ultimate removal, NMPC intends to perform prompt removal decommissioning. This method includes removal of all fuel assemblies, radioactive fluids, and other materials having activities above accepted unrestricted activity levels, disposal offsite to an approved facility, and site restoration. The monetary costs associated with current NMPC plans for prompt removal decommissioning of Unit 2, as well as the long-term uses of the land and the amount of land irretrievably committed are presented as follows.

5.9.2.1 Monetary Costs

The total cost of decommissioning Unit 2 is estimated to be $123 million in terms of 1982 dollars.

5.9.2.2 Site Condition After Decommissioning and Dismantling

Upon completion of the decommissioning and dismantling activities, the Unit 2 site will have been restored to essentially preconstruction condition for unrestricted use, except for parts of the electrical switchyard which may remain in the NMPC system electrical grid.

5.9.2.3 Amount of Land Irretrievably Committed

The construction and operation of Unit 2 has been and will be conducted to preclude the irreversible and irretrievable commitments of land. In addition, current NMPC plans for decommissioning call for immediate removal and disposal of all materials and structures. As a result, no land is foreseen to be irretrievably committed.

5.9.3 Summary of Adverse Environmental Impacts

The principal environmental impact of decommissioning a reactor will be the occupational radiation doses received by the decommissioning workers. These doses will be minimized in accordance with the intent of ALARA, and in no case will individual dosages exceed permissible levels. Very small amounts of radioactivity could be released off site as a consequence of onsite decommissioning, but onsite radioactive material control practices will assure that these are minimal and substantially below permissible levels. In addition, there may be small amounts of nonradioactive dust associated with physical demolition, but these will be controlled to acceptable limits by employment of standard demolition dust control practices. Finally, there will be truck or rail transport of demolition equipment, of radioactive wastes packaged in licensed containers to licensed disposal sites, and of nonradioactive components and wastes to a local licensed landfill or other disposal or salvaged equipment site. Approximately 2 yr before the actual decommissioning, a detailed assessment of environmental impacts will be made as a part of the licensing process, and mitigation procedures appropriate to the specific circumstances that prevail at that time will be undertaken.

5.9.4 Commitment of Resources for the Site

Consideration has been given, during plant design, to measures or features that facilitate operations activities. To the extent that design features that make decontamination easier for operational reasons also improve the ease of

decommissioning, such features are available. However, in many areas, the goals of safe operation are in conflict with the goals of easing decommissioning (such as structural strength for seismic reasons versus easier demolition), and operational safety goals must prevail. Thus, there is essentially no commitment of present resources that are uniquely relevant to future decommissioning.

The commitment of future resources is best represented in aggregate by the cost of decommissioning, which is identified in Section 5.9.2.1. These costs include labor, equipment rental, and a variety of materials and fuels that are used in the decommissioning activity.

5.10 MEASURES AND CONTROLS TO LIMIT ADVERSE IMPACTS

Many features of the design and operation of Unit 2 limit adverse environmental impacts. Impacts relative to the operation of Unit 2 have been discussed previously in this chapter. The principal features of Unit 2 provided to limit or minimize environmental impacts are the cooling tower, the discharge diffuser system, the intake/fish return system, shoreline protection, and various waste treatment systems. These and other mitigative measures are discussed in the following paragraphs.

5.10.1 Noise Impacts

Site and Vicinity

Because of the location of Unit 2 on the site, and the design of the various plant systems, noise levels are in compliance with both HUD and EPA guidelines (Section 5.8.1.3) and no additional mitigative measures are required.

Transmission Corridor and Offsite Areas

Considering the transmission line voltage, rural nature of the area, and location of the line adjacent to an existing corridor, no major noise impact is expected. Therefore, no mitigative measures are needed.

5.10.2 Erosion

Site and Vicinity

Erosion is not expected to be a concern during Unit 2 operation. The shoreline is protected by the revetment-ditch system. All other site areas are graded and either paved or planted with grass or other vegetation to prevent erosion.

Transmission Corridor and Offsite Areas

Erosion potential will be limited in the transmission line corridor by the maintenance practices discussed in Section 5.6.2.1. In general, vegetative buffers will be retained in stream and wetland areas, and vehicular access will be restricted to existing access roads and stream crossings.

5.10.3 Impacts of Effluents and Wastes on Water Quality

Site and Vicinity

As discussed in Section 5.5.3, the two major wastes discharged to Lake Ontario are the combined plant discharge (cooling tower blowdown, service water discharge, chemical waste treatment, and treated liquid radwaste effluent) and the sanitary system effluent. These effluents are subject to appropriate treatment as necessary to comply with federal effluent limitations and state water quality standards (Section 5.5). There are no effluents or wastes that will affect groundwater quality.

Transmission Corridor and Offsite Areas

There are no effluents potentially affecting surface or groundwater quality associated with the operation of the transmission line.

5.10.4 Surface Water Impacts

Site and Vicinity

Unit 2 operation is expected to have little impact on Lake Ontario, the only surface water body affected. Consumptive water use of the plant is small (Sections 3.3.1 and 5.2). In addition, the shoreline revetment-ditch system does not affect current patterns in the lake. The site drainage path has been improved by the presence of Unit 2 and does not alter any permanent water bodies.

The cooling tower reduces the amount of water utilized; consequently, operation of the intake system does not significantly alter natural velocity patterns in the area (Section 5.3.1). As a result of cooling tower operation, reduced heat is dissipated in Lake Ontario. The discharge diffuser system, while adding small amounts of heat to the lake, is designed and operated to minimize bottom scouring and to rapidly mix the heated effluent with ambient lake water (Section 5.3.2.1). In the worst case, surface water temperatures are increased by less than 1.7°C (3°F) and comply with New York State thermal criteria.

Transmission Corridor and Offsite Areas

Unit 2 operation will have minimal impact on surface water bodies (streams and wetlands) crossed by the transmission corridor because of the proposed mitigative measures (Section 5.6.2).

5.10.5 Groundwater Impacts

As discussed in Sections 5.2.1.1 and 5.2.2.1, Unit 2 operation has no impact on groundwater outside the vicinity of the plant.

5.10.6 Terrestrial Ecosystem Impacts

<u>Site and Vicinity</u>

The potential for adverse impact on plants or animals in the vicinity of the site due to Unit 2 operation is extremely low (Section 5.3.3.2).

<u>Transmission Corridor and Offsite Areas</u>

Minimal impact is expected due to the operation and maintenance of the transmission line. Successional development within the corridors will be held in the old field stage, creating a greater vegetative diversity and improved wildlife habitat (Section 5.6.1). The right-of-way (ROW) management plan is designed to protect ecologically sensitive areas in the transmission corridor.

5.10.7 Aquatic Ecosystem Impacts

<u>Site and Vicinity</u>

The intake and discharge systems of Unit 2 are designed and operated to minimize impact on aquatic organisms. The small volume of water utilized, the low intake velocities, and the presence of a fish protection and removal system result in minimal potential impact to Lake Ontario aquatic populations (Section 5.3.1.2). Similarly, the diffuser discharge system with its low-volume, high-velocity plume will minimize thermal impacts on the biota of Lake Ontario (Section 5.3.2.2). Benthic habitats may be subjected to some minor scouring near the diffuser, and planktonic organisms may briefly be subjected to thermal stress during plume entrainment. However, no observable impacts are anticipated. Due to high discharge velocities, fish will not be able to maintain position in areas of the plume where potentially harmful temperatures occur. Further, fish will not be subject to cold shock, as discussed in Section 5.3.2.2.

<u>Transmission Corridor and Offsite Areas</u>

Section 5.6.2 discusses the impact of transmission line maintenance and operation on aquatic life. The potential

for impact is small since few aquatic habitats are crossed by the corridor. The transmission line maintenance program, which limits access to existing roads and stream crossings, and provides vegetative buffer areas around the streams and wetlands, protects these habitats.

5.10.8 Socioeconomic Impacts

Site and Vicinity

The adverse land use impacts associated with Unit 2 operation are minimal and are related to the visual impact of the cooling tower under certain meteorological conditions (Section 5.1.1). Similarly, adverse socioeconomic impacts are insignificant because the small operating staff is dispersed over a relatively large geographic area (Section 5.8). No mitigative actions are necessary to control socioeconomic impacts.

Transmission Corridor and Offsite Areas

Because of the location of the transmission line within an existing ROW and the agricultural uses of the ROW, there will be no socioeconomic impacts (Sections 5.1 and 5.8).

5.10.9 Other Site-Specific Impacts

There are no other known impacts of operation on the environment in the vicinity of Unit 2.

APPENDIX 5A

DOSE CALCULATION MODELS AND ASSUMPTIONS

APPENDIX 5A

DOSE CALCULATION MODELS AND ASSUMPTIONS

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APPENDIX 5A

DOSE CALCULATION MODELS AND ASSUMPTIONS

Calculation of dose rates to biota other than man was performed by means of the computer programs ARRRG and CRITER[1], developed at the Pacific Northwest Laboratory of Battelle Memorial Institute under contract to the Atomic Energy Commission (AEC), currently the Nuclear Regulatory Commission (NRC). The calculation of the dose rate to deer and the resultant dose to the maximum individual from the consumption of these animals was performed using the Stone & Webster Engineering Corporation (SWEC) computer code BAMBIE, which employs the methodology of CRITER, and Regulatory Guide 1.109, Revision 1. Except where noted, the calculation of doses to man was performed using the methodology described in Regulatory Guide 1.109, Revision 1. Bioaccumulation factors used in ARRRG and CRITER have been updated to correspond to the latest published values in Regulatory Guide 1.109, Revision 0 (plants) and Regulatory Guide 1.109, Revision 1 (all others).

A summary of the dose models and a list of assumptions used for the site are contained in this Appendix and in Tables 5A-1 through 5A-3.

5A.1 DOSE TO BIOTA OTHER THAN MAN

5A.1.1 Internal Doses to Aquatic Organisms

Aquatic organisms were considered to receive an internal dose rate from uptake and concentration of radiochemicals in the water and from exposure through the food chain. Dose rates to primary organisms were calculated directly from radioisotopic concentrations in discharge water and from equilibrium bioaccumulation factors listed in Table 5.4-3. The dose rate through the food chain was estimated for secondary organisms such as muskrats and raccoons feeding on primary organisms whose radionuclide content was estimated in the first calculation.

The dose rates to biota other than man are expressed in units of mrad rather than mRem, since mRem is the unit used specifically to express the effect of radiation on human tissue. Therefore, when dose conversion factors for man (expressed in mRem/yr) are used to derive dose rates to biota other than man, it is assumed that mRem/yr equals mrad/yr for biota.

Equations used by the program CRITER for these calculations are as follows:

$$(DR)_i = AE_i b_i \qquad (5A\text{-}1)$$

Where:

$(DR)_i$ = Dose rate for radionuclide i (mrad/yr)

E_i = Effective absorbed energy (MeV/disintegration in organ of interest)

b_i = Specific body burden of nuclide i (pCi/kg)

A = Conversion factor
= $0.0187 \frac{\text{dis-kg-mrad}}{\text{pCi-yr-MeV}}$

and:

$$b_i = C_{iw} B_i$$

Where:

C_{iw} = Concentration of nuclide i in water (pCi/l)

B_i = Equilibrium bioaccumulation factor for nuclide i (pCi/kg per pCi/l)

The concentration in water C_{iw} is calculated from:

$$C_{iw} = 1,119 \frac{Q_i R_i M_p}{F} \exp(-\lambda_i t_p) \qquad (5A\text{-}2)$$

Where:

Q_i = Release rate of nuclide i (Ci/yr)

R_i = Reconcentration factor to estimate recycling of effluent (dimensionless)

M_p = Mixing ratio at point of exposure (1/dilution factor)

F = Flow rate of the liquid effluents (cfs)

λ_i = Radiological decay constant of nuclide i (hr^{-1})

t_p = Transit time for nuclides to reach point of exposure (hr)

1,119 = Constant to convert Ci/yr per cfs to pCi/l

The total-body dose rate to secondary organisms was calculated as[1]:

$$DR'_i = 0.365\ b_i\ P'\ D'_i \qquad (5A\text{-}3)$$

Where:

DR'_i = Total-body dose rate to secondary organisms due to nuclide i (mrad/yr)

0.365 = kg-day/g-yr

b_i = Specific body burden of nuclide i (pCi/kg)

P' = Consumption rate of primary organisms by the secondary organisms (g/day)

and:

$$D'_i = 70{,}000\ \frac{D_i(\text{man})}{e_i(\text{man})}\ \frac{e'_i}{m'}$$

D_i(man) = Total-body dose conversion factor for man for radionuclide i $\left(\frac{\text{mRem}}{\text{pCi}}\right)$

e_i(man) = Effective absorbed energy for man for radionuclide i (meV/disintegration)

e'_i = Effective absorbed energy for secondary organism for radionuclide i (meV/disintegration)

m' = Mass of secondary organisms (grams)

70,000 = Total-body mass of adult (grams)

The actual equation used by CRITER was of the form:

$$DR' = 2.86 \times 10^7 \frac{M_p P'}{F\ m'} \sum_{i=1}^{n} Q_i\ R_i\ B_i\ e'_i \exp\left(-\lambda_i t_p\right)\left[D_i/e_i\right]^{(man)} \qquad (5A\text{-}4)$$

Where:

DR' = Total-body dose rate to secondary organisms (mrad/yr)

n = 136, number of radionuclides

2.86×10^7 = (0.365) (1,119) (70,000)

All other terms are as previously defined.

5A.1.2 External Doses to Aquatic Organisms

5A.1.2.1 Doses From Shoreline Deposits

The doses from shoreline deposits were calculated using the following equation:

$$(DR)' = 111{,}900 \frac{U_p M_p W_f}{F} \sum_{i=1}^{n} Q_i\ R_i\ T_i \exp\left(-\lambda_i\ t_p\right)\left(1-\exp\left(-\lambda_i t\right) D_{ipr}\right) \qquad (5A\text{-}5)$$

Where:

$(DR)'$ = Total-body dose to organisms from shoreline deposits (mrad/yr)

U_p = Duration of exposure to external radiation sources (hr/yr)

W_f = Shore width factor
= 0.3 (lake shoreline)

T_i = Radiological half-life of radionuclide i (days)

t = Total time the sediment is exposed to the contaminated water, normally taken to be the operating lifetime of the facility (hr)

D_{ipr} = Dose conversion factor for radionuclides deposited in lake sediments (mrad/hr per pCi/m^2)

111,900 = Factor to convert (Ci/yr)/(cfs) to pCi/l and to account for the proportionality constant used in the sediment radioactivity model

All other terms are as previously defined.

5A.1.2.2 Dose From Swimming and Water Surface Exposure

The doses from swimming and water surface exposure were calculated using the following equation:

$$(DR)_{pr} = 1,119 \frac{U_p M_p}{F K_p} \sum_{i=1}^{n} Q_i R_i D_{ipr} \exp\left(-\lambda_i t_p\right) \qquad (5A\text{-}6)$$

Where:

$(DR)_{pr}$ = Total-body dose rate to primary and secondary organisms (mrad/yr)

K_p = Hemispherical correction constant, 1 for total water immersion, and 2 for water surface activities

All other terms are as previously defined.

5A.1.2.3 Dose From Immersion in Gaseous Effluents

These doses were calculated in the same manner as doses to humans, with appropriate changes in use factors as presented in Table 5A-1.

5A.2 DOSE TO HUMANS

Dose rates to humans were calculated using the equations recommended in Regulatory Guide 1.109, Revision 1.

5A.2.1 Doses From Liquid Pathways

The generalized equation for calculating radiation doses to humans via liquid pathways is:

$$R_{aipj} = (C_{ip})\ (U_{ap})\ (D_{aipj}) \qquad (5A\text{-}7)$$

Where:

R_{aipj} = Annual dose to organ j, of an individual of age group a, from nuclide i, via pathway p (mRem/yr)

C_{ip} = Concentration of nuclide i, in the media of pathway p (pCi/l, pCi/kg, or pCi/m^2)

U_{ap} = Exposure time or intake rate (usage) associated with pathway p, for age group a (hr/yr, l/yr, or kg/yr, as appropriate)

D_{aipj} = Dose factor, specific to age group a, radionuclide i, pathway p, and organ j (mRem/pCi ingested or mRem/hr per pCi/m^2 from exposure to deposited activity in sediment or on the ground)

5A.2.1.1 Potable Water

The doses from ingestion of potable water were calculated using the following equation:

$$R_{apj} = 1{,}100\ \frac{M_p\ U_{ap}}{F} \sum_i Q_i\ D_{aipj}\ \exp\left(-\lambda_i\ t_p\right) \qquad (5A\text{-}8)$$

Where:

R_{apj} = Total annual dose to organ j, of individuals of age group a, from all nuclides i, in pathway p (mRem/yr)

M_p = Mixing ratio (reciprocal of the dilution factor) at the point of exposure, or the point of withdrawl of drinking water, or point of harvest of aquatic food (dimensionless)

F = Flow rate of the liquid effluent (cfs)

Q_i = Release rate of nuclide i (Ci/yr)

λ_i = Radioactive decay constant of nuclide i (hr^{-1})

t_p = Average transit time required for nuclides to reach point of exposure. For internal dose, t_p is the total time elapsed between release of the nuclides and ingestion of food or water (hr)

1,100 = Factor to convert Ci/yr per cfs to pCi/l

All other terms are as previously defined.

5A.2.1.2 Aquatic Foods

The doses from ingestion of aquatic food were calculated using the following equation:

$$R_{apj} = 1{,}100 \frac{U_{ap} M_p}{F} \sum_i Q_i B_{ip} D_{aipj} \exp\left(-\lambda_i t_p\right) \quad (5A-9)$$

Where:

R_{apj} = Total annual dose to organ j, of individuals of age group a, from all nuclides i, in pathway p (mRem/yr)

B_{ip} = Equilibrium bioaccumulation factor for nuclide i, in pathway p, expressed as the ratio of the concentration in biota (pCi/kg) to the radionuclide concentration in water (pCi/l), (l/kg)

M_p = Mixing of ratio (reciprocal of the dilution factor) at the point of exposure (or the point of withdrawal of drinking water, or point of harvest of aquatic food), (dimensionless)

F = Flow rate of the liquid effluent (cfs)

Q_i = Release rate of nuclide i (Ci/yr)

λ_i = Radioactive decay constant of nuclide i (hr^{-1})

t_p = Average transit time required for nuclides to reach the point of exposure. For internal dose, t_p is the total time elapsed between release of the nuclides and ingestion of food or water (hr)

1,100 = Factor to convert from Ci/yr per cfs to pCi/l

All other terms are as previously defined.

5A.2.1.3 Doses From Shoreline Deposits

The doses from shoreline recreation were calculated using the following equation:

$$R_{apj} = 110,000 \frac{U_{ap} M_p W}{F} \sum_i Q_i T_i D_{aipj} \left[\exp(-\lambda_i t_p)\right]\left[1-\exp(-\lambda_i t_b)\right] \qquad (5A\text{-}10)$$

Where:

R_{apj} = Total annual dose to organ j, of individuals of age group a, from all nuclides i, in pathway p (mRem/yr)

W = Shoreline width factor that describes the geometry of the exposure (dimensionless)
= 0.3 (lake shoreline)

T_i = Radiological half-life of nuclide i (days)

t_b = Period of time for which sediment or soil is exposed to the contaminated water (hr)

110,000 = Factor to convert Ci/yr per cfs to pCi/l and to account for the proportionality constant used in the sediment radioactivity model

All other terms are as previously defined.

5A.2.1.4 Doses From Foods Grown on Land With Contaminated Water

The doses to the maximum individual from consumption of vegetables grown in a garden irrigated with receiving water were calculated using the following equation:

$$R_{apj} = U_{ap} \sum_{i}^{veg} C_{iv} D_{aipj} + u_{ap} \sum_{i}^{animal} C_{iA} D_{aipj} \qquad (5A\text{-}11)$$

Where:

R_{apj} = Total annual dose to organ j, of individuals of age group a, from all nuclides i, in pathway p (mRem/yr)

C_{iv} = Concentration of radionuclide i in the edible portion of crop species v (pCi/kg)

C_{iA} = Concentration of radionuclide i in the animal product, either meat or milk (pCi/kg or pCi/l)

All other terms are as previously defined.

5A.2.1.5 Doses From Swimming and Boating

The dose from swimming and boating was calculated using the methodology described in WASH 1258[2].

The equation for calculation of external dose to skin and total body from swimming (water immersion) or boating (water surface) is:

$$R_{apj} = 1{,}100 \frac{U_{ap} M_p}{F K_p} \sum_{i} Q_i D_{ij} \exp\left(-\lambda_i t_p\right) \qquad (5A\text{-}12)$$

Where:

K_p = Geometry correction factor equal to 1 for swimming and 2 for boating, dimensionless (no credit is taken for the shielding provided by the boat)

D_{ij} = Dose conversion factor for radionuclide i and organ j in water exposure (mRem/hr per pCi/l)

All other terms are as previously defined.

5A.2.2 Doses From Air Pathways

5A.2.2.1 Gamma and Beta Doses From Noble Gases Discharged to the Atmosphere

5A.2.2.1.1 Annual Gamma and Beta Air Doses From Noble Gas Releases

The annual gamma and beta air doses from noble gas releases were calculated using the following equations:

$$D^{\gamma}(r,\theta) \text{ or } D^{\beta}(r,\theta)$$

$$= 3.17\text{x}10^{4} \sum_{i} Q_i [\chi/Q](r,\theta) \left(DF_i^{\gamma} \text{ or } DF_i^{\beta}\right) \qquad (5A\text{-}13)$$

Where:

$D^{\gamma}(r,\theta)$, $D^{\beta}(r,\theta)$ = Annual gamma and beta air doses at distance r in the sector, at angle θ from the discharge point (mrad/yr)

Q_i = Release rate of the radionuclide i (Ci/yr)

$[\chi/Q](r,\theta)$ = Annual average gaseous dispersion factor at distance r in sector θ (sec/m³)

$DF_i^{\gamma}, DF_i^{\beta}$ = Gamma and beta air dose factors for a uniform semi-infinite cloud of radionuclide i, (mrad-m³/ pCi-yr)

$3.17\text{x}10^{4}$ = Number of pCi/Ci divided by the number of sec/yr

5A.2.2.1.2 Annual Total-Body Dose From Noble Gas Releases

The annual total-body doses from noble gas releases were calculated using the following equation:

$$D_{\infty}^{T}(r,\theta) = S_F \sum_{i} \chi_i (r,\theta) \, DFB_i \qquad (5A\text{-}14)$$

Where:

$D_\infty^T(r,\theta)$ = Annual total-body dose due to immersion in a semi-infinite cloud at distance r in sector θ (mRem/yr)

S_F = Attention factor that accounts for dose reduction due to shielding provided by residential structures (dimensionless)

$\chi_i(r,\theta)$ = Annual average ground-level concentration of radionculide i at distance r in sector θ (pCi/m^3)

DFB_i = Total-body dose factor for a semi-infinite cloud of the radionuclide i which includes the attenuation of 5 g/cm^2 of tissue ($mRem\text{-}m^3/pCi\text{-}yr$)

5A.2.2.1.3 Annual Skin Dose From Noble Gas Releases

The annual skin doses from noble gas releases were calculated using the following equation:

$$D_\infty^S(r,\theta) = 1.11\ S_F \sum_i \chi_i(r,\theta)\ DF_i^\gamma + \sum_i \chi_i(r,\theta)\ DFS_i \qquad (5A\text{-}15)$$

Where:

$D_\infty^S(r,\theta)$ = Annual skin dose due to immersion in a semi-infinite cloud at distance r in sector θ (mRem/yr)

DFS_i = Beta skin dose factor for a semi-infinite cloud of radionuclide i, which includes the attenuation by the outer "dead" layer of the skin ($mRem\text{-}m^3/pCi\text{-}yr$)

1.11 = Average ratio of tissue to air energy absorption coefficients

All other terms are as previously defined.

5A.2.2.2 Doses From Radioiodines and Other Radionuclides (Not Including Noble Gases) Released to the Atmosphere

5A.2.2.2.1 Annual Organ Dose From External Irradiation From Radionuclides Deposited Onto the Ground Surface

The annual organ dose from external irradiation from radionuclides deposited onto the ground surface was calculated using the following equation:

$$D_j^G (r,\theta) = 8{,}760\ S_F \sum_i C_i^G (r,\theta)\ DFG_{ij} \qquad \text{(5A-16)}$$

Where:

$D_j^G (r,\theta)$ = Annual dose to the organ j at location (r,θ), (mRem/yr)

S_F = Shielding factor that accounts for the dose reduction due to shielding provided by residential structures during occupancy (dimensionless)

$C_i^G (r,\theta)$ = Ground plane concentration of radionuclide i at distance r in sector θ (pCi/m^2)

DFG_{ij} = Open field ground plane dose conversion factor for organ j from radionuclide i (mRem-m^2/pCi-hr)

8,760 = Number of hours in a year

5A.2.2.2.2 Annual Organ Dose From Inhalation of Radionuclides in Air

The annual organ dose from inhalation of radionuclides in air was calculated using the following equation:

$$D_{ja}^A (r,\theta) = R_a \sum_i \chi_i (r,\theta)\ DFA_{ija} \qquad \text{(5A-17)}$$

Where:

$D_{ja}^A (r,\theta)$ = Annual dose to organ j, of an individual in age group a, at location (r,θ), due to inhalation (mRem/yr)

R_a = Annual air intake for individuals in age group a (m^3/yr)

$\chi_i(r,\theta)$ = Annual average concentration of radionuclide i, in air at location (r,θ) (pCi/m^3)

DFA_{ija} = Inhalation dose factor for radionuclide i, organ j, and age group a (mRem/pCi)

5A.2.2.2.3 Annual Organ Dose From Ingestion of Atmospherically Released Radionuclides in Food

The annual organ dose from ingestion of atmospherically released radionuclides in food was calculated using the following equation:

$$D^D_{ja}(r,\theta) = \sum_i DFI_{ija} \Big[U^v_a f_g C^v_i(r,\theta) + U^m_a C^m_i(r,\theta) + U^F_a C^F_i(r,\theta) + U^L_a f_1 C^L_i(r,\theta)\Big] \quad (5A\text{-}18)$$

Where:

$C^v_i(r,\theta)$, $C^m_i(r,\theta)$, $C^L_i(r,\theta)$, $C^F_i(r,\theta)$ = Concentrations of radionuclide i in produce (nonleafy vegetables, fruits, and grains), milk, leafy vegetables, and meat, respectively, at location (r,θ), (pCi/kg or pCi/l)

$D^D_{ja}(r,\theta)$ = Annual dose to the organ j of an individual in age group a from ingestion of produce, milk, leafy vegetables, and meat at location (r,θ), (mRem/yr)

DFI_{ija} = Ingestion dose factor for radionuclide i, organ j, and age group a (mRem/pCi)

f_g, f_l = Respective fractions of the ingestion rates of produce and leafy vegetables that are produced in the garden of interest

U_a^v, U_a^m, U_a^F, U_a^L = Annual intake (usage) of produce, milk, meat, and leafy vegetables, respecttively for individuals in age group a (kg/yr or l/yr)

5A.3 GENERAL EXPRESSION FOR POPULATION DOSES

The general expression for calculating the annual population-integrated dose is:

$$D_j^P = 0.001 \sum_d P_d \sum_a D_{jda} f_{da} \qquad (5A\text{-}19)$$

Where:

D_j^P = Annual population-integrated dose to organ j (total body or thyroid), (man-Rems or thyroid man-Rems)

P_d = Population associated with subregion d

D_{jda} = Annual population-integrated dose to organ j (total body or thyroid) of an average individual of age group a in subregion d (mRem/yr)

f_{da} = Fraction of the population in subregion d that is in age group a

0.001 = Conversion factor from mRem to Rem

Equation 5A-19 . used in conjunction with the preceding equations and average adult usage factors was used to calculate the population doses.

For further refinements on the preceding equation used to calculate the doses to man, refer to Regulatory Guide 1.109, Revision 1.

5A.4 REFERENCES

1. Soldat, S.K.; Robinson, N.M.; and Baker, D.A. Models and Computer Codes for Evaluating Environmental Radiation Doses. Battelle Pacific Northwest Laboratories, BNWL-1754, Richland, WA, February 1974.

2. Nuclear Regulatory Commission (NRC). 10CFR50, Appendix I, Annex: Concluding Statement of Position of the Regulatory Staff (Docket-RM-50-2), Guides on Design Objectives for Light-Water-Cooled Nuclear Power Reactors, 1973.

TABLE 5A-1

ASSUMPTIONS USED IN ESTIMATING DOSES TO AQUATIC AND TERRESTRIAL BIOTA

	Values Assigned					
	Primary Organisms	Secondary Organisms				
Parameter	(Fish, Crustaceans, Mollusks, Algae)	Muskrat	Heron	Duck	Raccoon	Deer
R (recirculation factor)	1	1	1	1	1	-
F (flow rate, cfs)	66.8	66.8	66.8	66.8	66.8	-
M (mixing ratio)[1]	0.17	0.17	0.17	0.17	0.17	-
W (shore width factor)	-	0.3	0.3	0.3	0.3	-
K (water immersion)	1	1	-	-	-	-
(water surface)	2	-	2	2	-	-
Effective radius (cm)	2	6	11	5	14	30
M mass (kg)	-	1	4.6	1	12	115
P food consumption (gpd)						
aquatic plants	-	100	-	100	-	-
fish	-	-	600	-	-	-
invertebrate	-	-	-	-	200	-
U usage (hr/yr)						
shoreline	-	2,922	2,922	4,383	2,191	-
water immersion	-	2,922	-	-	-	-
water surface	-	-	2,922	4,383	-	-
holdup time (hr)	0	0	0	0	0	-
Residence time (month)	12	12	12	12	12	12
Additional deer parameters[2]						
X/Q (sec/m^3)						
Release Point 1A[3]						8.86-09
Release Point 1B[4]						4.64-08
Release Point 2[5]						1.60-07
D/Q ($1/m^2$)						
Release Point 1A[3]						1.40-09
Release Point 1B[4]						4.31-09
Release Point 2[5]						3.51-09
Crop ingestion (kg/d)						10

TABLE 5A-1 (Cont)

Parameter	Values Assigned: Primary Organisms (Fish, Crustaceans, Mollusks, Algae)	Secondary Organisms: Muskrat	Heron	Duck	Raccoon	Deer
Vegetation yield (kg/sq m)						0.7
Vegetation exposure period (hr)						6,574.5
Holdup time - crop exposure to ingestion by deer						0.0
Effective soil surface density (kg/sq m)						240
Buildup time on soil, t_b(hr)						1.75+05
Crop retention factor particulates/iodine						0.2 particulates; 1.0 iodine
Absolute humidity (g/cu m)						10.3
Fraction of year deer consumes crop						0.75
C-14 fractional equilibrium ratio: continuous release						1.0
intermittent release						0.073

NOTE: 8.86-09 = 8.86×10^{-9}

(1)Edge of mixing zone and nearest shoreline
(2)1,603 m (5,259 ft) east
(3)Unit 2 stack (continuous)
(4)Unit 2 stack (intermittent)
(5)Radwaste/reactor building vent (continuous)

TABLE 5A-2

DILUTION FACTORS, POPULATION SERVED, AND TRAVEL TIMES FROM THE SITE

Public Water Systems[1]	Approximate Distance From Site to Point of Intake (mi)	Dilution Factor	Population Served (people/yr)	Transit Time to Intake (hr)
Ontario Water District	46 WSW	871	5,000	225
Williamson Water District	41 WSW	826	4,700	200
Wolcott Village	25 WSW	647	2,500	122
City of Oswego	11 WSW	471	32,000	54
Metropolitan Water Board Onondaga County[2]	8 WSW	464	120,000	39
Sackets Harbor Village	32 NNE	487	1,200	156
Chaumont Village	38 NNE	531	550	186
Sodus Village	36 WSW	773	4,500	176
Sodus Point	33 WSW	743	1,800	161
Cape Vincent Village	41 N	550	750	200
R. J. Sweezy	49 N	606	170	244
Township of Ernestown	48 NNW	606	892	244
Kingston Water Intake Plant, Kingston Ontario	47 N	582	77,000	244
Pickton Public Utility	48 NW	606	6,000	244
Kingston Township	46 N	582	22,000	244
Sandhurst Water Works	48 NNW	606	200	244

TABLE 5A-2 (Cont)

Incremental Regions[3] (km)	Approximate Distance From Site to Point of Analysis (km)	Dilution Factor	Population Usage (people/yr) Boating	Population Usage (people/yr) Recreation Shoreline	Transit Time to Point of Analysis (hr)
0 to 10	5	738	1.5+04	0	15
10 to 20	15	307	1.5+04	3.1+05	46
20 to 30	25	348	1.5+04	4.7+05	76
30 to 40	35	404	1.5+04	6.9+04	107
40 to 50	45	457	1.5+04	1.9+05	137
50 to 60	55	504	1.5+04	1.8+04	168
60 to 70	65	548	1.5+04	1.2+04	199
70 to 80	75	589	1.5+04	1.4+05	229

Other Locations[4]	Approximate Distance From Site to Point of Intake (km)	Dilution Factor	Transit Time to Intake (hr)
Edge of initial mixing zone[4]	0	5.9	0.0 (assumed)
Closest accessible shoreline[5]	15	307	46

NOTE: 1.5+04 = 1.5×10^4

[1] Public water supply systems used to calculate 80-km (50-mi) radius population doses from ingestion of potable water.
[2] Public water supply system used to calculate the dose to the maximum offsite individuals from the ingestion of potable water and irrigated foods.
[3] Regions used to calculate 80-km (50-mi) radius population doses from ingestion of fish, boating, shoreline recreation (assumed one-eighth of fish caught in each region), and swimming.
[4] Locations used to calculate doses to maximum offsite individuals from ingestion of aquatic foods, and from swimming and boating.
[5] Location used to calculate doses to maximum offsite individuals from shoreline recreation. Closest accessible shoreline - closest occupied beach.

TABLE 5A-3

PARAMETERS AND ASSUMPTIONS USED IN EQUATIONS FOR ESTIMATING DOSES TO HUMANS[1]

Parameter[2]	Values
Effluent flow rate, F (cfs)	66.8
Transit time, T_p[3]	[4]
Average irrigation rate, I ($l/m^2/hr$)	0.05
Fraction of year that crops are irrigated, f_i	0.5 (6 months)
Fractional equilibrium ratio of C-14, p	
Continuous releases	1
Intermittent release	0.073
Fraction of year that animals graze on pasture, f_p	0.5 (6 months)
Fraction of daily feed which is pasture grass when animal is grazing, f_s	1 (100%)
Absolute humidity of atmosphere at location of analysis, H (g/m^3)	10.3
Usage factor, U_{ap} (hr/yr of exposure)	
Swimming	
Maximum individual adult	100
Maximum individual teen	100
Maximum individual child	56
80-km (50-mi) radius population adult	3.4
80-km (50-mi) radius population teen	19
80-km (50-mi) radius population child	12
Boating	
Maximum individual adult	200
Maximum individual teen	200
Maximum individual child	114

TABLE 5A-3 (Cont)

Parameter[2]	Values
Boating (Cont)	
80-km (50-mi) radius population adult	70
80-km (50-mi) radius population teen	70
80-km (50-mi) radius population child	40
Total commercial U.S. fish harvest, V_p (kg/yr)	$1.1x10^9$
80-km (50-mi) commercial fish harvest, V_{dp}(kg/yr)	$2.7x10^5$
80-km (50-mi) sports fish harvest, V_{dp}' (kg/yr)	$2.8x10^6$
80-km (50-mi) milk production, V_{dp}'' (1/yr)	$6.3x10^8$
80-km (50-mi) meat production, V_{dp}''' (kg/yr)	$6.6x10^6$
80-km (50-mi) vegetation production, V_{dp}'''' (kg/yr)	$3.2x10^8$

(1) All parameters and assumptions used are recommended values from Regulatory Guide 1.109, Revision 1, in lieu of site-specific data.

(2) Site-specific parameters or parameters for which there are no recommended value.

(3) T used in calculations was increased, where appropriate, by the distribution or holdup time recommended by Regulatory Guide 1.109, Revision 1.

(4) Refer to Table 5A-2 for calculated values.

CHAPTER 6

ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

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ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.1 THERMAL

6.1.1 Preoperational/Preapplication Thermal Monitoring

Temperature measurements have been conducted at the Nine Mile Point site since 1969. Temperature profiles were collected at the site by Stone & Webster Engineering Corporation (SWEC) in 1969 and 1970. These measurements were part of the design studies for Unit 2 and the James A. Fitzpatrick (JAF) plant. During 1970, Dr. J. F. Storr commenced routine monitoring of the Nine Mile Point Unit 1 (Unit 1) thermal plume[1]. During 1972, discussions with the NRC staff led to Environmental Technical Specifications (ETS) (issued for Unit 1) requiring aquatic studies and thermal monitoring for the site. A similar ETS is part of the JAF plant operating license. These ETS (and their revisions) are the basis for most of the thermal and aquatic ecology studies conducted at the site. They also reflect the monitoring requirements resulting from the Unit 2 Environment Report - Construction Permit Stage (ER-CPS). From 1973 through 1978, temperature measurements to determine the movement and timing of natural lake thermal stratification were taken weekly from April through December[2]. These data, describing thermal structure at the site, fulfilled requirements of the Unit 1 and JAF plant operating license ETS.

In the fall of 1975, the JAF plant went into commercial operation. As required by the ETS, triaxial thermal plume and dye measurements were made in 1976 and 1977.

The following sections provide further details of the thermal monitoring of the site prior to construction of Unit 2. The results of these measurements are summarized in Section 2.3.1.1.1.

6.1.1.1 Measurements of Vertical Temperature Profiles

Each year from 1973 through 1978 weekly surveys were conducted from April through December at various water depths at three transects: directly off Unit 1 (NMPP), east of the plant (NMPE), and west of the plant (NMPW), as shown on Figure 6.6-1. The east or west transects act as controls depending on the ambient lake current, while the plant

transect is at the Unit 1 outfall. The study area includes the existing Unit 1 plume and the area potentially affected by Unit 2. Some data were also collected near the Oswego Steam Station, 11 km (7 mi) west of Nine Mile Point.

Measurements of temperature at 1-m (3.3-ft) intervals were made to define the seasonal progression of thermal stratification at the 30-m (100-ft) depth contour in 1973 through 1978, and at the 15-m (50-ft) depth contour in 1973 and 1974. Measurements were made with a Martek Mark II multiprobe analyzer, a Montedoro Whitney Model TF-20 thermistor, or a GM Model OC-1/S bathythermograph. Temperatures were also measured with most biological collections and water quality sampling; these data are consistent with the Unit 1 and JAF plant plume survey data described in Sections 6.1.1.2 and 6.1.1.3. The profile data were evaluated to identify when and where thermal stratification existed in the lake. Stratification is defined as a vertical temperature gradient in excess of 1°C/m (1.8°F/3.3 ft).

6.1.1.2 Unit 1 Plume Surveys

The Unit 1 plume surveys were conducted by Dr. J. F. Storr[1,3-7]. The area surveyed varied among dates in response to the Unit 1 thermal configuration. The western boundary was commonly 1 km (0.6 mi) west of Unit 1, while the eastern boundary of the surveyed area occasionally extended 1 km (0.6 mi) east of the JAF plant.

Instrumentation used in the surveys consisted of four thermistors spaced to measure the temperature at desired depths below the lake surface. The thermistor string was attached to a weighted line suspended from the side of the boat, with the topmost detector within the upper 0.3 m (1 ft) of water as the boat followed the transect course.

Four Rustrak recorders, Model 2133, and four Gulton Industries thermistor probes, #133, were used in each survey. In combination, the recording range is 0 to 40°C (32°F to 104°F), the accuracy is ±0.5 percent of the scale, and the response time is 90 percent in 5 sec. A Taylor precision thermometer (mercury) with an accuracy of ±0.1°C (±0.2°F) was used to calibrate the recorders prior to each thermal run. Later, the recorders were rechecked at ambient temperatures on the lake and in the discharge plume. Periodic checks of equipment were made throughout the study.

Temperature at the four detector depths was continuously recorded by a four-pen strip chart recorder. As the

preselected transect was followed, the recorder chart was marked when the traverse intersected another transect as sighted against a shoreline marker. Temperatures recorded at this time were plotted later as depth and isothermal points for that particular grid location. The course along each transect was maintained and temperatures recorded until the temperature was within about 0.5°C (1°F) of ambient.

To allow the determination and reproduction of boat location in the water, shoreline markers, in the form of triangular arrays of poles, were installed to form a base for each lakeward transect. The arrays were spaced at approximately 305-m (1,000-ft) intervals along the entire site shoreline. While one pair of poles was used to traverse a course along a 45-deg angle to the shore, a pair of poles at each shore base of successive transects was used to mark boat position along the course. Runs were made at speeds generally between 0.3 and 1.0 m/s (1 and 3 fps). Meteorological data were recorded during each survey.

A complete survey was performed on each day. Daily surveys were plotted as triaxial isotherm contours at 0.5°C (1°F) or 1.0°C (1.8°F) intervals on a grid map of the survey area. Ambient temperatures, meteorological conditions, and plant operating parameters were listed on each map.

6.1.1.3 James A. FitzPatrick Plant Plume Surveys

The JAF plume surveys, which included dye and temperature measurements, were conducted by Aquatec, Inc. under the direction of SWEC[8]. The study area included the JAF plant plume, the Unit 1 plume, and farfield ambient monitoring locations. The data acquisition system used in the surveys included a data logger which records on magnetic tape. This system was used to collect data in two sampling modes during the JAF plant hydrothermal surveys. In the first mode, horizontal sampling, the tracking boat traveled along a transect while water was pumped at a constant rate from selected depths and passed through the fluorometer cell(s) where its dye content was continuously measured. Water temperature was measured with a thermistor probe near the pump intake. In the second mode, vertical sampling, the boat remained stationary at a buoy and a hose was raised from the bottom to the surface at a constant rate while the sample was continuously pumped through the sensing units.

During those surveys when dye was used, Rhodamine WT dye was injected into the JAF plant circulating water system upstream of the center circulating water pump in the screenhouse, using an FMI positive displacement fluid

metering pump. The weight of the dye was recorded each hour as a check on the rate of dye release.

Circulating water intake and discharge dye concentrations were measured at the intake and discharge shafts inside the pumphouse. Measurements of dye scale readings and temperature, used for dye correction, were recorded on analog strip chart recorders. Background fluorescence was determined before each survey.

Following the survey, the dye concentrations were converted to equivalent temperature rises, neglecting atmospheric heat exchange and plotted as a calculated thermal plume.

Temperature measurements were converted to temperature rise by subtracting an ambient surface temperature for each survey. The resulting triaxial plume was then compared with the calculated thermal plumes, based on dye results, for surveys that included the dye release. These data are summarized in Section 2.3.1.1.1.

6.1.2 Operational Thermal Monitoring

Intake and discharge temperatures will be monitored as required by the NRC operating license and the New York State Department of Environmental Conservation State Pollutant Discharge Elimination System (SPDES) permit. Under average operating conditions, the Unit 2 discharge plume is predicted to encompass approximately 210 cu m (0.17 acre-ft). However, this size will vary depending upon unit heat rejection, nearshore lake dynamics, and local meteorology. Since maximum surface temperature rises will be less than 1.3°C (2.3°F) under all operating conditions, the discharge will be in full compliance with New York State surface temperature criteria (Section 5.3.2).

Operational thermal plume measurements will be conducted as required by the SPDES permit and the Environmental Protection Plan.

6.1.3 References

1. Storr, J.F. Mr. R. Clancy. Re: Three-Dimensional Thermal Study, Nine Mile Point, July 22, 1970. Prepared for Niagara Mohawk Power Corporation, January 16, 1971.

2. Lawler, Matusky & Skelly Engineers. Nine Mile Point Aquatic Ecology Study Summary (1973-1981). Prepared for Niagara Mohawk Power Corporation, 1982.

3. Storr, J.F. Mr. R. Clancy. Re: Three-Dimensional Thermal Studies, 1971. Prepared for Niagara Mohawk Power Corporation, February 15, 1972.

4. Storr, J.F. Mr. R. Clancy. Re: Three-Dimensional Thermal Surveys. Prepared for Niagara Mohawk Power Corporation, August 28, 1973.

5. Storr, J.F. Mr. R. Clancy. Re: Three-Dimensional Thermal Surveys, Nine Mile Point, 1973. Prepared for Niagara Mohawk Power Corporation, May 15, 1974.

6. Storr, J.F. Mr. R. Clancy. Re: Three-Dimensional Thermal Surveys, Nine Mile Point, 1974. Prepared for Niagara Mohawk Power Corporation, May 28, 1975.

7. Storr, J.F. Three-Dimensional Thermal Surveys, Nine Mile Point, 1975. Prepared for Niagara Mohawk Power Corporation, 1976.

8. Aquatec, Inc. James A. FitzPatrick Nuclear Power Plant, Second Operational Hydrothermal Survey, August 19 and 20, 1976. Power Authority of the State of New York. Prepared for Stone & Webster Engineering Corporation. Aquatec, Inc., South Burlington, VT, 1976.

6.2 RADIOLOGICAL

6.2.1 Preoperational Monitoring

The preoperational radiological environmental monitoring program for Unit 2 was described in Niagara Mohawk Power Corporation's Environmental Report, Construction Permit Stage, Nine Mile Point Nuclear Station Unit 2[1] and the Final Environmental Statement Related to Construction of Nine Mile Point Nuclear Station Unit 2[2]. The environmental monitoring program is expected to be modified by the NRC with the issuing of the Radiological Effluent Technical Specifications (RETS)[3,4]. The RETS are expected to be issued in 1983. Since this report is in support of an operating license, further discussion of preoperational monitoring is not required.

6.2.2 Operational Monitoring

6.2.2.1 Objectives

A radiological environmental monitoring program will be conducted to evaluate the effects of Unit 2 operation on the environs and to verify the effectiveness of the controls on radioactive materials sources.

6.2.2.2 Descriptions

The operational radiological environmental monitoring program for Unit 2 will be performed jointly with the James A. FitzPatrick (JAF) and Unit 1 plants. The program includes the collection and analysis of samples for air particulates, air radioiodine, direct radiation, surface lake water, shoreline sediment, milk, fish, and food crops. In addition, a yearly milch animal census will be conducted. The required sample collection and analysis frequencies are listed in Table 6.2-1.

Air sampling stations are located downwind of the site at locations where there is high potential for the presence of radionuclides. Three stations are located offsite in three different 22 1/2-deg sectors (the offsite areas are designated as sixteen 22 1/2-deg sectors originating from the center of the site). In addition to these three downwind stations, there is one station located near a community having the highest potential for the presence of radionuclides and one station located 14.5 to 32.2 km (9 to 20 mi) distant from the site. The designated stations sample ambient air for particulates and radioiodine. Air samples are collected weekly or as required by loading.

Samples are analyzed weekly for I-131 and for gross beta after each filter change. In addition, a gamma isotopic analysis for gamma-emitting nuclides is performed on composites (by location) on a quarterly basis (as a minimum).

Thermoluminescent dosimeters (TLDs) are used to measure direct radiation in the environment. The TLDs are located in land-based 22 1/2-deg sectors. TLDs are placed in an inner ring in the general area of the site boundary, in an outer ring 6.4 to 8.0 km (4 to 5 mi) from the site, in special interest areas (population centers, etc), and in control locations. TLDs are changed and read out on a quarterly basis.

Surface lake water samples are taken from the respective intake canals of the JAF and Unit 1 plants. A third sample is taken as a control station sample at a location beyond influence of the site. A fourth lake sample will be collected from the Unit 2 inlet canal when the unit becomes operational. Monthly composite samples are analyzed for gamma-emitting radionuclides (gamma isotopic analysis). Quarterly composites are analyzed for tritium.

Shoreline sediment samples are taken from a location downstream with existing or potential recreational value. Sediment samples are analyzed for gamma-emitting radionuclides (gamma isotopic analysis) twice per year.

Milk samples are collected from three locations within 5.6 km (3.5 mi) distant of the site. In the event of sample unavailability, collections are made beyond a 5.6-km (3.5-mi) distance. In addition, a sample is taken from a control location 14.5 to 32.1 km (9 to 20 mi) distant from the site. Milk samples are collected twice per month from April through December. Samples are analyzed for gamma-emitting radionuclides (gamma isotopic analysis) and I-131.

Fish samples are taken from the vicinity of the plant discharges. Two samples will be taken of species that are commercially or recreationally important. In addition, one sample is taken from a control location of at least 8.0 km (5 mi) distant from the site. Fish samples are collected twice per year. Samples are analyzed for gamma-emitting radionuclides (gamma isotopic analysis) on edible portions.

Food crop samples are collected from six offsite locations. The six locations are from areas of highest calculated average site deposition values (D/Q). D/Q values are

considered for both elevated (three locations) and ground-level (three locations) releases. In addition, one sample is collected as a control sample located 14.5 to 32.1 km (9 to 20 mi) distant from the site in a less prevalent wind direction. Food crop samples considered here are typically broadleaf vegetables. Food crop samples are collected once per year during the harvest season. Samples are analyzed for gamma-emitting radionuclides (gamma isotopic analysis) and I-131.

A milch animal census is conducted to identify the location of milch animals in each sector of the 16 land-based 22 1/2-deg sectors out to a distance of 4.8 km (3 mi). The census is conducted once per year using information that will provide the best results, such as door-to-door surveys and consultations with agricultural authorities.

6.2.2.3 Analysis Procedures

Samples analyzed for gamma-emitting radionuclides (gamma isotopic analysis) are counted on Ge(Li) or NaI systems. Samples for I-131 analysis are either counted on the Ge(Li) or NaI systems or a radiochemical extraction is performed with counting on a beta-gated gamma coincidence system. Gross beta samples are counted on high sensitivity, low background beta counters.

Samples for analysis are analyzed either by the site's environmental laboratory or by a contractor laboratory. Samples taken for quality control are analyzed by alternate facilities.

6.2.3 References

1. Nine Mile Point Nuclear Station Unit 2, Applicant's Environmental Report - Construction Permit Stage. NRC Docket No. 50-410, Niagara Mohawk Power Corporation, June 1972.

2. United States Atomic Energy Commission. Final Environmental Statement Related to Construction of Nine Mile Point Nuclear Station Unit 2. NRC Docket No. 50-410, Niagara Mohawk Power Corporation, June 1973.

3. Nuclear Regulatory Commission. Draft Radiological Effluent Technical Specifications for BWR's, NUREG-0473, Revision 1, Washington, DC, October 1978.

4. Nuclear Regulatory Commission. Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants, NUREG-0133, Revision 1, Washington, DC, October 1978.

TABLE 6.2-1

OPERATIONAL RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
Airborne			
Radioiodine and particulates	Samples from 5 locations: 3 samples from offsite locations in different sectors of the highest calculated site average D/Q 1 sample from the vicinity of a community having the highest calculated site average D/Q 1 sample from a control location 14.5-32.1 km (9-20 mi) distant and in a least prevalent wind direction	Continuous sampler operation with sample collection weekly or as required by dust loading, whichever is more frequent.	Radioiodine canisters: analyze weekly for I-131 Particulate samplers: Gross beta radioactivity following filter change, composite (by location) for gamma isotopic quarterly (as a minimum)
Direct radiation	40 stations with two or more dosimeters to be placed as follows: an inner ring of stations in the general area of the site boundary and an outer ring in the 6.4- to 8.0-km (4- to 5-mi) range from the site with a station in each land-based sector of each ring (16 sectors and 2 rings = 32 stations). The balance of the stations (8) should be placed in special interest areas, such as population centers, nearby residences, and schools, and in 2 or 3 areas to serve as control stations.	Quarterly	Gamma dose quarterly

TABLE 6.2-1 (Cont)

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
Waterborne			
Surface	1 sample upstream 1 sample from the site's most downstream cooling water intake	Composite sample over 1-month period	Gamma isotopic analysis monthly; composite for tritium analysis quarterly
Sediment from shoreline	1 sample from a downstream area with existing or potential recreational value	Twice per year	Gamma isotopic analysis
Ingestion			
Milk	Samples from milking animals in 3 locations within a 5.6-km (3.5-mi) distance having the highest calculated site average D/Q. If there are none, then 1 sample from milking animals in each of 3 areas 5.6-8.0 km (3.5-5.0 mi) distant having the highest calculated site average D/Q. 1 sample of milking animals at a control location 14.5-32.1 km (9-20 mi) distant and in a less prevalent wind direction	Twice per month, April-December (samples will be collected in January-March if I-131 is detected in November and December of the preceding year)	Gamma isotopic and I-131 analysis twice per month when animals are on pasture (April-December); monthly at other times, if required
Fish	2 samples of commercially or recreationally important species in the vicinity of a site discharge point 1 sample each of the same species (or of a species with similar feeding habits) from an area at least 8.0 km (5 mi) distant from the site	Twice per year	Gamma isotopic analysis of edible portions

TABLE 6.2-1 (Cont)

Exposure Pathway and/or Sample	Number of Samples and Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
Ingestion (Cont)			
Food products	3 samples of broadleaf vegetables will be collected from available offsite locations of highest calculated site average D/Q for elevated release points. In addition, 3 samples will be collected from available offsite locations of highest calculated site average D/Q for ground-level release points.	Once during harvest season	Gamma isotopic analysis of edible portions (isotopic to include I-131)
	1 sample each of similar broadleaf vegetation grown 14.5-32.1 km (9-20 mi) distant in a less prevalent wind direction	Once during harvest season	Gamma isotopic analysis of edible portions (isotopic to include I-131)

6.3 HYDROLOGICAL

6.3.1 Preapplication and/or Preoperational Monitoring

Hydrologic measurements to determine the magnitude and direction of currents in the Nine Mile Point vicinity were made off the Nine Mile Point promontory in 1969, 1970, 1976, and 1977. The 1976 and 1977 studies were conducted after both Unit 1 and the James A. FitzPatrick (JAF) plant were operational. The scope of each study is summarized below; results are provided in Section 2.3.1.

Currents were measured continuously from May through October 1969 and from July through October 1970 at two fixed towers placed offshore from the Nine Mile Point site, one in 7 m (24 ft) of water and one in 14 m (46 ft) of water. Hourly current speed and direction were recorded simultaneously from three depths at each location, utilizing reduced-sized Savonius rotor meters. In addition, drifting drogues were released and tracked during the 1969 study. These studies have been reported by Gunwaldsen et al[1] and the Power Authority of the State of New York[2].

During 1976 and 1977, additional postoperational hydrothermal surveys were conducted for the JAF plant[3]. The focus of this study was on thermal plume mapping. Current speed and direction, lake temperature, and lake level were also monitored.

During the two June 1976 surveys, the current was monitored 3 m (10 ft) below the water surface at a fixed tower positioned approximately 610 m (2,000 ft) east and along the same depth contour (9 m [30 ft]) of the JAF plant discharge. During the two August 1976 and October 1976 surveys, currents were monitored at the 3-, 6-, and 9-m (10-, 20-, and 30-ft) depths at the same location.

The first 1977 survey was conducted on April 13 and 14. Three in situ current monitoring locations were established: one was the same as the 1976 location; the second was approximately 0.8 km (0.5 mi) directly offshore of the JAF plant; and the third was midway between the JAF plant and Unit 1 and 2 sites at the 9-m (30-ft) depth contour (Figure 6.6-1). Currents were monitored at the 4.5-m (15-ft) depth at all three locations during the 2-day April study. Subsequent 1977 surveys were conducted on June 14 with monitoring at the same location and depth. The last survey was conducted on November 2 with current monitoring at a 4.5-m (15-ft) depth at the original station east of the

JAF plant, and a second station located 0.8 km (0.5 mi) offshore of the JAF plant[3].

The results of all current measurement programs are summarized in Section 2.3.1.

6.3.2 Site Preparation and Construction Monitoring

Drainage of the site during construction is provided by two ditches and five storm water lines. One of the drainage ditches is located at the eastern edge of the site and the other at the western edge of the site, as shown on FSAR Figure 2.4-6. The western ditch drains the majority of the site area, as well as conveying all discharges from the sanitary treatment plant to the lake. Flows in this ditch are measured on a weekly basis by a rectangular weir located at the discharge outlet. Suspended solids, pH, settleable solids, and oil and grease are also measured. Monitoring data are reported to the New York State Department of Environmental Conservation in accordance with State Pollutant Discharge Elimination System Permit requirements. The eastern drainage ditch and the storm water lines handle only runoff and, therefore, are not required to be monitored.

As discussed in FSAR Section 2.5.4, groundwater levels during construction are monitored by four piezometers located at the reactor building site. Only groundwater elevation data are collected at each piezometer approximately once every week. Monitoring by these piezometers will continue until the completion of construction.

6.3.3 Operational Monitoring

Station operation will not affect surface water flow or groundwater; therefore, no operational hydrological-monitoring programs are planned for these parameters. Sediment transport in Lake Ontario will not be altered; therefore, sediment transport monitoring is not required.

6.3.4 References

1. Gunwaldsen, R. W.; Brodfeld, B.; and Hecker, G. E. Current and Temperature Surveys in Lake Ontario for James A. FitzPatrick Nuclear Power Plant. Proc. 13th Conf. Great Lakes Res., 1970.

2. Power Authority of the State of New York. Environmental Report for James A. FitzPatrick Nuclear Power Plant. Prepared for United States Atomic Energy Commission, 1971.

3. Stone & Webster Engineering Corporation. Final Report - Postoperational Hydrothermal Surveys, June 1976-November 1977 for James A. FitzPatrick Nuclear Power Plant. Prepared for Power Authority of the State of New York, 1978.

6.4 METEOROLOGICAL MONITORING

The following sections provide summaries of meteorological information compiled in a detailed technical report prepared in support of the Unit 2 ER-OLS[1]. Where appropriate, references to related FSAR sections have been provided.

6.4.1 Preoperational Monitoring Program

The preoperational monitoring program is designed to establish a climatologically representative data base for assessing environmental impacts resulting from plant operation. The program provides meteorological data to be used in appropriate models to develop transport and diffusion estimates used in assessing routine and accidental releases of radioactive material to the atmosphere. The data are also used for cooling tower impact assessments and local climatological summaries.

The Nine Mile Point meteorological station is located approximately 2.0 km (1.2 mi) west-southwest of Unit 2 near the shore of Lake Ontario, as shown on Figure 6.4-1. The station has been in routine operation since January 1974. The meteorological tower is 61 m (200 ft) high and instrumented at three levels: 9 m (30 ft), 30 m (100 ft), and 61 m (200 ft). Wind speed and direction are measured at all three levels. Ambient air temperature, difference temperatures, and atmospheric moisture are also measured. In addition to these measurements, barometric pressure and precipitation are recorded at appropriate locations near the base of the tower.

Instrumentation for digital and analog recording systems is located in a temperature-controlled instrument shelter approximately 23 m (75 ft) from the base of the tower.

A detailed description of the preoperational monitoring program, including instrument siting, sensor performance specifications, and data acquisition and reduction systems, appears in FSAR Section 2.3.3.

6.4.2 Operational Monitoring Program

The operational meteorological monitoring program is designed to provide a complete climatology of the site area. The operational monitoring instrumentation is in accordance with NUREG-0654, and the system accuracy meets the requirements of Regulatory Guide 1.23. The main components of the system are a central processor, meteorological sensors at three locations, and equipment for displaying

pertinent parameters. A complete description of the system is given in FSAR Section 2.3.3.

6.4.3 Reference

1. Meteorological and Radiological Technical Report in Support of the Nine Mile Point - Unit 2 Environmental Report - Operating License Stage. Prepared for Niagara Mohawk Power Corporation by Meteorological Evaluation Services, Inc. July 1982.

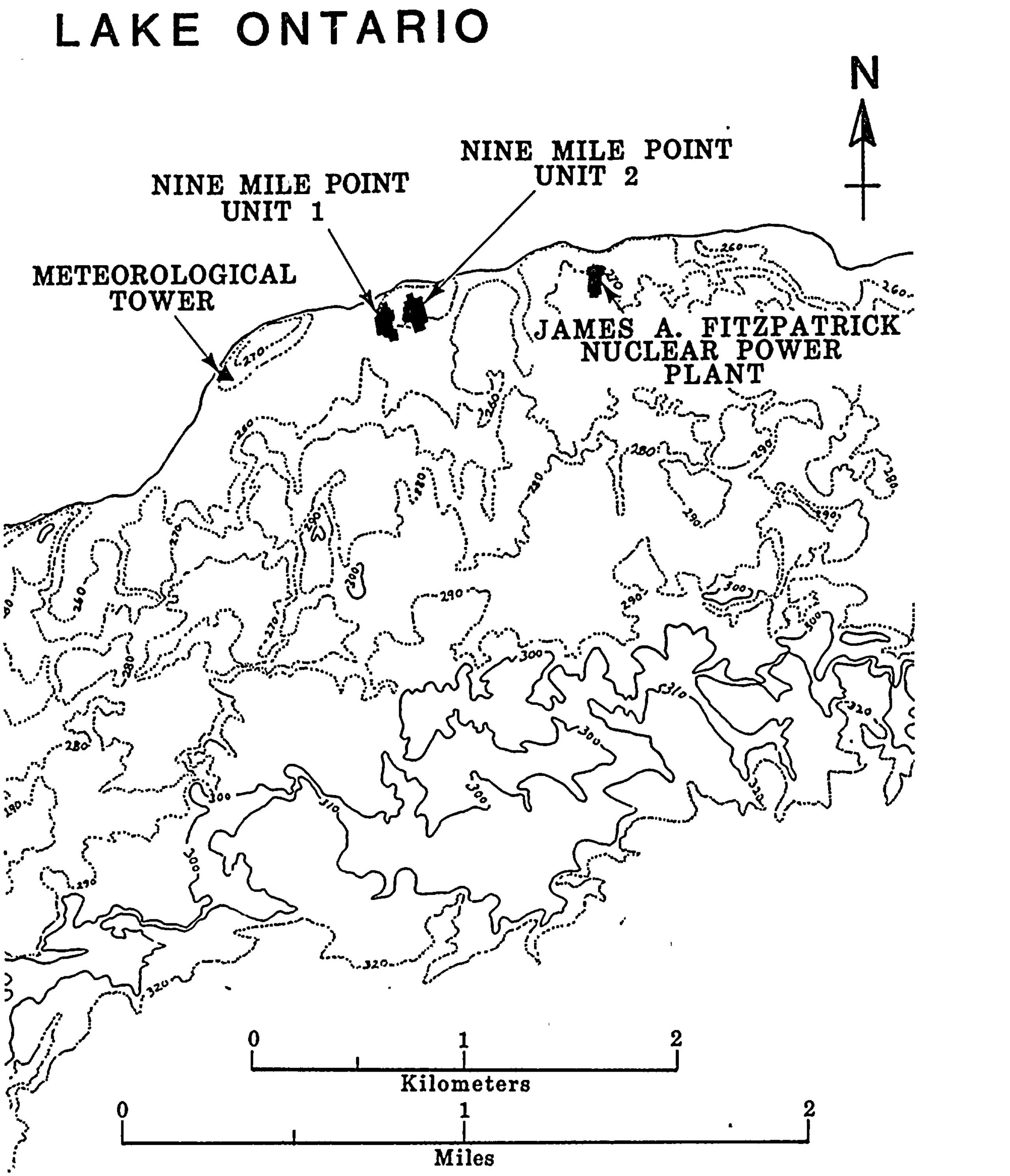

FIGURE 6.4-1

LOCATION OF METEOROLOGICAL TOWER

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

6.5 BIOLOGICAL

6.5.1 Terrestrial Ecology

Baseline terrestrial ecology studies were described in the Unit 2 ER-CPS.

A supplemental baseline ecological study was designed to update available information on the existing terrestrial ecosystem, to document construction impacts, and to help predict the potential effects of plant operation. The study consisted of a literature survey, aerial photography of the site, and an onsite field study. Study results are provided in Section 2.4.1.

Stereoscopic false-color infrared and true-color aerial photographs were taken of the land area within a 1.6-km (1-mi) radius of Unit 2 in August 1979. These photographs were used to develop site descriptions, including a preliminary vegetative cover type map, and to delineate areas of stress. The photographs and the preliminary cover type map were then used to set up the field study.

The terrestrial field study was conducted over a period of 7 days in September 1979. Vegetation cover type designations that were previously determined from photogrammetric analysis were verified. Qualitative and quantitative information were obtained for forested vegetation types by sampling selected forest communities. A list of commonly occurring understory and ground-cover species was compiled for each sampled forest community. Lists of commonly occurring species for old field shrub, agricultural, or pasture vegetation types that were greater than 4.0 ha (10 acres) were also compiled.

Forest communities sampled were those greater than 4.0 ha (10 acres) in size and with dominant species averaging greater than 10 cm (4 in) diameter at breast height (DBH). The standard point quarter technique was used along transects in the representative vegetative communities (Figure 6.5-1). Measurements were taken on the nearest tree in each of four quadrants at sample points located 30 m (98 ft) apart along these transects. Quantitative information obtained from this sampling effort included density, frequency, dominance, relative density, relative frequency, relative dominance, and importance values for overstory species[1].

Wildlife was identified during the vegetation survey using direct observations and enumeration, and by examination of tracks, road kills, and scat. Small mammals were also qualitatively sampled using double transects (Figure 6.5-1), totaling 24 Sherman live traps placed in four of the major vegetation types (early second growth forest [T-1], mixed hardwood forest [T-3], transmission line [T-4], and open field [T-5]). Traps were baited with peanut butter and oatmeal, checked once each day during the early morning hours, and maintained for 5 trap nights.

Literature sources surveyed in support of the descriptive ecology section included scientific journal articles and standard field guides and references. State and federal biologists and local specialists were contacted to obtain available data.

During the first 2 yr of operation, an infrared aerial photography program, similar to the supplemental baseline study, will be performed to assess vegetative stress due to salt drift accumulation or diseases of unknown origin. Further details of this operational monitoring program will be included in the Environmental Protection Plan (EPP).

6.5.2 Aquatic Ecology - Monitoring Program

6.5.2.1 Preapplication and/or Preoperational Monitoring

The data base of the preoperational monitoring program at Unit 2 was developed principally from studies of the Nine Mile Point vicinity conducted by Lawler, Matusky, & Skelly Engineers (LMS) from 1972 through 1977[2-5] and by Texas Instruments, Inc. (TI) during 1977 through 1981[6-9]. Other studies in the immediate vicinity of the study area have been conducted by the Lake Ontario Environmental Laboratory (LOTEL)[10], McNaught and Fenlon[11], McNaught and Buzzard[12], and Storr[13].

6.5.2.1.1 Objectives

The objective of the aquatic ecology monitoring programs for Unit 2 was to determine the taxonomic composition of the biota and characterize the temporal/spatial abundance and distribution of major groups and selected species in the Nine Mile Point vicinity of Lake Ontario. The biotic groups studied included phytoplankton, microzooplankton, macrozooplankton, ichthyoplankton, benthic invertebrates, periphyton, and nekton (fish).

Other variables were monitored for some biota to obtain additional information on the ecology of the area. For example, primary productivity, chlorophyll a and phaeopigments, and biovolume were measured as part of the phytoplankton study; length-frequency or developmental stage was determined for ichthyoplankton; and data on reproduction, age, growth, and food habits were obtained for fish. Supporting data (e.g., water temperature, light intensity, sediment characteristics) were obtained as necessary to aid in interpretation of the biological data.

Finally, entrainment and impingement studies conducted at Nine Mile Point Unit 1 (Unit 1) and the James A. FitzPatrick (JAF) plant provided information necessary to estimate intake effects for Unit 2.

6.5.2.1.2 Descriptions and Methodologies

6.5.2.1.2.1 Phytoplankton Field Methods

Lake Studies

Details of the field procedures used to collect phytoplankton in the Nine Mile Point vicinity of Lake Ontario in 1973 through 1978 are provided in LMS 1980[14]. A summary of the program is presented in the following paragraphs.

Phytoplankton samples were collected in the Nine Mile Point vicinity along four transects (NMPE, NMPP, NMPW, and FITZ) approximately 4.0 km (2.5 mi) along the lake shore at four depth contours (3, 6, 12, and 18 m [10, 20, 40, and 60 ft]), as depicted on Figure 6.5-2. These sampling locations, established in 1973, were used throughout the program without further modification.

The frequency of sample collection varied from 2- to 4-week intervals, depending on year and season[14]. Whole water samples collected using plastic water samplers were processed in the field and returned to the laboratory for analysis. Between 1973 and 1975, in addition to the regular lake phytoplankton program, samples were collected as part of the windrow phytoplankton program. A complete description of the windrow phytoplankton program is found in the LMS yearly reports[2-4].

Entrainment Studies

A summary of the field procedures used in the phytoplankton entrainment programs at Unit 1 and the JAF plant is provided in LMS 1980[14]. Details of these programs are found in the LMS[2-5] and TI[6-8] yearly reports.

The phytoplankton entrainment programs generally consisted of sample collections at the intake and discharge to determine cross-plant effects on standing stock (as abundance and/or chlorophyll a) and primary productivity. The 1976 through 1979 program at the JAF plant included studies of plume entrainment, which involved either collection of samples at the +1.7°C (+3°F) and +1.1°C (+2°F) zones in the lake or simulation of plume entrainment when inclement weather prevented lake collections. Simulations of plume entrainment were achieved by mixing discharge samples with filtered intake water at rates that approximated temperature decay to the +1.7°C (+3°F) and +1.1°C (+2°F) levels in the lake.

6.5.2.1.2.2 Phytoplankton Laboratory Methods

Identification and Enumeration

To facilitate analysis, the preserved whole water samples were concentrated by allowing the phytoplankton to settle. The phytoplankton present in two subsamples were then enumerated and identified to the lowest possible taxonomic level.

Phytoplankton abundance was calculated using equations described in the LMS annual reports[4,5]. Biovolume was estimated by calculating an average cell volume for individuals of a species[15].

Photosynthetic Pigments

Samples for pigment analysis were filtered onto either 0.45 um membrane filters (1973) or glass fiber filters (1974 through 1978) with subsequent extraction in acetone. Spectrophotometric measurements of the extract were made on either a Spectronic 20 or a Beckman Model 26 spectrophotometer. Phaeopigment concentrations were obtained by acidifying the acetone extract with dilute HCl and determining the absorbance at 663 nm. Chlorophyll a and phaeopigments were calculated according to the methods described by Golterman[16].

Primary Production

The ^{14}C labeled samples were analyzed according to the Millipore filtration-liquid scintillation technique, similar to one described by Vollenweider[17].

After correction for background radiation, ^{14}C-uptake/unit volume/unit time was calculated for light and dark bottles. Primary production (generally considered to approximate net production using the ^{14}C-uptake method) was calculated by subtracting ^{14}C-uptake in the dark bottle from the mean of ^{14}C-uptake in the light bottle.

From 1974 through 1976, total inorganic carbon was determined by titration according to the method described by Golterman[16]. During 1977 and 1978, alkalinity was measured[18] and available inorganic carbon was calculated from these measurements.

6.5.2.1.2.3 Microzooplankton Field Methods

Lake Studies

Details of the field and laboratory procedures used to study microzooplankton in the Nine Mile Point vicinity from 1973 through 1978 are provided in LMS 1980[14]. Additional descriptions of the program are found in the annual reports prepared by LMS[2-5] and TI[6,7].

Microzooplankton samples were collected in the Nine Mile Point vicinity along four transects (NMPW, NMPP, FITZ, and NMPE) encompassing approximately 4.0 km (2.5 mi) at four depth contours (3, 6, 12, and 18-m [10, 20, 40, and 60 ft]), as depicted on Figure 6.5-2. The same sampling locations were used throughout the program without modification. The frequency with which samples were collected varied from 2 to 4 weeks, depending on year and season[14]. All surveys were conducted during the day. Samples were collected with 76 um mesh nets towed vertically or obliquely through the water column. Either a Wisconsin-type net or Clarke-Bumpus quantitative plankton sampler was used, both with mouth diameters of approximately 12 cm (5 in)[14].

Entrainment Studies

The microzooplankton entrainment program at Unit 1 and the JAF plant generally consisted of collecting samples from the intake forebay, discharge bay, and sometimes (1976 through 1979) the discharge areas in the lake, and analyzing them

for viability and/or abundance and species composition[14]. As in the lake, microzooplankton were collected on a 76 um mesh for all years of study. Collection techniques were designed to minimize collection-induced mortality.

6.5.2.1.2.4 Microzooplankton Laboratory Methods

The following procedure was used for analyses of enumeration and taxonomy. A 1-ml (0.3-oz) aliquot of a measured, well-mixed sample was pipetted into a Sedgwick-Rafter cell, and all organisms in a specified number of horizontal strips the length of the cell were counted and identified. For identification and enumeration of microzooplankton in entrainment samples, dead organisms in unpreserved samples were counted and identified immediately after collection or incubation. These numbers were then compared with the total count after preservation to determine the plant-induced mortality[5-7].

6.5.2.1.2.5 Macrozooplankton Field Methods

Lake Studies

Macrozooplankton sampling was conducted at the same 15 stations in the Nine Mile Point vicinity from 1973 through 1978[14]. The stations were located at the 6- and 12-m (20- and 40-ft) depth contours east and west of the Unit 1 plant and at the 18-, 24-, and 30-m (60-, 80-, and 100-ft) depth contours directly offshore. The stations were arranged to permit samples to be obtained within concentric arcs 4.8, 1.6, and 0.8 km (3,1, and 0.5 mi) from the plant (Figure 6.5-2).

Samples were collected weekly from April through December. Samples were collected with a 1.0-m (3.3-ft) mouth diameter Hensen-type plankton net of 571 um mesh from just below the surface, at mid-depth, and near the bottom. A single TSK flowmeter was mounted in the net mouth to permit the volume of water sampled to be calculated.

Entrainment Studies

Macrozooplankton entrainment studies were conducted from 1973 through 1976 at Unit 1 and from 1975 through 1979 at the JAF plant. Details were presented by LMS[2-5] and TI[6,7].

The basic program at Unit 1 consisted of sample collection at the intake and discharge to determine organism density

and viability at both locations[14]. The study at the JAF plant was similar to that at Unit 1; however, density measurements were obtained only at the intake, and viability analyses were limited to a dominant organism, the amphipod Gammarus. In addition to investigation of plant entrainment effects on viability, laboratory simulations of plume entrainment were conducted and samples in the discharge plume were obtained to investigate the effects of plume entrainment on Gammarus viability[14].

Samples were collected with 0.5-m (1.6-ft) mouth diameter conical plankton nets of 571 um mesh or a 0.05-cu m^3/s (13-gal) centrifugal water pump with a 571 um mesh screen (net). A single TSK or digital flowmeter was used to monitor flow through the plankton nets, and the pump had been calibrated prior to use to determine volume sampled per unit time.

Plume entrainment was simulated by adding filtered discharge water (at discharge temperature) to intake collections and then ambient temperature intake water at rates that approximated temperature decay in the plume (to +1.1°C and 1.7°C [+2°F and +3°F]). Temperature decay (to 1.1°C [+2°F]) was also simulated for all discharge samples collected after June 1976.

6.5.2.1.2.6 Macrozooplankton Laboratory Methods

After fish larvae and eggs were sorted and removed from the ichthyoplankton samples, macrozooplankton from the same samples were counted and identified. Details were presented by LMS[2-5] and TI[6,7]. Several subsampling schemes were used, with the choice dependent on organism density. Viability from the entrainment samples was estimated on the basis of motility; samples were examined as soon as possible following collection. Analyses to determine entrainment macrozooplankton density were as described for lake samples.

6.5.2.1.2.7 Benthos Field Methods

The 1973 through 1978 surveys are summarized in LMS 1980[14] with additional details in the annual reports[2-7]. Benthic macroinvertebrate samples were collected along four transects perpendicular to the shoreline (Figure 6.5-3). From 1973 through 1975, when Cladophora beds were present, samples were collected in non-Cladophora and Cladophora areas, if possible, at the 3-m (10-ft) depth contours.

Benthos samples were collected with a diver-operated pump. A metal ring was used to define the bounds of the sampling area at each station.

Sediment analyses were carried out as part of the 1973 through 1976 benthos studies. These involved visual analyses by divers and various chemical and physical analyses over the 4-yr period(14).

6.5.2.1.2.8 Benthos Laboratory Methods

Analysis preparation involved sieving, to separate organisms and sediment, followed by preservation (70 percent ethanol) of the material on the sieve. A 420 um sieve was used from 1973 through 1976; a 500 um sieve was employed during 1977 and 1978. A stain, Phloxine-B, was added to the preservative from 1973 through 1976 to aid in organism recognition(19).

Organisms were identified to the lowest feasible taxonomic level using a dissecting microscope or, for diptera larvae and oligochaetes, slide mounts and a light microscope.

Biomass estimates were based on wet weight, measured on a Mettler balance after washing and removal of interstitial water by blotting or by drying 30 min over desiccant.

6.5.2.1.2.9 Periphyton Field Methods

Bottom Periphyton

Bottom periphyton studies were carried out in the Nine Mile Point vicinity from 1973 through 1978. Four transects (NMPW, NMPP, FITZ, and NMPE) were established perpendicular to the shoreline in the vicinity of Unit 1 (Figure 6.5-3). Sampling locations were established at the 2-, 3-, 6-, 10-, and 12-m (7-, 10-, 20-, 33-, and 40-ft) depth contours.

The duration of these studies varied among years, but generally samples representative of spring, summer, and fall conditions were obtained. Exposure periods also varied among years; 4-week exposures were common to 1975 through 1978 programs and were used for some months during ealier years.

In 1973, glass slides were used as the substrates. The artificial substrates used from 1974 through 1978 were doubled Plexiglas plates. On each collection date, scuba divers collected the exposed substrates and replaced them

with cleaned plates. Exposed substrates were returned to the laboratory for analysis preparation.

Buoy Periphyton

Buoy periphyton studies were conducted from 1973 through 1978. Three stations were used for buoy periphyton collections: NMPE, NMPP, and NMPW (Figure 6.5-3). Samples were collected from the 1-, 2-, 4-, and 5-m (3-, 7-, 13-, and 16-ft) depths[14]. The same sampling locations were used from 1973 through 1976. In 1977 and 1978, the transects used were NMPW, NMPP, and FITZ (Figure 6.5-3).

In 1973, glass slides and Styrofoam blocks were used as the substrates. From 1974 through 1978, doubled Plexiglas plates were used. On each collection date, scuba divers retrieved the exposed substrates and replaced them with clean ones. Exposed substrates were returned to the laboratory for analysis.

6.5.2.1.2.10 Periphyton Laboratory Methods

Methods of periphyton analysis were essentially the same for bottom and buoy collections and were basically similar among the years of study. Details were presented in annual reports prepared by LMS[2-5] and TI[6,7].

Taxonomy and Abundance

Material was scraped from glass slides or sections of Plexiglas plates, agitated to break up algal films and clumps, and preserved in 5 percent formalin. Basically, the same procedure was followed for Styrofoam substrates, except that the surfaces of the blocks were sliced off and homogenized in a blender at low speed to separate the substrate from sample material.

A Palmer-Maloney and/or Sedgwick Rafter counting chamber and light microscope were used for analyses. Counts were expressed as clumps, algal cells, and organisms (for zooperiphyton) per square decimeter or centimeter. Taxonomic identifications were to the lowest feasible level.

Biomass

Biomass determinations used either entire glass slides or scrapings from sections of Plexiglas plates. In both cases, samples were dried in a hot air oven, cooled, weighed, ashed in a muffle furnace, cooled, and reweighed. Dry weight, ash

weight, and ash-free dry weight were computed as appropriate for the two drying techniques[14].

Chlorophyll a

The trichromatic method was used for chlorophyll a analyses during 1973 through 1975[20].

6.5.2.1.2.11 Ichthyoplankton Field Methods

Lake Studies

Ichthyoplankton samples were collected at the same stations in the Nine Mile Point vicinity from 1973 through 1978. The stations were located at the 6- and 12-m (20- and 40-ft) depth contours east and west of Unit 1 and at the 18-, 24-, and 30-m (60-, 80-, and 100-ft) depth contours directly offshore from the plant.

Samples were collected weekly at all stations from April through December during all years of study. The samples were collected with a 1.0-m (3.3-ft) mouth diameter Hensen-type plankton net of 571 um mesh from just below the surface, at mid-depth, and near the bottom. A single TSK flowmeter was mounted in the net mouth to permit the volume of water sampled to be computed.

Entrainment Studies

Ichthyoplankton entrainment studies were conducted from 1973 through 1978 at Unit 1 and from 1975 through 1979 at the JAF plant. Details were presented by LMS[2-5] and TI[6-8].

The basic program at Unit 1 consisted of sample collection at the intake and discharge to determine organism density at these locations and changes in viability after plant entrainment. Samples were collected at least twice per month during the day and at night. Discharge collections were omitted after 1974.

The entrainment study at the JAF plant was similar to that at Unit 1[14]. In addition to investigating organism density and plant entrainment effects on viability, laboratory simulations of plume entrainment were conducted and samples from the discharge plume were obtained to investigate the effects of plume entrainment on ichthyoplankton viability.

Samples were collected with 0.5-m (1.6-ft) mouth diameter conical plankton nets of 571 um mesh or a 0.05-cu m/s (13-gal/s) centrifugal water pump with a 571 um mesh screen (net). A single TSK flowmeter was used to monitor flow through the plankton nets, or the pump calibrated prior to use to determine volume sampled per unit time.

Plume entrainment was simulated by adding filtered discharge water (at discharge temperature) to intake collections and then ambient temperature intake water at rates approximating temperature decay in the plume (to +1.1°C and +1.7°C [+2°F and +3°F]). Temperature decay (to +1.1°C [+2°F]) was also simulated for all discharge samples collected after June 1976.

6.5.2.1.2.12 Ichthyoplankton Laboratory Methods

Lake Studies

After sorting and transfer to 70 percent alcohol, ichthyoplankton were counted, identified, and measured for total length. Details of analysis were presented by LMS[2-5] and TI[6-8]. Viability observations on entrainment collections were estimated on the basis of motility; samples were examined as soon as possible following collection. Methods and procedures for identification by species and life stage, enumeration, and length measurements were as for lake studies.

6.5.2.1.2.13 Fish Field Methods

Lake Studies

Early in the design-construction phase of Unit 1, Dr. J. F. Storr assessed Lake Ontario fish populations near the Nine Mile Point area. Abundance and distribution of fish stocks were determined by fathometric surveys and by gill net collections[21-35]. Additional studies were conducted to determine the food preferences of yellow perch[36,37] and other fish[38-43].

LMS (QLM prior to 1975) conducted additional studies on the distribution and abundance of fish in the Nine Mile Point area from 1972 to 1977[2-5,44,45]. TI conducted studies from 1977 to 1981[6-9]. Fish populations were sampled periodically by surface and bottom trawling; surface, bottom, and mid-depth gill netting; and beach seining. Anatomical and meristic data from these fish were used to determine population characteristics, i.e., length-weight

relationship, condition factors, length-frequency distributions, coefficients of maturity, and sex ratios for selected species.

The gear used to sample fish in the vicinity of Nine Mile Point from 1972 through 1981 and the dimensions for each gear type are provided in the annual reports prepared by LMS[2-5] and TI[6-9]. Trawl runs (Otter and Yankee) and gill net sets were made parallel to shore along the selected depth contour. Trap nets were set at sunset and retrieved shortly after sunrise on each sampling date.

Table 6.5-1 summarizes the sampling schedule, and includes sampling location and frequency for the period from 1972 through 1981. The basic program was to sample fishes with a variety of gear from four transects distributed around Unit 1 and the JAF plant. Figure 6.5-4 gives the transects sampled from 1972 through 1981. Special sampling was conducted during a number of years. From 1973 through 1978, special gill net sampling was employed to obtain specimens for food habit studies[14]. In 1975, a special seine sampling program was conducted at 10 sites from April through December. Two sites were located at the end of transect NMPW, and eight sites were distributed along the shore east of Nine Mile Point to the mouth of the Salmon River[14]. The purpose of this program was to collect as large a number and variety of species as possible, particularly young-of-the-year.

From 1972 through 1978, fishes were sampled intensively, with few changes in the program from year to year. The reduced sampling program after 1978 reflects changes in the Unit 1 and the JAF plant technical specifications.

Impingement Studies

Impinged fishes were sampled at Unit 1 from 1973 through 1981 and at the JAF plant from September 1975 through 1981. The gear used to collect fish and the sampling frequency are summarized in LMS 1980[14]. Before each 24-hr sampling period, the bar racks and traveling screens were cleaned to remove accumulated fish so that each collection represented exactly 24 hr of impingement.

All fish were identified to the species level and enumerated at the collection site except when the traveling screens were continuously washed because of large *Cladophora* accumulations or large numbers of impinged fish[14].

In most cases, the collections were made from all three traveling screens. However, if one or two of the screens were not in operation, the numbers of fish collected were extrapolated, assuming uniform impingement among screens. Similarly, during the continuous wash sampling program when subsampling was necessary, the numbers of fish impinged were extrapolated according to the hourly rate. These adjustments are incorporated into the estimates of the total annual number impinged.

6.5.2.1.2.14 Fish Laboratory Methods

Fish were identified to the species level and enumerated where possible. Total length and weight were determined for all individuals (up to 40) per net catch. From 1972 through 1976, the sex and gonadal development of each fish (up to 40 individuals for abundant species) were determined, while in 1977 and 1978 these characteristics were determined for only three key species (white perch, yellow perch, and smallmouth bass).

For fish collected in 1972, condition factor ($K = W \cdot 10^5/L^3$, where W = weight in grams, L = length in millimeters) and coefficient of maturity were determined for all species collected in substantial abundance. The studies were expanded from 1973 through 1976 to include age and growth, fecundity, coefficient of maturity, and food habits of five important species: alewife (Alosa pseudoharengus), rainbow smelt (Osmerus mordax), white perch (Morone americana), yellow perch (Perca flavescens), and smallmouth bass (Micropterus dolomieui). In 1977 and 1978, these same studies were conducted for white perch and smallmouth bass only. In addition, fecundity was determined for alewife and rainbow smelt in 1977. The techniques used for these studies are discussed in LMS 1980[14].

6.5.2.1.3 Data Analysis Procedures and Statistical Methods

Data analysis procedures included some methodologies conducted in the field or laboratory in conjunction with routine data accumulation. Those procedures are explained in individual sections earlier in this chapter.

Data for each biotic group and for water quality were presented in the annual reports in either graphic or tabular form but do not necessarily represent all the data analyzed. When a single year or event was representative of several, a representative unit may be shown and reference made to the total data set. The taxonomic level for data interpretation

varied with sampling program (e.g., fish at species level, phytoplankton at class level).

Data were compared within and between sampling programs wherever such comparisons were biologically meaningful; parameters monitored in the water quality program were also discussed in relation to biotic groups where appropriate.

Various statistical tests were conducted, using both original and replicate samples wherever possible, to increase the sensitivity of the test and to determine levels of significance for spatial/temporal distribution patterns.

The statistical tests used are described and referenced in detail in the annual reports[2-9]. The tests used included Bartlett's test for homogeneity of variance, T-tests, paired T-tests, least significant differece test, analysis of variance, analysis of covariance, Student-Newman-Keuls procedure, and simple linear regression.

Specific tests were chosen after each individual data base was reviewed to ensure correct application of the statistic being used. For example, to analyze the impingement data collected in 1975, parametric techniques, following the method of Steel and Torrie[46] and Sokal and Rohlf[47], were used because of the large sample sizes and the high sensitivity of the tests. The analysis of variance and the correlation analysis techniques were used whenever their application was meaningful; an $\alpha = 0.05$ was chosen for the significance level for all correlations. Statistical techniques for stratified sampling and the optimum allocation procedures were applied to the impingement data analyzed.

To facilitate handling the extensive data base, cluster analyses were used where applicable[48]. Two measures of association have been used with Nine Mile Point data: Gower's similarity coefficient[49] for quantitative data and the Per Cent Similarity (PS) measure given by Haedrich[50].

The clustering strategy chosen was the group average, also known as the unweighted pair-group average[49]. This strategy has proved generally satisfactory in many ecological studies, and, since it gives only moderately sharp clustering (i.e., it is a relatively conservative strategy), it has the advantage of being relatively immune to misclassification and is generally not group-size dependent[51].

6.5.2.2 Operational Monitoring of Aquatic Ecology

Present aquatic ecology studies at the Nine Mile Point site fulfill the requirements of the Environmental Technical Specifications of the Unit 1 and JAF power plants, as well as programs specified in the State Pollutant Discharge Elimination System (SPDES) permits for these facilities. Unit 2 operational aquatic ecology studies will comply with the requirements of the Unit 2 SPDES permit and the NRC Environmental Protection Plan.

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TABLE 6.5-1

SUMMARY OF FIELD MATERIALS AND METHODS FOR FISH COLLECTIONS
NINE MILE POINT VICINITY - 1972-1981

Year	Gear	Frequency	Transect	Depth Contour m (ft)	Sample Depth	Comments
1972	Otter trawl	Monthly (D&N) Apr, Oct	NMPW, NMPP	6, 12, (20, 40)	Surface and bottom	Floats were attached to trawl for surface sampling. Bottom trawls were made with net slightly above bottom to avoid net fouling.
	Gill net	Monthly (D) Sept, Oct	NMPW, NMPP	5, 9, 12, (15, 30, 40)	Mid-depth at 5 m (15 ft); surface and bottom at 10 and 12 m (30 and 40 ft)	
	Beach seine	Monthly (D) Sept	-	-	Shoreline to 2.5 m (8 ft)	
1973	Otter trawl	Monthly (D&N) Mar-May, Dec	NMPW, NMPP, NMPE	6, 12, 18 (20, 40, 60)	Surface and bottom	Trawling at NMPP crossed the FITZ transect eliminating the need for trawling at the FITZ transect (comments for 1972 apply)
	Gill net	Semimonthly (D&N) June-Dec	NMPW, NMPP, FITZ, NMPE	5, 9, 12, 18 (15, 30, 40, 60)	Bottom at 5 m (15 ft); surface and bottom at 10, 12, and 20 m (30, 40, and 60 ft)	Nets set for 48 hr and harvested every 12 hr at dawn and dusk approximately
	Beach seine	Semimonthly (D) June-Nov	NMPW, NMPP, FITZ, NMPE	-	Shoreline to 2.5 m (8 ft) at end of each transect	
1974	Otter trawl	Semimonthly (D&N) Apr-Nov	NMPW, NMPP, NMPE	6, 12, 18 (20, 40, 60)	Surface and bottom	Comments for 1972 and 1973 apply

TABLE 6.5-1 (Cont)

Year	Gear	Frequency	Transect	Depth Contour m (ft)	Sample Depth	Comments
1974 (Cont)	Gill net	Apr, May and July, 3 samples; June, 4 samples; Aug-Nov, 2 samples; Dec, 1 sample (D&N for all months)	NMPW, NMPP, FITZ, NMPE	5, 9, 12, 18 (15, 30, 40, 60)	Bottom at 5 m (15 ft); surface and bottom at 10, 12, and 20 m (30, 40, and 20 m)	Comments for 1973 apply
	Beach seine	Semimonthly Apr-Nov, 1 sample in Dec	NMPW, NMPP, FITZ, NMPE	-	Shoreline to 2.5 m (8 ft) at end of each transect	
1975	Otter trawl	Apr, Aug, Sept, 3 samples; May, June, July, Oct, 2 samples; Nov, 4 samples; Dec, 1 sample (D&N for all months)	NMPW, NMPP NMPE	6, 12, 18 (20, 40, 60)	Surface and bottom	Comments from 1972 and 1973 apply
	Gill net	Apr & Dec, 1 sample; Semimonthly May; Nov (D&N)	NMPW, NMPP, FITZ, NMPE	5, 9, 12, 18 (15, 30, 40, 60)	Surface at 5 m (15 ft); surface and bottom at 10, 12 and 20 m (30, 40, and 60 ft)	Comments for 1974 apply
	Beach seine	Apr, July, Oct, Nov, Dec, 1 sample; May and June, 2 samples; Aug, Sept, 3 samples	NMPW, NMPP, FITZ	-	Shoreline to 2.5 m (8 ft) at end of each transect	See text for special seine sampling program in 1975
1976	Otter trawl	Semimonthly (D&N) Apr-Dec (12- and 20-m, [40- and 60-ft] contours at NMPE from Apr-June only)	NMPW, NMPP, NMPE	6, 12, 18 (20, 40, 60)	Bottom	Comments for 1972 and 1973 apply

TABLE 6.5-1 (Cont)

Year	Gear	Frequency	Transect	Depth Contour m (ft)	Sample Depth	Comments
1976 (Cont)	Yankee trawl	Semimonthly (D&N) June-Dec	NMPE	12, 18 (40, 60)	Bottom	See text for trawl comparison study in 1976
	Gill net	Semimonthly (D&N) Apr-Dec	NMPW, NMPP, FITZ, NMPE	5, 9, 12, 18 (15, 20, 40, 60)	Bottom only at 5, 10, and 18 m (15, 30, and 60 ft); surface and bottom at 12 m (40 ft)	Comments for 1973 apply; surface at 12-m (40-ft) contour was a night collection only and bottom net was for day collection only
	Beach seine	Semimonthly (D) Apr-Dec	NMPW, NMPP, FITZ, NMPE	-	Shoreline to 2.5 m (8 ft) at end of each transect	
1977	Otter trawl	Semimonthly (D&N) Apr-Dec	NMPW, NMPP, NMPE	6, 12, 18 (20, 40, 60)	Bottom	Comments for 1972 and 1973 apply
	Yankee trawl	Semimonthly (D&N) Apr-Dec	NMPE	12, 18 (40, 60)	NA	
	Gill net	Semimonthly (D&N) Apr-Dec	NMPW, NMPP, FITZ, NMPE	5, 6, 9, 12, 18 (15, 20, 30, 40, 60)	Bottom	Comments for 1973 apply. No sampling at 6-m (20-ft) contour for NMPP
	Beach seine	Semimonthly (D) Apr-Dec	NMPW, NMPP, FITZ, NMPE	-	Shoreline to 2.5 m (8 ft) at end of each transect	
	Trap net	Semimonthly (N) Apr-Dec	NMPW, NMPP, FITZ, NMPE	6 (20)	Bottom	
1978	Otter trawl	Semimonthly (D&N) Apr-Dec	NMPW, NMPP, NMPE/FITZ	6, 12, 18 (20, 40, 60)	Bottom	Comments for 1972 and 1973 apply
	Gill net	Semimonthly (D&N) Apr-Dec	NMPW, NMPP, FITZ, NMPE	5, 6, 9, 12, 18 (15, 20, 30, 40, 60)	Bottom	Comments for 1973 apply. No sampling at 6-m (20-ft) contour for NMPP
	Beach seine	Semimonthly (D) Apr-Dec	NMPW, NMPP, FITZ, NMPE	-	Shoreline to 2.5 m (8 ft) at end of each transect	

TABLE 6.5-1 (Cont)

Year	Gear	Frequency	Transect	Depth Contour m (ft)	Sample Depth	Comments
1978 (Cont)	Trap net	Semimonthly (N) Apr-Dec	NMPW, NMPP, FITZ, NMPE	6 (20)	Bottom	
1979	Gill net	Semimonthly (N) Apr-Dec; monthly (N) Sept-Dec	NMPW, NMPP, FITZ, NMPE	9 (30)	Bottom	
1980	Gill net	Same as during 1979	Same as during 1979	Same as during 1979	Same as during 1979	
1981	Gill net	Same as during 1979-1980	Same as during 1979-1980	Same as during 1979-1980	Same as during 1979-1980	

KEY: NA = Not available
D = Day sampling
N = Night sampling

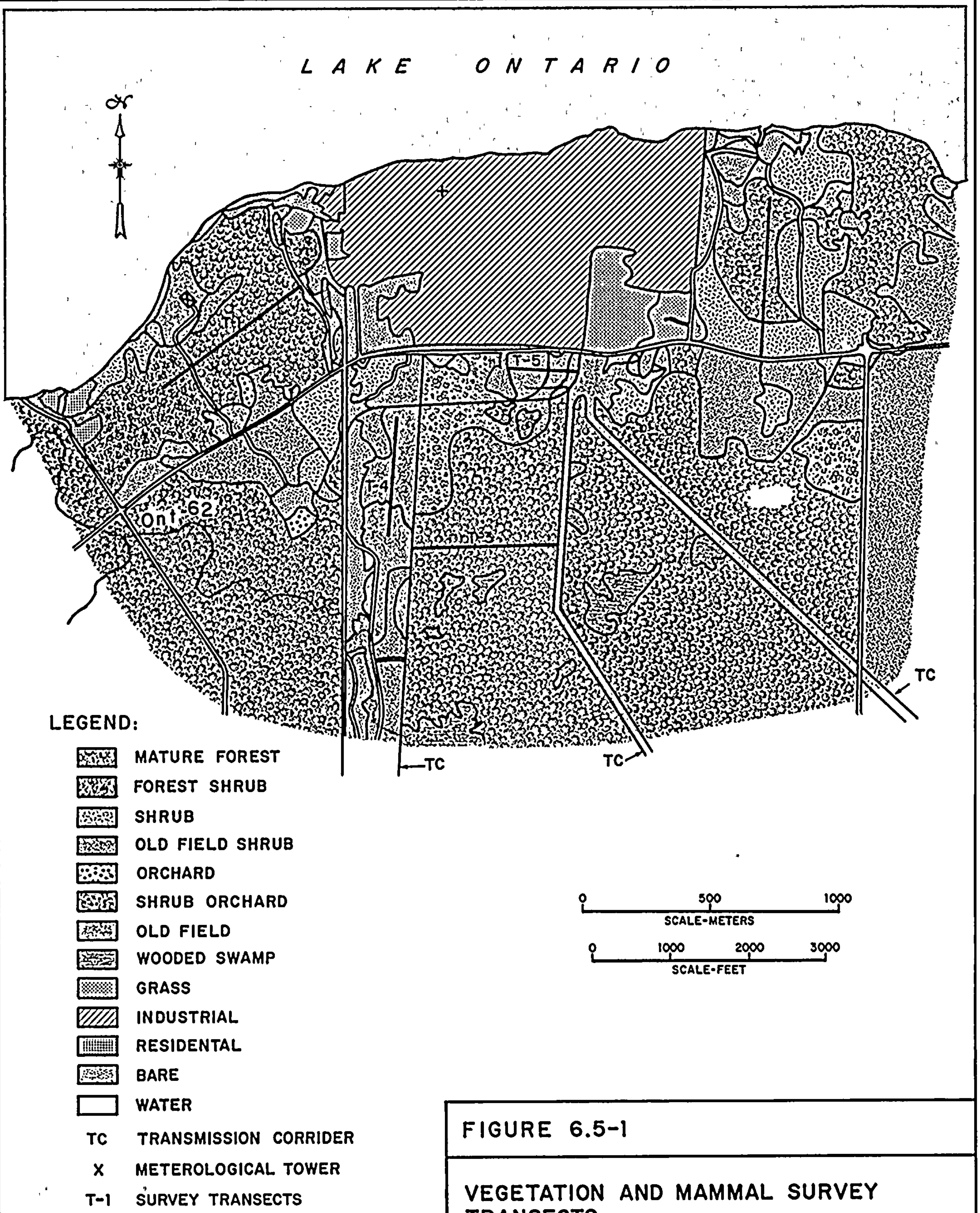

FIGURE 6.5-1

VEGETATION AND MAMMAL SURVEY TRANSECTS

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT - UNIT 2
ENVIRONMENTAL REPORT - OLS

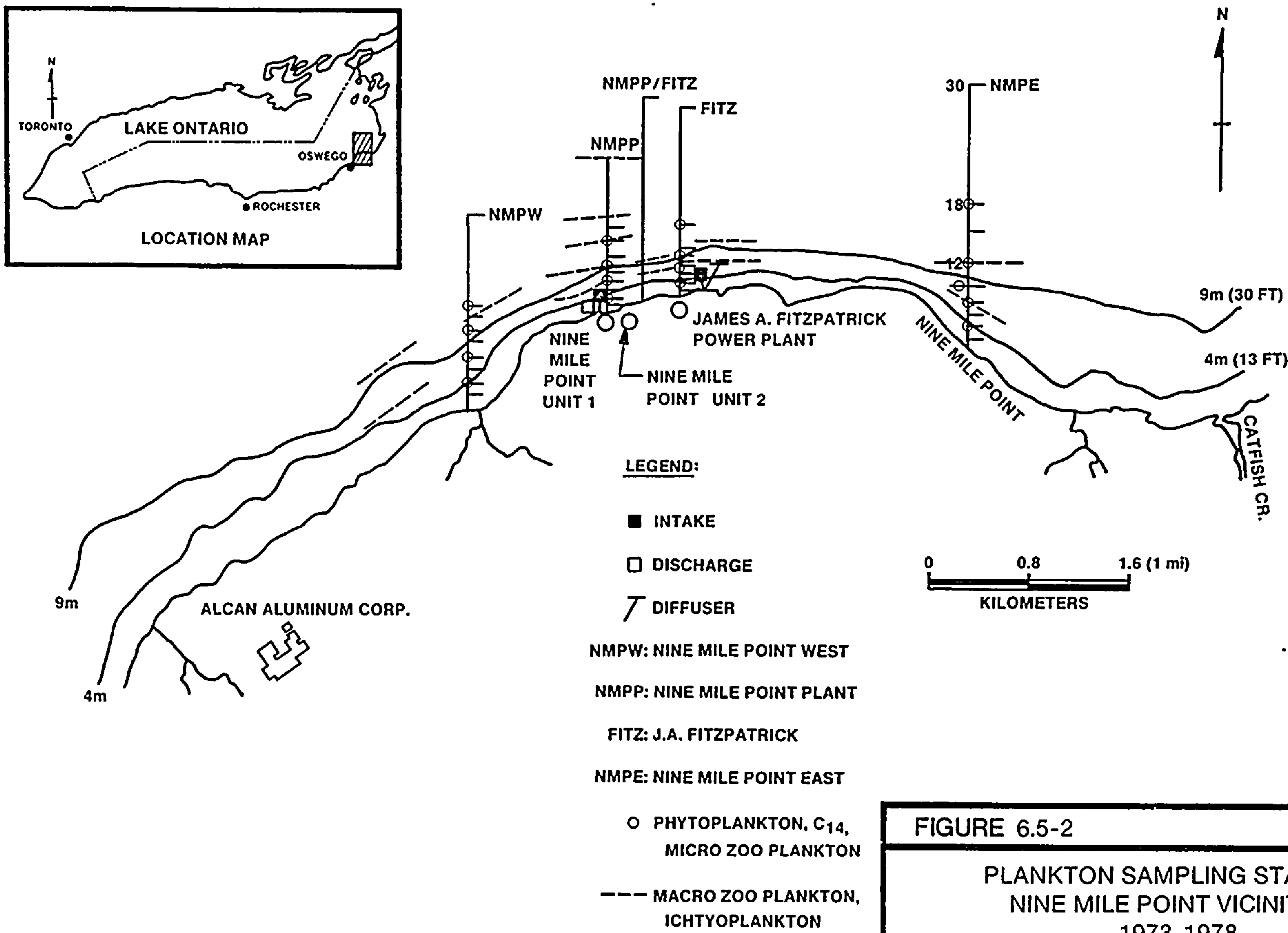

FIGURE 6.5-2

PLANKTON SAMPLING STATIONS
NINE MILE POINT VICINITY —
1973-1978

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

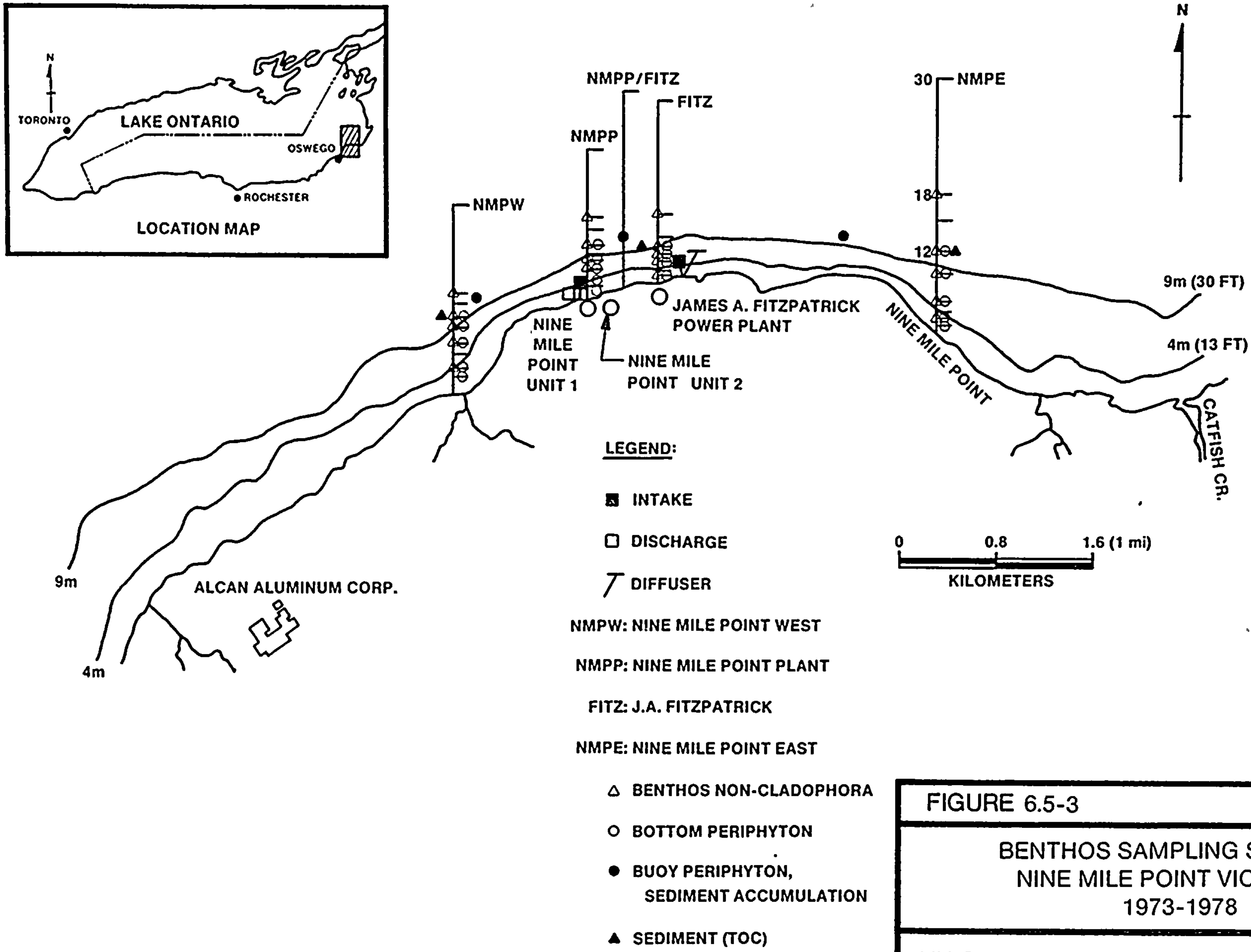

FIGURE 6.5-3

BENTHOS SAMPLING STATIONS
NINE MILE POINT VICINITY —
1973-1978

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

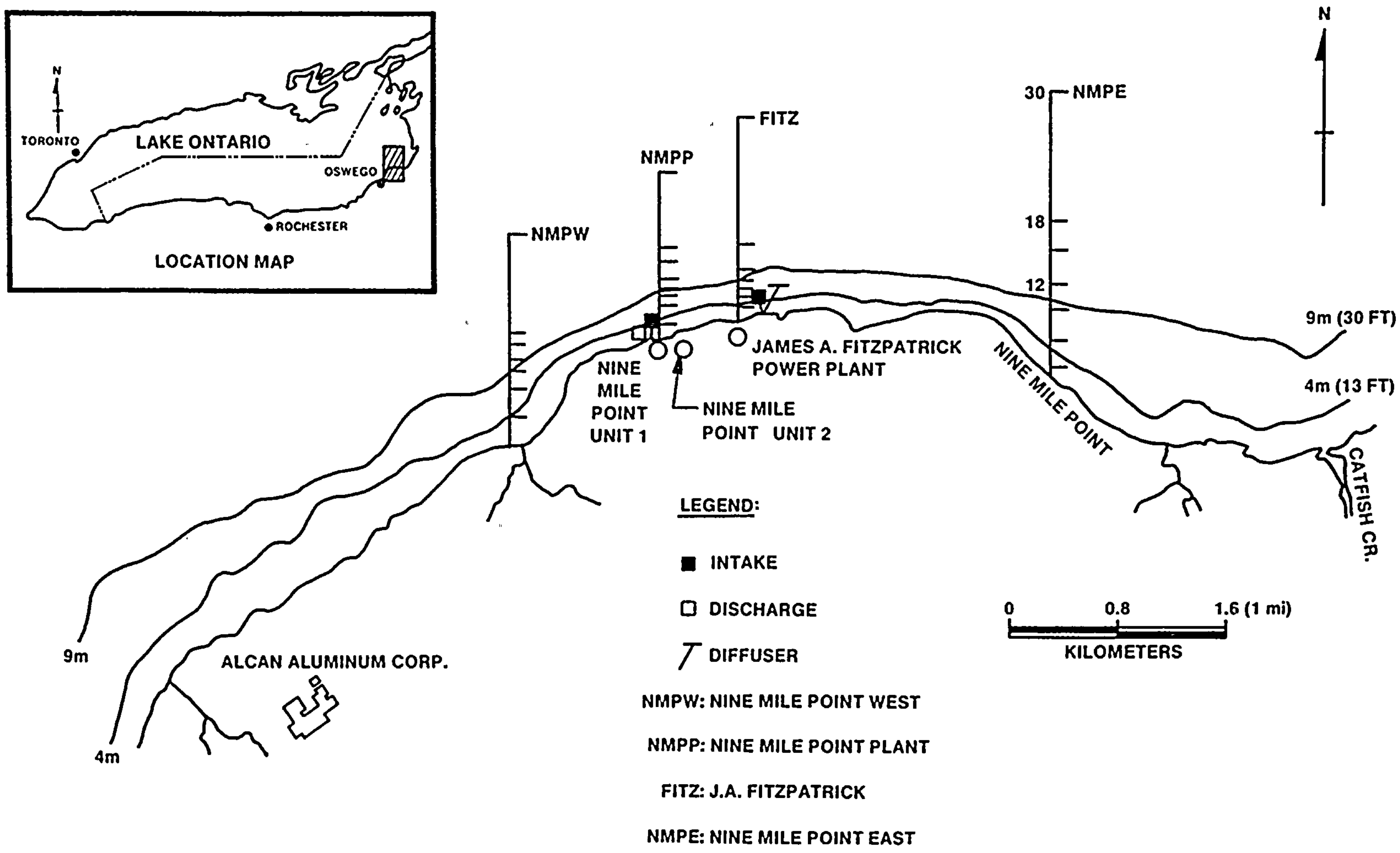

FIGURE 6.5-4

SAMPLING TRANSECTS FOR FISH COLLECTIONS NINE MILE POINT VICINITY — 1972-1981

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

6.6 CHEMICAL

6.6.1 Groundwater

6.6.1.1 Preoperational Monitoring

The purpose of preoperational monitoring of groundwater quality is to establish a baseline for the assessment of water quality changes resulting from plant operation. Since Unit 2 does not use groundwater for operational purposes and does not discharge wastes to the groundwater system, no changes in water quality are expected to result from plant operation. Therefore, no preoperational groundwater monitoring of water quality was performed.

6.6.1.2 Operational Monitoring

An operational program to monitor groundwater quality is not planned, since the potential for affecting groundwater quality is negligible.

6.6.2 Surface Waters (Water Quality)

6.6.2.1 Preoperational Monitoring

6.6.2.1.1 Description of Sampling

A number of comprehensive studies of the water quality in Lake Ontario were undertaken during the late 1960s. These surveys were performed under the auspices of several state, national, and international agencies and include the International Joint Commission[1], Weiler and Chawla[2], and Chau et al[3]. A review of these water quality surveys, along with a review of surveys conducted in the subject area from 1970 through 1972, was included in a report by Quirk, Lawler & Matusky Engineers (QLM) to Niagara Mohawk Power Corporation (NMPC)[4]. Several other studies, conducted in the area during 1970 by Storr, concerned nitrate and phosphate concentrations[5].

Since 1970, Lawler, Matusky & Skelly Engineers (LMS) and Texas Instruments, Inc. (TI) have been surveying the water chemistry of the nearshore waters and sediments in the general area of Oswego and Nine Mile Point. The early (1970 through 1972) studies are summarized in QLM report 1974[4]. A summary of the 1973 through 1980 water quality sampling programs is given below. Details of each program are provided in LMS report 1982[6]. The results of these studies are presented in Section 2.3.3.

1973

Water quality sampling conducted during 1973 in the Nine Mile Point vicinity included weekly thermal measurements, bimonthly (twice per month) chemistry collections in conjunction with biological sampling, and monthly collections for extensive water quality analyses. Special studies were conducted to characterize the bottom sediment and the storm drain and sanitary effluent. The specific locations of lake sampling stations are shown on Figure 6.6-1. The water quality parameters measured are presented in Table 6.6-1.

Weekly temperature surveys were conducted from April through November at the NMPC, NMPE, and NMPW transects at the 6-, 12-, 15-, 18-, and 30-m (20-, 40-, 50-, 60-, and 100-ft) depth contours (Figure 6.6-1). Bimonthly chemistry collections were made from June through December at the same three transects (Table 6.6-2). Monthly collections were made from March through November as outlined in Table 6.6-2.

The Unit 1 sanitary sewage treatment plant effluent was monitored monthly from August through November 1973. A separate 1.2-m (4-ft) storm drain located at the edge of the lake on the west side of Unit 1 was also sampled monthly from August through November. Additional sampling was conducted in the Oswego vicinity[4].

1974

The 1974 water quality sampling program was similar to the 1973 program (Tables 6.6-1 and 6.6-2). The analyses were designed to supplement the 1973 study and to determine which parameters should continue to be monitored[6].

Thermal profiles were conducted weekly during 1974 at the 15- and 30-m (50- and 100-ft) depth contours at NMPW, NMPP/FITZ (formerly NMPC), and NMPE (Figure 6.6-1). Bimonthly and monthly sampling was conducted as outlined in Tables 6.6-1 and 6.6-2.

1975

Temperature measurements were taken weekly from April through December 1975 at the 30-m (100-ft) contour at three transects: NMPW, NMPP/FITZ, and NMPE (Figure 6.6-1).

Bimonthly and monthly sampling was conducted as described in Tables 6.6-1 and 6.6-2. Sediment samples were collected once during the year at the 6- and 12-m depth (20- and

40-ft) contours along NMPW, NMPP, FITZ, and NMPE transects[7].

1976

Three water quality sampling programs were conducted during 1976: the Nine Mile Point monthly water quality program, the James A. FitzPatrick (JAF) plant monthly water quality program, and the JAF plant twice-monthly water quality program[8]. The parameters measured and the stations sampled are provided in Tables 6.6-1 and 6.6-2, respectively.

Temperature was measured for the 1976 thermal profile programs approximately weekly at the 30-m (100-ft) contour of three transects (NMPW, NMPP/FITZ, and NMPE). Temperature measurements were also made in conjunction with each of the biological sampling programs.

1977 and 1978

The water quality programs for these years were essentially the same as the 1976 program[9,10]. Locations and frequencies remained the same; some parameters were added and some deleted (Tables 6.6-1 and 6.6-2).

1979 and 1980

For these 2 yr, the water quality program was designed to provide environmental information (dissolved oxygen and water temperature) in the vicinity of the gill net sampling locations. Water samples were collected from the bottom at the 9-m (30-ft) contour of the NMPW, NMPP, FITZ, and NMPE transects. Collections were made twice per month from April through August and once per month from September through December[11,12].

6.6.2.1.2 Analysis Methodologies

From 1973 through 1980, most temperature measurements were made with a Martek Mark II multiprobe analyzer or Y.S.I. Model 57 DO Meter, in which cases pH, DO, and specific conductivity were also measured. On occasion, thermal stratification measurements were made with a Montedoro Whitney Model TF-20 thermistor or a GM Model OC-1/S bathythermograph.

For the bimonthly and monthly water collections, samples were taken with a 4- or 9-l (1-gal or 2.4-gal) PVC Van Dorn sampler and were dispensed into 4-l (1-gal) polyethylene

bottles for immediate transport to the laboratory; sterile 300-ml (0.6-qt) Pyrex BOD bottles were used for bacteriological and DO analyses. Free CO_2 was determined in the field by titration.

Bottom sediment collections were performed by scuba divers. The samples were placed in ice chests and returned to the laboratory for analysis. Effluent samples of the sewage treatment plant were 24-hr composites of the oxidation pond influent and effluent. Sampling at the 1.2-m (4-ft) storm drains was carried out by grab samples taken every 6 hr for 24 hr.

The EPA has promulgated mandatory guidelines establishing test procedures for the analysis of pollutants[13,14]. All analyses conformed either to these guidelines or, by permission of the EPA Region II laboratory, to current standard methods[15-17]. The orthotolidine field measurement technique for total chlorine residual was used at Nine Mile Point. Details of specific analytical procedures are available in the annual reports[4,7-12].

6.6.2.1.3 Data Analysis Procedures and Statistical Methods

Data reduction procedures are included in the annual reports[4,7-12]. Concentrations of most water quality parameters were usually displayed graphically or in tables, and visual comparisons were made between stations. In some instances, analysis of variance was conducted to test for possible differences among dates of collection, stations, and sample depth means. Biologically significant water quality parameters received special attention to aid in interpreting certain biological patterns.

6.6.2.2 Operational Monitoring of Surface Water Chemistry

No operational studies for surface water chemistry are planned for Unit 2.

6.6.3 References

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TABLE 6.6-1

WATER QUALITY PARAMETERS MEASURED IN THE MONTHLY AND BIMONTHLY SAMPLING PROGRAMS
NINE MILE POINT VICINITY

Parameter	1973 Mo	1973 Bi	1974 Mo	1974 Bi	1975 Mo	1975 Bi	1976 Mo	1976 Bi	1977-1978 Mo	1977-1978 Bi	1979-1980 Bi
pH	X	X	X	X	X	X	X	X	X	X	
Temperature	X	X	X	X	X	X	X	X	X	X	X
Specific conductance	X	X	X	X	X	X	X	X	X	X	
Turbidity	X	X	X	X	X	X	X	X	X	X	
Color	X		X		X		X		X		
Alkalinity	X		X		X		X		X		
Carbon dioxide		X		X		X		X		X	
Dissolved oxygen	X	X	X	X	X	X	X	X	X	X	X
Biological oxygen demand	X	X	X	X	X	X	X	X	X	X	
Chemical oxygen demand	X	X	X	X	X	X	X	X	X	X	
Chlorophyll *a*		X		X		X		X			
Total solids	X	X	X	X	X	X	X	X	X	X	
Total dissolved solids	X		X		X		X		X		
Total suspended solids	X	X	X	X	X	X	X	X	X	X	
Total volatile solids	X		X		X		X		X		
Settleable solids	X				X		X				
Total coliforms	X		X		X		X		X		
Fecal coliforms	X		X		X		X		X		
Phenols	X		X		X		X		X		
Surfactants	X		X		X		X		X		
Nitrate nitrogen	X	X	X	X	X	X	X	X	X	X	
Ammonia nitrogen	X		X	X	X	X	X	X	X	X	
Total Kjeldahl nitrogen	X	X	X	X	X	X	X	X	X	X	
Orthophosphate	X	X	X	X	X	X	X	X	X	X	
Total phosphorus	X	X	X	X	X	X	X	X	X	X	
Silicate	X	X	X	X	X	X	X	X	X	X	
Sulfate	X		X		X	X	X		X		
Aluminum	X		X		X		X		X		
Arsenic	X		X		X		X		X		
Barium	X		X		X		X		X		
Beryllium	X		X		X		X		X		
Cadmium	X		X		X		X		X		
Calcium	X		X		X	X	X		X		
Chloride	X		X		X		X		X		
Chromium	X		X		X	X	X		X		
Copper	X		X		X		X		X		
Cyanide	X		X		X		X		X		
Fluoride	X		X		X		X		X		
Iron	X		X		X		X		X		
Lead	X		X		X		X		X		
Magnesium	X		X		X		X		X		

TABLE 6.6-1 (Cont)

Parameter	1973 Mo	1973 Bi	1974 Mo	1974 Bi	1975 Mo	1975 Bi	1976 Mo	1976 Bi	1977-1978 Mo	1977-1978 Bi	1979-1980 Bi
Manganese	X		X		X		X		X		
Mercury	X		X		X		X		X		
Nickel	X		X		X		X		X		
Potassium	X		X		X		X		X		
Silver	X		X		X		X		X		
Sodium	X		X		X	X	X		X		
Vanadium	X		X		X		X		X		
Zinc	X		X		X		X		X		
Total organic carbon			X				X				
Selenium	X		X				X		X		
Organic nitrogen	X		X		X		X		X		
Radiological	X		X		X		X		X		
Carbon chloroform extract									X		

KEY: Mo = Monthly
Bi = Bimonthly

TABLE 6.6-2

SAMPLING LOCATIONS USED IN THE MONTHLY AND BIMONTHLY
WATER QUALITY PROGRAMS
NINE MILE POINT VICINITY: 1973-1980

Station	Depth Contour m	Depth Contour ft	1973	1974	1975	1976	1977	1978	1979	1980
Monthly										
NMPI	Intake		X	X						
NMPI	Discharge		X	X						
NMPC	6	20	X							
	14	45	X							
NMPP/FITZ	6	20		X	X	X	X	X		
	12	40				X	X	X		
	14	45		X	X	X	X	X		
NMPN	6	20				X	X	X		
	12	40				X	X	X		
NMPE	6	20				X	X	X		
	12	40				X	X	X		
Bimonthly										
NMPE	6	20	X	X	X	X	X	X		
	9	30							X	X
	12	40			X					
	18	60	X	X	X	X	X	X		
NMPW	6	20	X	X	X	X	X	X		
	9	30							X	X
	12	40			X					
	18	60	X	X	X	X	X	X		
NMPC	6	20	X							
	12	40	X							
	18	60	X							
NMPP/FITZ	6	20		X	X	X	X	X		
	12	40			X					
	18	60		X	X	X	X	X		
NMPP	9	30							X	X
FITZ	9	30							X	X

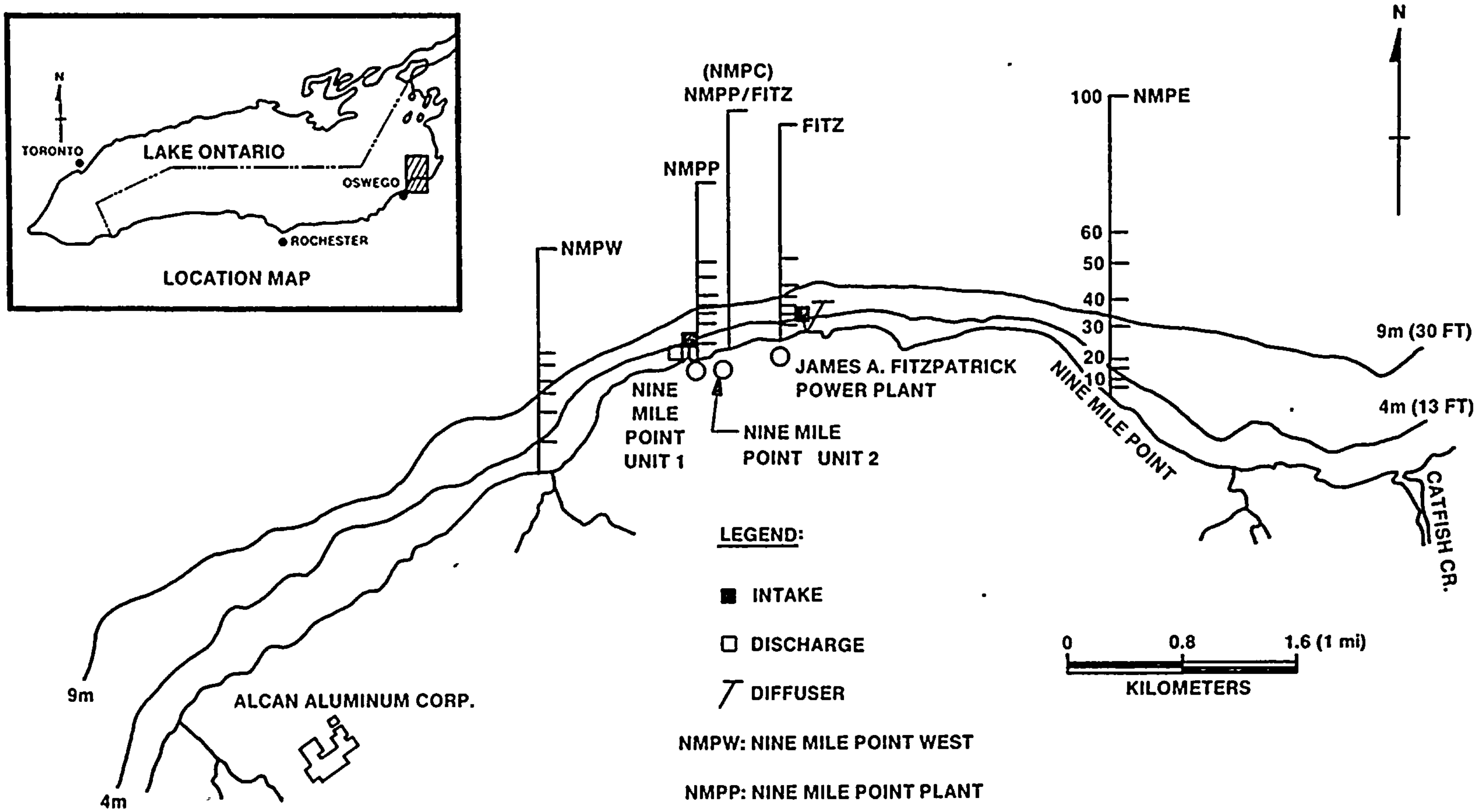

FIGURE 6.6-1

WATER SAMPLING STATIONS
NINE MILE POINT VICINITY

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

6.7 OTHER MONITORING PROGRAMS

6.7.1 Ambient Noise Survey

The objective of the ambient noise survey performed was to define the existing acoustical environment of the Nine Mile Point area by obtaining sound level measurements at a number of locations within a 4.8-km (3-mi) radius of the site. The site characteristics and results of the noise survey are provided in Section 2.10. The acoustical environment of an area, which can be quantitatively defined as the ambient sound level, encompasses all sounds, whether from manmade noise sources such as the existing two power plants, traffic, aircraft, and other industrial sites, or from natural sources such as animals, insects, and the wave action of water bodies such as Lake Ontario. Ambient sound levels in a given area can vary greatly with time and locale. The proximity of a specific location within an area to noise sources such as highways can influence ambient levels, as can temporal variations in the activities that produce sound.

To evaluate the impact of introducing a new noise source (Unit 2) into the acoustical environment of the area, a detailed analysis of the existing ambient sound levels, including the impact from the existing two nuclear power stations, was necessary. The Nine Mile Point ambient noise survey was conducted during a 5-day period between September 27 and October 1, 1979. Except for 1 day of rain during which no noise data were obtained, the weather conditions were favorable for taking noise measurements. The wind was relatively calm during the entire measurement period, minimizing the noise impact of wind in the trees.

The following sections describe the techniques used to assess the existing ambient noise environment in the area surrounding the Nine Mile Point site. These sections include a description of the instrumentation used during the ambient noise survey, a description of the data measurement methodology, and the type of analysis performed in defining the ambient noise levels. In addition, Section 2.10 contains a description of the general site characteristics, as well as a summary of the measured ambient noise levels. Section 5.8.1 deals with the prediction and evaluation of the noise impact expected from the operation of Unit 2.

6.7.1.1 Description of Site Selection

Site 1, located at the end of Lakeview Road, approximately 152 m (500 ft) from the shore of Lake Ontario, is

representative of the nearest residential area along the western boundary of the power plant property line. This site is owned and operated by the Ontario Bible Conference Group and is located approximately 1.6 km (1 mi) from Units 1 and 2. Although several of the homes in this area are occupied year-round, the majority of the dwellings are utilized during the summer months to house those attending the Bible Conference. During the time of the ambient noise survey, this area was relatively quiet because the camp was closed. Site 2, also located on Lakeview Road, is near the southwest corner of the power plant property line, approximately 2.4 km (1.5 mi) from Units 1 and 2. The largest concentration of homes within a 4.8-km (3-mi) radius of the power plant site is located in the Lycoming area at the intersection of Miner Road and Route 29. As a result, Site 3, located on Miner Road approximately 137 m (450 ft) from the intersection, was selected as one of the primary noise-monitoring sites. This site, located near the southeast corner of the power plant boundary line, was approximately 2.9 km (1.8 mi) from Units 1 and 2 and 2.7 km (1.7 mi) from the James A. FitzPatrick (JAF) plant.

Site 4 was located east of the power plant site, at the intersection of Lake Road and Parkhurst Road, approximately 2.4 km (1.5 mi) from Units 1 and 2, and 1.6 km (1 mi) from the JAF plant. Site 5 was located along Lake Ontario, east of the power plant site, approximately 2.7 km (1.7 mi) from Units 1 and 2, and 1.7 km (1.1 mi) from the JAF plant. This site is on a lightly traveled dirt road leading to a number of homes along the waterfront, approximately half of which appear to be year-round residences. As with Site 1, this site was located approximately 152 m (500 ft) from the water to avoid any noise impact from the wave action on Lake Ontario.

Site 6, located on Route 29, was selected because it represented a location along the eastern boundary of the power plant property line. This site was located 365 m (1,200 ft) from the intersection of Lake Road, approximately 1.9 km (1.2 mi) from Units 1 and 2, and 1.2 km (0.8 mi) from the JAF plant.

Site 7, located on North Road, approximately 4.0 km (2.5 mi) south of the power plant site, was on a hill overlooking the entire power plant facility. Site 8, located west of the power plant site approximately 130 m (425 ft) from Lake Road, was selected because it represented an area that was in contrast to Site 1, where there was very little activity. This site was located approximately 2.2 km (1.4 mi) from Units 1 and 2, and 3.0 km (1.9 mi) from the JAF plant.

Site 9, located on Miner Road directly south of the power plants, was approximately 2.4 km (1.5 mi) from Units 1 and 2, and 2.7 km (1.7 mi) from the JAF plant. In addition, this site was near the transmission line corridor leading away from the power plant site. Measurements taken at this site provided noise-monitoring data for the southern boundary of the power plant property line.

All nine noise-monitoring sites were located in open areas so that there were no problems with sound reflections from buildings.

6.7.1.2 Description of Noise-Monitoring Equipment

The measured ambient sound level data consisted of continuous, automatically recorded statistical measurements, as well as manually recorded hand-held statistical noise samples obtained during both daytime and nighttime noise-monitoring periods.

The following instrumentation was used during this ambient noise survey:

1. Two Metrosonics dB-602 Community Noise Analyzers (CNA).
2. General Radio 1945-9730 Weatherproof Microphone Systems.
3. Two General Radio 1961-9601 1-in Electret Microphone.
4. One General Radio 1562A Acoustic Calibrator.
5. One Bruel & Kjaer (B&K) 2209 Sound Level Meter.
6. One B&K 1613 Octave Band Filter Set.
7. One B&K 4145 1-in Condenser Microphone.
8. One B&K 4220 Pistonphone Calibrator.
9. One B&K UA0207 Windscreen.
10. One NAGRA IV-SJS Tape Recorder.

The CNA is an automatic instrument powered by an internal dc power supply, and as a result, could be left in the field unattended for a period of 24 to 36 hr, depending on the temperature. The CNA samples the existing sound level twice

per second and stores the result in working memory for future analysis. At the end of an hourly period, the CNA processes the data stored in the working memory and computes the equivalent sound level, L_{eq}, which is the steady A-weighted sound level that has the same total sound energy as the fluctuating noise levels occurring during the measurement period. During the measurement period, the CNA also computes the L_{10}, L_{50}, and L_{90} sound levels, which are the A-weighted levels exceeded 10, 50, and 90 percent of the time, respectively. These hourly statistical sound levels are then placed in storage memory for later retrieval by the survey team. Each of the CNAs was configured with a General Radio 1945-9730 Weatherproof Microphone System and a 1961-9601 1-in Microphone.

For the hand-held statistical measurements, the noise-monitoring instrumentation included a B&K 4145 Microphone mounted on a tripod approximately 1.5 m (5 ft) high. The microphone was connected by cable to a B&K 2209 Sound Level Meter. Calibration of the measurement system was performed at each site (prior to beginning each measurement period) with a B&K 4220 Pistonphone. The B&K Sound Level Meter was also fitted with a B&K Type 1613 Octave Band Filter Set. This provided residual octave band sound level data at each site. The residual octave band sound level is the minimum sound level reading obtained in each octave band in the absence of any identifiable or intermittent local noise sources, such as passing cars and barking dogs. In addition, a NAGRA IV-SJS tape recorder was used to record a 3-min noise sample at each of the nine noise-monitoring sites for further analysis, if necessary.

6.7.1.3 Data Collection Methodology

In order to adequately define the ambient noise levels surrounding the Nine Mile site, a series of both daytime and nighttime noise measurements was obtained at each of the nine noise-monitoring locations. The continuously monitoring CNAs were used at the four primary noise-monitoring sites (1, 2, 3, and 4) to obtain a complete 24-hr time history of the noise environment at each of these locations. Except for 1 day of rain (September 28) when no ambient noise levels were obtained, one of the CNAs was left in operation at Site 1 for almost the entire ambient noise survey to serve as a constant reference data point. The second CNA was used at the other three primary noise-monitoring sites and was moved after each 24-hr noise measurement period. The following is a summary of the times and dates that the CNAs were in operation:

Site 1 - 1300 hr September 27, 1979
to 1200 hr September 28, 1979
0100 hr September 29, 1979
to 1500 hr September 30, 1979

Site 2 - 1500 hr September 30, 1979
to 1500 hr October 1, 1979

Site 3 - 1500 hr September 27, 1979
to 1200 hr September 28, 1979

Site 4 - 1400 hr September 29, 1979
to 1400 hr September 30, 1979

During the ambient noise measurement program, the noise-monitoring sites were visited once during the daytime and once during the nighttime hours. At each visit to the primary noise-monitoring sites, the system was switched into the standby mode, and the hourly statistical data (L_{eq}, L_{90}, L_{50}, and L_{10}) stored in the analyzer memory was retrieved and recorded on a data sheet. The B&K system was then set up and calibrated for the hand-held statistical measurements. This method of data collection consisted of using a statistical sampling technique that provides an accurate description of the short-term variations in the ambient noise environment and a sound level meter to sample the existing A-weighted sound levels in 5-sec intervals. A series of 50 samples was generally more than sufficient to provide a statistically reliable sample defining the minimum (L_{90}) dBA noise levels obtainable at each site. During the 50-sample time period (4 min, 10 sec), all activity in the area was noted and all noise sources were identified. Each of the 50 instantaneous sound level readings was recorded on a data sheet by a checkmark next to the correct dBA level. The collected data were later used to determine the appropriate statistical descriptors, such as the L_{90}, L_{50}, L_{10}, and L_{eq} levels, which correspond to the residual, average, intrusive, and equivalent levels, respectively.

Residual octave band sound levels were also obtained. The residual octave band sound level is the minimum repeatable sound level reading obtained in each octave band (63, 125, 250, 500, 1k, 2k, 4k, and 8k Hz) in the absence of any identifiable or intermittent local noise sources, such as passing cars and barking dogs. From the residual octave band data, the residual dBA noise level can be calculated at each site and should agree with the minimum (L_{90}) dBA levels obtained by using the hand-held statistical sampling technique.

This ambient noise measurement procedure was followed during each visit to the noise-monitoring sites. At the end of each visit, the CNA was recalibrated and switched from the standby mode to the active mode to begin another noise measurement period. Each site was visited twice daily for a total of four or five ambient noise measurement sessions during the survey. In addition, the NAGRA tape recorder was used to record a 3-min ambient noise sample at each of the nine noise-monitoring sites. These tape recordings were obtained during the nighttime, when the ambient noise levels were generally lower, so that power plant noise was usually audible at each of the noise-monitoring sites.

Throughout the survey, periodic observations and measurements were made of the meteorological conditions, including wind speed and direction, wet-bulb and dry-bulb ambient air temperature, and sky conditions. For the entire ambient noise survey, the winds were generally calm, ranging from 0 to 8 km/h (5 mph). This minimized the impact of wind in the trees, which tends to be a problem when measuring low ambient noise levels.

6.7.2 Seismic Monitoring

There is no preoperational seismic monitoring program planned at the Unit 2 site. However, Niagara Mohawk Power Corporation, in conjunction with other state utilities, is funding a seismic monitoring research program in New York state, as described in FSAR Section 2.5.

6.7.3 Air Quality Monitoring Programs

The potential sources of gaseous emissions at Unit 2 are two standby diesel generators, one HPCS diesel generator, one diesel-driven emergency fire pump, and a natural-draft cooling tower (NDCT). The diesel units will burn No. 2 fuel oil (0.5 percent sulfur content) and, due to infrequent operation, will emit small amounts of pollutants (i.e., nitrogen oxides [NO_x], sulfur dioxide [SO_2], and particulates), as described in Section 3.6.3.4. Criteria-pollutant emissions from these sources, even with the addition of the particulate emissions from the NDCT, will not exceed an emission requirement of 100 tons/yr and are not considered a major source. Therefore, the sources are not subject to prevention of significant deterioration (PSD) or emission offset (EO) regulations. On this basis, a post-operational air quality monitoring program is neither necessary nor required by state or federal regulations for this facility.

6.7.4 Geotechnical Monitoring

Preoperational subsurface monitoring has been undertaken subsequent to submission of the ER-CPS and is discussed in FSAR Section 2.5.4.13.

There are no plans for operational monitoring of geotechnical parameters at Unit 2.

6.8 ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

A summary of preoperational monitoring and operational monitoring programs for Unit 2 is presented in Tables 6.8-1 and 6.8-2.

TABLE 6.8-1

SUMMARY OF PREOPERATIONAL MONITORING

Section Reference	Description	Frequency	Location	Method
6.1.1.1	Vertical temperature distribution (Lake Ontario)	Weekly April-December 1973-1978	Transects NMPP, NMPE, and NMPW	1-m intervals at 15-m contour in 1973-1974 and 30-m contour in 1973-1978. Measurements made with Martek MK II multiprobe analyzer, Montedoro Whitney TF-20 thermistor, or GM model OC-1/s bathythermograph.
6.1.1.2	Unit 1 thermal plume survey	Periodically 1970-1975	Unit 1 thermal plume	Vertical profile at 4 depths utilizing Gulton Industries thermistor probes (No. 133) and Rustrak recorder (model 2133).
6.1.1.3	James A. FitzPatrick (JAF) thermal discharge	June, August, October 1976; April, June, November 1977	JAF thermal plume and vicinity	Fluorescent dye (Rhodamine WT) and temperature, vertical and horizontal transects, utilizing fluorometer thermistor probes and data logger.
6.3.1	Hydrological measurements (Lake Ontario)	Hourly 1969 and 1970	Offshore of Nine Mile Point, 7.3-m (24-ft) and 14.2-m (46-ft) depth contour	Current speed and direction at 3 depths, utilizing reduced-size Savonius rotor meters.
		Continuous measurements during 1- or 2-day surveys; June, August, October 1976, and April, June, November 1977	Various, offshore of Nine Mile Point	In situ current measurements at various depths.
6.4.1	Meteorological	Continuous since 1974	Meteorological tower site	
	Wind speed/direction	Continuous since 1974	9 m (30 ft), 30 m (100 ft), 61 m (200 ft)	Bendix 120 Aerovanes, Climatronics F-460 vane and anemometer.
	Air temperature	Continuous since 1974	8 m (27 ft), 30 m (100 ft), 61 m (200 ft)	Climatronics TS-10 aspirated thermistor.

TABLE 6.8-1 (Cont)

Section Reference	Description	Frequency	Location	Method
6.4.1 (Cont)	Relative humidity	Continuous 1974-1978	9 m (30 ft), 61 m (200 ft)	Xeritron humidity sensors.
	Dew point	Continuous since 1978	8 m (25 ft)	EG&G 220 dew point sensor.
	Precipitation	Continuous since 1974	Near base of tower	Weathermeasure P511E rain gauge.
	Barometric pressure	Continuous since 1974	Near base of tower	Climatronics sensor.
6.5.2	Aquatic Ecology			
6.5.2.1	Preoperational Monitoring			
6.5.2.1.2.1	Phytoplankton			
	Lake studies	Bimonthly or monthly depending upon year and season 1973 through 1978	NMPE, NMPP, NMPW, FITZ at 3,6,12, and 18-m (10,20,40, and 60-ft) depth contours	Whole water samples; Palmer-Maloney cell 1973-1974 and 1977-1978 Utermohl 1975-1976 Chlorophyll 1973-1978 C-14 1974-1978
	Entrainment	Bimonthly or monthly depending upon year and season 1973-1974, 1976-1979	Unit 1 intake and discharge 1973-1975 JAF intake and discharge 1976-1979	Whole water, 1974, 1976; Chlorophyll, 1973-1974, 1976-1979; Productivity, 1973-1979
6.5.2.1.2.3	Microzooplankton			
	Lake studies	Bimonthly or monthly depending upon year and season 1973-1978	NMPE, NMPP, NMPW, FITZ at 3,6,12, and 18-m (10,20,40, and 60-ft) depth contours	76-um mesh vertical tows 1973-1974 Clarke-Bumpus oblique tow 1975-1976, Wisconsin net oblique 1977-1978; Sedgewick-Rafter counting cell 1973-1978

TABLE 6.8-1 (Cont)

Section Reference	Description	Frequency	Location	Method
	Entrainment	Bimonthly or monthly depending upon year and season 1973-1979	Unit 1 intake and discharge 1973-1975 JAF intake and discharge 1976-1979	Bucket collection 1973 Pump collection 1974-1979 Viability by motility
6.5.2.1.2.5	Macrozooplankton Lake sampling	Weekly April-December 1973-1977; monthly 1978	6 and 12-m (20 and 40-ft) depth contour E and W of Unit 1; 18,24, and 30-m (60,80, and 100-ft) depth contour directly off Unit 1	1.0-m diameter Hensen net 1973-1978 5-min tow; S, M, B enumeration and identification
	Entrainment	Weekly or bimonthly depending upon year and season 1973-1979	Unit 1 intake and discharge 1973-1974 Unit 1 and JAF intake 1975 JAF intake and discharge 1976-1979	0.5-m diameter conical net, 571-um mesh Centrifugal pump into a 571-um mesh net Viability by motility
6.5.2.1.2.7	Benthos	Monthly or bimonthly depending upon year 1973-1978	NMPW, NMPP, FITZ, NMPE 3,6,9,12, and 18-m (10,20, 30,40, and 60-ft) depth contours	Diver-operated pump, washed through 420-um screen 1973-1976 washed through 500-um screen 1977-1978 Enumeration and identification
6.5.2.1.2.9	Periphyton Bottom	Spring, summer, and fall seasons, 1973-1978	NMPW, NMPP, FITZ, NMPE 2,3,6,10, and 12-m (5,10, 20,30, and 40-ft) depth contours	Glass slides, 1973; plexiglass plates 1974-1978; collected by divers; Biomass, Chlorophyll and Enumeration and identification

TABLE 6.8-1 (Cont)

Section Reference	Description	Frequency	Location	Method
	Buoy	Spring, summer, and fall seasons, 1973-1978	NMPE, NMPP, NMPW 12-m (40-ft) depth contour @ 1,2,4, and 5-m (3,6,12, and 15-ft) depths 1973-1976 NMPW, NMPP, and FITZ 1977-1978	Glass slides and styrofoam 1973 plexiglass plates 1974-1978 collected by divers; Biomass, Chlorophyll and Enumeration and identification
6.5.2.1.2.11	Ichthyoplankton			
	Lake studies	Weekly or bimonthly depending upon year and season 1973-1979	NMPE, NMPW at 6 and 12-m (20 and 40-ft) depth contour NMPP at 18,24, and 30-m (60,80, and 100-ft) depth contour	1.0-m diameter Hensen net, 571-um mesh, S, M, B Enumeration and identification of eggs and larvae
	Entrainment	Weekly or bimonthly depending upon year and season 1973-1979	Unit 1 intake and discharge 1973-1974 Unit 1, JAF intake 1975-1978 JAF intake and discharge 1975-1979	0.5-m diameter conical net 571-um mesh 1973-1975; Centrifugal pump into a 571-um mesh net; 1976-1979
6.5.2.1.2.13	Fish			
	Otter trawl	Bimonthly or monthly depending upon year and season 1973-1978	NMPW,NMPP 6 and 12-m (20 and 40-ft) 1972 NMPW, NMPP, NMPE 6,12, and 18-m (20,40, and 60-ft) depth contour 1973-1978	9.1-m (30-ft) otter trawl, surface and bottom
	Gill net	Bimonthly or monthly depending upon year and season 1972-1981	NMPW, NMPP 5,10,12-m (16,33, and 40-ft) depth contour 1972 NMPW,NMPP,FITZ,NMPE 5,10,12, and 20-m (16,33,40, and 66-ft) 1973-1978 NMPW,NMPP,NMPE,FITZ 10-m (33-ft) 1979-1981	Surface and bottom 1972-1976 bottom only 1977-1981 2,4x46-m (8x150-ft) experimental net

TABLE 6.8-1 (Cont)

Section Reference	Description	Frequency	Location	Method
	Beach seine	Bimonthly or monthly depending upon year and season 1972-1978	NMPE,NMPW,NMPP,FITZ	30-m (100-ft) long 1972-1973; 15-m (50-ft) long 1974-1978
	Trap net	Bimonthly April-December 1977-1978	NMPW,NMPE,FITZ,NMPP at 6-m (20-ft) depth contour	Set overnight, two 7.6-m (25-ft) leads
	Impingement	Unit 1 1973-1981 JAF 1975-1981 24-hr collections on a variable schedule	Unit 1 and JAF traveling screens	Identification and enumeration; Length and weight on subsample
6.6.2	Chemical-surface water			
6.6.2.1	Preoperational monitoring	Bimonthly and monthly depending upon parameters and stations 1973-1978; Bimonthly only 1979-1981	Monthly, NMPC,NMPP intake and discharge 1973-1974 NMPP/FITZ, 1975, NMPP/FITZ, NMPW,NMPE 1976-1978 Bimonthly, NMPE,NMPW,NMPC 1973; NMPE,NMPW,NMPP/FITZ 1974-1978	Monthly, 49 to 51 chemical parameters Bimonthly; 16 to 21 parameters 1973-1978 2 parameters (temp, D.O.) 1979-1981

TABLE 6.8-2

SUMMARY OF OPERATIONAL MONITORING

Section Reference	Description	Frequency	Location	Method
6.1.2	Thermal	As required by SPDES permit	As required by SPDES permit	As required by SPDES permit
6.4.2	Meteorological	Continuous	Main 61-m (200-ft) tower site	
	Wind speed/direction	Continuous	9 m (30 ft), 30 m (100 ft), 61 m (200 ft)	Teledyne Geotech 40.12C Wind Speed Processor 50.1B Wind Speed Sensor 52.1 Standard Anemometer 21.21 Wind Direction Processor 50.2C Wind Direction Sensor 53.2 Quick Two Vane
		Continuous	Inland supplemental tower, 9 m (30 ft)	Teledyne Geotech 40.12C Wind Speed Processor 50.1B Wind Speed Sensor 52.12 Standard Anemometer 21.21 Wind Direction Processor 50.2C Wind Direction Sensor 53.2 Quick Two Vane
		Continuous	James A. FitzPatrick backup meteorological pole 27 m (90 ft)	Teledyne Geotech 40.12C Wind Speed Processor 50.1B Wind Speed Sensor 52.2 Standard Anemometer 21.21 Wind Direction Processor 50.2C Wind Direction Sensor 53.2 Quick Two Vane
	Air temperature/ T	Continuous	9 m (30 ft), 30 m (100 ft), 61 m (200 ft)	Teledyne Geotech 21.32 Temperature Processor T-200 Platinum RTD 327B Aspirated Thermal Shield
	Dew point	Continuous	9 m (30 ft)	General Eastern 1200 EPS Chilled Mirror Dew Point System
	Precipitation	Continuous	Ground level	Teledyne Geotech 21.52 Precipitation Processor PG-200A-H Heated Precipitation Sensor S-100 Wind Screen

TABLE 6.8-2 (Cont)

Section Reference	Description	Frequency	Location	Method
6.4.2 (Cont)	Barometric pressure	Continuous	Ground level	Teledyne Geotech 40.61 Barometric Pressure Processor BP-100 Aneroid Pressure Sensor
6.5.2	Aquatic ecology	As required by SPDES permit	As required by SPDES permit	As required by SPDES permit
6.6.2.2	Chemical	As required by SPDES permit	As required by SPDES permit	As required by SPDES permit

Key: SPDES = State pollutant discharge elimination system

CHAPTER 7

ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

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ENVIRONMENTAL IMPACTS OF POSTULATED ACCIDENTS INVOLVING RADIOACTIVE MATERIALS

7.1 PLANT ACCIDENTS

This section discusses the radiological environmental impact of Unit 2, as required by 10CFR51 and based on the accident assumptions provided in the Environmental Standard Review Plan (ESRP), Section 7.1, and meets the criterion of Regulatory Guide 4.2. For each postulated accident, the following is provided:

1. Description of a representative type of accident appropriate for each accident class, together with its basic assumptions.

2. Determination of the radiological doses for each accident class as it applies to Unit 2.

Table 7.1-1 identifies the accidents considered. Table 7.1-2 summarizes the radiological doses for each accident to a hypothetical maximum exposed individual at the exclusion area boundary (EAB), as defined in 10CFR100. Table 7.1-3 summarizes the population doses for each accident at an 80-km (50-mi) radius, utilizing the projected demography for the year 2000.

The demographic data and the realistic X/Q values (50-percent probability level) that were used in these analyses can be found in Sections 2.5.1 and 2.7, respectively. Both the demographic data and X/Q values were based on the most recent information available, thus providing more representative individual and population doses.

7.1.1 Identification of Design Basis Accidents

7.1.1.1 Trivial Incidents (Class 1 Accidents)

These incidents are included and evaluated under routine release in accordance with Appendix I to 10CFR50 and are discussed in Section 5.4.

7.1.1.2 Small Releases Outside Containment (Class 2 Accidents)

These releases include releases from small spills or leaks of radioactive materials outside the containment. These releases are included and evaluated under routine releases in accordance with Appendix I to 10CFR50 and are discussed in Section 5.4.

7.1.1.3 Radwaste System Failures (Class 3 Accidents)

7.1.1.3.1 Equipment Leakage or Malfunction

The sources for this event are the largest radioactive liquid and gas storage tanks, which are the phase separator tank and the off-gas system charcoal delay bed, respectively. The rupture of a phase separator tank would cause the release of 25 percent of the maximum inventory of the liquid tank. The source of activity for the tank is based on the reactor water cleanup filter/demineralizer backwash. The duration of the accident is assumed to be 2 hr. A rupture of the off-gas system charcoal delay bed would cause the release of 25 percent of the average inventory on the bed. The source of activity for a bed is based upon the expected reactor steam activities. The effective charcoal delay bed holdup time for krypton is 41.5 hr and for xenon is 717.5 hr. The duration of the accident is assumed to be 2 hr.

7.1.1.3.2 Release of Waste Gas Storage Tank Contents

This event is similar to the previous accident with the exception that 100 percent of the charcoal bed inventory is released to the atmosphere.

7.1.1.3.3 Release of Liquid Waste Storage Tank Contents

This event is similar to the accident described in Section 7.1.1.3.1 with the exception that 100 percent of the tank inventory is spilled on the floor of the building. A partition factor of 0.002 is used for halogens released to the atmosphere.

7.1.1.4 Fission Products to Primary System (Class 4 Accidents)

7.1.1.4.1 Fuel Cladding Defects

These events are included and evaluated under routine releases in accordance with Appendix I to 10CFR50 and are discussed in Section 5.4.

7.1.1.4.2 Off-Design Transients That Induce Fuel Failures Above Those Expected

An off-design transient is postulated inducing fuel failures greater than those expected. Radioactivity is assumed to be carried to the condenser.

A representative source is defined as 0.02 percent of the core inventory of noble gases and halogens released to the reactor water. One percent of the halogens and 100 percent of the noble gases are assumed to be carried to the condenser, where all the gases and 10 percent of the halogens are available for leakage from the condenser to the turbine building at 0.5 percent/day. The accident is assumed to continue for 24 hr, after which all radioactive releases are terminated.

All activity released during the accident is assumed to be released from the turbine building, with no credit taken for holdup or plateout on the turbine building internal structures and no credit taken for an elevated release.

7.1.1.5 Refueling Accidents (Class 6 Accidents)

7.1.1.5.1 Fuel Bundle Drop

One fuel assembly is assumed to be dropped underwater during refueling, damaging one row of fuel pins. Activity is released from the rod gaps of the damaged pins and transported to the reactor building atmosphere. Release is through the standby gas treatment system (SGTS), due to the reactor building ventilation time-delay duct, allowing reactor building isolation prior to any releases.

A representative source is defined as the average rod-gap activity for eight rods as predicted for each isotope, assuming 1 week of decay has taken place. Gap activity is assumed to be 1 percent of the total activity in a pin. The activity is released underwater, and the retention factor of the water for iodine is assumed to be 500. The released activity is conservatively assumed to be instantaneously

available in the containment atmosphere. The exhaust is passed through charcoal filters whose efficiency is assumed to be 99 percent for iodines.

7.1.1.5.2 Heavy Object Drop Onto Fuel in Core

A heavy object is assumed to be dropped onto the reactor core during the refueling operation, damaging the equivalent of one complete fuel assembly. Activity is released from the rod gaps of the damaged pins and transported to the reactor building atmosphere. Release is through the SGTS, due to the reactor building ventilation time-delay duct, allowing reactor building isolation prior to any releases.

A representative source is defined as the average rod-gap activity for one fuel assembly as predicted for each isotope, assuming 100 hr of decay have taken place. The activity release mechanism is as described in Section 7.1.1.5.1.

7.1.1.6 Spent Fuel Handling Accident (Class 7 Accidents)

7.1.1.6.1 Fuel Assembly Drop in Fuel Storage Pool

This is the same as the fuel bundle drop accident discussed in Section 7.1.1.5.1, since the reactor building ventilation time-delay duct allows reactor building isolation prior to any release.

7.1.1.6.2 Heavy Object Drop Onto Fuel Rack

A heavy object is assumed to be dropped onto the spent fuel rack, damaging the equivalent of one complete fuel assembly. Activity is released from the rod gaps of the damaged pins and transported to the reactor building atmosphere. Release is through the SGTS charcoal filters.

A representative source is defined as the average rod-gap activity for one fuel assembly as predicted for each isotope, assuming 30 days of decay have taken place. The activity release mechanism is as described in Section 7.1.1.5.1.

7.1.1.6.3 Fuel Cask Drop

One fully loaded fuel cask is assumed to be dropped during vehicle loading, damaging the equivalent of 24 fuel assemblies. Activity is released from the rod gaps of the damaged pins directly to the environment at a very high rate.

A representative source is defined as the average noble gas rod-gap activity for 24 fuel assemblies as predicted for each isotope, assuming 120 days of decay have taken place. No ventilation systems or filters are considered in the release to the environment.

7.1.1.7 Accident Initiation Events Considered in Design Basis Evaluation in the Safety Analysis Report (Class 8 Accidents)

7.1.1.7.1 Loss-of-Coolant Accidents

7.1.1.7.1.1 Small Pipe Break

As a result of a postulated small pipe break inside the primary containment, 100 percent of the expected noble gas and halogen activity in the steam and 100 percent of the expected halogen activity in the water are assumed to be released. The total primary coolant mass releases are 275,736 kg (608,000 lb) of water and 11,791 kg (26,000 lb) of steam. This activity is assumed to leak from the primary containment at a rate of 1.1 percent per day; then it is mixed with 50 percent of the reactor building volume. The total leakage is assumed to be released through the SGTS charcoal filters, which are postulated to be 99 percent efficient for removal of iodine. Also, the dose reduction due to plateout and the decontamination factor in the suppression pool is assumed to be 20 percent for halogens. The dose at the EAB is calculated for a 30-day release period.

7.1.1.7.1.2 Large Pipe Break

The assumptions for a postulated accident of a large pipe break inside the primary containment are similar to those given in Section 7.1.1.7.1.1, except that an additional source corresponding to 0.2 percent of the core inventory of iodines and noble gases is assumed to be released instantaneously to the primary containment.

The representative source is defined as 100 percent of the expected noble gas and halogen activity in the steam, 100 percent of the expected halogen activity in the water, and an additional 0.2 percent of the core inventory of iodines and noble gases. The source is assumed to be instantly available to the primary containment, which leaks at 1.1 percent per day. This activity is mixed with 50 percent of the reactor building volume. The total leakage is assumed to be released through the SGTS charcoal filters, which are assumed to be 99 percent efficient for removal of iodine. The dose reduction due to plateout and the decon-

tamination factor in the suppression pool is assumed to be 20 percent for halogens.

7.1.1.7.2 Break in Instrument Line from Primary System That Penetrates the Primary Containment

This event postulates that a 0.64-cm (0.25-in) diameter instrument line carrying primary coolant ruptures in the reactor building. The inventory of the line is based on expected coolant activity. The dose reduction due to plateout and mixing is assumed to be 10 percent. The total release is purged through the SGTS charcoal filters, which are assumed to be 99 percent efficient for removal of iodine.

7.1.1.7.3 Rod Drop Accident

This event postulates that a control rod is dropped out of the core, resulting in a transient which induces fuel failure. Activity is assumed to be carried to the condenser, where condenser leakage is released to the turbine building and subsequently to the atmosphere.

A representative source is defined as 0.025 percent of the core inventory of noble gases and halogens released to the reactor water. One percent of the halogens and 100 percent of the noble gases are assumed to be carried to the condenser, where all the noble gases and 10 percent of the halogens are available for leakage from the condenser to the environment via the turbine building at 0.5 percent per day, for 1 day, with no credit taken for holdup or plateout on the turbine building internal structures.

7.1.1.7.4 Steam Line Breaks

7.1.1.7.4.1 Small Pipe Break

This event is postulated as a sudden and complete severance of a small (0.023-sq m [0.25-sq ft]) steam line in the turbine building. As a result, an integrated quantity of 4.9×10^3 kg (1.07×10^4 lb) of steam is released. The representative source has been defined as 10 percent of the expected halogen activity in the reactor coolant and 100 percent of the expected noble gas activity in the reactor steam. The halogens and noble gases are released to the environment through the main stack via the turbine building ventilation system, which has no charcoal filtration.

7.1.1.7.4.2 Large Pipe Break

This event is postulated as the sudden, complete severance of a main steam line in the turbine building. The isolation signal is expected to occur within 0.5 sec after the break, and an additional 5 sec are assumed for effecting full closure of the main steam isolation valve. During this 5.5-sec period, an integrated quantity of 4.1×10^4 kg (9.13×10^4 lb) of water and 7.1×10^3 kg (1.56×10^4 lb) of steam are estimated to be released in the turbine building.

The representative source has been defined as 100 percent of the expected noble gas activity in the reactor steam and 50 percent of the halogens in the fluid exiting the break. The halogens and noble gases are released to the environment via the turbine building blowout panels.

7.1.2 Discussion of Plant Accidents and Methodology Used to Calculate Doses

Doses are calculated for a representative accident from each accident class defined in ESRP Section 7.1. Calculations of doses to individuals and the population are performed in accordance with the method and assumptions of ESRP Section 7.1 and Regulatory Guides 1.3 and 1.145. Population doses are calculated by adjusting the individual doses by a factor that incorporates population density and X/Q values for each sector.

7.1.2.1 Estimates of Doses for Accidents

A summary of the radiological doses to an individual at the EAB is provided in Table 7.1-2. For each accident, the resultant thyroid, beta, and gamma doses are listed.

7.1.2.2 Man-Rem Values for Accidents

A summary of the population doses within an 80-km (50-mi) radius of Unit 2 is provided in Table 7.1-3. For each accident, the resultant thyroid, beta, and gamma population doses are listed.

7.1.3 Class 9 Accidents Analysis

The effect of Class 9 accidents at Unit 2 is analyzed probabilistically by comparing the Unit 2 plant with a reference BWR plant for which a full analysis has been completed. The reference BWR plant chosen for accident/event and system analyses is the Grand Gulf 1 (GG1) plant. The reference BWR chosen for primary containment

analysis is the Limerick plant. The consequence analysis is plant and site specific to Unit 2. Analysis methods are similar to those presented in the GCl study (NUREG/CR-1659/4 of 4), WASH-1400 (NUREG-75/014), and the Limerick probabilistic risk assessment (Docket Nos. 50-352 and 50-353). Details of the analysis, results, and conclusions are presented in Appendix 7A.

TABLE 7.1-1

REACTOR FACILITY - CLASSIFICATION OF POSTULATED ACCIDENTS AND OCCURRENCES

Class Description	Accident*	Plant Design Analyses
Trivial incidents	Releases in accordance with Appendix I to 10CFR50	Included in normal releases
Small releases outside containment	Spills, leaks, and pipe breaks	Included in normal releases
Radwaste system failures	Equipment leakage or malfunction (including operator error)	25 percent of charcoal bed activity - 2-hr release period
	Release of gas storage tank contents	100 percent of charcoal bed activity - 2-hr release period
	Release of liquid storage tank contents	100 percent of phase separator tank activity - 2-hr release period
Fission products to primary system	Fuel-cladding defects	Included in normal releases
	Off-design transients that induce fuel failure	0.02 percent core inventory release through condenser leakage - 24-hr release period
Refueling accidents	Fuel bundle drop	One row of fuel pins at 1-week decay - 2-hr release period
	Heavy object drop onto fuel in core	One assembly at 100-hr decay - 2-hr release period

TABLE 7.1-1 (Cont)

Class Description	Accident*	Plant Design Analyses
Spent fuel handling accident	Fuel assembly drop in storage pool	One row of fuel pins at 1-week decay - 2-hr release period
	Heavy object drop onto fuel rack	One assembly at 30 days decay - 2-hr release period
	Fuel cask drop	24 fuel assemblies at 120 days decay - 2-hr release period
Accident initiation events considered in design basis evaluation in the safety analysis report	Loss of coolant	Small and large break - 30-day release period
	Rod drop accident	0.025 percent core inventory with releases through condenser leakage - 24-hr release period
	Main steam line break	Small and large break - 2-hr release period

*As defined in ESRP Section 7.1.

TABLE 7.1-2

SUMMARY OF RADIOLOGICAL DOSES AT THE EXCLUSION AREA BOUNDARY

Accident	Thyroid Dose (Rem)	Total Beta Dose (Rem)	Total Gamma Dose (Rem)
10CFR100 dose criteria	3.0+02*	-	2.5+01
Equipment leakage or malfunction			
Liquid	2.30-03	8.50-07	3.35-06
Gas	-	8.75-04	1.05-03
Release of gas storage tank	-	3.5-03	4.2-03
Release of liquid storage tank	9.18-03	3.40-06	1.34-05
Off-design transients that induce fuel failure	7.22-04	1.43-04	2.05-04
Fuel bundle drop	9.38-09	3.32-08	1.94-08
Heavy object drop onto fuel in core	9.25-08	5.43-07	2.86-07
Fuel assembly drop in storage pool	9.38-09	3.32-08	1.94-08
Heavy object drop onto ruel rack	1.01-08	1.64-08	7.27-09
Fuel cask drop	-	2.31-04	7.86-06
Loss-of-coolant -			
Small break	9.32-09	3.92-10	1.03-09
Large break	2.02-03	5.15-05	7.60-05
Instrument line break	2.35-08	5.29-10	2.04-09
Rod drop accident	9.05-04	1.79-04	2.56-04

TABLE 7.1-2 (Cont)

Accident	Thyroid Dose (Rem)	Total Beta Dose (Rem)	Total Gamma Dose (Rem)
Main steam line -			
Small break	3.5-07	1.6-08	2.2-08
Large break	2.78-03	3.59-05	1.16-05

*3.0+02 = $3.0x10^2$

TABLE 7.1-3

SUMMARY OF POPULATION DOSES WITHIN AN 80-KM (50-MI) RADIUS

Accident	Thyroid Dose (man-Rem)	Total Beta Dose (man-Rem)	Total Gamma Dose (man-Rem)
Radwaste equipment leakage or malfunction -			
Gaseous	-	5.00+00*	6.00+00
Liquid	1.31+01	4.86-03	2.00-02
Release of gas storage tank	-	2.00+01	2.40+01
Release of liquid storage tank	5.24+01	2.00-02	8.00-02
Off-design transients that induce fuel failure	4.15+00	8.20-01	1.17+00
Fuel bundle drop	3.00-03	1.20-02	7.00-03
Heavy object drop onto fuel in core	3.30-02	1.93-01	1.02-01
Fuel assembly drop in storage pool	3.00-03	1.20-02	7.00-03
Heavy object drop onto fuel rack	4.00-03	6.00-03	3.00-03
Fuel cask drop	-	1.32+00	4.50-02
Loss-of-coolant -			
Small break	2.89-03	1.22-04	3.24-04
Large break	6.17+02	1.58+01	2.38+01
Instrument line break	1.00-02	1.88-04	7.26-04
Rod drop accident	5.21+00	1.03+00	1.48+00

TABLE 7.1-3 (Cont)

Accident	Thyroid Dose (man-Rem)	Total Beta Dose (man-Rem)	Total Gamma Dose (man-Rem)
Main steam line -			
Small break	1.20-01	1.00-02	1.00-02
Large break	1.59+01	2.10-01	7.00-02

*5.00+00 = 5.00×10^0

NOTES: 1. Based on U.S. population projected for the year 2000.
2. Natural background radiation is 6.56+01 mRem/yr.

7.2 TRANSPORTATION ACCIDENTS

The transportation of fuel and wastes to and from Unit 2 is within the scope of paragraph (g) of 10CFR51.20. The expected environmental risk for Unit 2 falls within the evaluation provided in Summary Table S-4 of 10CFR51.

APPENDIX 7A

PROBABILISTIC RISK ANALYSIS

APPENDIX 7A

PROBABILISTIC RISK ANALYSIS

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PROBABILISTIC RISK ANALYSIS (PRA)

7A.1 INTRODUCTION

The design and construction of Unit 2 has included considerable effort to produce a highly reliable and safe plant. This is achieved through correct design, manufacture, and installation of basic plant structures and components, within the context of an effective quality assurance program. Similar emphasis is placed on the operational aspects in terms of developing detailed procedures and providing for quality training of plant operating and maintenance personnel. In the very unlikely event that serious accidents might occur, the station is equipped with a complement of emergency safety features for mitigating the effects and consequences of such accidents.

In this appendix the potential environmental effects of postulated accidents from internal initators at Unit 2 are assessed. The assessment is done in a risk analysis format. That is, the probabilities of realizing various levels of consequences from a wide spectrum of possible but low probability accidents and associated environmental conditions are considered. The intent of such an analysis is to produce an assessment which realistically reflects the environmental risk from postulated accidents and which is responsive to the recent interim policy statement issued by the NRC regarding nuclear power plant accident assessments under the National Environment Policy Act.

7A.1.1 General Approach and Scope of Analysis

The Unit 2 risk analysis is performed using the methodology presented in WASH-1400, Reactor Safety Study (RSS)[1]. In October 1981, the RSS methodology was applied to four U.S. light-water reactors (LWR), one of which was Grand Gulf 1 (GG1). The GG1 results are presented in the following report: Reactor Safety Study Methodology Applications Program: Grand Gulf 1 BWR Power Plant (RSSMAP)[2]. GG1 is a MARK III/BWR 6, while Unit 2 uses the MARK II/BWR 5 design. For the safety-related systems (including reactor core isolation cooling [RCIC]), the designs are identical, with the exception of some improvements in certain systems at Unit 2. Therefore, the systems analysis and accident sequence analysis presented in the Reactor Safety Study Methodology Applications Program for GG1 are used for performing the Unit 2 analyses. Equipment failure data,

operator failure data, and similar information are taken from WASH-1400 unless otherwise stated.

Recent risk assessments clearly indicate that the risk from LWR power plants is dominated by the severe accidents[1,2]. Since the observation is based upon a comparative evaluation rather than upon absolute assessed risk, it is applicable to any particular LWR power plant. Accordingly, the scope of the present analysis for Unit 2 emphasizes consideration of environmental effects from postulated severe accidents.

The offsite consequences of the specified releases are evaluated in this study using a similiar calculational mechanism as was used in WASH-1400[1], but the weather data file and the population distributions used are specific to the site. The treatment of evacuation in the analysis also utilizes population movement data that have been developed from actual site survey studies.

The particular methodologies employed in both the accident frequency determinations and in the consequence assessment portions of the analysis are discussed in more detail in the following sections. The combined risk assessment results for all accident release categories are displayed in probabilistic format. These results adopt many of the measures of risk that are customarily used in probabilistic risk assessments of nuclear facilities.

7A.2 SYSTEMS ANALYSIS

In lieu of developing detailed fault trees for safety-related systems, Unit 2 systems are analyzed in the same manner as the GG1 study; that is, system failures are determined by writing the Boolean equation for the system and then substituting failure rate data into the equations to calculate system unavailability. The same types of failures as analyzed in a fault tree are analyzed in tabular format. These types of failures are:

1. Hardware failures.
2. Maintenance outage.
3. Valve plugged.
4. Testing outage.
5. Initiating circuit failure.

The following accident cases were chosen for Unit 2:

1. Transient requiring reactor scram initiated by the loss of offsite power, designated transient T_1.
2. Transient requiring reactor scram initiated by the loss of the power conversion system (PCS) or reactor scram initiated by other causes (except loss of offsite power) where the PCS is initially available, designated transient T_{23}. Offsite and/or onsite emergency power is assumed to be available during T_{23}.
3. Small loss-of-coolant accident (LOCA) where the equivalent leak diameter is less than 34 cm (13.5 in), designated S.

In the GG1 study and in the RSS, these cases were the initiating events that mostly contributed to risk; therefore, system unavailabilities are calculated for these cases only. Transients, not LOCAs, strongly dominate the risk in BWRs. The Boolean reduction of the transient and LOCA event trees in this study came directly from the GG1 study. Large LOCAs were several orders of magnitude less significant than small LOCAs and transients.

The following safety-related systems are analyzed:

1. Reactor protection system (RPS).
2. Emergency ac power system (EPS).
3. DC power system (DCPS).
4. Vapor suppression system (VSS).
5. High-pressure core spray system (HPCS).
6. Reactor core isolation cooling system (RCIC).
7. Low-pressure core spray system (LPCS).
8. Automatic depressurization system (ADS).
9. Low-pressure coolant injection system (LPCI).
10. Residual heat removal system (RHR).
11. Service water system (SW).

A brief system description is presented in the following paragraphs. Table 7A.2-1 provides a listing of the calculated system unavailabilities for Unit 2.

7A.2.1 Reactor Protection System

The RPS consists of two subsystems: the reactor protection system logic (RPSL) and the control rod drive (CRD) system. The RPSL monitors various plant parameters and systems status and initiates a reactor scram if predetermined values are reached. When a scram is initiated by the RPS, the CRD system inserts negative reactivity necessary to shut down the reactor. Each control rod is individually controlled by a hydraulic control unit (HCU). When a scram signal is received, high-pressure water stored in an accumulator in the HCU or reactor pressure forces the control rod into the core.

Complete descriptions of these subsystems are provided in FSAR Sections 7.1.3 and 3.9.4/4.6, respectively.

7A.2.2 Emergency AC Power System

A standby power supply system is provided for the operation of emergency systems and engineered safety features (ESF) during and following the shutdown of the reactor when the preferred power supply is not available. The standby power supply system consists of three standby diesel generators. One generator is dedicated to each of the three divisions of the safety-related electric power distribution system feeding each Class 1E load group. Any two of the three standby diesel generators have sufficient capacity to start, and accelerate to rated speed, all needed ESFs and emergency shutdown loads in case of a LOCA and/or loss of offsite power. The standby diesel generator fuel oil storage tanks are sized to hold a 7-day supply of fuel oil based on the engine running continuously at full load. A LOCA and/or loss of offsite power signal initiates start of the standby diesel generators and the generators pick up the loads in a programmed sequence. Standby diesel generators are independent and feed separate load groups through separate physically and electrically isolated distribution systems.

A full description of the EPS is provided in FSAR Section 8.3.1.

7A.2.3 DC Power System

A 125-V emergency dc power system feeds all safety-related dc protection, control and instrumentation loads, and safety-related dc motors under normal operation of the plant as well as during emergency conditions. The system is divided into three redundant divisions each consisting of its own battery, primary and backup battery chargers, switchgears/motor control centers, and distribution panels. Each division feeds dc loads associated with corresponding divisions of the safety-related electric power distribution system. Batteries and battery chargers are redundant and feed separate load groups through separate and isolated distribution systems.

A complete description of the dc power system is provided in FSAR Section 8.3.2.

7A.2.4 Vapor Suppression System

The VSS consists of the primary containment structure, the downcomer piping from the drywell air space to the suppression pool, and the containment spray system.

The primary containment structure is a steel-lined, reinforced concrete structure consisting of a conical drywell chamber above a cylindrical suppression pool chamber separated by a drywell floor. The downcomer piping system consisting of 122 25-cm (10-in) diameter pipes penetrate the drywell floor and direct steam emitted from a LOCA into the suppression pool resevoir where it is quenched. The containment spray system consists of two redundant subsystems, each with its own full-capacity spray header. Each subsystem is supplied from a separate, redundant RHR loop.

A complete description of the VSS is provided in FSAR Section 6.2.

7A.2.5 High-Pressure Core Spray System

The HPCS system provides and maintains an adequate coolant inventory inside the reactor pressure vessel (RPV) to limit fuel cladding temperatures in the event of a LOCA. The system is initiated by either high pressure in the drywell or low water level in the vessel, and pumps water from the condensate storage tanks (preferred source) or the suppression pool (backup source) directly into the RPV via an electrically driven pump. It operates independently of all other systems over the entire range of pressure differences from greater than normal operating pressure to zero. The HPCS cooling decreases vessel pressure to enable the low-pressure cooling systems to function. The HPCS system pump motor is powered by a dedicated onsite diesel generator if offsite power is not available. The system may also be used as a backup for the RCIC system.

A complete description of the HPCS system is provided in FSAR Section 6.3.

7A.2.6 Reactor Core Isolation Cooling System

The RCIC system provides makeup water to the RPV from the condensate storage tanks (preferred) on the suppression pool (backup) when the vessel is isolated. The RCIC system uses a steam-driven turbine-pump unit and automatically operates to maintain adequate water level in the RPV.

A complete description of the RCIC system is provided in FSAR Section 5.4.6.

7A.2.7 Low-Pressure Core Spray System

The LPCS system consists of one independent pump and valves and piping to deliver cooling water from the suppression pool to a spray sparger over the core. The system is actuated by either low water level in the RPV or high pressure in the drywell, but water is delivered to the core only after RPV pressure is reduced. This system provides the capability to cool the fuel by spraying water into each fuel channel. The LPCS loop functioning in conjunction with the ADS or HPCS can provide sufficient fuel cladding cooling following a LOCA.

A complete description of the LPCS system is provided in FSAR Section 6.3.

7A.2.8 Automatic Depressurization System

The ADS rapidly reduces RPV pressure in a LOCA situation in which the HPCS system fails to maintain the RPV water level. The depressurization provided by the system enables the low-pressure emergency core cooling system (ECCS) to deliver cooling water to the RPV. The ADS uses some of the relief valves that are part of the nuclear system pressure relief system. The automatic relief valves are arranged to open on conditions indicating both that a break in the reactor coolant pressure boundary (RCPB) has occurred and that the HPCS system is not delivering sufficent cooling water to the RPV to maintain the water level above a preselected value. The ADS is not activiated unless either the LPCS or LPCI pumps are operating. This is to ensure that adequate makeup coolant is available for core delivery prior to allowing coolant loss through the relief valves.

A complete description of the ADS is provided in FSAR Sections 5.4.13 and 6.3.

7A.2.9 Low-Pressure Coolant Injection

LPCI is an operating mode of the RHR system, but is discussed here because the LPCI mode acts as an ESF in conjunction with the other ECCSs. LPCI uses the pump loops of the RHR to inject cooling water into the RPV from the suppression pool. LPCI is actuated by either low water level in the RPV or high pressure in the drywell, but water is delivered to the core only after RPV pressure is reduced. LPCI operation provides the capability of core reflooding, following a LOCA, in time to maintain the fuel cladding below the prescribed temperature limit.

A complete description of the LPCI operating mode of the RHR system is provided in FSAR Sections 5.4.7 and 6.3.

7A.2.10 Residual Heat Removal System

The RHR system is a system of pumps, heat exchangers, and piping that fulfills the following functions:

1. Removes decay and sensible heat during and after plant shutdown.

2. Injects water into the RPV following a LOCA to reflood the core independently of other core cooling systems.

3. Removes heat from the containment following a LOCA, to limit the increase in containment pressure. This is accomplished by cooling and recirculating the suppression pool water (containment cooling) and by spraying the drywell and suppression pool air spaces (containment spray) with suppression pool water.

A complete description of the RHR system, is provided in FSAR Sections 5.4.7 and 6.3.

7A.2.11 Service Water System

The SW system provides cooling water to various essential and nonessential components throughout the plant. Essential components are serviced by two 100-percent redundant subsystems. The nonessential components will be automatically isolated upon receipt of a LOCA signal coincident with a loss of offsite power. The SW pumps take their suction from Lake Ontario via the screenwell complex and intake tunnels. After passing through the system, the discharge is returned to the lake and to the circulating water system as makeup.

A complete description of the SW system is provided in FSAR Section 9.2.1.

7A.2.12 Systems Analysis Summary

Table 7A.2-1 shows a comparison between Unit 2 and Peach Bottom 2 (PB2) (RSS) for those systems analyzed in Sections 7A.2.1 through 7A.2.11. The PB2 values are median unavailabilities computed using a Monte Carlo statistical simulation. The Unit 2 and GG1 values are point estimates

of unavailabilities computed for different initiating events, i.e., LOCA (S) and transients (T_1 and T_{23}).

The system unavailabilities presented in Table 7A.2-1 represent independent unavailabilities because system interactions are not represented. To properly analyze unavailability, the interactions and system successes must be factored into the problem, which is done in Section 7A.3, where the event sequence probabilities are developed. The system success and failure Boolean equations, not the numerical system unavailability values, are properly combined according to the laws of Boolean algebra. However, computing the numerical values does provide an indication of what dominates the system unavailability.

TABLE 7A.2-1

COMPARISON OF SYSTEM UNAVAILABILITIES
BETWEEN UNIT 2, PB2, AND GG1

System	Median Unavailability PB2 (from RSS)	GG1 Unavailability	Unit 2 Unavailability
RPS	$1.3x10^{-5}$	RPS(S, T_{23}) $7.7x10^{-6}$ RPS(T_1) $5.8x10^{-6}$	RPS(S,T_{23}) $7.7x10^{-6}$ RPS(T_1) $5.8x10^{-6}$
EPS[(1)]	$1x10^{-6}$	$6x10^{-5}$	$5.0x10^{-6}$
DCPS	$1x10^{-3}$	$1x10^{-3}$	$1x10^{-3}$
VSS	Large LOCA $4.6x10^{-5}$ Small LOCA $1.6x10^{-3}$	$8.0x10^{-5}$	$5.5x10^{-5}$
HPCS/HPCI	HPCI $9.8x10^{-2}$	HPCS(S) $2.2x10^{-2}$ HPCS(T_1) $3.3x10^{-2}$ HPCS(T_{23}) $2.2x10^{-2}$	HPCS(S) $4.0x10^{-2}$ HPCS(T_1) $4.0x10^{-2}$ HPCS(T_{23}) $3.8x10^{-2}$
RCIC	$8x10^{-2}$	$5.2x10^{-2}$	$6.7x10^{-2}$
LPCS/CSIS	CSIS(one loop) $6x10^{-2}$ CSIS(both loops) $9.5x10^{-4}$	LPCS(S,T_{23}) $2.2x10^{-2}$ LPCS(T_1) $3.5x10^{-2}$	LPCS(S,T_1,T_{23}) $3.6x10^{-2}$
ADS	$5x10^{-3}$	ADS(S) $5x10^{-3}$ ADS(T_1,T_{23}) $1.5x10^{-3}$	ADS(S) $5x10^{-3}$ ADS(T_1,T_{23}) $1.5x10^{-3}$
LPCI	$1.5x10^{-2}$	LPCIA,B(S) $2.8x10^{-2}$ LPCIA,B(T_1) $4.1x10^{-2}$ LPCIA,B(T_{23}) $2.8x10^{-2}$ LPCIC(S) $2.3x10^{-2}$ LPCIC(T_1) $3.6x10^{-2}$ LPCIC(T_{23}) $2.3x10^{-2}$	LPCIA,B(S) $3.1x10^{-2}$ LPCIA,B(T_1) $3.1x10^{-2}$ LPCIA,B(T_{23}) $2.8x10^{-2}$ LPCIC(S) $2.6x10^{-2}$ LPCIC(T_1) $2.6x10^{-2}$ LPCIC(T_{23}) $2.3x10^{-2}$
RHR/LPCRS[(2)]	LPCRS $1.2x10^{-4}$	RHR(S) $3.0x10^{-3}$ RHR(T_1,T_{23}) $2.7x10^{-4}$	RHR(S) $4.3x10^{-3}$ RHR(T_1, T_{23}) $8.5x10^{-6}$

TABLE 7A.2-1 (Cont)

System	Median Unavailability PB2 (from RSS)	GG1 Unavailability	Unit 2 Unavailability
Service Water/ HPSWS and ESWS(3)	HPSWS(30 min) 4.3×10^{-4} HPSWS(25 hr) 1.1×10^{-4} ESWS 1.2×10^{-4}	SSWA,B(S) 2.2×10^{-2} SSWA,B(T_1) 2.3×10^{-2} SSWA,B(T_{23}) 2.2×10^{-2} SSWC(S) 1.5×10^{-2} SSWC(T_1) 1.6×10^{-2} SSWC(T_{23}) 1.5×10^{-2}	SWA,B(S) 5.5×10^{-3} SWA,B(T_1) 2.7×10^{-3} SWA,B(T_{23}) 2.7×10^{-3}

(1)All unavailabilities shown are on a per reactor-year basis.
(2)This unavailability represents total loss of ac power (offsite and onsite). The Unit 2 calculation of total loss of ac power is: T_1*EPS1*EPS2*EPS3 = $(5.9\times10^{-2})*(4.8\times10^{-2})*(4.8\times10^{-2})*(3.7\times10^{-2})$ = 5.0×10^{-6}
(3)The PB2 value of LPCRS is completely dominated by failure to cool the CSIS and LPCI pump rooms, which is caused by ESWS failures.
(4)The combined Unit 2 service water unavailability is: $(2.7\times10^{-3})*(2.7\times10^{-3}) = 7.3\times10^{-6}$ for transients and $(5.5\times10^{-3})*(5.5\times10^{-3}) = 3.0\times10^{-5}$ for LOCAs.

KEY:
- CSIS = Core spray injection system
- LPCIA,B,C = LPCI loops A,B, or C
- LPCRS = Low-pressure coolant recirculation system
- SSWA,B,C = Standby service water loop A, B, or C
- SWA,B = Service water loop A or B
- HPSWS = High-pressure service water system
- ESWS = Emergency service water system

7A.3 ACCIDENT SEQUENCES

Accidents are analyzed using the event tree methodology presented in the RSS. Separate event trees are developed for transients and LOCAs. The event tree method shows, in a logical manner, which event sequences lead to core melt and which sequences result in an adequately cooled core. Event sequences are defined as combinations of required system operations in which one or more systems fail to perform as designed to protect the core. Symbols for event trees in this section are listed in Table 7A.3-1.

7A.3.1 Transient Event Tree

The transient event tree for Unit 2 is shown on Figure 7A.3-1. Transients considered are those that are anticipated, are not LOCA-induced, and require prompt reactor shutdown. Functions required to mitigate the effects of these transients are:

1. The reactor must be rapidly brought to a subcritical condition.

2. Reactor coolant system pressure must be controlled and kept from exceeding a value that would fail the RCPB.

3. RPV level must be maintained above the top of the active fuel bundles.

4. Core decay heat must be transferred to the ultimate heat sink (UHS).

System operations (or combinations of systems) that perform these functions are the column headings of the event tree and are described as follows:

1. The RPS promptly renders the reactor subcritical, if it functions properly, by rapidly inserting all control rods into the core. Subcriticality can also be effected by use of alternative shutdown systems, such as recirculation pump trip (RPT), initiation of poison injection (standby liquid control [SLC] system), and alternate rod insertion. These alternative functions are actuated manually.. Collectively, these functions, as installed at Unit 2, are referred to as ATWS Mod 2A.

2. The safety/relief valves (SRVs) perform the pressure control function. Both the opening of the

valves at high pressure and the proper reseating of valves are considered in the analysis.

3. Several systems provide makeup water to the core after a transient. The low-pressure systems require that the ADS functions properly in order to lower RPV pressure and allow delivery to the core. Systems designated as core makeup systems are:

    a. PCS (consisting of feedwater and condensate)

    b. HPCS

    c. RCIC

    d. LPCS

    e. LPCI

4. The PCS or the RHR system, in conjunction with the SW system, must function to remove decay heat from the core and transfer it to the UHS (Lake Ontario).

Systems required to perform successfully during a transient are summarized in Table 7A.3-2.

7A.3.2 LOCA Event Tree

The LOCA event tree for Unit 2 is shown on Figure 7A.3-2. Functions required to mitigate the effects of a LOCA are:

1. The reactor must be rapidly brought to a subcritical condition.

2. The core must be kept covered and cooled.

3. Overpressurization of the containment must be prevented.

4. Radioactive material must be prevented from escaping to the environment.

Systems that perform these functions are the column headings of the event tree and are as follows:

1. The RPS or ATWS Mod 2A components promptly render the reactor subcritical.

2. Several systems are available to make up core inventory lost through a leak: HPCS, RCIC, LPCS, and LPCI. For small leaks, ADS is necessary to depressurize the RPV in order to allow LPCS and/or LPCI operation. For large leaks, the RPV will depressurize through the leakage path and the ADS is not required. Although RCIC is not an ECCS, it is effective in providing makeup water during small LOCAs and credit is taken for its operation and account is made for its failure to operate over the whole spectrum of small LOCAs (up to 34-cm [13.5-in] equivalent diameter). The RSS assumed credit for RCIC only up to 5-cm (2-in) diameter leaks. In the GG1 study (BWR 6), credit was taken for RCIC during all small LOCAs, and the difference in final overall core melt probability was less than 1 percent. Therefore, credit for.RCIC during all small LOCAs is assumed for Unit 2.

   No credit for the PCS is taken for injection or long-term cooling, because the PCS may be isolated by main steam isolation valve (MSIV) closure at the outset of the accident . In addition, the manual actions required to recover PCS renders it inoperable during the initial stages of the accident.

3. The VSS is expected to quench steam emitted from the reactor coolant system throughout a LOCA. Failure of the VSS to perform this function could eventually compromise containment integrity. As the event progresses, the suppression pool will heat up, requiring the RHR and SW systems to function to remove heat in the suppression pool cooling mode or containment spray mode.

4. The VSS also plays an important role in limiting the emission of radioactive material to the environment. As steam is condensed in the suppression pool, radioactive material is deposited in the pool. Also, the containment spray mode of the RHR system scrubs radioactivity from the containment atmosphere. Successful containment spray requires successful RHR system operation.

Systems required to successfully operate are summarized in Table 7A.3-3.

7A.3.3 Accident Sequence Summary

The following sections provide a short description and the probability for each dominant accident sequence for Unit 2.

7A.3.3.1 Sequence T_1PQI

This sequence is initiated by a loss of offsite power followed by an SRV failing to reseat, a failure of the PCS, and a failure of the RHR system to remove decay heat.

When an SRV fails to reseat, the suppression pool will heat up due to the constant deposition of core decay heat in the pool. Failure of the RHR system to remove this heat will eventually overpressurize the containment.

Recovery of the PCS requires the recovery of offsite power. Terms LOPNRS and LOPNRL reflect the failure to accomplish this within 28 hr. Since long-term failures are required to cause core melt in this sequence, a recovery factor is applied to all cut sets, which accounts for plant personnel attempting to restore or repair critical equipment or to take other possible corrective actions to mitigate the event.

The most probable cut sets are dominated by the inability to recover offsite power, failure of onsite emergency power, and RHR system hardware faults.

The probability of occurrence for sequence T_1PQI is $5.8x10^{-10}$/reactor-year.

7A.3.3.2 Sequence $T_{23}PQI$

This sequence is initiated by a T_{23} transient, followed by the same failures as T_1PQI. The same recovery factor used in sequence T_1PQI is applied in sequence $T_{23}PQI$. The most probable cut sets are dominated by failure of the PCS to remove decay heat long term (even with ac power available) and valve failures in the RHR system that prevent the suppression pool from being cooled.

The probability of occurrence of sequence $T_{23}PQI$ is $3.2x10^{-6}$/reactor-year.

7A.3.3.3 Sequence T_1PQE

This sequence is initiated by a loss of offsite power, followed by an SRV failing to reseat, a failure of PCS (due to unavailability of ac power), and a failure of core makeup (ECCS) systems to deliver water to the RPV.

Core makeup can be accomplished by HPCS, RCIC, LPCS, or two of three LPCI loops. LPCS and LPCI require ADS operation to lower RPV pressure. It is assumed that the transient does not automatically initiate ADS; therefore, the operator must perform this action. Failure to make up water to the RPV with a stuck-open relief valve will quickly lead to core melt.

The PCS will be interrupted shortly after the sequence develops, when the MSIVs close on low RPV level or low steam pressure. No credit is taken for PCS providing core makeup because of the relatively long period of time required to restore the steam, feedwater, and condensate systems to operation. Since this sequence is not long term, the recovery factor is not included.

The most probable cut sets are dominated by RCIC and HPCS hardware faults, ac power unavailability, and operator failure to actuate ADS.

The probability of occurrence of sequence T_1PQE is $2.4x10^{-8}$/reactor-year.

7A.3.3.4 Sequence $T_{23}PQE$

This sequence is initiated by a T_{23} transient followed by the same failures as sequence T_1PQE. The most probable cut sets are dominated by HPCS and RCIC hardware (mechanical and electrical) faults and the failure of the operator to manually initiate the ADS.

The probability of occurrence of sequence $T_{23}PQE$ is $2.1x10^{-6}$/reactor-year.

7A.3.3.5 Sequence SI

This sequence is initiated by a small LOCA followed by a failure of the RHR system to remove decay heat from the suppression pool. Failure to cool the pool will eventually cause containment failure due to overpressure. No credit for the PCS is taken in this sequence because it is assumed that the MSIVs will be shut during the accident. Since this

is a long-term sequence, the recovery factor for long-term cooling is incorporated.

The most probable cut sets are dominated by RHR hardware faults and SW loop B hardware faults.

The probability of occurrence of sequence SI is 1.0×10^{-6}/reactor-year.

7A.3.3.6 Sequence T_1QW

This sequence is initiated by a loss of offsite power, followed by the unavailability of the PCS and RHR system. Failure to remove decay heat from the suppression pool within about 28 hr will eventually cause containment failure due to overpressure. Successful operation of either the PCS or RHR system will require ac power (offsite power to operate the PCS). This is reflected in the cut sets. Since this sequence involves long-term failures, the recovery factor is applied to each cut set.

The most probable cut sets are dominated by ac power system failures and RHR system valve failures.

The probability of occurrence of sequence T_1QW is 3.5×10^{-9}/reactor-year.

7A.3.3.7 Sequence $T_{23}QW$

This sequence is initiated by a T_{23} transient and is followed by the same failures as sequence T_1QW. Since ac power is available, other failures within the PCS must cause its unavailability. This is accounted for by the term Q in the cut sets. Also, this is a long-term failure sequence; therefore, the recovery factor has been included.

The most probable cut sets are dominated by PCS unavailability, RHR system valve failures, and SW loop hardware failures.

The probability of occurrence of sequence $T_{23}QW$ is 1.1×10^{-5}/reactor-year.

7A.3.3.8 Sequence T_1QUV

This sequence is initiated by a loss of offsite power followed by the unavailability of the PCS and a failure of the high-pressure and low-pressure core makeup systems to deliver water to the RPV. Failure to keep the core covered will quickly lead to core melt and containment failure due

to overpressure or hydrogen burning. Credit is not taken for the PCS because it is assumed that offsite power cannot be restored within 1/2 hr. Successful low-pressure makeup depends upon the operator manually actuating the ADS, because it is assumed that system parameters do not reach automatic ADS set points. This is a short-term sequence; therefore, no recovery factor is included.

The most probable cut sets are dominated by failure to recover offsite power within 1/2 hr, diesel failures, operator failure to manually actuate the ADS, and HPCS/RCIC hardware failures.

The probability of occurrence of sequence T_1QUV is $3.1x10^{-7}$/reactor-year.

7A.3.3.9 Sequence $T_{23}C$

This sequence is initiated by a T_{23} transient followed by a failure to achieve reactor subcriticality. Failure of the RPS and the operator is expected to leave reactor power low in the power range. The SRVs will lift to reject heat to the suppression pool; however, this heat load is beyond the heat removal capability of the RHR system and will cause containment failure due to overpressure. It is assumed ECCS pumps will cavitate and fail due to suppression pool boiling, which will lead to core melt.

The probability of occurrence of sequence $T_{23}C$ is 5.4×10^{-6}/reactor-year.

The following is a summary of Unit 2 dominant accident sequence probabilities:

T_1PQI	$5.8x10^{-10}$
$T_{23}PQI$	$3.2x10^{-6}$
T_1PQE	$2.4x10^{-8}$
$T_{23}PQE$	$2.1x10^{-6}$
SI	$1.0x10^{-6}$
T_1QW	$3.5x10^{-9}$
$T_{23}QW$	$1.1x10^{-5}$
T,QUV	$3.1x10^{-7}$
$T_{23}C$	$5.4x10^{-6}$

Total core melt frequency is $2.4x10^{-5}$.

Table 7A.3-4 provides a comparison of predicted core melt frequencies between Unit 2 and several other BWRs.

The preceding sequence probabilitues are combined with the containment failure mode probabilities developed in Section 7A.4 to produce the BWR release category probabilities for Unit 2 in Section 7A.5.

TABLE 7A.3-1

ACCIDENT SEQUENCE SYMBOLS

Initiating Events

T_1 = Loss of offsite power-induced transient

T_{23} = Any other transient requiring reactor scram

S = Small LOCA (break diameter < 34 cm (13.5 in)

System, Component, and Functional Failures

C = Failure to make the reactor subcritical

D = Failure of the VSS

E = Failure to keep the core covered

I = Failure of RHR after LOCA (including transient-induced LOCA)

M = Failure of SRVs to open

P = Failure of SRVs to reseat

Q = Failure of the PCS

U = Failure of HPCS and RCIC

V = Failure of low-pressure ECCS to provide core makeup

W = Failure of RHR after transient

TABLE 7A.3-2

SYSTEM SUCCESS COMBINATIONS FOR TRANSIENTS

Reactor Subcriticality	Overpressure Protection	Core Makeup	Decay Heat Removal
RPS inserts all control rods rapidly	SRVs open at high-pressure set point and reclose properly at reseat set point	PCS	PCS
OR		OR	OR
ATWS Mod 2A systems function to shut down the reactor (alternate rod insertion, recirculation pump trip, automatic poison injection)		HPCS	RHR loop A and SW loop A in suppression pool cooling mode
		OR	OR
		RCIS	RHR loop A AND SW loop A in steam condensing mode
		OR	OR
		ADS AND LPCS	RHR loop B AND SW loop B in suppression pool cooling mode
		OR	OR
		ADS AND 2 of 3 LPCI loops	RHR loop B and SW loop B in steam condensing mode

TABLE 7A.3-3

SYSTEM SUCCESS COMBINATIONS
FOR LOCA'S

LOCA Size	Reactor Subcriticality	Core Makeup	Early Containment Overpressure Protection	Long-Term Containment Overpressure Protection	Post-Accident Radioactivity Removal
Greater than 34 cm (13.5 in) large LOCA	RPS OR ATWS Mod 2A components	HPCS OR LPCS OR All 3 LPCI loops	VSS	RHR loop A AND SW loop A in suppression pool cooling mode or spray mode OR RHR loop B AND SW loop B in suppression pool cooling mode or spray mode	VSS (including containment sprays)
Less than 34 cm (13.5 in) small LOCA	RPS ATWS Mod 2A components	RCIC OR HPCS OR ADS AND LPCS OR ADS AND 2 of 3 LPCI loops	VSS	RHR loop A AND SW loop A in suppression pool cooling mode or spray mode OR RHR loop B AND SW loop B in suppression pool cooling mode or spray mode	

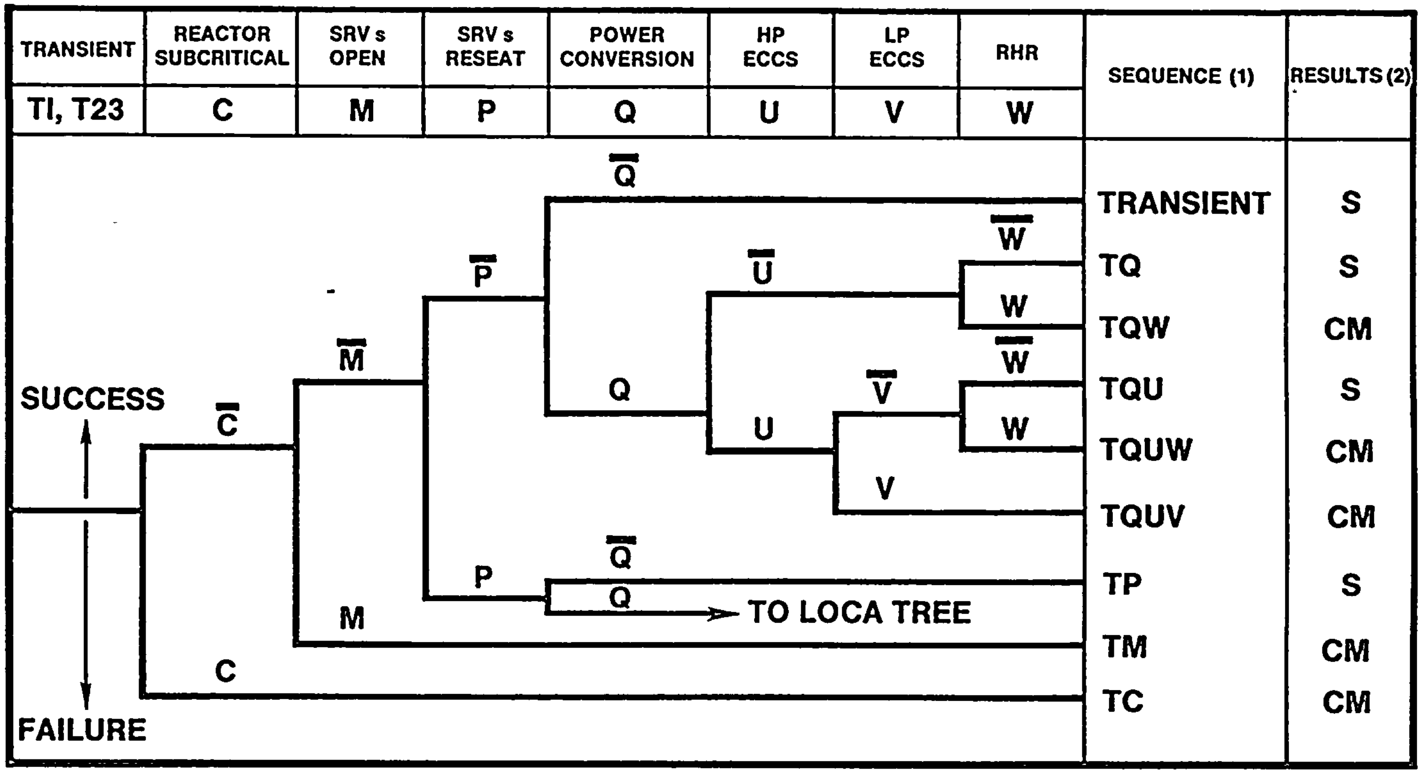
TABLE 7A.3-4

COMPARISON OF PREDICTED CORE MELT FREQUENCIES

BWR Plant	Core Melt Frequency (per reactor-year)
Peach Bottom 2 (BWR 4/MK I)	3.0×10^{-5}
Big Rock Point (early vintage BWR)	1.0×10^{-3}
Limerick (BWR 4/MK II)	1.5×10^{-5}
Grand Gulf 1 (BWR 6/MK III)	3.6×10^{-5}
Nine Mile Point 2 (BWR 5/MK II)	2.4×10^{-5}

SOURCES: Peach Bottom 2 - RSS (Reference 1)
Big Rock Point - IDCOR Program (Reference 3)
Limerick - Limerick PRA (Reference 4)
Grand Gulf 1 - RSSMAP - GG1 (Reference 2)

UNIT 2 TRANSIENT EVENT TREE



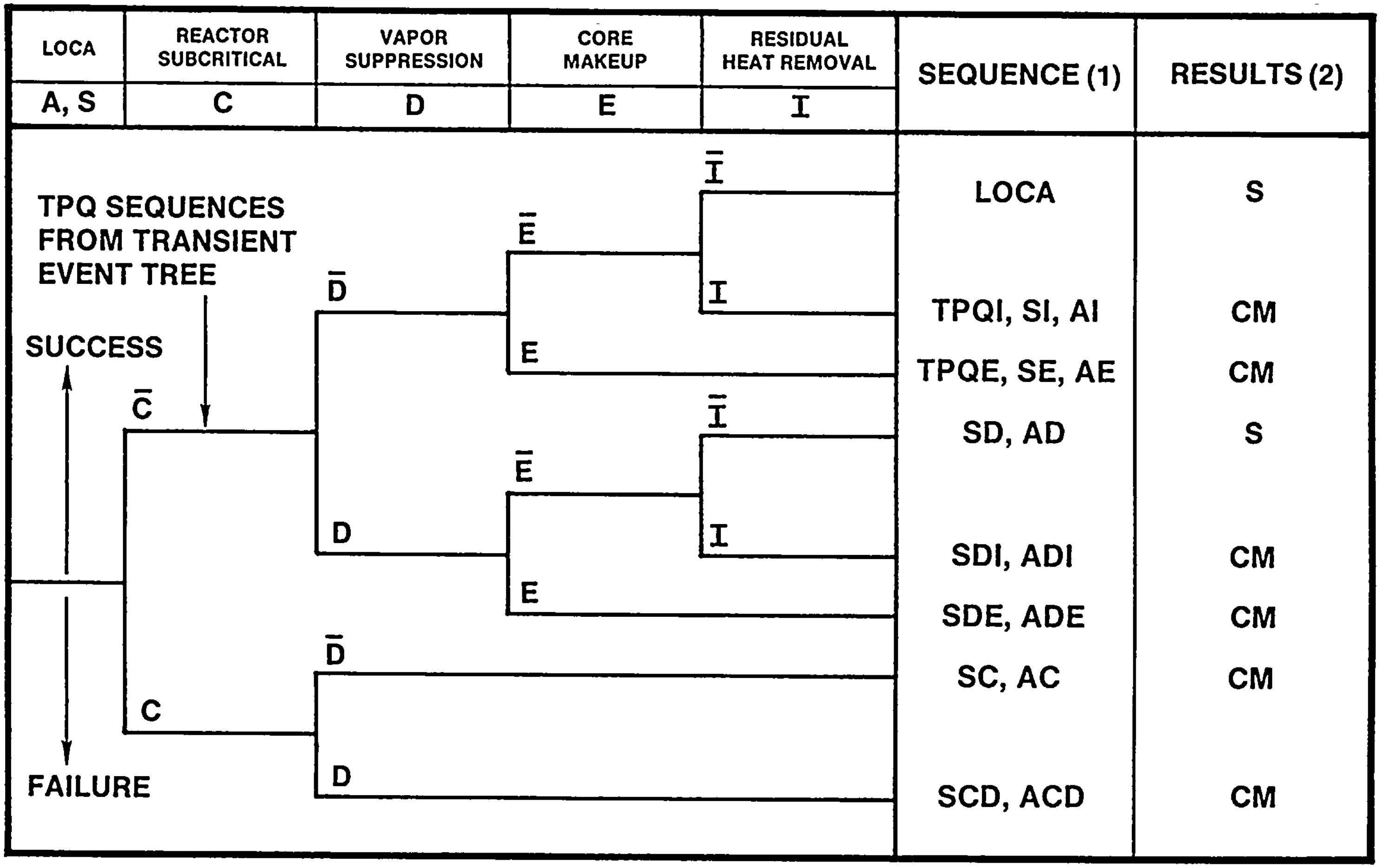
(2) KEY TO RESULTS
S = SAFE CONDITION
CM = CORE MELT EXPECTED

(1) SEQUENCES ARE DESIGNATED ONLY IN TERMS OF SYSTEM FAILURES; e.g., SEQUENCE TP IS ACTUALLY TCMP; TAKING THE SUCCESS OF C AND M INTO ACCOUNT, HOWEVER, C AND M ARE APPROXIMATELY EQUAL TO ONE BECAUSE C AND M ARE VERY LOW PROBABILITIES ($\bar{C}$ = 1-C≈1) AND ARE, THEREFORE, NOT INCLUDED IN SEQUENCE DESIGNATIONS.

FIGURE 7A. 3-1

UNIT 2 TRANSIENT EVENT TREE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



(1) SEQUENCES ARE DESIGNATED ONLY IN TERMS OF SYSTEM FAILURES; e.g. SEQUENCE SI IS ACTUALLY SCDEI ACCOUNTING FOR THE SUCCESS OF C, D, AND E; HOWEVER, C, D, AND E ARE ALL APPROXIMATELY EQUAL TO 1 BECAUSE C, D, AND E ARE ALL VERY LOW PROBABILITY EVENTS ($\bar{C} = 1\text{-}C \approx 1$) AND, THEREFORE, SUCCESS TERMS ARE NOT INCLUDED IN SEQUENCE DESIGNATIONS.

(2) KEY TO RESULTS:
S = SAFE CONDITION
CM = CORE MELT EXPECTED

FIGURE 7A.3-2

LOCA EVENT TREE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

7A.4 CONTAINMENT ANALYSIS

The Unit 2 containment employs the BWR Mark II design (Figure 7A.4-1) as opposed to the Mark I design utilized by the RSS BWR. The Limerick Generating Station also uses the Mark II design. The Limerick containment is fully analyzed in the Limerick PRA (Reference 4). While both designs employ the pressure suppression concept, the major difference is the internal configuration of the drywell and its relationship to the wetwell. Both containment atmospheres are inerted during operation.

7A.4.1 Containment Event Tree

The containment event tree for the Unit 2 analysis was developed from the Limerick and RSS BWR containment event trees, with a few modifications as follows:

1. Although the Unit 2 containment will be inerted, the analysis considers generation of a combustible gas mixture and subsequent containment failure due to burning or detonation. The reason for this assumption is that there will be short periods prior to shutdown and after startup when the containment will be deinerted. Credit is not taken for the presence of hydrogen recombiners even though redundant safety-grade combiners are installed.

2. Containment isolation system failure causing significant containment leakage is included in the containment event tree.

The resultant containment event tree is shown on Figure 7A.4-2. Symbology for this figure is listed in Table 7A.4-1.

TABLE 7A.4-1

CONTAINMENT FAILURE MODE SYMBOLS

Containment Failure Modes After Core Melt

α = Containment failure due to RPV steam explosion

β = Containment failure due to containment steam explosion

u = Containment failure due to overpressure from burning of a combustible gas mixture

u' = Containment failure due to detonation of a combustible gas mixture

δ = Containment isolation failure

γ = Containment failure due to wetwell overpressure

γ' = Containment failure due to drywell overpressure

ξ = Containment failure due to large leakage

ε = Standby gas treatment system (SGTS) failure

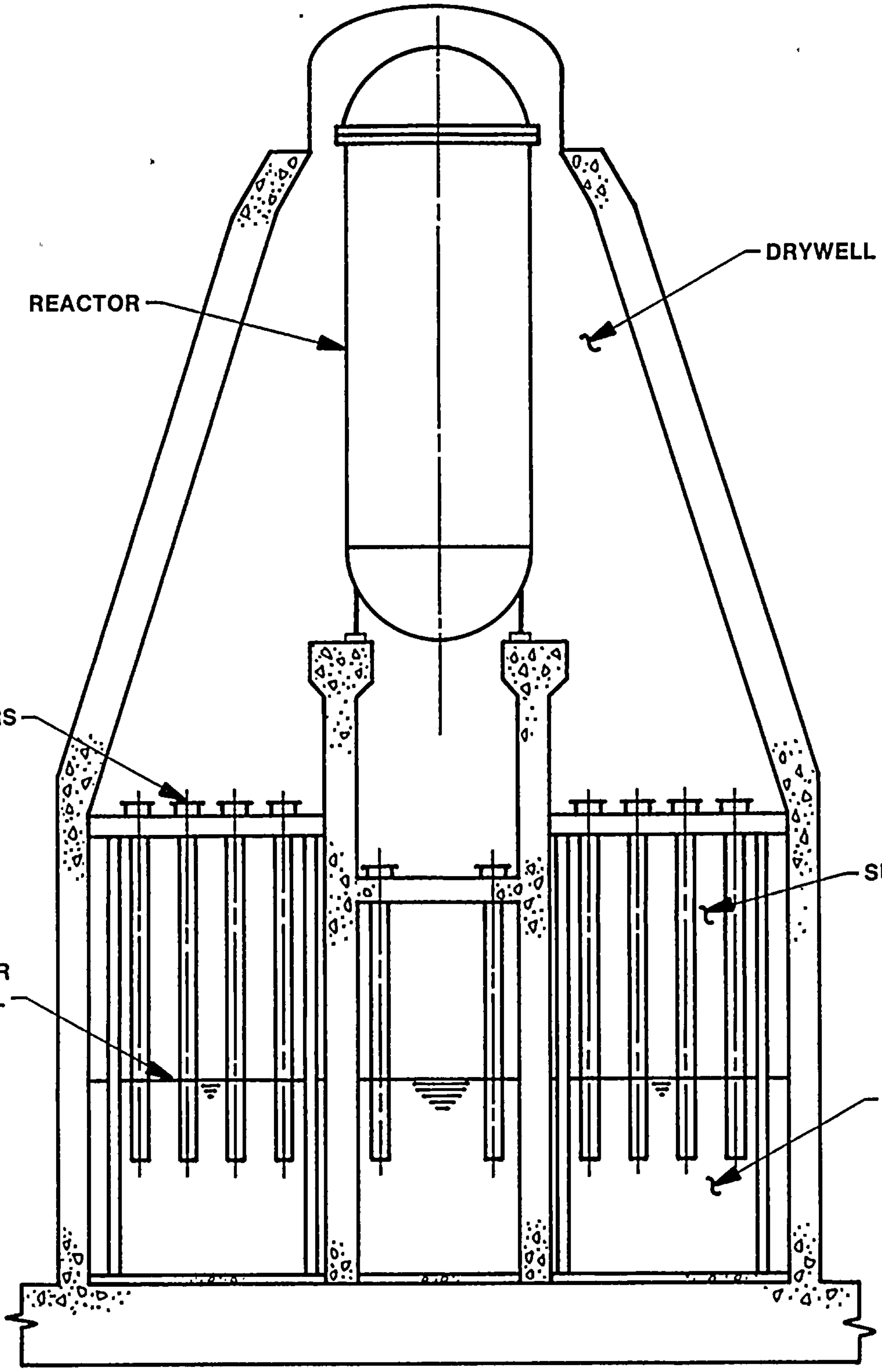


FIGURE 7A.4-1

MARK II
PRIMARY CONTAINMENT

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

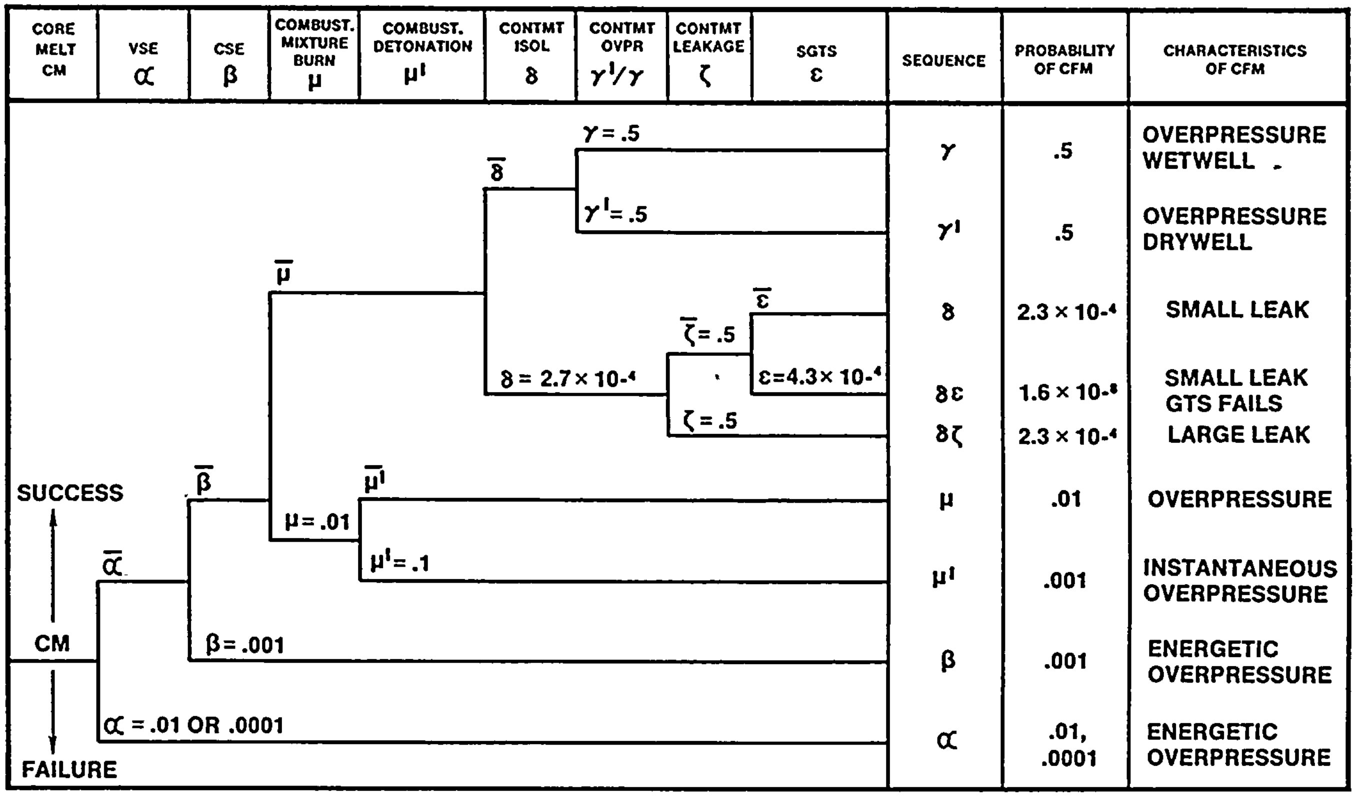


FIGURE 7A.4-2

CONTAINMENT EVENT TREE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

7A.5 RELEASE CATEGORIES

7A.5.1 Definition of Release Categories

RSS BWR Core Melt Release Categories 1, 2, 3, and 4 are used for the Unit 2 analysis. The RSS, GG1, and Limerick studies were used as guidance for assigning accident sequences to the release categories. These categories are defined as follows.

<u>BWR Release Category 1</u>

This release category is representative of a core meltdown followed by a steam explosion in the reactor vessel and simultaneous breach of containment integrity. The latter would cause the release of a substantial quantity of radioactive material to the atmosphere. The total release is assumed to contain approximately 40 percent of the iodines and alkali metals present in the core at the time of containment failure. Most of the release would occur over a 1/2-hr period. Because of the energy generated in the steam explosion, this category would be characterized by a relatively high rate of energy release to the atmosphere. This category also includes certain sequences that involve overpressure failure of the containment prior to the occurrence of core melting and a steam explosion. In these sequences, the rate of energy release would be somewhat smaller than for those previously discussed, although it would still be relatively high.

<u>BWR Release Category 2</u>

This release category is representative of a core meltdown resulting from a transient event in which decay heat removal systems are assumed to fail. Containment overpressure failure would result, and core melting would follow. Most of the release would occur over a period of about 3 hr. The containment failure would be such that radioactivity would be released directly to the atmosphere without significant retention of fission products. This category involves a relatively high rate of energy release due to the sweeping action of the gases generated by the interaction of water and concrete with the molten mass. Approximately 90 percent of the iodines and 50 percent of the alkali metals present in the core would be released to the atmosphere.

<u>BWR Release Category 3</u>

This release category represents a core meltdown caused by a transient event accompanied by a failure to scram or failure

to remove decay heat. Containment failure would occur either before core melt or as a result of gases generated during the interaction of the molten fuel with concrete after reactor vessel melt-through. Some fission product retention would occur either in the suppression pool or the reactor building prior to release to the atmosphere. Most of the release occurs over a period of about 3 hr and is postulated to comprise 10 percent of the iodines and 10 percent of the alkali metals. For those sequences in which the containment would fail due to overpressure after core melt, the rate of energy release to the atmosphere would be relatively high. For those sequences in which overpressure failure would occur before core melt, the energy release rate would be somewhat smaller, although still moderately high.

<u>BWR Release Category 4</u>

This release category is representative of a core meltdown with enough containment leakage to the reactor building to prevent containment failure by overpressure. The quantity of radioactivity released to the atmosphere would be significantly reduced by normal ventilation paths in the reactor building and potential mitigation by the secondary containment filter systems (SGTS). Condensation in the containment and the action of the SGTS on the releases would also lead to a low rate of energy release. The radioactive material would be released from the reactor building or the stack at an elevated level. Most of the release would occur over a 2-hr period and is assumed to contain approximately 0.08 percent of the iodines and 0.5 percent of the alkali metals.

7A.5.2 Combined Dominant Accident Sequence Probabilities

The dominant accident sequences for Unit 2 have been quantified and are listed in Table 7A.5-1. The probability of any accident sequence was calculated by multiplying the core melt sequence probability (from Section 7A.3.3) by its containment failure mode probability, e.g., probability of sequence T_1PQE- would be $(2.4 \times 10^{-8}) \times (0.012) = 2.9 \times 10^{-10}$ per reactor-year. The release category frequencies were found by summing the probabilities of the dominant accident sequences for each release category. Release category totals were not smoothed as was done in the RSS. See the RSS, Appendix V, Section 4.1.2 for a more detailed example of smoothing release category probabilities.

TABLE 7A.5-1

DOMINANT CORE MELT ACCIDENT SEQUENCE PROBABILITIES

Sequence	Release Category Probabilities (per reactor-year) 1	2	3	4
T_1PQI		$2.9x10^{-10}$	$2.9x10^{-10}$	$1.3x10^{-13}$
$T_{23}PQI$		$1.6x10^{-6}$	$1.6x10^{-6}$	$7.4x10^{-10}$
T_1PQE	$2.9x10^{-10}$			$5.5x10^{-12}$
$T_{23}PQE$	$2.5x10^{-8}$			$4.8x10^{-10}$
SI		$5.0x10^{-7}$	$5.0x10^{-7}$	$2.3x10^{-10}$
T_1QW		$1.8x10^{-9}$	$1.8x10^{-9}$	$8.1x10^{-13}$
$T_{23}QW$		$5.5x10^{-6}$	$5.5x10^{-6}$	$2.5x10^{-9}$
T_1QUV	$6.5x10^{-10}$			$7.1x10^{-11}$
$T_{23}C$	$5.4x10^{-10}$	$2.7x10^{-6}$	$2.7x10^{-6}$	$1.2x10^{-9}$
Total	$2.6x10^{-8}$	$1.0x10^{-5}$	$1.0x10^{-5}$	$5.2x10^{-9}$

Total Release Frequency: $2.0x10^{-5}$/reactor-year

7A.6 CONSEQUENCE ANALYSIS

7A.6.1 Description of the CRAC2 Computer Code

The consequences to public health and safety, and the regional economy are evaluated using the CRAC2 computer code[5]. The first version of CRAC (Calculation of Reactor Accident Consequences) was developed to support WASH-1400. Sandia National Laboratories has updated the code to its present version.

CRAC2 computations begin with a postulated accident (or accidents if grouped into release categories) which includes a breach of containment. The resultant release of radioactivity is described in terms of its probability of occurrence, isotopic release quantities, heat release quantity, time and duration of release, and warning time.

Meteorological data is processed using the bin sampling technique developed specifically for CRAC2. An entire year's worth of hourly weather observations (8,760 data points) which include wind direction and speed, atmospheric stability, and precipitation rate are grouped into sequences or bins with given characteristics. Examples are: it begins to rain at a certain distance from the site; a wind slowdown occurs at a certain distance from the site; or a certain combination of wind speed and stability class occurs. Twenty-nine bins are defined by CRAC2 and the subsequent bin sampling is carried out so that each bin is taken into account. This ensures that important weather types are neither ignored nor given excessive weight, so that peak consequences produced by certain weather situations are not missed. This technique has provided an improvement in meteorological sampling over the CRAC code which was used in the RSS.

Weather conditions from each of the 29 bins are then applied to a Gaussian Plume model to calculate the atmospheric dispersion term X/Q. Special effects which modify the basic Gaussian model, such as radioactive decay, duration of release, building wakes, inversion lids, and plume rise, are factored into the analysis. Additionally, the effects of both wet and dry deposition are taken into account. The resultant X/Q values and deposition processes define air and ground radioactivity concentrations at each spatial interval from the site.

Air and ground contamination levels are used to form dosimetric models. For determining early health effects, the most important pathways are:

1. Inhalation from the passing radioactive cloud.

2. External exposure from the passing cloud.

3. External exposure (short-term) from deposited ground contamination.

For estimating latent health effects, the pathways of interest are:

1. External exposure from deposited ground contamination (long- and short-term).

2. Inhalation of radioactivity from the passing cloud and from the resuspension of deposited ground contamination.

3. Ingestion of contaminated foods, milk, and milk products.

Early or acute effects are defined as those which occur within 1 yr. These include both fatalities and injuries. Latent effects usually manifest themselves in the form of cancer later in life. Health physics data such as organ dose conversion factors; milk consumption rates; threshold doses for fatalities, injuries, and various cancer types; timing data for computing lifetime doses; isotope weathering/decay data; and inhalation/ingestion factors are supplied to the code in order to allow public radiation health effects to be computed. Table 7A.6-1 provides information on which isotopes are important for each exposure pathway.

The effects of mitigative actions taken to reduce public exposure such as evacuation and sheltering are taken into account. Evacuation parameters such as distance traveled, delay time, effective evacuation speed, exposure duration, sheltering factors, and radius of evacuation for the region are supplied to the code. These evacuation and sheltering scenarios are used to compute the dose reduction achieved by the emergency action.

Regional economic impact is also calculated by CRAC2. Agricultural and economic data including farm and dairy production; farm, business, and residential property values; and relocation and evacuation costs are supplied to the code and the impact is calculated in terms of food, crop, and dairy losses; interdiction costs; decontamination costs; and relocation and evacuation costs.

The final results of the CRAC2 consequence model are displayed as a set of complementary cumulative distribution functions (CCDFs). A CCDF is defined as the probability that the consequences will exceed a given magnitude. CRAC2 determines the final CCDFs by summing the effects of all trials. A trial is defined as one combination of accident release parameters, weather conditions, and downwind population. The curves produced from the CRAC2 CCDF output may be then used to evaluate the health and economic risks to the public from a large scale core melt accident in a given region surrounding the plant.

Figure 7A.6.1 provides an overall view of the site region. Figure 7A.6-2 shows a schematic of the CRAC2 consequence model.

Table 7A.6-2 provides on identification of the sources for the input parameters to CRAC2 for Unit 2.

Tables 7A.6-3 through 7A.6-7 provide the CRAC2 input for Unit 2 for the isotopes, release parameters, evacuation, population, and meteorological data requirements, respectively.

7A.6.2 Discussion of Health and Economic Impacts

The results of CRAC2 computations are presented in Figures 7A.6-3 through 7A.6-7. CCDFs representing acute fatalities, acute injuries, latent fatalities, total whole-body man-Rem, and property damage are provided. Table 7A.6-8 shows the sensitivity of early effects (acute fatalities and injuries), late effects (latent fatalities), and economic effects (property damage) to various parameters.

Acute fatalities are dominated by the high probability of Release Category 2 (Section 7A.5). Release Category 1, although possessing rather rapid timing and a large quantity of released activity is not as consequential a release as Category 2. Release Category 3 has a relatively high probability but a lower amount of released activity. Category 4 is characterized by releases through the SGTS, therefore the activity released is much lower. Category 4 does not contribute to acute fatality consequences.

Acute injuries are dominated by Categories 2 and 3 due to their relatively high probability of occurrence and higher release fractions. The lower activity magnitude of Release Category 3 is not quite as important for injuries as it is for fatalities because of the lower dose thresholds for

injuries. Release Category 4 makes a small but essentially negligible contribution to acute injuries. The Oswego County, New York Radiological Emergency Response Plan (RERP) outlines six evacuation scenarios covering the various combinations of season and time of day. No one evacuation model dominated early effects. The difference in early effect consequences among the 6 models differed by no more than 10 percent.

Latent fatalities result from lower doses than those that produce acute fatalities. These are integral effects over large areas and long time periods. According to the Committee of the Biological Effects of Ionizing Radiation (BEIR)[6], solid tumors may take as long as 30 yr to develop, whereas leukemia can occur within 5 yr. Release Categories 2 and 3 with their higher probabilities of occurrence, dominate the latent fatality CCDFs.

Economic impact is assessed in terms of the total cost to all affected property. As with latent fatalities, property damage CCDFs are dominated by Release Categories 2 and 3.

The results indicate that the probability of causing $1,000 total costs is about the same as causing $10,000,000 total costs. Therefore, for the accidents postulated herein, $10,000,000 total costs would be a minimum value.

Figure 7A.6-6 indicates that the probability of property damages is relatively constant to a total cost of about $10,000,000.

The demography and annual wind rose frequencies for the Unit 2 site are such that approximately 46 percent of the time the wind blows out over Lake Ontario including sectors containing both land and lake. Therefore, there is roughly 50 percent probability that a release will be blown toward an unpopulated or sparsely populated area. Only 9 percent of the total 80-km (50-mi) regional population resides in sectors which border Lake Ontario, and one-half of these people live beyond 72 km (45 mi) where there is essentially zero risk of fatality. There is little doubt that releases blown in these directions will result in considerably lower health consequences due to the deposition mechanisms and the lack of people liable to exposure.

Exposure pathways could result from the ingestion of fish caught from the lake, ingestion of drinking water from the lake, and direct exposure from contaminated beaches and nearshore land. Interdicting these pathways is entirely possible; however, the socioeconomic impact of such action

is difficult to assess. A liquid pathway consequence analysis is not within the scope of this study; however, the economic effect of the loss of drinking water supply and recreational areas would be temporarily felt. Some beaches and recreational areas might suffer permanent closure or abandonment by the public. Commercial fishing does take place on Lake Ontario. However, it is concentrated in the far northeast corner of the lake and does not constitute a major industry. Nearly 90 percent of all fish commercially caught in the lake are landed by Canadian fishermen. Some of these fish could be temporarily affected by a release from Unit 2.

For the Unit 2 site, the CRAC2 results revealed that fatalities would most likely occur within 32 km (20 mi) of the plant and in no case would fatalities occur beyond 72 km (45 mi). Injuries would most likely occur within 56 km (35 mi) of the plant. Although the risk of injury exists beyond 80 km (50 mi); the probability of occurence is very low.

For comparison purposes, the CCDFs for acute and latent fatalities for GG1, Limerick, and PB2 (rebaselined RSS results) have been plotted against the Unit 2 results. These comparisons are shown on Figures 7A.6-8 and 7A.6-9. Because of the uncertainty bands associated with each curve, the CCDFs for acute and latent fatalities for the four plants may be considered consistent.

7A.6.3 Risk Due to External Causes

The foregoing analysis has confined itself to event sequences generated by inplant failures (with the exception of loss of offsite power). However, the possibility exists that some large external event could initiate an accident or adversely affect the plant's response to an internal initiating event.

The Unit 2 plant is not considered singularly vulnerable to external initiators. It is located in an area of low seismic activity, far away from a large body of seawater, and in an area of relatively low tornado probability. Therefore, earthquakes, hurricanes, tidal waves, and tornadoes are not expected to be high probability events. Man-made hazards such as aircraft impact, accidents at nearby industrial or military facilities, and pipeline accidents are not considered viable because the site is located at least 32 km (20 mi) from any major air traffic lane and 64 km (40 mi) from the nearest major airport (Syracuse, New York). Also, there are no large industrial

or military facilities or pipelines near the site. The risk from transportation accidents exists only from dangerous materials on vehicular and rail traffic destined to/from the site itself. There are no major highways or rail lines carrying dangerous materials near the site. Single rail spurs and access roads provide egress routes from the three plants on site including Unit 2. The hazards due to flooding from Lake Ontario, flooding from internal sources, fires, chemical hazards, turbine missile hazards, and sabotage exist at about the same probability as at any U.S. nuclear power plant and are taken into account in the basic design criteria of the plant.

The following FSAR sections provide an indepth treatment of these topics:

Title	FSAR Section
Fire Protection	9.5.1, Appendix 9A
Flooding	3.4
Turbine Missiles	3.5.1.3
Chemical Hazards	2.2, 6.4.4.2, 9.4.1
Security	13.6
Seismic Design	3.7, 3.8
Tornado Design	3.3

Some external events will affect only one accident sequence while some external events will affect all accident sequences. With external causes taken into account, it is expected that the event sequence probabilities and hence the release category probabilities will increase slightly. However, because Unit 2 is less than or equal to most U.S. sites with respect to external vulnerability, it is anticipated that external events will not be significant contributors to risk at Unit 2.

7A.6.4 Limitations and Sources of Uncertainties

7A.6.4.1 Limitations

The following limitations are identified in this study:

1. Following the RSSMAP methodology, full fault trees were not developed for the Unit 2 systems analysis.

The survey and analysis technique employed in the GG1 study was used. This method, however, truncated the system unavailability analysis at the major component level. Small, but possibly sensitive components are covered by the failure rates for the parent equipment. Also, components were considered generically from system to system; ie., HPCS control circuits were assumed to have the same failure probability as diesel control circuitry; all motor-operated valves were assumed to have the same failure contributors, and each contributor was assumed to exhibit the same failure rate. This will not significantly alter the final results. However, a plant and/or manufacturer specific research of equipment operating histories might reveal slightly different failure rate information. Human error data was taken directly from the RSS and the GG1 study. A thorough human reliability analysis including a comprehensive review of plant operating and casualty procedures might also slightly alter the data.

2. The success criteria for ECCS operation during transients and LOCAs was taken as the same as GG1 (BWR 6).

3. Because Unit 2 is still under construction, as-built plant information is not available. The FSAR, PSAR, ER-CPS, Standard Technical Specifications for BWR 5[7], and design P&IDs were used in lieu of the as-built drawings, technical specifications, and actual plant operating/ emergency procedures.

4. The containment analysis consisted of comparing the Unit 2 Mark II containment with containments of plants where a full PRA had been performed (particularly Limerick) and adopting their results to Unit 2.

7A.6.4.2 Sources of Uncertainties

The specific sources of uncertainty in this study have been enumerated in the previous section. It should be noted that the RSS methodology used to analyze Unit 2 has been found to be sound based upon the results of the Lewis Committee review[8]. In the RSS, the uncertainties were found to fall into two groups: dispersion-dosimetric model (accident release source terms, probabilities, physical characteristics of the accident, and atmospheric dispersion)

and the dose-response model (health physics and cost parameters).

Early fatalities are most sensitive to the dispersion-dosimetric model uncertainties. This report has utilized theoretical accident source term information as an input to the risk analysis contained herein. Based upon recently generated information[9-17] regarding the accuracy of this source term information, there appears to be sound reasons to believe that it is significantly more conservative than originally assumed. Therefore, the consequences described in this study may be significantly overestimated. It is possible that a reduction in the iodine and particulate fission product (Cs-Rb) release fractions by a factor of 10 might likely result in zero acute fatalities being predicted[18].

The other consequences, latent fatalities and property damage, are less sensitive to the uncertainties in the dispersion-dosimetric model than early effects. Total population and cost parameters tend to have a greater effect on these results because the effects are integrated over large areas and long time periods and the accident characteristics become less important. The health physics models used in CRAC2 and this study are based upon the 1980 BEIR Committee findings. These findings are generally considered as an improvement over the previous (1972 BEIR) models; however, the lack of information available regarding the dose effectiveness of low dose rates is indicative of the uncertainties still present regarding the risk of radiation induced cancer.

7A.6.5 Conclusions

The preceding sections have considered the potential environmental impacts of core melt accident releases into the atmosphere. The impacts which have been analyzed include possible exposures to individuals and to the surrounding population as a whole, the near- and long-term consequences of such exposure, and the socioeconomic effects of property contamination.

Figures 7A.6-10, 7A.6-11, and 7A.6-12 provide comparisons of risk of acute fatality and property damage from the Unit 2 reactor versus risk of acute fatality and property damage from man-caused events, naturally-occurring events, and 100 nuclear power plants (overall U.S. nuclear risk). From these figures, it can be seen that the operation of Unit 2 will not contribute measurably to the overall acute fatality or property damage risks from either man-caused or

naturally-occurring events, including other nuclear power plant operations.

Table 7A.6-9 provides comparison data in the area of early illness and latent fatalities. The contribution to these consequences from the operation of Unit 2 is negligible.

In order for the consequences of a potential core melt accident at Unit 2 to be significant, the release parameters, weather conditions, and downwind population must be at their worst conditions. The probability of this occurring is extremely low. For even modest consequences to occur, the trial values must be well above average in severity. The probability of these conditions existing simultaneously is still quite low. Since the three components of a trial (release parameters, weather conditions, and downwind population density) are completely independent of each other, accidents with even modest environmental impact at Unit 2 are considered highly unlikely.

TABLE 7A.6-1

EXPOSURE IMPACT OF VARIOUS ISOTOPES

Exposure Pathway/Effect	Most Contributing Radionuclides
Cloudshine	Kr-88, Te-132, I-132, I-133, I-131, I-135
Inhalation (early effects)	Te-132, I-131, Cs-134, Ba-140
Inhalation (leukemia)	Sr-90
Inhalation (bone cancer)	Sr-90, Pu-241, Pu-238
Inhalation (lung cancer)	Ru-106, Ce-144
Groundshine (early effects)	Te-132, I-131, I-132, I-133, I-135
Thyroid dose	I-131, I-132, I-135
Milk ingestion	I-131, I-133
Long-term groundshine	Cs-137

NOTE: Radionuclides which have a negligible effect on health are: Co-58, Co-60, Kr-85, Kr-85m, Kr-87, Rb-86, Y-90, Nb-95, Tc-99m, Ru-105, Rh-105, Te-127, Te-129, Ce-143, Pr-143, Nd-147, Am-241 (Reference 19).

SOURCE: NUREG/CR-2300 (Reference 19)

TABLE 7A.6-2

CRAC2 DATA SOURCES

Data	Source (Reference Number)
Isotopic inventory (list of isotopes in Table 7A.6-1)	1, 20
Release parameters	
Timing data	4
Release fractions	1
Evacuation strategies	
Timing and distance data	21, 22, 23
Sheltering factors	19
Population distributions	
U.S.	24, 25, 26
Canadian	27
Meteorological data	
Weather data	Site measurements (Jan 1, 1979 - Dec 31, 1979)
Atmospheric mixing heights	28
Economic data	1, 29

TABLE 7A.6-3

CRAC2 COMPUTER CODE ISOTOPES

Element	Isotopes
Cobalt	Co-58*, Co-60*
Krypton	Kr-85, Kr-85m, Kr-87, Kr-88
Rubidium	Rb-86
Strontium	Sr-89, Sr-90, Sr-91
Yttrium	Y-90, Y-91
Zirconium	Zr-95, Zr-97
Niobium	Nb-95
Molybdenum	Mo-99
Technetium	Tc-99m
Ruthenium	Ru-103, Ru-105, Ru-106
Rhodium	Rh-105
Tellurium	Te-127, Te-127m, Te-129, Te-131m, Te-132
Antimony	Sb-127, Sb-129
Iodine	I-131, I-132, I-133, I-134, I-135
Xenon	Xe-133, Xe-135
Cesium	Cs-134, Cs-136, Cs-137
Barium	Ba-140
Lathanum	La-140
Cerium	Ce-141, Ce-143, Ce-144
Praseodymium	Pr-143
Neodymium	Nd-147

TABLE 7A.6-3 (Cont)

Element	Isotopes
Neptunium	Np-239*
Plutonium	Pu-238*, Pu-239*, Pu-240*, Pu-241*
Americium	Am-241*
Curium	Cm-242*, Cm-244*

*RSS data corrected to values consistent with an end-of-cycle 3,489-MWt BWR. BWR 5-specific data from GE was not available for these isotopes.

TABLE 7A.6-4

CRAC2 RELEASE PARAMETERS

RSS Release Category	Probability/ Reactor-year	Time of Release (hr)	Duration of Release (hr)	Warning Time for Evacuation (hr)	Elevation of Release (m)	Heat Released (cal/sec)	Fraction of Core Inventory Released						
							Xe-Kr	I	Cs-Rb	Te-Sb	Ba-Sr	Ru[1]	La[2]
BWR 1	3.5×10^{-6}	2.6	0.5	1.3	45	2.80×10^{6}	1.0	0.4	0.4	0.7	0.05	0.5	5×10^{-3}
BWR 2	1.1×10^{-5}	39.0	2.0	7.0	45	2.10×10^{5}	1.0	0.9	0.5	0.3	0.1	0.03	4×10^{-3}
BWR 3	1.1×10^{-5}	39.0	2.0	7.0	45	2.10×10^{5}	1.0	0.1	0.1	0.3	0.01	0.02	3×10^{-3}
BWR 4	5.6×10^{-9}	5.0	2.0	2.0	45	0	0.6	8×10^{-4}	5×10^{-3}	4×10^{-3}	6×10^{-4}	6×10^{-4}	1×10^{-4}

(1) Includes Mo, Rh, Tc, Co.
(2) Includes Nd, Y, Ce, Pr, La, Nb, Am, Cm, Pu, Np, Zr.

TABLE 7A.6-5

CRAC2 EVACUATION STRATEGIES

Strategy	Probability of Strategy (%)	Time Delay Before Evacuation (hr)	Evacuation Speed (mph)	Maximum Distance from Site Evacuated (mi)	Maximum Distance Moved by Evacuees (mi)	Sheltering Radius (mi)
Weekday (school in session)	18	3.0	.79	10	20	10
Weekday (school not in session)	17	2.0	.73	10	20	10
Weekend/holiday (summer daytime)	5	2.0	1.15	10	20	10
Weekend/holiday (winter daytime)	10	2.0	1.48	10	20	10
Evening	17	1.5	1.18	10	20	10
Night	33	1.0	1.38	10	20	10

NOTE: Models correspond to the six typical evacuation periods outlined in the Nine Mile Point Nuclear Station Site Emergency Plan, New York State Radiological Emergency Preparedness Plan, and the Radiological Emergency Response Plan for Oswego County, NY (References 21 through 23).

TABLE 7A.6-6

CRAC2 POPULATION DISTRIBUTION DATA
(1986 Projected)

	Radial Distance (Mi)																								
Sector	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0	7.0	8.5	10.0	12.5	15.0	17.5	20.0	25.0	30.0	35.0	40.0	45.0	50.0	Sector Totals
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	24	353	1,781	28,051	30,209
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	990	797	2,443	4,760	2,895	2,896	14,824
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	62	428	739	1,976	4,002	2,274	21,798	15,890	7,162	54,331
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	257	2,528	1,173	2,359	963	482	259	185	1,155	5,898	15,259
5	0	0	3	23	33	15	0	58	150	141	107	0	467	244	778	1,489	809	841	1,542	836	440	635	1,130	1,972	11,713
6	0	0	9	27	61	14	82	107	131	136	403	175	214	1,791	1,135	1,183	1,341	977	1,715	2,157	3,556	5,103	11,293	22,738	54,348
7	0	0	0	50	56	89	72	73	15	49	218	87	146	199	995	1,275	2,082	2,569	7,141	7,648	10,274	10,679	20,778	18,925	83,420
8	0	0	0	27	112	96	18	120	276	122	128	118	211	194	1,376	1,515	2,188	2,983	27,775	50,483	138,635	147,163	21,544	7,426	402,510
9	0	0	0	8	50	24	90	146	66	62	195	235	254	240	1,712	15,581	3,005	2,780	8,857	15,906	23,606	17,204	25,850	4,863	120,734
10	0	0	9	4	40	83	163	162	217	199	483	191	840	2,012	1,809	1,554	2,094	1,371	2,095	3,569	6,375	6,281	19,807	20,319	69,737
11	0	0	49	42	35	31	56	140	177	302	3,216	9,923	7,842	1,956	1,641	1,346	802	942	3,220	4,270	3,727	7,459	10,058	19,090	76,324
12	0	0	0	18	2	9	0	9	4	0	3	544	5,324	1,057	16	0	0	0	0	32	1,478	4,510	6,837	10,849	30,692
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	171	338	509
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	245	1,279	7,650	9,174
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	220	2,932	3,152
Interval Totals	0	0	70	199	389	361	481	815	1,036	1,011	4,753	11,273	15,298	7,693	9,779	26,533	13,922	15,604	56,274	90,182	193,091	226,375	140,688	161,109	976,936

NOTES:
1. Figures are based on the 1980 census projected to 1986.
2. Figures include a small portion of the Province of Ontario, Canada which is cut by the 80-km (50-mi) arc around the site.
3. Sector designations correspond to those used in Table 7A.6-7.

NINE MILE POINT UNIT 2 ER-OLS

TABLE 7A.6-7

CRAC2 METEOROLOGICAL BIN DATA SUMMARY

WIND DIRECTION

METBIN	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Total	Percent
1 R 0	1	5	28	18	21	36	59	28	42	6	15	23	24	16	18	8	348	3.9726
2 R 5	0	1	5	6	14	8	8	7	5	3	0	1	3	1	1	7	70	0.7991
3 R 10	0	4	6	6	8	11	21	18	21	10	4	4	3	3	2	3	124	1.4155
4 R 15	0	5	4	5	5	13	17	17	13	11	5	7	3	2	4	5	116	1.3242
5 R 20	0	0	4	3	9	7	16	13	21	4	0	9	6	3	4	4	103	1.1758
6 R 25	0	1	2	3	8	6	8	16	10	6	5	4	6	4	4	2	85	0.9703
7 R 30	0	2	5	5	4	9	13	15	19	3	1	4	7	5	6	1	99	1.1301
8 S 10	1	0	0	0	0	2	8	2	7	5	4	11	10	9	9	6	74	0.8447
9 S 15	0	1	0	0	0	2	7	2	7	2	1	8	3	4	7	3	47	0.5365
10 S 20	0	0	2	0	1	1	0	4	4	1	3	13	7	7	13	3	59	0.6735
11 S 25	0	0	0	0	0	3	5	2	6	5	1	3	5	4	6	2	42	0.4795
12 S 30	0	0	0	0	3	3	7	4	7	6	4	9	5	6	7	3	64	0.7306
13 C 3	15	71	48	22	7	2	13	24	38	7	1	1	11	9	43	28	340	3.8813
14 C 4	2	7	3	1	1	6	41	46	44	6	3	28	99	109	148	55	599	6.8379
15 D 1	8	26	34	27	33	13	12	10	10	1	1	6	9	8	19	26	243	2.7740
16 D 2	4	31	48	19	11	16	17	28	74	7	5	9	17	3	24	21	334	3.8128
17 D 3	0	34	33	9	6	13	17	21	57	16	8	10	22	11	21	30	308	3.5160
18 D 4	5	21	36	4	1	28	71	47	106	48	49	61	64	42	70	71	724	8.2648
19 D 5	1	0	1	0	1	10	28	11	8	8	57	152	255	281	209	49	1071	12.2260
20 E 1	13	40	65	38	68	40	37	27	32	16	19	21	15	12	27	34	504	5.7534
21 E 2	4	24	35	26	22	29	53	50	94	43	23	21	21	10	8	17	480	5.4795
22 E 3	1	7	9	8	4	39	95	83	104	39	28	20	23	7	11	6	484	5.5251
23 E 4	3	1	7	0	1	21	135	133	195	82	44	48	20	18	14	11	733	8.3676
24 E 5	3	0	1	0	0	4	50	37	30	5	34	37	65	49	40	7	352	4.0183
25 F 1	9	12	16	12	91	51	85	90	95	15	16	29	23	16	30	16	606	6.9178
26 F 2	4	7	7	2	14	24	96	120	110	19	10	6	10	3	2	10	44	5.0685
27 F 3	0	9	3	5	0	4	41	35	79	11	7	5	6	6	2	3	216	2.4658
28 F 4	2	0	0	0	0	0	5	10	13	1	1	24	6	1	6	4	73	0.8333
29 F 5	0	0	0	0	0	0	0	0	0	0	3	12	2	0	0	1	18	0.2055
All	76	309	402	219	333	401	965	890	1,251	386	353	586	750	649	755	436	8,760	100

TABLE 7A.6-7 (Cont)

KEY TO METBIN DESCRIPTION:

R = Rain within intervals (mi); e.g., R 5 means rain within 5 mi of the site.
S = Wind slowdowns within intervals (mi); e.g., S 10 means a wind slowdown within 10 mi of the site.
C, D, E, F = Stability Categories
1 (0-1), 2 (1-2), 3 (2-3), 4 (3-5), 5 (>5) = Wind speed intervals (m/sec) used in combination with stability categories.

NOTES:

1. This table represents the number of hours that the weather conditions described by each bin occurred from each wind direction.
2. This table is based upon site hourly measurements made from January 1, 1979 through December 31, 1979.
3. Wind directions are given by sector numbers. Each sector is 22 1/2 deg in arc and is centered on the 16 compass points. Sector 1 is centered on north and sector 2 is immediately clockwise (NNE). Wind speeds were measured at a height of 10 m.
4. The metbin categorizations are made automatically by the CRAC2 code.

TABLE 7A.6-8

CRAC2 RESULT SENSITIVITIES

	CCDF Sensitivities[2]		
Parameter[1]	Early Effects	Late Effects	Economic Effects
Release category probability	Major	Major	Major
Magnitude of released activity	Major	Major	Major
Release timing (beginning warning, duration)	Major	Low	Low
Magnitude of heat released	Moderate to Major	Low	Low
Weather conditions (wind direction, wind speed, rainfall, deposition, and dispersion conditions)	Major	Moderate	Moderate
Evacuation timing (warning and delay)	Major	Low	Low
Evacuation parameters (speed, radius evacuated, sheltering models)	Moderate	Low	Low

(1) Other parameters such as dose conversion factors, dose threshold data, and other health physics parameters can also have major or moderate effects upon CCDFs. However, these parameters are not plant- or site-dependent and are the same data that was used in the RSS. The parameters listed in this table are all plant or site specific.

(2) The above sensitivites (major, moderate, low) are qualitative in nature.

SOURCE: NUREG/CR-2300 (Reference 19)

TABLE 7A.6-9

COMPARISON OF EARLY INJURY AND LATENT FATALITIES BETWEEN UNIT 2 AND OVERALL U.S.

Early Illness

Probability of one early illness (per reactor-year):

U.S. overall[1]: 3.6×10^{-2}

Unit 2[2]: 1.1×10^{-5}

Latent Fatality

Probability of one latent cancer fatality (per reactor-year):

U.S. Overall[3]: 1.9×10^{-3}

Unit 2[2]: 2.7×10^{-5}

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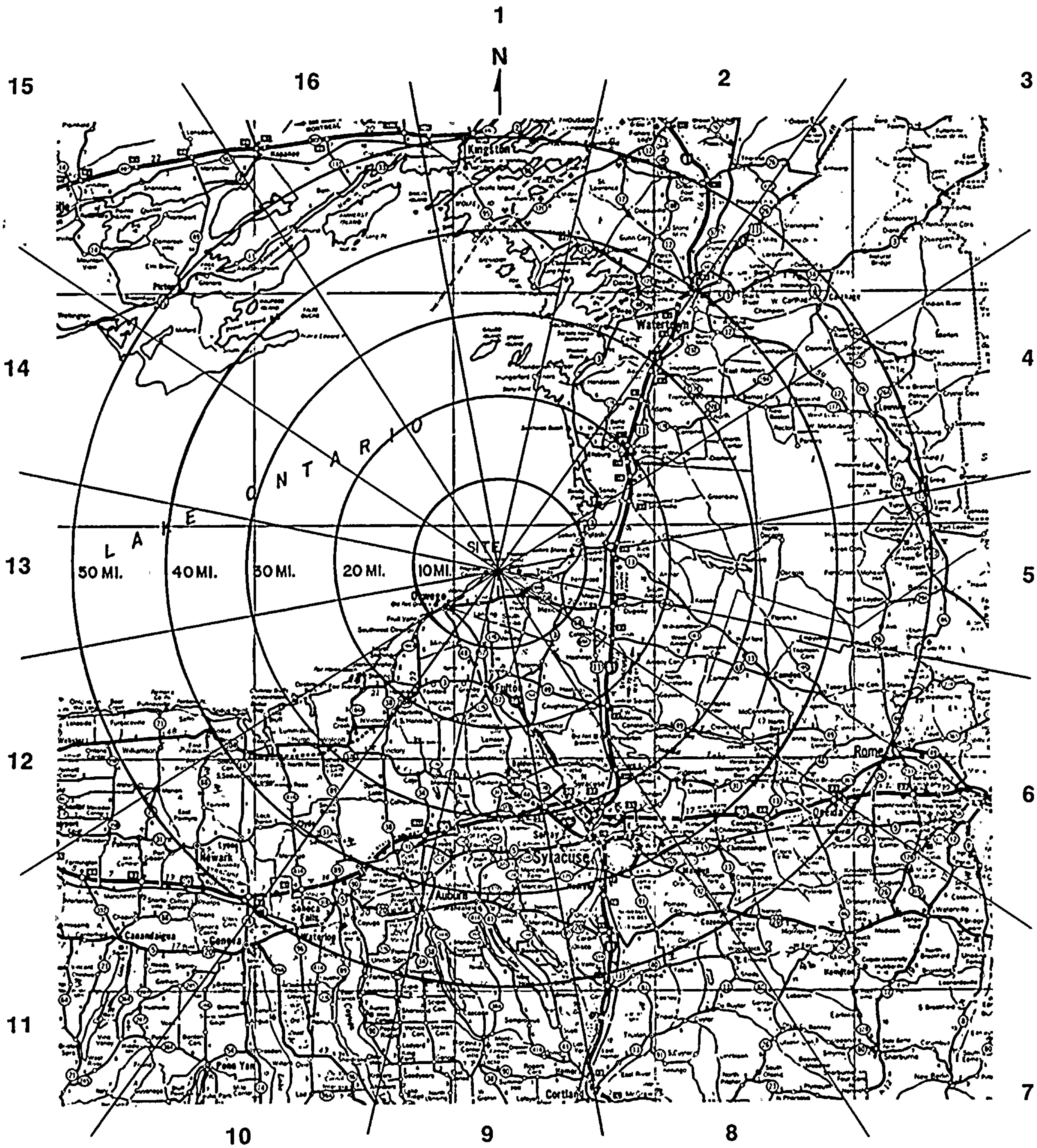
[1] Based on American Cancer Society data (Reference 30) of 421,000 cancer deaths in 1981. The population of the U.S. is assumed to be 225 million.

[2] The Unit 2 values represent only the incremental contribution to early illness and latent fatility due to plant accidents.

[3] Based on RSS data of 8 million injuries per year from all accidents. The population of the U.S. is assumed to be 225 million.



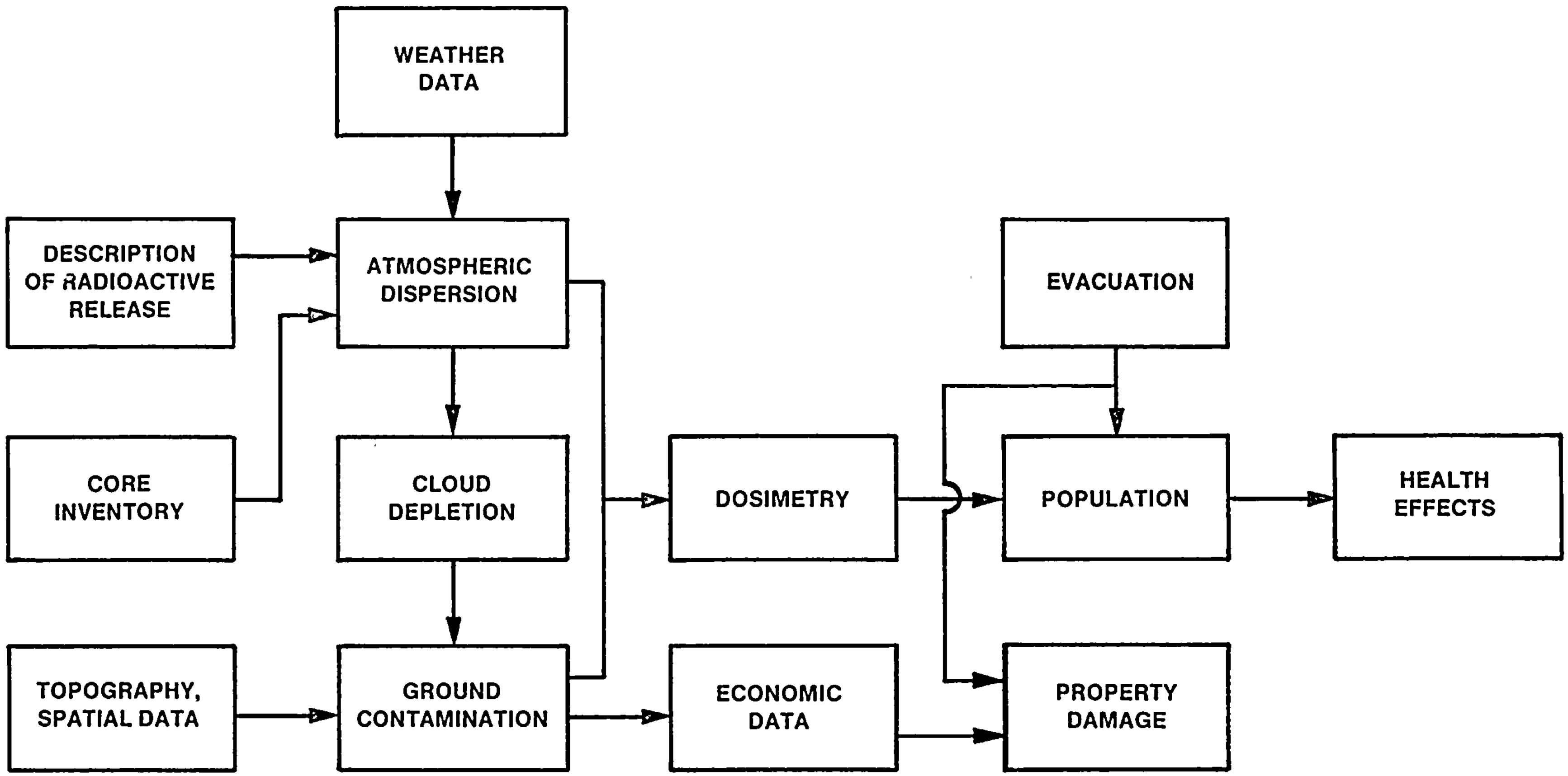
NOTES:
1. EACH SECTOR IS 22½ DEGREES WIDE. SECTOR 1 IS CENTERED ON NORTH AND EACH SECTOR FOLLOWS COUNTER-CLOCKWISE AS SHOWN.
2. FOR CLARITY ONLY 10 MI. INCREMENTAL RADII ARE SHOWN. THE ACTUAL ANALYSIS USES A MUCH CLOSER SPACING.

SOURCE:
Reference 31

FIGURE 7A.6-1

AREA MAP

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



ADAPTED FROM: — NUREG 0340 (REFERENCE 32)

FIGURE 7A.6-2

CRAC2 CONSEQUENCE MODEL SCHEMATIC

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

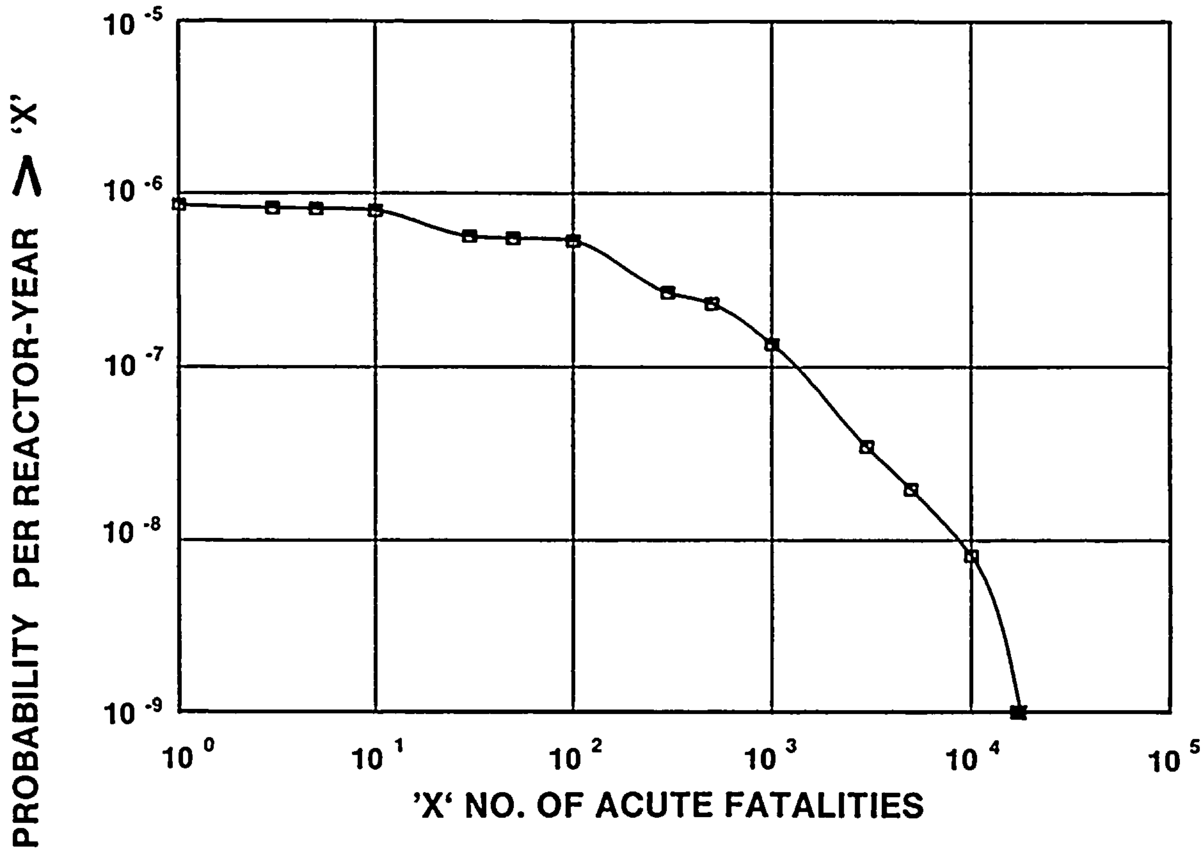


FIGURE 7A.6-3

ACUTE FATALITIES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

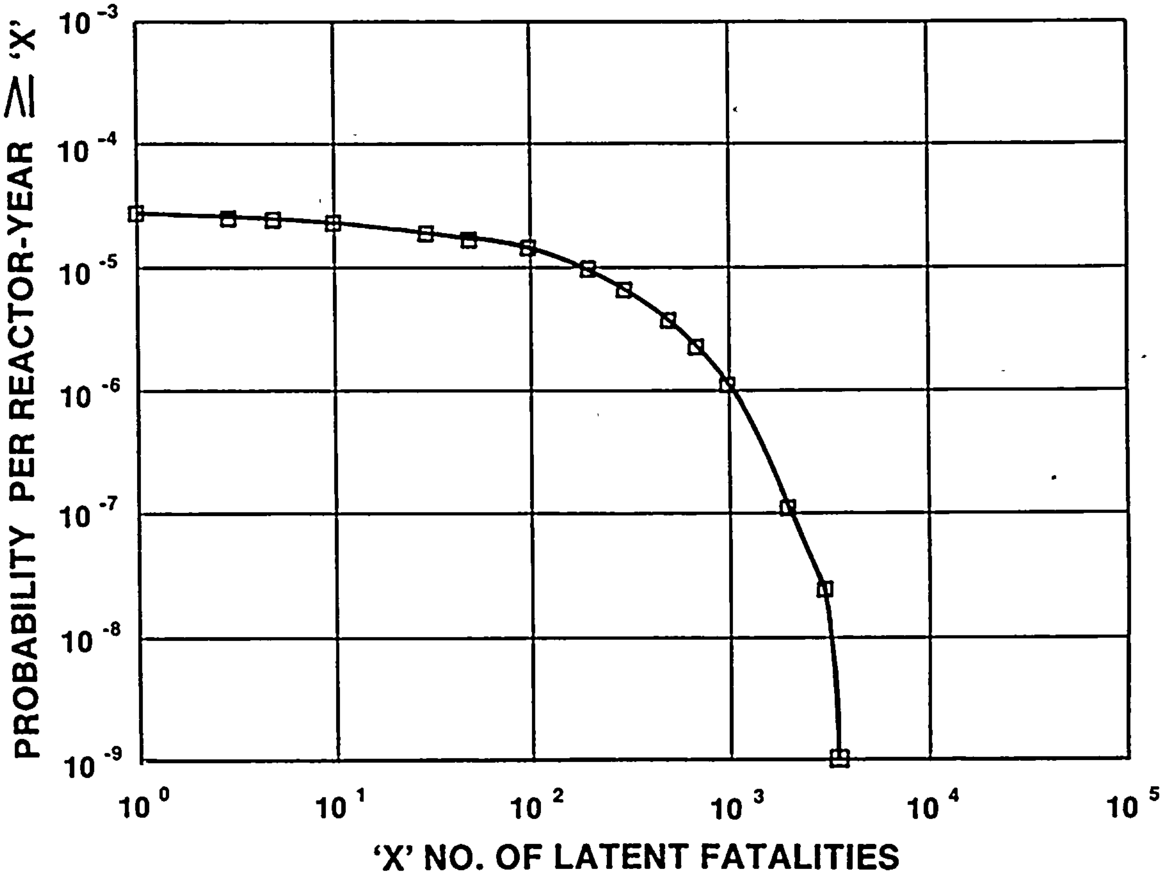


FIGURE 7A.6-4

LATENT FATALITIES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

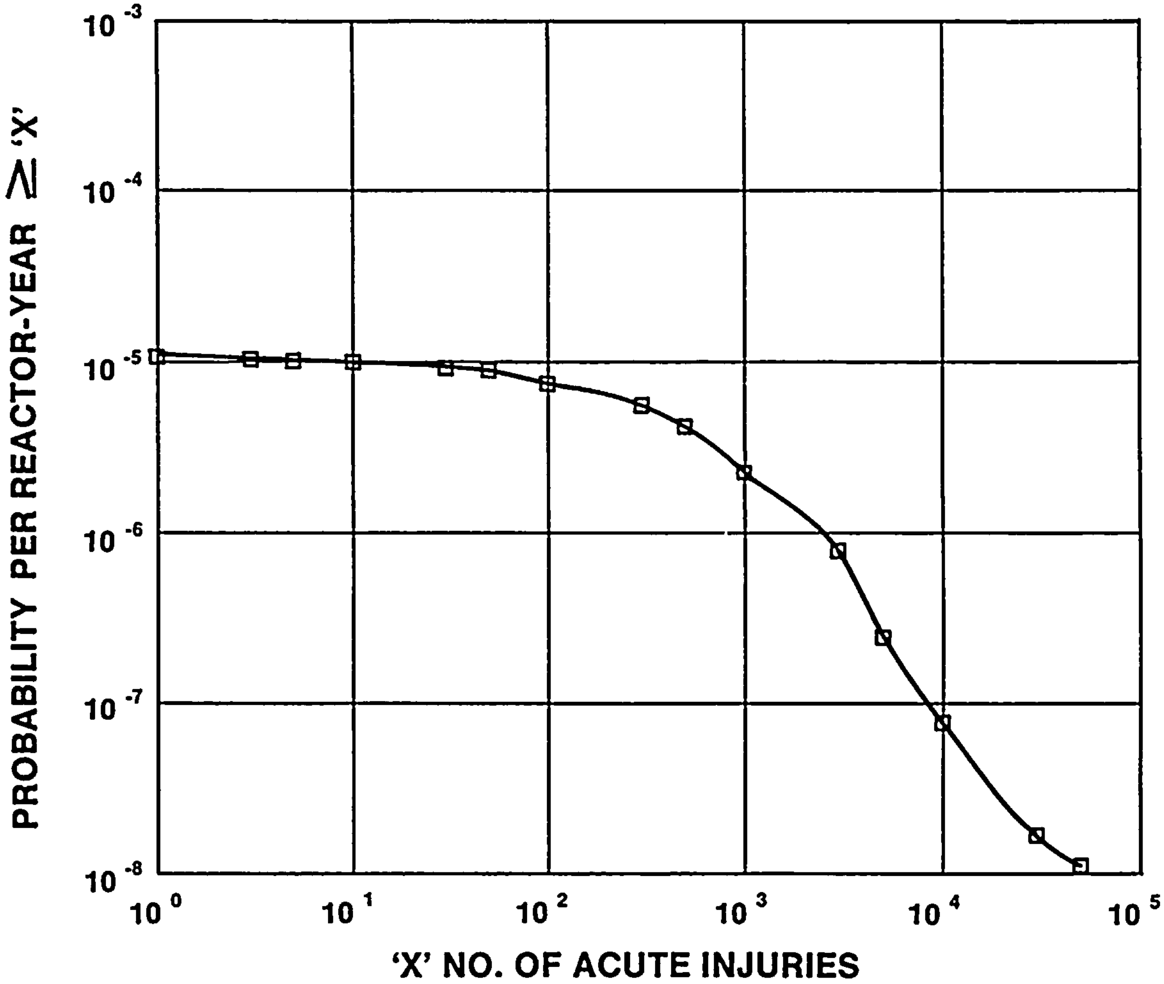


FIGURE 7A.6-5

ACUTE INJURIES

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

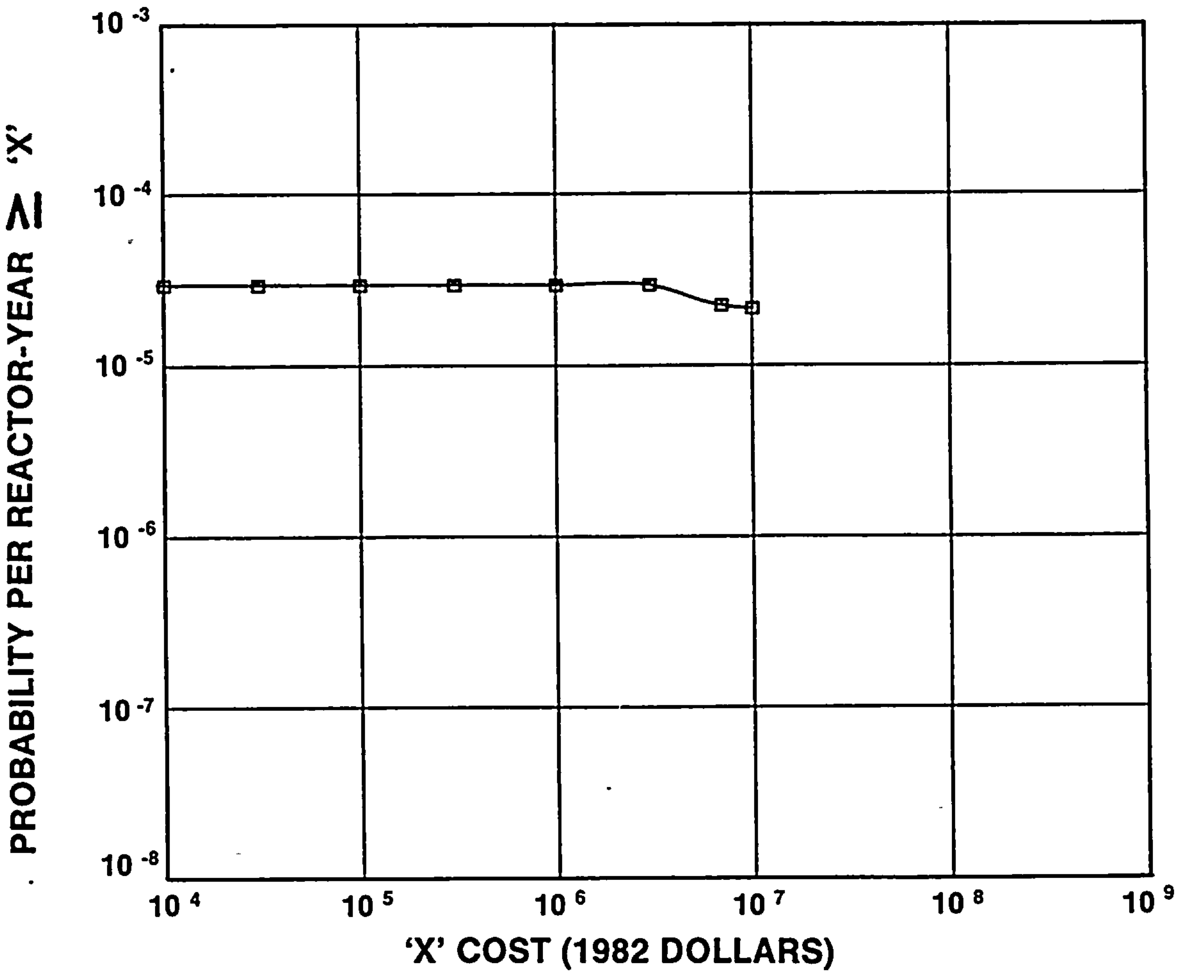


FIGURE 7A.6-6

TOTAL COST (1982 DOLLARS)

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

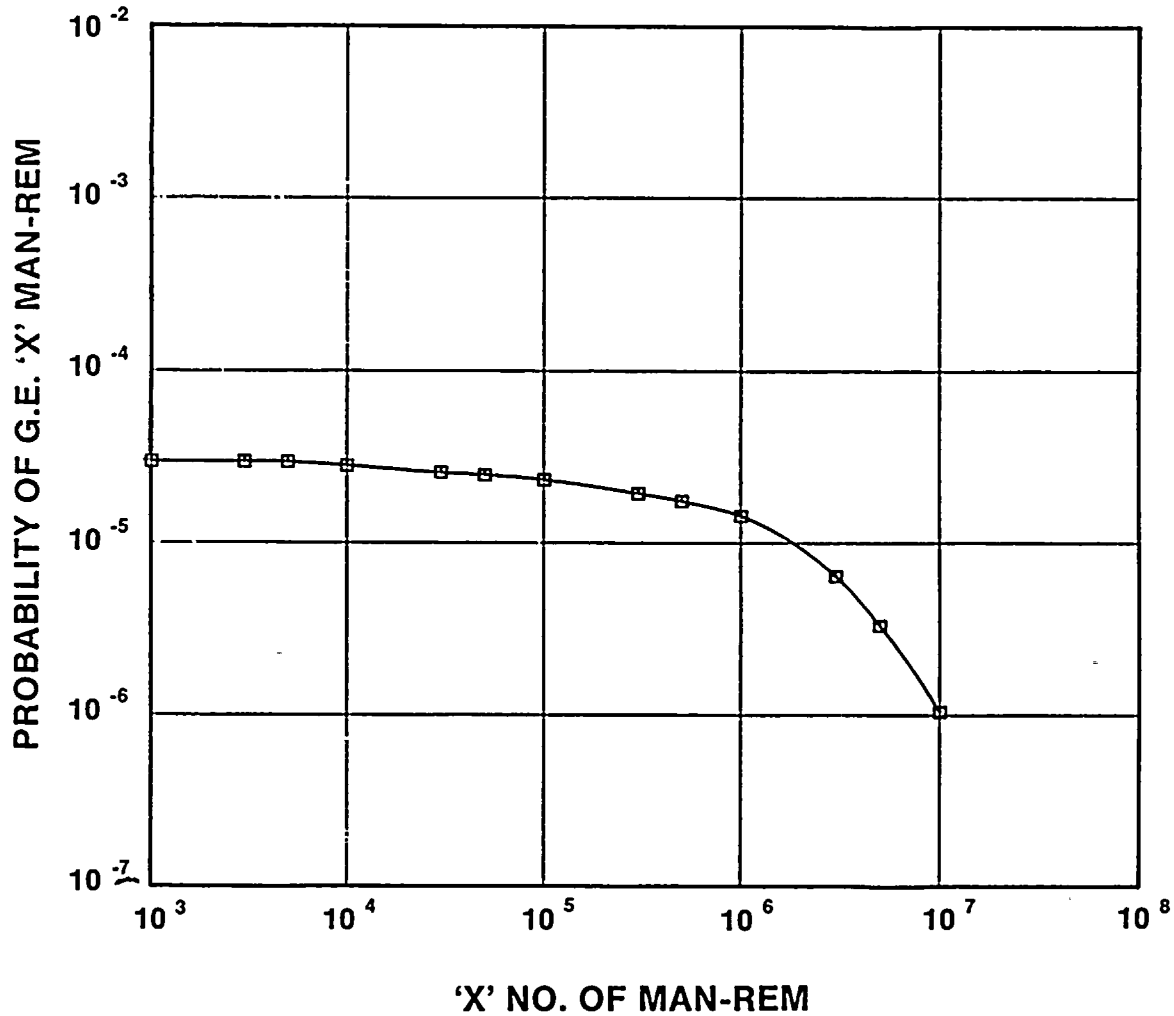
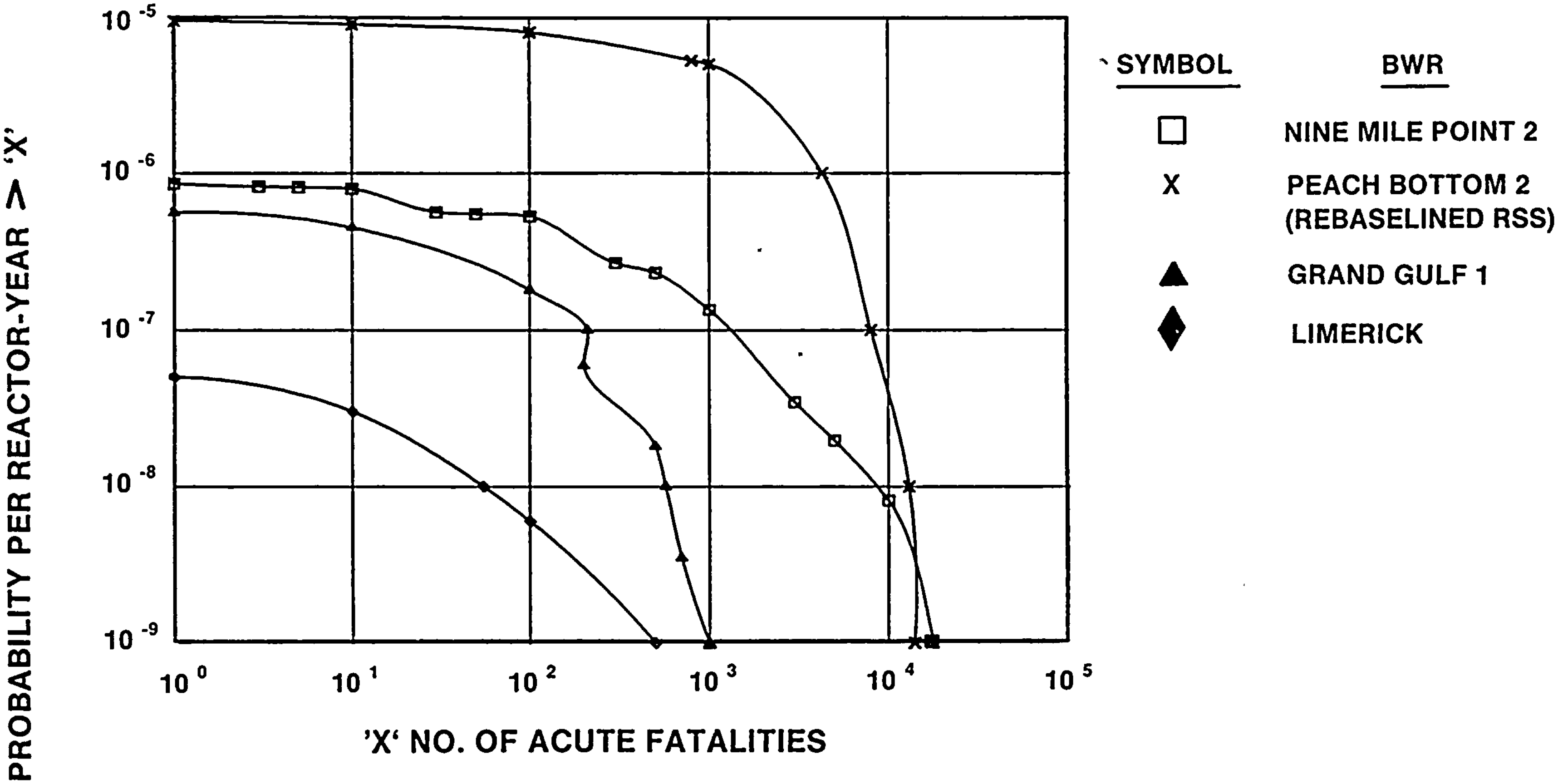


FIGURE 7A.6-7

TOTAL WHOLE-BODY MAN-REM

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



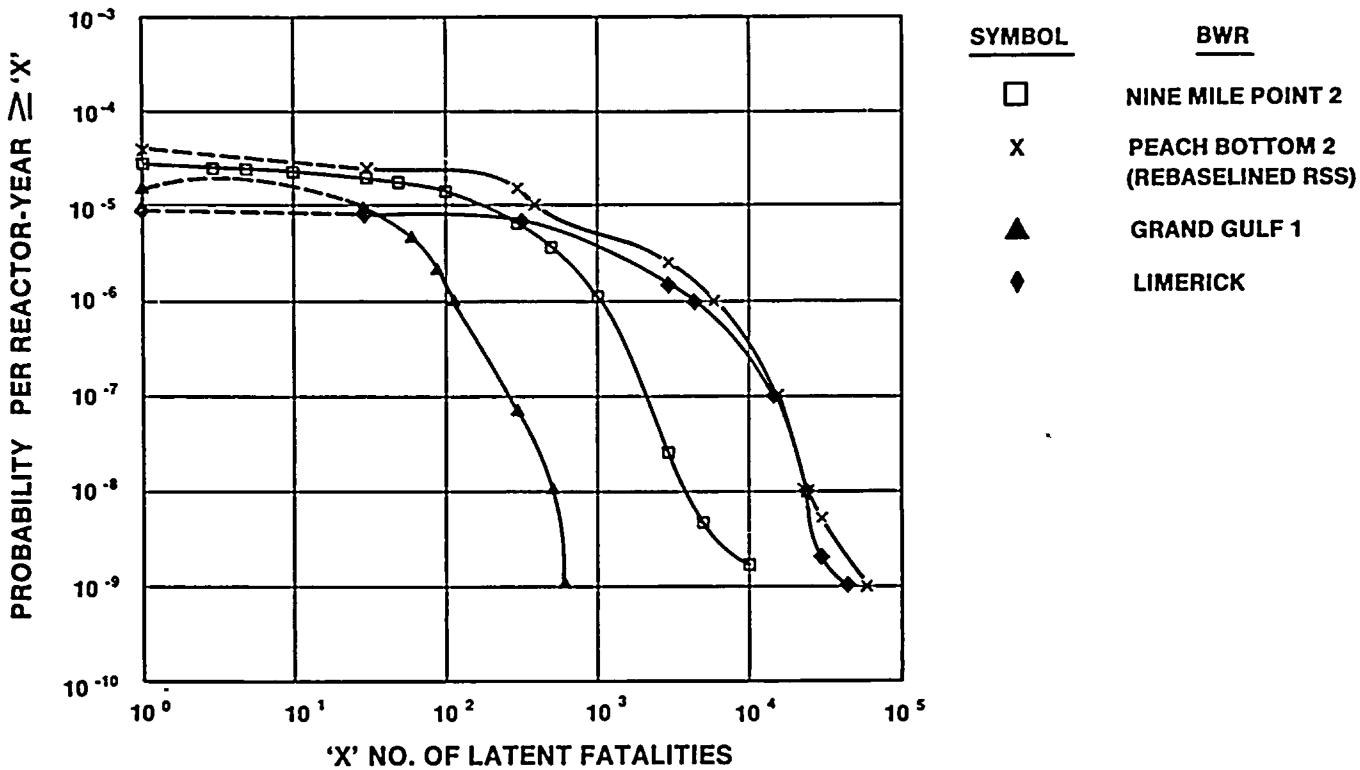
NOTES: 1. THE SOURCES FOR THE LIMERICK,PB2, AND GG1 CURVES ARE REFERENCES 4, 33, AND 34, RESPECTIVELY.

NOTES: 2. THE Y-AXIS UNITS FOR THE LIMERICK CURVES ARE: FREQUENCY (EVENTS/YEAR) ≥ 'X'.

FIGURE 7A.6-8

ACUTE FATALITIES-BWR COMPARISON

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



NOTES: 1. THE SOURCES FOR THE LIMERICK,PB2, AND GG1 CURVES ARE REFERENCES 4, 33, AND 34, RESPECTIVELY.

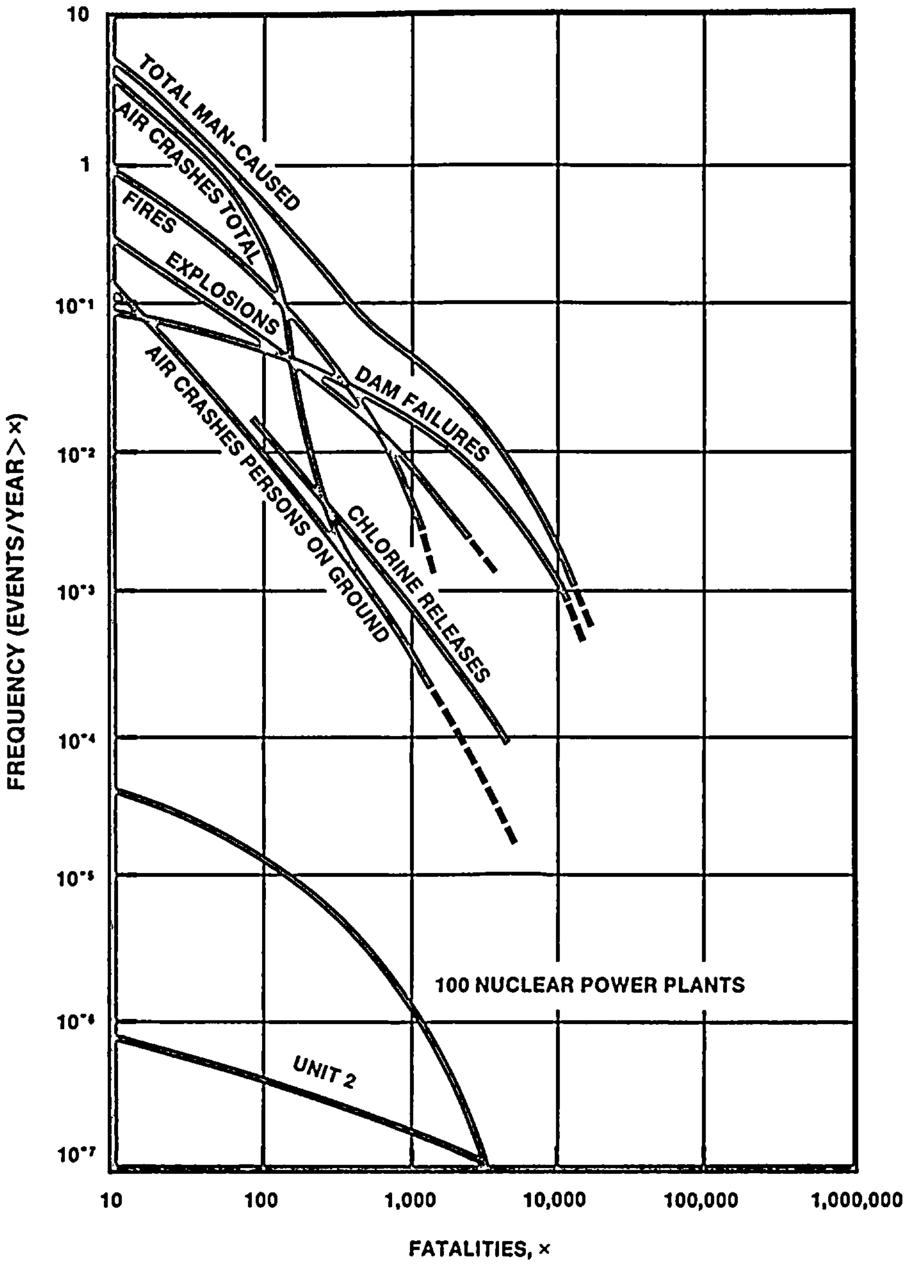
NOTES: 2. THE Y-AXIS UNITS FOR THE LIMERICK CURVES ARE: FREQUENCY (EVENTS/YEAR) 'X'.

NOTES: 3 THE LATENT FATALITY CCDF'S FOR GGI, LIMERICK AND PB2 WERE GENERATED USING THE CRAC CODE. CRAC CALCULATED CANCER DEATHS USING A 30 YEAR LATENCY PERIOD AND THE RESULTS WERE ALL NORMALIZED TO 1 YEAR BY DIVIDING BY 30. THE UNIT 2 LATENT FATALITY CCDF'S ARE NOT NORMALIZED TO ONE YEAR, THEREFORE, THE GGI, LIMERICK, AND PB2 LATENT FATALITY RESULTS HAVE BEEN MULTIPLIED BY 30 TO PROVIDE A COMMON BASE FOR COMPARISON. THE CURVES FOR THESE 3 PLANTS HAVE BEEN EXTRAPOLATED IN THE 1 TO 30 MAGNITUDE RANGE (SHOWN AS DASHED LINES).

FIGURE 7A.6-9

LATENT FATALITIES-BWR COMPARISON

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS

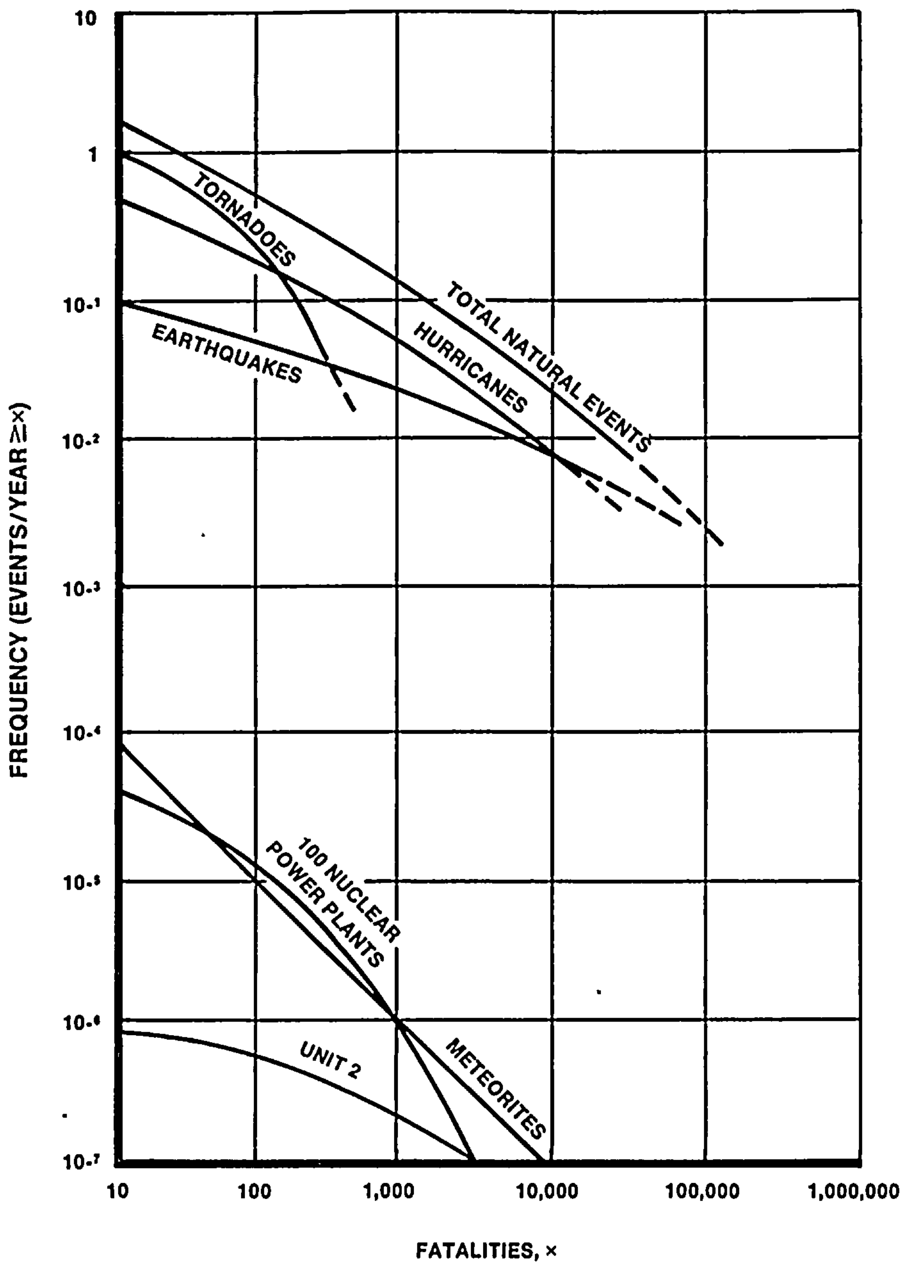


NOTE:
1. FATALITIES DUE TO AUTO ACCIDENTS ARE NOT SHOWN BECAUSE DATA ARE NOT AVAILABLE FOR LARGE CONSEQUENCE ACCIDENTS. AUTO ACCIDENTS CAUSE ABOUT 50,000 FATALITIES PER YEAR IN THE U.S.

FIGURE 7A.6-10

CCDF'S COMPARISON OF UNIT 2 VERSUS OVERALL U.S. MAN-CAUSED FATALITIES RISK

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



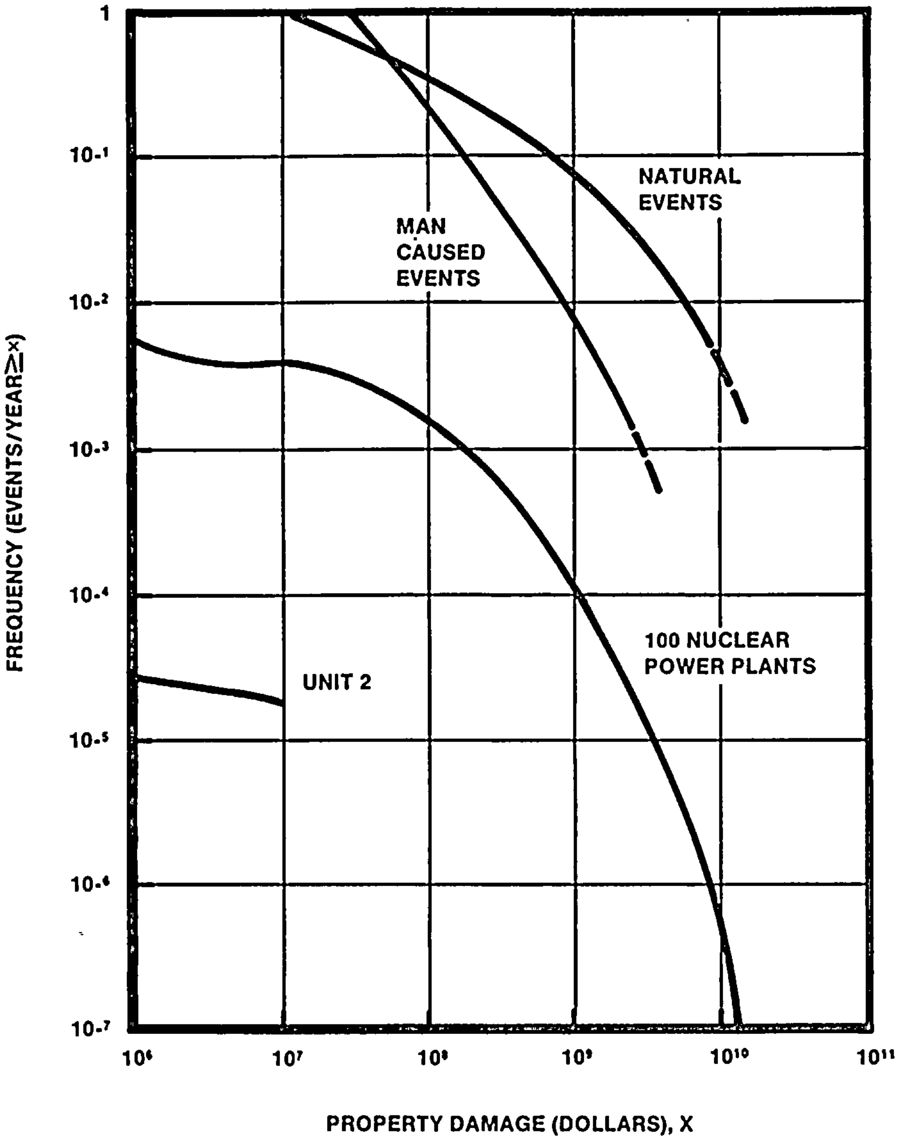
SOURCE: WASH — 1400 (RSS)

NOTE:
1. DATA FOR HURRICANES, TORNADOES, AND EARTHQUAKES ARE BASED ON THE AVERAGE U.S. VALUES FOR EVENTS DURING 1900-1972, 1953-1971, AND 1906-1971, RESPECTIVELY. DATA ARE TAKEN AS PRESENTED IN THE RSS.

FIGURE 7A.6-11

CCDFs COMPARISON OF UNIT 2 VERSUS OVERALL U.S. NATURALLY OCCURRING EVENT FATALITIES RISK

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



NOTE:

1 PROPERTY DAMAGE DUE TO AUTO ACCIDENTS IS NOT INCLUDED BECAUSE DATA ARE NOT AVAILABLE FOR LOW PROBABILITY EVENTS. AUTO ACCIDENTS CAUSE ABOUT $15 BILLION DAMAGE EACH YEAR.

FIGURE 7A.6-12

CCDFs COMPARISON OF UNIT 2 VERSUS OVERALL U.S. PROPERTY DAMAGE RISK

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT-UNIT 2

ENVIRONMENTAL REPORT-OLS

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APPENDIX 7B

MAIN STACK AND COMBINED RADWASTE AND REACTOR BUILDING VENT ANNUAL AND GRAZING SEASON X/Q AND D/Q AT GROUND LEVEL FOR LOCATIONS OF MILK ANIMALS, MEAT ANIMALS, VEGETABLE GARDENS AND RESIDENCES BY SECTOR

APPENDIX 7B

LIST OF TABLES

TABLE 7B-1

MAIN STACK X/Q AND D/Q AT GROUND LEVEL
LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES
LOCATIONS OF MILK ANIMALS BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q ($1/m^2$)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q ($1/m^2$)
ESE	2,350	9.38E-09	8.81E-10	8.84E-09	5.92E-10
	4,838	1.26E-08	3.85E-10	1.14E-08	2.58E-10
SSE	2,587	6.13E-09	4.23E-10	4.40E-09	2.94E-10
	3,926	1.17E-08	2.67E-10	8.99E-09	1.72E-10
	3,995	1.16E-08	2.61E-10	8.96E-09	1.69E-10
	5,919	1.10E-08	1.50E-10	9.86E-09	9.48E-11
SW	2,713	4.41E-09	2.56E-10	4.19E-09	1.87E-10

TABLE 7B-2

MAIN STACK X/Q AND D/Q AT GROUND LEVEL
LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES
LOCATIONS OF MEAT ANIMALS BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
E	1,693	8.48E-09	1.34E-09	1.04E-08	1.37E-09
ESE	2,539	1.03E-08	8.06E-10	9.46E-09	5.42E-10
	2,727	1.05E-08	7.50E-10	9.56E-09	5.04E-10
	3,035	1.08E-08	6.75E-10	9.70E-09	4.54E-10
	3,184	1.16E-08	6.45E-10	1.04E-08	4.33E-10
	3,224	1.17E-08	6.38E-10	1.04E-08	4.28E-10
	3,383	1.17E-08	6.09E-10	1.04E-08	4.09E-10
	3,652	1.18E-08	5.68E-10	1.05E-08	3.81E-10
	3,841	1.18E-08	5.43E-10	1.05E-08	3.64E-10
	4,529	1.22E-08	4.28E-10	1.09E-08	2.87E-10
	4,838	1.26E-08	3.85E-10	1.14E-08	2.58E-10
	5,028	1.24E-08	3.62E-10	1.12E-08	2.43E-10
	5,218	1.22E-08	3.41E-10	1.10E-08	2.29E-10
SE	2,881	1.03E-08	6.36E-10	6.67E-09	3.20E-10
	3,109	1.03E-08	5.85E-10	6.69E-09	2.94E-10
	3,913	1.95E-08	4.85E-10	1.39E-08	2.38E-10
	4,062	1.90E-08	4.62E-10	1.37E-08	2.27E-10
	4,759	1.81E-08	3.90E-10	1.38E-08	1.93E-10
	4,949	1.78E-08	3.66E-10	1.37E-08	1.81E-10
	5,328	1.65E-08	3.23E-10	1.30E-08	1.60E-10

TABLE 7B-2 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SSE	3,003	6.44E-09	3.52E-10	4.50E-09	2.40E-10
	3,966	1.17E-08	2.63E-10	8.97E-09	1.70E-10
	3,995	1.16E-08	2.61E-10	8.96E-09	1.69E-10
SSW	4,147	8.94E-09	2.01E-10	8.33E-09	1.61E-10
	4,417	8.85E-09	1.82E-10	8.32E-09	1.46E-10
	4,716	8.72E-09	1.64E-10	8.26E-09	1.31E-10
	4,826	8.66E-09	1.58E-10	8.24E-09	1.26E-10
	5,795	1.11E-08	1.22E-10	1.12E-08	9.75E-11
	5,915	1.09E-08	1.18E-10	1.10E-08	9.43E-11
	6,215	1.05E-08	1.09E-10	1.06E-08	8.70E-11
SW	2,713	4.41E-09	2.56E-10	4.19E-09	1.87E-10
	3,213	5.53E-09	2.21E-10	5.07E-09	1.60E-10

TABLE 7B-3

MAIN STACK X/Q AND D/Q AT GROUND LEVEL
LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES
LOCATIONS OF VEGETABLE GARDENS BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
E	1,922	8.81E-09	1.23E-09	1.07E-08	1.25E-09
	2,111	9.17E-09	1.16E-09	1.11E-08	1.18E-09
	2,918	1.20E-08	8.69E-10	1.44E-08	8.90E-10
ESE	2,539	1.03E-08	8.06E-10	9.46E-09	5.42E-10
	2,727	1.05E-08	7.50E-10	9.56E-09	5.04E-10
	2,846	1.06E-08	7.19E-10	9.62E-09	4.83E-10
	2,995	1.08E-08	6.84E-10	9.68E-09	4.60E-10
	3,075	1.16E-08	6.67E-10	1.03E-08	4.48E-10
	3,145	1.16E-08	6.53E-10	1.04E-08	4.38E-10
	3,184	1.16E-08	6.45E-10	1.04E-08	4.33E-10
	3,453	1.18E-08	5.98E-10	1.04E-08	4.02E-10
	3,642	1.18E-08	5.69E-10	1.05E-08	3.82E-10
	3,841	1.18E-08	5.43E-10	1.05E-08	3.64E-10
	4,529	1.22E-08	4.28E-10	1.09E-08	2.87E-10
	4,838	1.26E-08	3.85E-10	1.14E-08	2.58E-10
	5,068	1.24E-08	3.57E-10	1.12E-08	2.40E-10
SE	2,386	9.45E-09	7.95E-10	6.33E-09	3.99E-10
	2,881	1.03E-08	6.36E-10	6.67E-09	3.20E-10
	2,999	1.03E-08	6.09E-10	6.68E-09	3.06E-10
	3,069	1.03E-08	5.94E-10	6.69E-09	2.98E-10
	3,109	1.03E-08	5.85E-10	6.69E-09	2.94E-10
	3,228	1.03E-08	5.62E-10	6.70E-09	2.83E-10

TABLE 7B-3 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
SE	3,267	1.03E-08	5.55E-10	6.71E-09	2.79E-10
	3,297	1.03E-08	5.50E-10	6.71E-09	2.77E-10
	3,376	1.23E-08	5.37E-10	8.02E-09	2.70E-10
	3,565	1.62E-08	5.07E-10	1.09E-08	2.55E-10
	3,605	1.61E-08	5.01E-10	1.09E-08	2.52E-10
	3,903	1.79E-08	4.63E-10	1.26E-08	2.33E-10
	3,953	1.93E-08	4.79E-10	1.38E-08	2.35E-10
	4,062	1.90E-08	4.62E-10	1.37E-08	2.27E-10
	4,291	1.97E-08	4.64E-10	1.47E-08	2.29E-10
	4,371	1.95E-08	4.50E-10	1.45E-08	2.22E-10
	4,720	1.83E-08	3.96E-10	1.39E-08	1.95E-10
	4,949	1.78E-08	3.66E-10	1.37E-08	1.81E-10
	5,288	1.67E-08	3.28E-10	1.30E-08	1.62E-10
SSE	2,577	6.13E-09	4.25E-10	4.40E-09	2.95E-10
	2,933	6.44E-09	3.62E-10	4.51E-09	2.48E-10
	3,042	6.43E-09	3.47E-10	4.50E-09	2.36E-10
	3,846	1.18E-08	2.73E-10	9.02E-09	1.77E-10
	3,926	1.17E-08	2.67E-10	8.99E-09	1.72E-10
	3,995	1.16E-08	2.61E-10	8.96E-09	1.69E-10
	4,035	1.15E-08	2.57E-10	8.94E-09	1.66E-10
	4,264	1.23E-08	2.52E-10	9.82E-09	1.60E-10
	4,344	1.21E-08	2.45E-10	9.76E-09	1.55E-10
	4,423	1.20E-08	2.37E-10	9.70E-09	1.50E-10
	4,652	1.16E-08	2.18E-10	9.52E-09	1.38E-10
S	2,811	7.73E-09	4.10E-10	7.31E-09	3.76E-10
	3,307	8.18E-09	3.39E-10	7.60E-09	3.07E-10

TABLE 7B-3 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
S	3,914	1.43E-08	2.90E-10	1.39E-08	2.59E-10
	4,103	1.48E-08	2.81E-10	1.46E-08	2.50E-10
	5,110	1.41E-08	2.10E-10	1.47E-08	1.82E-10
	5,210	1.39E-08	2.04E-10	1.45E-08	1.76E-10
	5,260	1.38E-08	2.00E-10	1.44E-08	1.74E-10
SSW	4,566	8.79E-09	1.72E-10	8.29E-09	1.38E-10
	4,646	8.75E-09	1.68E-10	8.28E-09	1.34E-10
	4,716	8.72E-09	1.64E-10	8.26E-09	1.31E-10
	4,796	8.68E-09	1.59E-10	8.25E-09	1.28E-10
	4,876	8.64E-09	1.55E-10	8.23E-09	1.24E-10
	5,565	1.15E-08	1.31E-10	1.15E-08	1.04E-10
	5,795	1.11E-08	1.22E-10	1.12E-08	9.75E-11
	5,985	1.08E-08	1.16E-10	1.09E-08	9.25E-11
	6,065	1.07E-08	1.14E-10	1.08E-08	9.05E-11
	6,145	1.06E-08	1.11E-10	1.07E-08	8.86E-11
SW	2,284	3.83E-09	3.02E-10	3.85E-09	2.23E-10
	2,324	3.85E-09	2.97E-10	3.86E-09	2.20E-10
	2,363	3.88E-09	2.93E-10	3.86E-09	2.16E-10
	2,713	4.41E-09	2.56E-10	4.19E-09	1.87E-10
	3,093	5.43E-09	2.28E-10	4.99E-09	1.66E-10
	3,443	5.69E-09	2.08E-10	5.21E-09	1.50E-10
	3,783	5.89E-09	1.93E-10	5.40E-09	1.38E-10
	4,022	6.00E-09	1.82E-10	5.52E-09	1.30E-10
	5,712	7.38E-09	1.04E-10	7.23E-09	7.43E-11
	6,052	7.17E-09	9.48E-11	7.07E-09	6.77E-11
	6,322	7.01E-09	8.84E-11	6.94E-09	6.32E-11

TABLE 7B-4

MAIN STACK X/Q AND D/Q AT GROUND LEVEL
LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES
LOCATIONS OF RESIDENCES BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
E	1,693	8.48E-09	1.34E-09	1.04E-08	1.37E-09
	1,802	8.62E-09	1.28E-09	1.05E-08	1.31E-09
	1,922	8.81E-09	1.23E-09	1.07E-08	1.25E-09
	2,111	9.17E-09	1.16E-09	1.11E-08	1.18E-09
	2,190	9.35E-09	1.12E-09	1.13E-08	1.15E-09
	2,728	1.15E-08	9.20E-10	1.38E-08	9.42E-10
	2,839	1.18E-08	8.90E-10	1.41E-08	9.11E-10
	2,918	1.20E-08	8.69E-10	1.44E-08	8.90E-10
	4,106	1.55E-08	6.45E-10	1.89E-08	6.63E-10
	4,136	1.55E-08	6.38E-10	1.89E-08	6.55E-10
ESE	2,539	1.03E-08	8.06E-10	9.46E-09	5.42E-10
	2,727	1.05E-08	7.50E-10	9.56E-09	5.04E-10
	2,846	1.06E-08	7.19E-10	9.62E-09	4.83E-10
	2,995	1.08E-08	6.84E-10	9.68E-09	4.60E-10
	3,075	1.16E-08	6.67E-10	1.03E-08	4.48E-10
	3,145	1.16E-08	6.53E-10	1.04E-08	4.38E-10
	3,184	1.16E-08	6.45E-10	1.04E-08	4.33E-10
	3,224	1.17E-08	6.38E-10	1.04E-08	4.28E-10
	3,344	1.17E-08	6.16E-10	1.04E-08	4.14E-10
	3,383	1.17E-08	6.09E-10	1.04E-08	4.09E-10
	3,413	1.17E-08	6.04E-10	1.04E-08	4.06E-10
	3,453	1.18E-08	5.98E-10	1.04E-08	4.02E-10
	3,572	1.18E-08	5.80E-10	1.05E-08	3.89E-10

TABLE 7B-4 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
ESE	3,642	1.18E-08	5.69E-10	1.05E-08	3.82E-10
	3,682	1.18E-08	5.64E-10	1.05E-08	3.79E-10
	3,841	1.18E-08	5.43E-10	1.05E-08	3.64E-10
	4,489	1.23E-08	4.34E-10	1.09E-08	2.91E-10
	4,529	1.22E-08	4.28E-10	1.09E-08	2.87E-10
	4,569	1.22E-08	4.22E-10	1.09E-08	2.83E-10
	4,609	1.22E-08	4.16E-10	1.09E-08	2.79E-10
	4,719	1.21E-08	4.01E-10	1.08E-08	2.69E-10
	4,749	1.21E-08	3.96E-10	1.08E-08	2.66E-10
	4,838	1.26E-08	3.85E-10	1.14E-08	2.58E-10
	4,878	1.26E-08	3.80E-10	1.13E-08	2.55E-10
	5,028	1.24E-08	3.62E-10	1.12E-08	2.43E-10
	5,068	1.24E-08	3.57E-10	1.12E-08	2.40E-10
	5,108	1.23E-08	3.53E-10	1.11E-08	2.37E-10
	5,218	1.22E-08	3.41E-10	1.10E-08	2.29E-10
SE	2,386	9.45E-09	7.95E-10	6.33E-09	3.99E-10
	2,544	1.01E-08	7.30E-10	6.66E-09	3.67E-10
	2,881	1.03E-08	6.36E-10	6.67E-09	3.20E-10
	2,910	1.03E-08	6.29E-10	6.68E-09	3.16E-10
	2,999	1.03E-08	6.09E-10	6.68E-09	3.06E-10
	3,039	1.03E-08	6.00E-10	6.69E-09	3.02E-10
	3,069	1.03E-08	5.94E-10	6.69E-09	2.98E-10
	3,109	1.03E-08	5.85E-10	6.69E-09	2.94E-10
	3,148	1.03E-08	5.78E-10	6.70E-09	2.91E-10
	3,188	1.03E-08	5.70E-10	6.70E-09	2.87E-10

TABLE 7B-4 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
SE	3,228	1.03E-08	5.62E-10	6.70E-09	2.83E-10
	3,267	1.03E-08	5.55E-10	6.71E-09	2.79E-10
	3,297	1.03E-08	5.50E-10	6.70E-09	2.77E-10
	3,337	1.23E-08	5.43E-10	8.02E-09	2.73E-10
	3,376	1.23E-08	5.37E-10	8.02E-09	2.70E-10
	3,565	1.62E-08	5.07E-10	1.09E-08	2.55E-10
	3,605	1.61E-08	5.01E-10	1.09E-08	2.52E-10
	3,794	1.66E-08	4.76E-10	1.14E-08	2.40E-10
	3,804	1.66E-08	4.75E-10	1.14E-08	2.39E-10
	3,903	1.79E-08	4.63E-10	1.26E-08	2.33E-10
	3,953	1.93E-08	4.79E-10	1.38E-08	2.35E-10
	4,062	1.90E-08	4.62E-10	1.37E-08	2.27E-10
	4,142	1.87E-08	4.48E-10	1.36E-08	2.20E-10
	4,291	1.97E-08	4.64E-10	1.47E-08	2.29E-10
	4,371	1.95E-08	4.50E-10	1.45E-08	2.22E-10
	4,640	1.85E-08	4.07E-10	1.40E-08	2.01E-10
	4,720	1.83E-08	3.96E-10	1.39E-08	1.95E-10
	4,759	1.81E-08	3.90E-10	1.38E-08	1.93E-10
	4,949	1.78E-08	3.66E-10	1.37E-08	1.81E-10
	5,218	1.69E-08	3.35E-10	1.32E-08	1.66E-10
	5,288	1.67E-08	3.28E-10	1.30E-08	1.62E-10
	5,527	1.59E-08	3.04E-10	1.26E-08	1.51E-10
SSE	2,577	6.13E-09	4.25E-10	4.40E-09	2.95E-10
	2,814	6.45E-09	3.81E-10	4.53E-09	2.62E-10
	2,933	6.44E-09	3.62E-10	4.51E-09	2.48E-10
	3,042	6.43E-09	3.47E-10	4.50E-09	2.36E-10
	3,807	1.19E-08	2.77E-10	9.04E-09	1.79E-10

TABLE 7B-4 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SSE	3,846	1.18E-08	2.73E-10	9.02E-09	1.77E-10
	3,926	1.17E-08	2.67E-10	8.99E-09	1.72E-10
	3,956	1.17E-08	2.64E-10	8.98E-09	1.71E-10
	3,966	1.17E-08	2.63E-10	8.97E-09	1.70E-10
	3,995	1.16E-08	2.61E-10	8.96E-09	1.69E-10
	4,035	1.15E-08	2.57E-10	8.94E-09	1.66E-10
	4,115	1.14E-08	2.49E-10	8.90E-09	1.61E-10
	4,264	1.23E-08	2.52E-10	9.82E-09	1.60E-10
	4,344	1.21E-08	2.45E-10	9.76E-09	1.55E-10
	4,423	1.20E-08	2.37E-10	9.70E-09	1.50E-10
	4,652	1.16E-08	2.18E-10	9.52E-09	1.38E-10
	5,191	1.08E-08	1.82E-10	9.18E-09	1.16E-10
	5,220	1.08E-08	1.81E-10	9.15E-09	1.15E-10
	5,490	1.03E-08	1.66E-10	8.84E-09	1.06E-10
	5,879	1.11E-08	1.52E-10	9.92E-09	9.58E-11
	5,919	1.10E-08	1.50E-10	9.86E-09	9.48E-11
	5,988	1.09E-08	1.48E-10	9.77E-09	9.29E-11
S	2,811	7.73E-09	4.10E-10	7.31E-09	3.76E-10
	3,307	8.18E-09	3.39E-10	7.60E-09	3.07E-10
	3,874	1.44E-08	2.94E-10	1.40E-09	2.62E-10
	3,914	1.43E-08	2.90E-10	1.39E-08	2.59E-10
	3,954	1.43E-08	2.87E-10	1.39E-08	2.56E-10
	3,994	1.50E-08	2.92E-10	1.47E-08	2.60E-10
	4,034	1.49E-08	2.89E-10	1.47E-08	2.57E-10
	4,074	1.49E-08	2.85E-10	1.46E-08	2.53E-10
	4,103	1.48E-08	2.81E-10	1.46E-08	2.50E-10
	4,991	1.44E-08	2.19E-10	1.50E-08	1.89E-10

TABLE 7B-4 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m³)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m³)
S	5,110	1.41E-08	2.10E-10	1.47E-08	1.82E-10
	5,140	1.41E-08	2.08E-10	1.47E-08	1.80E-10
	5,170	1.40E-08	2.06E-10	1.46E-08	1.79E-10
	5,180	1.40E-08	2.06E-10	1.46E-08	1.78E-10
	5,210	1.39E-08	2.04E-10	1.45E-08	1.76E-10
	5,260	1.38E-08	2.00E-10	1.44E-08	1.74E-10
	5,449	1.34E-08	1.89E-10	1.40E-08	1.64E-10
SSW	4,217	8.92E-09	1.96E-10	8.33E-09	1.57E-10
	4,327	8.88E-09	1.88E-10	8.33E-09	1.51E-10
	4,417	8.85E-09	1.82E-10	8.32E-09	1.46E-10
	4,566	8.79E-09	1.72E-10	8.29E-09	1.38E-10
	4,646	8.75E-09	1.68E-10	8.28E-09	1.34E-10
	4,716	8.72E-09	1.64E-10	8.26E-09	1.31E-10
	4,796	8.68E-09	1.59E-10	8.25E-09	1.28E-10
	4,876	8.64E-09	1.55E-10	8.23E-09	1.24E-10
	4,916	1.07E-08	1.53E-10	1.05E-08	1.23E-10
	4,986	1.06E-08	1.50E-10	1.04E-08	1.20E-10
	5,375	1.16E-08	1.33E-10	1.16E-08	1.06E-10
	5,455	1.14E-08	1.30E-10	1.15E-08	1.04E-10
	5,565	1.15E-08	1.31E-10	1.15E-08	1.04E-10
	5,645	1.13E-08	1.28E-10	1.14E-08	1.02E-10
	5,685	1.13E-08	1.26E-10	1.14E-08	1.01E-10
	5,755	1.11E-08	1.24E-10	1.13E-08	9.86E-11
	5,795	1.11E-08	1.22E-10	1.12E-08	9.75E-11
	5,825	1.10E-08	1.21E-10	1.12E-08	9.66E-11
	5,875	1.10E-08	1.20E-10	1.11E-08	9.53E-11
	5,915	1.09E-08	1.18E-10	1.10E-08	9.43E-11

TABLE 7B-4 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SSW	5,925	1.09E-08	1.18E-10	1.10E-08	9.40E-11
	5,985	1.08E-08	1.16E-10	1.09E-08	9.25E-11
	6,025	1.07E-08	1,15E-10	1.09E-08	9.15E-11
	6,065	1.07E-08	1.14E-10	1.08E-08	9.05E-11
	6,105	1.06E-08	1.12E-10	1.08E-08	8.95E-11
	6,145	1.06E-08	1.11E-10	1.07E-08	8.86E-11
	6,215	1.05E-08	1.09E-10	1.06E-08	8.70E-11
SW	1,984	3.70E-09	3.38E-10	3.87E-09	2.52E-10
	2,254	3.81E-09	3.06E-10	3.85E-09	2.26E-10
	2,284	3.83E-09	3.02E-10	3.85E-09	2.23E-10
	2,324	3.85E-09	2.97E-10	3.86E-09	2.20E-10
	2,363	3.88E-09	2.93E-10	3.86E-09	2.16E-10
	2,483	3.95E-09	2.80E-10	3.88E-09	2.06E-10
	2,593	4.31E-09	2.67E-10	4.14E-09	1.96E-10
	2,713	4.41E-09	2.56E-10	4.19E-09	1.87E-10
	2,823	4.50E-09	2.47E-10	4.23E-09	1.80E-10
	2,943	4.59E-09	2.38E-10	4.29E-09	1.73E-10
	3,093	5.43E-09	2.28E-10	4.99E-09	1.66E-10
	3,173	5.50E-09	2.23E-10	5.04E-09	1.62E-10
	3,213	5.53E-09	2.21E-10	5.07E-09	1.60E-10
	3,253	5.56E-09	2.19E-10	5.09E-09	1.58E-10
	3,393	5.66E-09	2.11E-10	5.18E-09	1.52E-10
	3,443	5.69E-09	2.08E-10	5.21E-09	1.50E-10
	3,633	5.81E-09	1.99E-10	5.32E-09	1.43E-10
	3,753	5.88E-09	1.94E-10	5.39E-09	1.39E-10
	3,783	5.89E-09	1.93E-10	5.40E-09	1.38E-10

TABLE 7B-4 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
SW	3,823	5.91E-09	1.91E-10	5.42E-09	1.37E-10
	4,022	6.00E-09	1.82E-10	5.52E-09	1.30E-10
	4,282	6.08E-09	1.65E-10	5.64E-09	1.18E-10
	4,322	6.09E-09	1.62E-10	5.65E-09	1.16E-10
	4,362	6.10E-09	1.60E-10	5.67E-09	1.14E-10
	4,442	6.12E-09	1.55E-10	5.70E-09	1.11E-10
	4,942	6.18E-09	1.31E-10	5.84E-09	9.37E-11
	5,172	6.13E-09	1.22E-10	5.82E-09	8.71E-11
	5,672	7.40E-09	1.05E-10	7.25E-09	7.52E-11
	5,712	7.38E-09	1.04E-10	7.23E-09	7.43E-11
	5,132	6.14E-09	1.23E-10	5.83E-09	8.82E-11
	5,782	7.34E-09	1.02E-10	7.20E-09	7.29E-11
	5,942	7.24E-09	9.76E-11	7.12E-09	6.98E-11
	6,052	7.17E-09	9.48E-11	7.07E-09	6.77E-11
	6,322	7.01E-09	8.84E-11	6.94E-09	6.32E-11
	7,962	7.36E-09	6.11E-11	7.64E-09	4.37E-11
	8,252	7.35E-09	5.78E-11	7.69E-09	4.13E-11
	8,322	7.30E-09	5.70E-11	7.64E-09	4.07E-11
	8,362	8.00E-09	5.65E-11	8.48E-09	4.04E-11
	8,672	7.75E-09	5.34E-11	8.23E-09	3.81E-11
	8,822	7.63E-09	5.19E-11	8.12E-09	3.71E-11
	9,052	7.46E-09	4.98E-11	7.95E-09	3.56E-11
	9,092	7.43E-09	4.95E-11	7.92E-09	3.53E-11
	9,292	7.28E-09	4.78E-11	7.77E-09	3.41E-11
WSW	4,142	2.46E-09	5.92E-11	2.01E-09	3.74E-11

TABLE 7B-5

COMBINED RADWASTE AND REACTOR BUILDING VENT X/Q AND D/Q AT GROUND LEVEL, LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES, LOCATIONS OF MILK ANIMALS BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
ESE	2,417	7.32E-08	1.54E-09	5.44E-08	9.52E-10
	4,915	4.03E-08	5.19E-10	3.65E-08	3.37E-10
SSE	2,475	3.06E-08	6.52E-10	2.31E-08	4.33E-10
	3,822	4.10E-08	3.61E-10	4.10E-08	2.35E-10
	3,892	4.01E-08	3.50E-10	4.03E-08	2.28E-10
	5,820	2.99E-08	2.23E-10	3.38E-08	1.69E-10
SW	2,485	3.36E-08	4.90E-10	3.10E-08	3.55E-10

TABLE 7B-6

COMBINED RADWASTE AND REACTOR BUILDING VENT X/Q AND D/Q AT GROUND LEVEL, LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES, LOCATIONS OF MEAT ANIMALS BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
E	1,842	1.42E-07	2.90E-09	1.42E-07	2.58E-09
ESE	2,607	7.06E-08	1.37E-09	5.40E-08	8.49E-10
	2,797	6.59E-08	1.23E-09	5.12E-08	7.66E-10
	3,106	5.94E-08	1.05E-09	4.73E-08	6.58E-10
	3,256	5.88E-08	9.77E-10	4.79E-08	6.15E-10
	3,296	5.81E-08	9.59E-10	4.74E-08	6.04E-10
	3,456	5.53E-08	8.93E-10	4.56E-08	5.64E-10
	3,726	5.11E-08	7.97E-10	4.28E-08	5.07E-10
	3,916	4.85E-08	7.40E-10	4.11E-08	4.73E-10
	4,605	4.20E-08	5.80E-10	3.71E-08	3.76E-10
	4,915	4.03E-08	5.19E-10	3.65E-08	3.37E-10
	5,105	3.86E-08	4.86E-10	3.51E-08	3.16E-10
	5,295	3.70E-08	4.57E-10	3.38E-08	2.97E-10
SE	2,857	5.04E-08	9.93E-10	3.30E-08	4.80E-10
	3,087	4.66E-08	8.80E-10	3.12E-08	4.27E-10
	3,896	5.84E-08	6.44E-10	5.17E-08	3.19E-10
	4,046	5.56E-08	6.04E-10	4.95E-08	3.00E-10
	4,745	4.81E-08	4.60E-10	4.54E-08	2.31E-10
	4,935	4.62E-08	4.31E-10	4.41E-08	2.18E-10
	5,315	4.18E-08	3.80E-10	4.03E-08	1.93E-10

TABLE 7B-6 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SSE	2,893	2.98E-08	5.32E-10	2.35E-08	3.46E-10
	3,862	4.05E-08	3.55E-10	4.06E-08	2.31E-10
	3,892	4.01E-08	3.50E-10	4.03E-08	2.28E-10
SSW	3,932	3.69E-08	3.06E-10	3.95E-08	2.48E-10
	4,202	3.44E-08	2.76E-10	3.71E-08	2.24E-10
	4,502	3.19E-08	2.46E-10	3.47E-08	2.00E-10
	4,611	3.11E-08	2.36E-10	3.39E-08	1.92E-10
	5,581	3.35E-08	1.84E-10	3.97E-08	1.54E-10
	5,701	3.27E-08	1.78E-10	3.87E-08	1.49E-10
	6,001	3.06E-08	1.64E-10	3.64E-08	1.39E-10
SW	2,485	3.36E-08	4.90E-10	3.10E-08	3.55E-10
	2,985	3.52E-08	3.75E-10	3.43E-08	2.73E-10

TABLE 7B-7

COMBINED RADWASTE AND REACTOR BUILDING VENT X/Q AND D/Q AT GROUND LEVEL, LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES, LOCATIONS OF VEGETABLE GARDENS BY SECTOR

		Annual		Grazing Season	
Sector Bearing	Distance (m)	X/Q (sec/m^3)	D/Q (1/m^2)	X/Q (sec/m^3)	D/Q (1/m^2)
E	2,072	1.26E-07	2.46E-09	1.29E-07	2.21E-09
	2,262	1.16E-07	2.15E-09	1.20E-07	1.96E-09
	3,072	8.97E-08	1.44E-09	9.91E-08	1.37E-09
ESE	2,607	7.06E-08	1.37E-09	5.40E-08	8.49E-10
	2,796	6.59E-08	1.23E-09	5.12E-08	7.66E-10
	2,916	6.33E-08	1.16E-09	4.96E-08	7.21E-10
	3,066	6.02E-08	1.07E-09	4.78E-08	6.70E-10
	3,146	6.09E-08	1.03E-09	4.92E-08	6.46E-10
	3,216	5.95E-08	9.95E-10	4.83E-08	6.26E-10
	3,256	5.88E-08	9.77E-10	4.79E-08	6.15E-10
	3,526	5.41E-08	8.66E-10	4.49E-08	5.49E-10
	3,716	5.12E-08	8.00E-10	4.29E-08	5.09E-10
	3,916	4.85E-08	7.40E-10	4.11E-08	4.73E-10
	4,605	4.20E-08	5.80E-10	3.71E-08	3.76E-10
	4,915	4.03E-08	5.19E-10	3.65E-08	3.37E-10
	5,145	3.82E-08	4.80E-10	3.48E-08	3.12E-10
SE	2,358	5.82E-08	1.29E-09	3.60E-08	6.15E-10
	2,857	5.04E-08	9.93E-10	3.30E-08	4.80E-10
	2,977	4.84E-08	9.31E-10	3.20E-08	4.51E-10
	3,047	4.73E-08	8.98E-10	3.15E-08	4.36E-10
	3,087	4.66E-08	8.80E-10	3.12E-08	4.27E-10
	3,356	4.81E-08	7.75E-10	3.43E-08	3.78E-10

TABLE 7B-7 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SE	3,207	4.48E-08	8.30E-10	3.03E-08	4.03E-10
	3,276	4.94E-08	8.05E-10	3.50E-08	3.92E-10
	3,247	4.98E-08	8.16E-10	3.53E-08	3.97E-10
	3,546	5.58E-08	7.27E-10	4.45E-08	3.57E-10
	3,586	5.50E-08	7.13E-10	4.40E-08	3.57E-10
	3,886	5.47E-08	6.25E-10	4.67E-08	3.09E-10
	3,936	5.77E-08	6.33E-10	5.11E-08	3.14E-10
	4,046	5.56E-08	6.04E-10	4.95E-08	3.00E-10
	4,275	5.54E-08	5.50E-10	5.14E-08	2.74E-10
	4,355	5.40E-08	5.32E-10	5.03E-08	2.66E-10
	4,705	4.87E-08	4.67E-10	4.58E-08	2.34E-10
	4,935	4.62E-08	4.31E-10	4.41E-08	2.18E-10
	5,275	4.23E-08	3.85E-10	4.06E-08	1.96E-10
SSE	2,465	3.23E-08	6.85E-10	2.45E-08	4.46E-10
	2,824	3.04E-08	5.52E-10	2.39E-08	3.59E-10
	2,933	2.95E-08	5.21E-10	2.33E-08	3.38E-10
	3,742	4.21E-08	3.74E-10	4.20E-08	2.43E-10
	3,822	4.10E-08	3.61E-10	4.10E-08	2.35E-10
	3,892	4.01E-08	3.50E-10	4.03E-08	2.28E-10
	3,931	3.97E-08	3.44E-10	3.98E-08	2.24E-10
	4,161	4.02E-08	3.13E-10	4.18E-08	2.05E-10
	4,241	3.92E-08	3.03E-10	4.09E-08	1.98E-10
	4,321	3.83E-08	2.94E-10	4.01E-08	1.92E-10
	4,551	3.59E-08	2.69E-10	3.78E-08	1.77E-10
S	2,633	3.91E-08	6.63E-10	3.88E-08	6.01E-10
	3,132	3.58E-08	5.09E-10	3.65E-08	4.60E-10

TABLE 7B-7 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
S	3,741	5.31E-08	4.08E-10	6.18E-08	3.68E-10
	3,931	5.29E-08	3.76E-10	6.26E-08	3.39E-10
	4,940	4.34E-08	2.82E-10	5.35E-08	2.71E-10
	5,040	4.23E-08	2.73E-10	5.21E-08	2.62E-10
	5,090	4.18E-08	2.69E-10	5.15E-08	2.58E-10
SSW	4,352	3.31E-08	2.60E-10	3.58E-08	2.11E-10
	4,432	3.25E-08	2.53E-10	3.53E-08	2.05E-10
	4,502	3.19E-08	2.46E-10	3.47E-08	2.00E-10
	4,581	3.13E-08	2.39E-10	3.41E-08	1.94E-10
	4,661	3.07E-08	2.32E-10	3.35E-08	1.88E-10
	5,351	3.53E-08	1.96E-10	4.18E-08	1.64E-10
	5,581	3.35E-08	1.84E-10	3.97E-08	1.54E-10
	5,771	3.22E-08	1.74E-10	3.82E-08	1.47E-10
	5,851	3.16E-08	1.71E-10	3.76E-08	1.44E-10
	5,931	3.11E-08	1.67E-10	3.70E-08	1.41E-10
SW	2,056	3.82E-08	6.44E-10	3.44E-08	4.64E-10
	2,096	3.77E-08	6.26E-10	3.40E-08	4.52E-10
	2,136	3.72E-08	6.09E-10	3.36E-08	4.40E-10
	2,485	3.36E-08	4.90E-10	3.10E-08	3.55E-10
	2,865	3.23E-08	3.98E-10	3.07E-08	2.89E-10
	3,215	3.34E-08	3.38E-10	3.30E-08	2.46E-10
	3,555	3.11E-08	2.94E-10	3.12E-08	2.15E-10
	3,795	2.96E-08	2.69E-10	3.00E-08	1.97E-10
	5,484	2.56E-08	1.53E-10	2.80E-08	1.12E-10
	5,824	2.40E-08	1.38E-10	2.64E-08	1.01E-10
	6,094	2.29E-08	1.28E-10	2.52E-08	9.38E-11

TABLE 7B-8

COMBINED RADWASTE AND REACTOR BUILDING VENT X/Q AND D/Q AT GROUND LEVEL, LONG-TERM (ROUTINE) AND GRAZING SEASON GASEOUS RELEASES, LOCATIONS OF RESIDENCES BY SECTOR

Sector Bearing	Distance (m)	Annual X/Q (sec/m^3)	Annual D/Q (1/m^2)	Grazing Season X/Q (sec/m^3)	Grazing Season D/Q (1/m^2)
E	1,842	1.42E-07	2.90E-09	1.42E-07	2.58E-09
	1,952	1.34E-07	2.68E-09	1.35E-07	2.40E-09
	2,072	1.26E-07	2.46E-09	1.29E-07	2.21E-09
	2,262	1.16E-07	2.15E-09	1.20E-07	1.96E-09
	2,342	1.12E-07	2.04E-09	1.17E-07	1.86E-09
	2,882	9.53E-08	1.59E-09	1.04E-07	1.50E-09
	2,992	9.20E-08	1.50E-09	1.01E-07	1.42E-09
	3,072	8.97E-08	1.44E-09	9.91E-08	1.37E-09
	4,261	7.00E-08	8.80E-10	8.28E-08	8.56E-10
	4,291	6.95E-08	8.69E-10	8.23E-08	8.46E-10
ESE	2,607	7.06E-08	1.37E-09	5.40E-08	8.49E-10
	2,796	6.59E-08	1.23E-09	5.12E-08	7.66E-10
	2,916	6.33E-08	1.16E-09	4.96E-08	7.21E-10
	3,066	6.02E-08	1.07E-09	4.78E-08	6.70E-10
	3,146	6.09E-08	1.03E-09	4.92E-08	6.46E-10
	3,216	5.95E-08	9.95E-10	4.83E-08	6.26E-10
	3,256	5.88E-08	9.77E-10	4.79E-08	6.15E-10
	3,296	5.81E-08	9.59E-10	4.74E-08	6.04E-10
	3,416	5.60E-08	9.09E-10	4.60E-08	5.74E-10
	3,456	5.53E-08	8.93E-10	4.56E-08	5.64E-10
	3,486	5.48E-08	8.81E-10	4.53E-08	5.58E-10
	3,526	5.41E-08	8.66E-10	4.49E-08	5.49E-10
	3,646	5.23E-08	8.24E-10	4.36E-08	5.23E-10

TABLE 7B-8 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
ESE	3,716	5.12E-08	8.00E-10	4.29E-08	5.09E-10
	3,756	5.07E-08	7.88E-10	4.25E-08	5.02E-10
	3,916	4.85E-08	7.40E-10	4.11E-08	4.73E-10
	4,565	4.24E-08	5.89E-10	3.74E-08	3.82E-10
	4,605	4.20E-08	5.80E-10	3.71E-08	3.76E-10
	4,645	4.16E-08	5.71E-10	3.68E-08	3.71E-10
	4,685	4.12E-08	5.63E-10	3.66E-08	3.65E-10
	4,795	4.01E-08	5.41E-10	3.58E-08	3.51E-10
	4,825	3.98E-08	5.35E-10	3.56E-08	3.48E-10
	4,915	4.03E-08	5.19E-10	3.65E-08	3.37E-10
	4,955	3.99E-08	5.12E-10	3.62E-08	3.32E-10
	5,105	3.86E-08	4.86E-10	3.51E-08	3.16E-10
	5,145	3.82E-08	4.80E-10	3.48E-08	3.12E-10
	5,185	3.79E-08	4.73E-10	3.45E-08	3.08E-10
	5,295	3.70E-08	4.57E-10	3.38E-08	2.97E-10
SE	2,358	5.82E-08	1.29E-09	3.60E-08	6.15E-10
	2,518	5.71E-08	1.21E-09	3.63E-08	5.80E-10
	2,857	5.04E-08	9.93E-10	3.30E-08	4.80E-10
	2,887	4.99E-08	9.77E-10	3.28E-08	4.72E-10
	2,977	4.84E-08	9.31E-10	3.20E-08	4.51E-10
	3,017	4.77E-08	9.12E-10	3.17E-08	4.42E-10
	3,047	4.73E-08	8.98E-10	3.15E-08	4.36E-10
	3,087	4.66E-08	8.80E-10	3.12E-08	4.27E-10
	3,127	4.60E-08	8.63E-10	3.09E-08	4.19E-10
	3,167	4.54E-08	8.46E-10	3.06E-08	4.11E-10

TABLE 7B-8 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SE	3,207	4.48E-08	8.30E-10	3.03E-08	4.03E-10
	3,247	4.98E-08	8.16E-10	3.53E-08	3.97E-10
	3,276	4.94E-08	8.05E-10	3.50E-08	3.92E-10
	3,316	4.87E-08	7.90E-10	3.47E-08	3.85E-10
	3,356	4.81E-08	7.75E-10	3.43E-08	3.78E-10
	3,546	5.58E-08	7.27E-10	4.45E-08	3.57E-10
	3,586	5.50E-08	7.13E-10	4.40E-08	3.57E-10
	3,776	5.30E-08	6.55E-10	4.34E-08	3.23E-10
	3,786	5.28E-08	6.52E-10	4.33E-08	3.22E-10
	3,886	5.47E-08	6.25E-10	4.67E-08	3.09E-10
	3,936	5.77E-08	6.33E-10	5.11E-08	3.14E-10
	4,046	5.56E-08	6.04E-10	4.95E-08	3.00E-10
	4,126	5.42E-08	5.84E-10	4.84E-08	2.91E-10
	4,275	5.54E-08	5.50E-10	5.14E-08	2.74E-10
	4,355	5.40E-08	5.32E-10	5.03E-08	2.66E-10
	4,625	4.98E-08	4.80E-10	4.68E-08	2.41E-10
	4,705	4.87E-08	4.67E-10	4.58E-08	2.34E-10
	4,745	4.81E-08	4.60E-10	4.54E-08	2.31E-10
	4,935	4.62E-08	4.31E-10	4.41E-08	2.18E-10
	5,205	4.30E-08	3.94E-10	4.13E-08	2.00E-10
	5,275	4.23E-08	3.85E-10	4.06E-08	1.96E-10
	5,515	3.99E-08	3.57E-10	3.85E-08	1.82E-10
SSE	2,465	3.23E-08	6.85E-10	2.45E-08	4.46E-10
	2,704	3.15E-08	5.91E-10	2.46E-08	3.84E-10
	2,824	3.04E-08	5.52E-10	2.39E-08	3.59E-10
	2,933	2.95E-08	5.21E-10	2.33E-08	3.38E-10
	3,702	4.26E-08	3.81E-10	4.24E-08	2.47E-10

TABLE 7B-8 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SSE	3,742	4.21E-08	3.74E-10	4.20E-08	2.43E-10
	3,822	4.10E-08	3.61E-10	4.10E-08	2.35E-10
	3,852	4.06E-08	3.56E-10	4.07E-08	2.32E-10
	3,862	4.05E-08	3.55E-10	4.06E-08	2.31E-10
	3,892	4.01E-08	3.50E-10	4.03E-08	2.28E-10
	3,931	3.97E-08	3.44E-10	3.98E-08	2.24E-10
	4,011	3.87E-08	3.33E-10	3.90E-08	2.17E-10
	4,161	4.02E-08	3.13E-10	4.18E-08	2.05E-10
	4,241	3.92E-08	3.03E-10	4.09E-08	1.98E-10
	4,321	3.83E-08	2.94E-10	4.01E-08	1.92E-10
	4,551	3.59E-08	2.69E-10	3.78E-08	1.77E-10
	5,090	3.15E-08	2.24E-10	3.38E-08	1.49E-10
	5,120	3.13E-08	2.22E-10	3.36E-08	1.48E-10
	5,390	2.93E-08	2.04E-10	3.17E-08	1.37E-10
	5,780	3.01E-08	2.26E-10	3.41E-08	1.71E-10
	5,820	2.99E-08	2.23E-10	3.38E-08	1.69E-10
	5,890	2.94E-08	2.19E-10	3.33E-08	1.66E-10
S	2,633	3.91E-08	6.63E-10	3.88E-08	6.01E-10
	3,132	3.58E-08	5.09E-10	3.65E-08	4.60E-10
	3,701	5.38E-08	4.16E-10	6.26E-08	3.74E-10
	3,741	5.31E-08	4.08E-10	6.18E-08	3.68E-10
	3,781	5.25E-08	4.01E-10	6.11E-08	3.61E-10
	3,821	5.47E-08	3.94E-10	6.46E-08	3.55E-10
	3,861	5.40E-08	3.87E-10	6.39E-08	3.49E-10
	3,901	5.34E-08	3.81E-10	6.31E-08	3.43E-10
	3,931	5.29E-08	3.76E-10	6.26E-08	3.39E-10
	4,820	4.49E-08	2.94E-10	5.52E-08	2.82E-10

TABLE 7B-8 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
S	4,940	4.34E-08	2.82E-10	5.35E-08	2.71E-10
	4,970	4.31E-08	2.80E-10	5.31E-08	2.68E-10
	5,000	4.27E-08	2.77E-10	5.27E-08	2.65E-10
	5,010	4.26E-08	2.76E-10	5.25E-08	2.64E-10
	5,040	4.23E-08	2.73E-10	5.21E-08	2.62E-10
	5,090	4.18E-08	2.69E-10	5.15E-08	2.58E-10
	5,280	3.99E-08	2.53E-10	4.93E-08	2.43E-10
SSW	4,002	3.62E-08	3.00E-10	3.88E-08	2.43E-10
	4,112	3.52E-08	2.86E-10	3.78E-08	2.32E-10
	4,202	3.44E-08	2.76E-10	3.71E-08	2.24E-10
	4,352	3.31E-08	2.60E-10	3.58E-08	2.11E-10
	4,432	3.25E-08	2.53E-10	3.53E-08	2.05E-10
	4,502	3.19E-08	2.46E-10	3.47E-08	2.00E-10
	4,581	3.13E-08	2.39E-10	3.41E-08	1.94E-10
	4,661	3.07E-08	2.32E-10	3.35E-08	1.88E-10
	4,701	3.63E-08	2.31E-10	4.12E-08	1.89E-10
	4,771	3.57E-08	2.26E-10	4.05E-08	1.85E-10
	5,161	3.64E-08	2.08E-10	4.28E-08	1.73E-10
	5,241	3.57E-08	2.03E-10	4.20E-08	1.69E-10
	5,351	3.53E-08	1.96E-10	4.18E-08	1.64E-10
	5,431	3.47E-08	1.92E-10	4.10E-08	1.60E-10
	5,471	3.44E-08	1.90E-10	4.07E-08	1.58E-10
	5,541	3.38E-08	1.86E-10	4.01E-08	1.56E-10
	5,581	3.35E-08	1.84E-10	3.97E-08	1.54E-10
	5,611	3.33E-08	1.82E-10	3.95E-08	1.53E-10
	5,661	3.29E-08	1.80E-10	3.91E-08	1.51E-10
	5,701	3.27E-08	1.78E-10	3.87E-08	1.49E-10

TABLE 7B-8 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SSW	5,711	3.26E-08	1.77E-10	3.87E-08	1.49E-10
	5,771	3.22E-08	1.74E-10	3.82E-08	1.47E-10
	5,811	3.19E-08	1.73E-10	3.79E-08	1.45E-10
	5,851	3.16E-08	1.71E-10	3.76E-08	1.44E-10
	5,891	3.14E-08	1.69E-10	3.73E-08	1.43E-10
	5,931	3.11E-08	1.67E-10	3.70E-08	1.41E-10
	6,001	3.06E-08	1.64E-10	3.64E-08	1.39E-10
SW	1,756	4.30E-08	7.91E-10	3.83E-08	5.69E-10
	2,026	3.86E-08	6.58E-10	3.47E-08	4.74E-10
	2,056	3.82E-08	6.44E-10	3.44E-08	4.64E-10
	2,096	3.77E-08	6.26E-10	3.40E-08	4.52E-10
	2,136	3.72E-08	6.09E-10	3.36E-08	4.40E-10
	2,256	3.58E-08	5.63E-10	3.26E-08	4.07E-10
	2,365	3.65E-08	5.26E-10	3.37E-08	3.81E-10
	2,485	3.36E-08	4.90E-10	3.10E-08	3.55E-10
	2,595	3.44E-08	4.59E-10	3.22E-08	3.32E-10
	2,715	3.34E-08	4.30E-10	3.15E-08	3.12E-10
	2,865	3.23E-08	3.98E-10	3.07E-08	2.89E-10
	2,945	3.55E-08	3.83E-10	3.45E-08	2.78E-10
	2,985	3.52E-08	3.75E-10	3.43E-08	2.73E-10
	3,025	3.49E-08	3.68E-10	3.41E-08	2.68E-10
	3,165	3.38E-08	3.46E-10	3.33E-08	2.52E-10
	3,215	3.34E-08	3.38E-10	3.30E-08	2.46E-10
	3,405	3.21E-08	3.12E-10	3.20E-08	2.28E-10
	3,525	3.13E-08	2.97E-10	3.14E-08	2.17E-10
	3,555	3.11E-08	2.94E-10	3.12E-08	2.15E-10

TABLE 7B-8 (Cont)

Sector Bearing	Distance (m)	Annual X/Q (sec/m³)	Annual D/Q (1/m²)	Grazing Season X/Q (sec/m³)	Grazing Season D/Q (1/m²)
SW	3,595	3.08E-08	2.89E-10	3.10E-08	2.12E-10
	3,795	2.96E-08	2.69E-10	3.00E-08	1.97E-10
	4,054	2.81E-08	2.46E-10	2.88E-08	1.80E-10
	4,094	2.79E-08	2.42E-10	2.86E-08	1.77E-10
	4,134	2.77E-08	2.38E-10	2.84E-08	1.74E-10
	4,214	2.72E-08	2.30E-10	2.81E-08	1.69E-10
	4,714	2.48E-08	1.91E-10	2.59E-08	1.40E-10
	4,904	2.39E-08	1.79E-10	2.52E-08	1.31E-10
	4,944	2.38E-08	1.76E-10	2.50E-08	1.29E-10
	5,444	2.57E-08	1.55E-10	2.82E-08	1.13E-10
	5,484	2.56E-08	1.53E-10	2.80E-08	1.12E-10
	5,554	2.52E-08	1.49E-10	2.76E-08	1.10E-10
	5,714	2.45E-08	1.42E-10	2.69E-08	1.04E-10
	5,824	2.40E-08	1.38E-10	2.64E-08	1.01E-10
	6,094	2.29E-08	1.28E-10	2.52E-08	9.38E-11
	7,824	2.08E-08	9.80E-11	2.41E-08	8.05E-11
	8,024	2.07E-08	9.66E-11	2.43E-08	8.11E-11
	8,094	2.05E-08	9.55E-11	2.40E-08	8.04E-11
	8,134	2.26E-08	9.85E-11	2.70E-08	8.47E-11
	8,444	2.16E-08	9.42E-11	2.59E-08	8.19E-11
	8,594	2.11E-08	9.23E-11	2.54E-08	8.06E-11
	8,824	2.05E-08	8.96E-11	2.46E-08	7.89E-11
	8,864	2.03E-08	8.91E-11	2.45E-08	7.86E-11
	9,064	1.98E-08	8.70E-11	2.39E-08	7.72E-11
WSW	3,931	1.33E-08	8.04E-11	1.34E-08	5.23E-11

APPENDIX 7C

POPULATION DISTRIBUTION - CLASS 9 ACCIDENTS

APPENDIX 7C

LIST OF TABLES

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APPENDIX 7C

POPULATION DISTRIBUTION - CLASS 9 ACCIDENTS

Population distribution within an 80-km (50-mi) radius of Nine Mile Point Unit 2 is listed by distance and direction in Tables 7C-1 through 7C-14. Population densities are listed in Tables 7C-15 through 7C-28. Figures 7C-1 and 7C-2 show the 16- and 80-km (10- and 50-mi) areas with sector overlays corresponding to the tables.

Population distribution between 0 and 6 km (0-3.7 mi) was determined through a door-to-door survey conducted by Stone & Webster Engineering Corporation on May 9 through 13, 1982.

Population distribution beyond 6 km (3.7 mi) was calculated using the same methods as those described in Section 2.5.1. Data from the 1980 U.S. Census of Population and the 1981 Canadian Census of Population provided the basis for the estimates.

Differences between total 0-50 mi population and 0-80 km population presented in Section 2.5.1 are due to rounding differences caused by different subsector definition.

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4. Statistics Canada. Population Projections for Canada and Provinces 1976-2001, June 1980.

5. New York Department of Commerce. 1978 Official Population Projections by Age and Sex for New York State Counties, 1979.

6. Envirodata Corp. Digitized Maps of Area Within 50 Miles of Nine Mile Point, 1982.

TABLE 7C-1

POPULATION DISTRIBUTION FOR 1980
0- TO 10-MILE RADIUS

Direction	Distance (mi) 0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Inner Rings Total
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	3	21	30	13	0	53	136	127	96	0	421	220	1,120
ESE	0	0	8	24	55	13	74	96	118	123	364	158	193	1,618	2,844
SE	0	0	0	45	50	82	65	66	13	44	197	79	131	180	952
SSE	0	0	0	25	101	87	17	109	249	110	115	107	191	176	1,287
S	0	0	0	7	45	22	81	132	60	56	176	212	229	217	1,237
SSW	0	0	8	4	36	75	147	146	196	180	436	172	758	1,817	3,975
SW	0	0	44	38	32	28	51	126	160	272	2,904	8,959	7,081	1,765	21,460
WSW	0	0	0	16	2	8	0	8	4	0	3	491	5,206	954	6,692
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	63	180	351	328	435	736	936	912	4,291	10,178	14,210	6,947	39,567

TABLE 7C-2

POPULATION DISTRIBUTION FOR 1986
0- TO 10-MILE RADIUS

	Distance (mi)														
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Inner Rings Total
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	3	23	33	15	0	58	150	141	107	0	467	244	1,241
ESE	0	0	9	27	61	14	82	107	131	136	403	175	214	1,791	3,150
SE	0	0	0	50	56	89	72	73	15	49	218	87	146	199	1,054
SSE	0	0	0	27	112	96	18	120	276	122	128	118	211	194	1,422
S	0	0	0	8	50	24	90	146	66	62	195	235	254	240	1,370
SSW	0	0	9	4	40	83	163	162	217	199	483	191	840	2,012	4,403
SW	0	0	49	42	35	31	56	140	177	302	3,216	9,923	7,842	1,956	23,769
WSW	0	0	0	18	2	9	0	9	4	0	3	544	5,324	1,057	6,970
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	70	199	389	361	481	815	1,036	1,011	4,753	11,273	15,298	7,693	43,379

TABLE 7C-3

POPULATION DISTRIBUTION FOR 1990
0- TO 10-MILE RADIUS

	Distance (mi)														Inner
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Rings Total
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	4	25	36	16	0	63	162	151	115	0	501	261	1,334
ESE	0	0	10	29	65	15	88	115	141	146	432	188	230	1,924	3,383
SE	0	0	0	53	60	97	77	78	16	52	234	94	156	214	1,131
SSE	0	0	0	29	120	103	20	129	297	131	137	127	228	209	1,530
S	0	0	0	8	54	26	96	157	71	67	209	252	273	258	1,471
SSW	0	0	10	5	43	89	175	173	233	214	519	205	903	2,161	4,730
SW	0	0	52	45	38	33	60	150	190	323	3,454	10,657	8,423	2,100	25,525
WSW	0	0	0	19	2	10	0	10	5	0	3	584	5,415	1,135	7,183
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	76	213	418	389	516	875	1,115	1,084	5,103	12,107	16,129	8,262	46,287

TABLE 7C-4

POPULATION DISTRIBUTION FOR 2000
0- TO 10-MILE RADIUS

	Distance (mi)														
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Inner Rings Total
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	4	28	41	18	0	71	184	173	131	0	572	299	1,521
ESE	0	0	11	33	75	18	101	131	161	167	494	214	262	2,197	3,864
SE	0	0	0	61	68	111	87	89	18	59	268	107	178	244	1,290
SSE	0	0	0	34	137	118	23	148	338	150	157	144	259	239	1,747
S	0	0	0	10	62	30	110	179	81	76	239	288	311	294	1,680
SSW	0	0	11	5	49	101	200	198	266	244	592	234	1,031	2,468	5,399
SW	0	0	60	51	43	38	69	171	217	370	3,944	12,167	9,616	2,398	29,144
WSW	0	0	0	22	3	11	0	11	5	0	4	667	5,601	1,296	7,620
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	86	244	478	445	590	998	1,270	1,239	5,829	13,821	17,830	9,435	52,265

TABLE 7C-5

POPULATION DISTRIBUTION FOR 2010
0- TO 10-MILE RADIUS

Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Inner Rings Total
	Distance (mi)														
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	5	33	47	21	0	83	214	200	152	0	665	347	1,767
ESE	0	0	13	38	87	21	117	152	187	194	574	249	304	2,552	4,488
SE	0	0	0	71	79	128	101	104	21	69	311	124	207	284	1,499
SSE	0	0	0	40	160	137	27	172	393	174	181	169	301	278	2,032
S	0	0	0	11	71	35	128	208	95	88	278	334	362	342	1,952
SSW	0	0	13	6	57	118	232	231	309	284	688	271	1,197	2,867	6,273
SW	0	0	69	60	51	44	80	198	252	429	4,581	14,135	11,173	2,786	33,858
WSW	0	0	0	25	3	13	0	13	6	0	4	775	5,844	1,505	8,188
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	100	284	555	517	685	1,161	1,477	1,438	6,769	16,057	20,053	10,961	60,057

TABLE 7C-6

POPULATION DISTRIBUTION FOR 2020
0- TO 10-MILE RADIUS

Direction	Distance (mi) 0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Inner Rings Total
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E.	0	0	5	38	55	24	0	96	247	231	175	0	767	401	2,039
ESE	0	0	15	44	101	24	135	175	215	223	662	287	351	2,945	5,177
SE	0	0	0	82	91	148	118	120	24	80	359	143	239	327	1,731
SSE	0	0	0	46	184	158	31	199	453	201	210	194	348	320	2,344
S	0	0	0	13	82	40	147	240	109	102	320	386	417	395	2,251
SSW	0	0	15	7	66	136	268	266	357	328	793	313	1,380	3,307	7,236
SW	0	0	80	69	58	51	93	229	291	495	5,285	16,304	12,886	3,212	39,053
WSW	0	0	0	29	4	15	0	15	7	0	5	894	6,112	1,736	8,817
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	115	328	641	596	792	1,340	1,703	1,660	7,809	18,521	22,500	12,643	68,648

TABLE 7C-7

POPULATION DISTRIBUTION FOR 2030
0- TO 10-MILE RADIUS

	Distance (mi)														
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0	Inner Rings Total
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	6	44	63	28	0	110	284	265	201	0	880	460	2,341
ESE	0	0	17	50	115	27	155	201	247	256	759	329	402	3,380	5,938
SE	0	0	0	94	105	171	135	137	27	91	412	165	274	375	1,986
SSE	0	0	0	52	211	182	35	228	520	230	240	222	399	367	2,686
S	0	0	0	15	94	46	169	276	125	117	368	443	478	453	2,584
SSW	0	0	17	8	75	157	307	305	409	376	911	359	1,585	3,795	8,304
SW	0	0	92	79	67	58	106	264	334	568	6,067	18,715	14,793	3,688	44,831
WSW	0	0	0	33	4	17	0	17	8	0	5	1,026	6,409	1,993	9,512
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	0	0	132	375	734	686	907	1,538	1,954	1,903	8,963	21,259	25,220	14,511	78,182

TABLE 7C-8

POPULATION DISTRIBUTION FOR 1980
0- TO 50-MILE RADIUS

	Distance (mi)											
Direction	0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	24	341	1,699	25,985	28,049
NNE	0	0	0	0	42	956	771	2,364	4,604	2,799	2,801	14,337
NE	0	0	56	396	711	1,911	3,872	2,199	21,085	15,349	6,910	52,489
ENE	0	232	2,282	1,061	2,130	879	449	242	176	1,086	5,554	14,091
E	1,120	703	1,343	729	760	1,393	758	421	615	1,086	1,895	10,823
ESE	2,844	1,024	1,069	1,210	881	1,549	1,976	3,518	5,103	11,287	22,726	53,187
SE	952	899	1,151	1,880	2,320	6,489	7,246	9,746	10,058	19,254	17,549	77,544
SSE	1,287	1,242	1,368	1,976	2,698	26,358	48,390	132,885	141,059	20,648	7,100	385,011
S	1,237	1,546	14,068	2,712	2,511	8,490	15,259	22,658	16,621	25,329	4,750	115,181
SSW	3,975	1,687	1,403	1,891	1,259	2,063	3,521	6,258	6,165	19,616	20,648	68,486
SW	21,460	1,482	1,234	767	929	3,121	4,062	3,541	7,089	9,583	18,091	71,359
WSW	6,692	15	0	0	0	0	31	1,404	4,286	6,496	10,308	29,232
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	164	323	487
NW	0	0	0	0	0	0	0	0	233	1,221	7,309	8,763
NNW	0	0	0	0	0	0	0	0	0	211	2,819	3,030
Total	39,567	8,830	23,974	12,622	14,241	53,209	86,335	185,260	217,435	135,828	154,768	932,069

TABLE 7C-9

POPULATION DISTRIBUTION FOR 1986
0- TO 50-MILE RADIUS

Direction	Distance (mi) 0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	24	353	1,781	28,051	30,209
NNE	0	0	0	0	43	990	797	2,443	4,760	2,895	2,896	14,824
NE	0	0	62	428	739	1,976	4,002	2,274	21,798	15,890	7,162	54,331
ENE	0	257	2,528	1,173	2,359	963	482	259	185	1,155	5,898	15,259
E	1,241	778	1,489	809	841	1,542	836	440	635	1,130	1,972	11,713
ESE	3,150	1,135	1,183	1,341	977	1,715	2,157	3,556	5,103	11,293	22,738	54,348
SE	1,054	995	1,275	2,082	2,569	7,141	7,648	10,274	10,679	20,778	18,925	83,420
SSE	1,422	1,376	1,515	2,188	2,983	27,775	50,483	138,635	147,163	21,544	7,426	402,510
S	1,370	1,712	15,581	3,005	2,780	8,857	15,906	23,606	17,204	25,850	4,863	120,734
SSW	4,403	1,869	1,554	2,094	1,371	2,095	3,569	6,375	6,281	19,807	20,319	69,737
SW	23,769	1,641	1,346	802	942	3,220	4,270	3,727	7,459	10,058	19,090	76,324
WSW	6,970	16	0	0	0	0	32	1,478	4,510	6,837	10,849	30,692
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	171	338	509
NW	0	0	0	0	0	0	0	0	245	1,279	7,650	9,174
NNW	0	0	0	0	0	0	0	0	0	220	2,932	3,152
Total	43,379	9,779	26,533	13,922	15,604	56,274	90,182	193,091	226,375	140,688	161,109	976,936

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-10

POPULATION DISTRIBUTION FOR 1990
0- TO 50-MILE RADIUS

	Distance (m)											
Direction	0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	25	363	1,848	30,355	32,591
NNE	0	0	0	0	44	1,017	820	2,513	4,893	2,977	2,980	15,244
NE	0	0	67	453	761	2,032	4,115	2,340	22,416	16,352	7,373	55,909
ENE	0	277	2,715	1,261	2,532	1,027	508	273	195	1,205	6,151	16,144
E	1,334	836	1,599	869	903	1,657	896	458	655	1,166	2,037	12,410
ESE	3,383	1,218	1,271	1,439	1,047	1,842	2,299	3,626	5,169	11,437	23,030	55,761
SE	1,131	1,069	1,370	2,236	2,760	7,645	8,025	10,777	11,259	22,117	20,130	88,519
SSE	1,530	1,478	1,627	2,350	3,200	29,117	52,652	144,589	153,485	22,468	7,755	420,251
S	1,471	1,839	16,735	3,228	2,984	9,234	16,573	24,583	17,783	26,283	4,965	125,678
SSW	4,730	2,007	1,669	2,249	1,455	2,116	3,601	6,453	6,363	19,927	20,148	70,718
SW	25,525	1,762	1,433	827	949	3,294	4,435	3,871	7,748	10,432	19,869	80,145
WSW	7,183	17	0	0	0	0	34	1,536	4,685	7,103	11,271	31,829
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	176	348	524
NW	0	0	0	0	0	0	0	0	252	1,315	7,853	9,420
NNW	0	0	0	0	0	0	0	0	0	225	2,969	3,194
Total	46,287	10,503	28,486	14,912	16,635	58,981	93,958	201,044	235,266	145,031	167,234	1,018,337

TABLE 7C-11

POPULATION DISTRIBUTION FOR 2000
0- TO 50-MILE RADIUS

	Distance (mi)											
Direction	0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	25	361	1,862	30,460	32,708
NNE	0	0	0	0	44	1,014	817	2,506	4,881	2,970	2,972	15,204
NE	0	0	76	493	767	2,026	4,104	2,333	22,364	16,341	7,378	55,882
ENE	0	315	3,100	1,440	2,888	1,150	549	289	199	1,240	6,334	17,504
E	1,521	954	1,824	991	1,031	1,890	1,019	479	664	1,188	2,074	13,635
ESE	3,864	1,392	1,451	1,645	1,196	2,104	2,583	3,658	5,125	11,340	22,833	57,191
SE	1,290	1,221	1,562	2,553	3,150	8,676	8,756	11,714	12,231	24,172	21,893	97,218
SSE	1,747	1,687	1,857	2,683	3,646	31,719	56,769	155,897	165,485	24,225	8,371	454,086
S	1,680	2,099	19,104	3,684	3,404	9,956	17,848	26,460	18,985	27,539	5,226	135,985
SSW	5,399	2,292	1,905	2,568	1,635	2,203	3,743	6,763	6,677	20,597	20,236	74,018
SW	29,144	2,012	1,615	891	984	3,531	4,905	4,288	8,583	11,511	21,979	89,443
WSW	7,620	20	0	0	0	0	37	1,700	5,189	7,865	12,479	34,910
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	177	349	526
NW	0	0	0	0	0	0	0	0	253	1,321	7,890	9,464
NNW	0	0	0	0	0	0	0	0	0	225	2,983	3,208
Total	52,265	11,992	32,494	16,948	18,745	64,269	101,130	216,112	250,997	152,573	173,457	1,090,982

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-12

POPULATION DISTRIBUTION FOR 2010
0- TO 50-MILE RADIUS

	Distance (mi)											
Direction	0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	26	373	1,938	35,193	37,530
NNE	0	0	0	0	45	1,043	841	2,580	5,024	3,056	3,061	15,650
NE	0	0	89	552	798	2,085	4,225	2,401	23,022	16,833	7,607	57,612
ENE	0	366	3,600	1,673	3,353	1,314	609	316	209	1,297	6,632	19,369
E	1,767	1,110	2,121	1,152	1,198	2,196	1,181	522	697	1,246	2,176	15,366
ESE	4,488	1,617	1,686	1,909	1,389	2,442	2,971	3,902	5,400	11,948	24,056	61,808
SE	1,499	1,418	1,816	2,966	3,661	10,061	10,026	13,394	14,025	27,827	25,092	111,785
SSE	2,032	1,960	2,157	3,117	4,234	36,299	64,745	177,797	188,734	27,627	9,555	518,257
S	1,952	2,439	22,195	4,281	3,953	11,327	20,304	30,056	21,142	29,246	5,616	152,511
SSW	6,273	2,662	2,214	2,984	1,864	2,284	3,876	7,082	7,014	21,233	20,558	78,044
SW	33,858	2,337	1,849	967	1,018	3,808	5,493	4,809	9,627	12,873	24,655	101,294
WSW	8,188	23	0	0	0	0	42	1,908	5,821	8,823	13,999	38,804
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	176	348	524
NW	0	0	0	0	0	0	0	0	252	1,316	7,812	9,380
NNW	0	0	0	0	0	0	0	0	0	217	2,811	3,028
Total	60,057	13,932	37,727	19,601	21,513	72,859	114,313	244,793	281,340	165,656	189,171	1,220,962

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-13

POPULATION DISTRIBUTION FOR 2020
0- TO 50-MILE RADIUS

	Distance (mi)											
Direction	0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	26	381	1,999	41,000	43,406
NNE	0	0	0	0	47	1,068	861	2,639	5,140	3,127	3,131	16,013
NE	0	0	102	616	824	2,133	4,323	2,457	23,552	17,227	7,788	59,022
ENE	0	422	4,153	1,930	3,866	1,494	674	344	215	1,336	6,829	21,263
E	2,039	1,279	2,444	1,328	1,382	2,533	1,360	571	732	1,302	2,274	17,244
ESE	5,177	1,864	1,945	2,204	1,602	2,819	3,402	4,249	5,821	12,879	25,933	67,895
SE	1,731	1,635	2,095	3,421	4,222	11,608	11,601	15,482	16,219	32,117	28,821	128,952
SSE	2,344	2,261	2,489	3,595	4,885	42,005	74,977	205,894	218,560	31,994	11,064	600,068
S	2,251	2,813	25,601	4,938	4,558	13,083	23,453	34,668	23,884	31,342	6,101	172,692
SSW	7,236	3,071	2,553	3,441	2,118	2,378	4,028	7,452	7,409	21,992	21,252	82,930
SW	39,053	2,696	2,108	1,051	1,056	4,135	6,194	5,431	10,868	14,498	27,801	114,891
WSW	8,817	27	0	0	0	0	47	2,154	6,569	9,959	15,804	43,377
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	170	336	506
NW	0	0	0	0	0	0	0	0	243	1,269	7,462	8,974
NNW	0	0	0	0	0	0	0	0	0	198	2,468	2,666
Total	68,648	16,068	43,490	22,524	24,560	83,256	130,920	281,367	319,593	181,409	208,064	1,379,899

TABLE 7C-14

POPULATION DISTRIBUTION FOR 2030
0- TO 50-MILE RADIUS

	Distance (mi)											
Direction	0-10	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Total 0-50.0
N	0	0	0	0	0	0	0	27	390	2,056	48,470	50,943
NNE	0	0	0	0	48	1,093	881	2,699	5,257	3,198	3,204	16,380
NE	0	0	118	686	853	2,182	4,421	2,513	24,095	17,621	7,965	60,454
ENE	0	485	4,768	2,215	4,435	1,696	744	374	219	1,361	6,965	23,262
E	2,341	1,468	2,806	1,525	1,587	2,909	1,560	631	772	1,364	2,378	19,341
ESE	5,938	2,139	2,233	2,529	1,840	3,235	3,891	4,712	6,417	14,201	28,594	75,729
SE	1,986	1,877	2,404	3,926	4,846	13,351	13,518	18,034	18,883	37,203	33,237	149,265
SSE	2,686	2,595	2,856	4,127	5,610	48,978	87,730	240,924	255,743	37,436	12,937	701,622
S	2,584	3,229	29,388	5,667	5,230	15,266	27,373	40,409	27,277	33,841	6,686	196,950
SSW	8,304	3,526	2,930	3,951	2,401	2,481	4,196	7,865	7,856	22,848	22,302	88,660
SW	44,831	3,095	2,394	1,144	1,096	4,508	7,006	6,150	12,307	16,389	31,433	130,353
WSW	9,512	31	0	0	0	0	53	2,438	7,441	11,278	17,897	48,650
W	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	159	313	472
NW	0	0	0	0	0	0	0	0	227	1,186	6,868	8,281
NNW	0	0	0	0	0	0	0	0	0	169	1,954	2,123
Total	78,182	18,445	49,897	25,770	27,946	95,699	151,373	326,776	366,884	200,310	231,203	1,572,485

TABLE 7C-15

POPULATION DENSITY FOR 1980
0- TO 10-MILE RADIUS

	Distance (mi)													
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	13	74	104	119	0	3,118	6,800	1,104	405	0	145	47
ESE	0	0	33	70	124	24	118	131	142	132	169	62	42	297
SE	0	0	0	131	113	152	102	90	16	47	91	31	29	33
SSE	0	0	0	73	229	161	27	148	298	118	107	89	42	32
S	0	0	0	20	102	41	127	179	72	60	81	83	50	40
SSW	0	0	33	12	81	139	230	198	235	193	202	67	166	333
SW	0	0	179	111	72	52	80	171	192	300	1,350	3,917	1,551	324
WSW	0	0	0	112	15	44	0	45	73	0	150	3,610	7,736	877
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7C-16

POPULATION DENSITY FOR 1986
0- TO 10-MILE RADIUS

Direction	Distance (mi) 0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	13	81	115	138	0	3,412	7,500	1,226	451	0	160	52
ESE	0	0	37	79	138	26	130	146	158	146	187	69	47	329
SE	0	0	0	146	127	165	113	99	18	53	101	34	32	37
SSE	0	0	0	79	254	178	28	163	331	131	119	99	46	36
S	0	0	0	23	113	44	141	198	79	66	90	92	56	44
SSW	0	0	37	12	91	154	255	220	260	213	224	75	184	369
SW	0	0	200	122	79	57	88	190	212	333	1,495	4,339	1,718	359
WSW	0	0	0	126	15	49	0	50	73	0	150	4,000	7,911	972
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-17

POPULATION DENSITY FOR 1990
0- TO 10-MILE RADIUS

	Distance (mi)													
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	17	88	125	147	0	3,706	8,100	1,313	485	0	172	55
ESE	0	0	41	84	147	28	140	157	170	157	200	74	50	353
SE	0	0	0	154	136	180	121	106	19	56	108	37	34	39
SSE	0	0	0	84	272	191	31	175	356	140	127	106	50	38
S	0	0	0	23	122	48	150	213	85	72	97	99	60	47
SSW	0	0	41	15	97	165	274	235	279	229	240	80	198	397
SW	0	0	212	131	86	61	94	204	228	356	1,606	4,660	1,845	385
WSW	0	0	0	133	15	55	0	56	91	0	150	4,294	8,046	1,043
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-18

POPULATION DENSITY FOR 2000
0- TO 10-MILE RADIUS

	Distance (mi)													
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	17	99	142	165	0	4,176	9,200	1,504	553	0	196	63
ESE	0	0	45	96	170	33	161	179	194	179	229	84	57	403
SE	0	0	0	178	154	206	136	121	22	63	124	42	39	45
SSE	0	0	0	99	310	219	36	201	405	161	146	120	57	44
S	0	0	0	29	140	56	172	243	97	81	111	113	68	54
SSW	0	0	45	15	111	187	313	269	319	262	274	92	226	453
SW	0	0	244	148	97	70	108	232	260	407	1,834	5,320	2,106	440
WSW	0	0	0	154	22	60	0	61	91	0	200	4,904	8,322	1,191
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7C-19

POPULATION DENSITY FOR 2010
0- TO 10-MILE RADIUS

Direction	Distance (mi) 0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	21	116	163	193	0	4,882	10,700	1,739	641	0	228	74
ESE	0	0	53	111	197	39	186	208	225	208	266	98	67	468
SE	0	0	0	207	179	237	158	141	25	74	144	49	45	52
SSE	0	0	0	116	362	254	42	234	471	187	168	141	66	51
S	0	0	0	32	161	65	201	282	114	94	129	131	79	63
SSW	0	0	53	17	129	219	364	314	370	305	319	106	262	526
SW	0	0	281	175	115	81	125	269	302	472	2,130	6,181	2,447	511
WSW	0	0	0	175	22	71	0	73	109	0	200	5,699	8,684	1,383
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7C-20

POPULATION DISTRIBUTION FOR 2020
0- TO 10-MILE RADIUS

Direction	Distance (mi) 0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	21	134	191	220	0	5,647	12,350	2,009	738	0	263	85
ESE	0	0	61	128	229	44	215	239	259	239	307	112	77	540
SE	0	0	0	239	206	274	185	163	29	86	166	56	52	60
SSE	0	0	0	134	416	293	49	270	543	216	195	162	76	59
S	0	0	0	38	186	74	230	326	131	109	148	151	91	72
SSW	0	0	61	20	149	252	420	361	428	352	367	123	302	607
SW	0	0	326	201	131	94	146	311	349	545	2,457	7,129	2,823	589
WSW	0	0	0	203	29	82	0	84	127	0	250	6,574	9,082	1,596
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7C-21

POPULATION DISTRIBUTION FOR 2030
0- TO 10-MILE RADIUS

	Distance (mi)													
Direction	0.0-0.5	0.5-1.0	1.0-1.5	1.5-2.0	2.0-2.5	2.5-3.0	3.0-3.5	3.5-4.0	4.0-4.5	4.5-5.0	5.0-6.0	6.0-7.0	7.0-8.5	8.5-10.0
N	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ENE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
E	0	0	25	155	219	257	0	6,471	14,200	2,304	848	0	302	98
ESE	0	0	69	146	260	50	246	275	297	274	351	129	88	620
SE	0	0	0	274	238	317	212	186	32	98	191	65	60	69
SSE	0	0	0	151	478	337	55	310	623	247	223	185	87	67
S	0	0	0	44	213	85	265	375	150	125	170	174	105	83
SSW	0	0	69	23	170	291	481	414	490	403	422	141	347	696
SW	0	0	375	230	152	107	166	359	400	626	2,821	8,183	3,240	677
WSW	0	0	0	231	29	93	0	95	145	0	250	7,544	9,523	1,832
W	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NNW	0	0	0	0	0	0	0	0	0	0	0	0	0	0

TABLE 7C-22

POPULATION DENSITY FOR 1980
10- TO 50-MILE RADIUS

Direction	Distance (mi) 10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
N	0	0	0	0	0	0	21	20	37	618	264
NNE	0	0	0	33	33	36	63	92	36	36	49
NE	0	49	41	42	43	72	34	286	184	74	119
ENE	63	181	67	116	20	10	4	3	13	61	32
E	65	99	46	43	33	15	7	8	13	20	23
ESE	93	79	76	52	46	37	56	73	139	246	113
SE	81	86	118	126	162	221	306	209	243	193	193
SSE	112	101	124	147	619	936	2,212	1,934	248	76	803
S	144	1,126	171	139	212	298	355	226	345	59	251
SSW	153	104	119	68	47	66	107	85	271	245	148
SW	137	96	60	77	94	82	59	96	115	194	155
WSW	139	0	0	0	0	55	449	169	154	185	226
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	31	33	33
NW	0	0	0	0	0	0	0	26	29	95	68
NNW	0	0	0	0	0	0	0	0	18	57	49

TABLE 7C-23

POPULATION DENSITY FOR 1986
10- TO 50-MILE RADIUS

Direction	Distance (mi) 10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
N	0	0	0	0	0	0	21	20	39	667	285
NNE	0	0	0	34	34	38	65	95	37	37	50
NE	0	55	45	44	45	74	36	296	190	77	124
ENE	70	200	74	128	22	11	4	3	14	65	35
E	72	110	51	48	37	17	7	9	14	21	25
ESE	103	88	84	58	51	40	56	73	139	246	115
SE	90	95	131	140	178	233	322	222	262	208	208
SSE	125	112	137	162	653	977	2,308	2,018	259	80	840
S	159	1,247	189	154	222	311	370	234	352	61	263
SSW	169	115	131	74	47	67	109	87	274	241	150
SW	152	104	63	78	97	86	63	101	121	205	166
WSW	148	0	0	0	0	57	473	178	162	195	237
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	32	35	34
NW	0	0	0	0	0	0	0	28	30	99	71
NNW	0	0	0	0	0	0	0	0	19	59	51

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-24

POPULATION DENSITY FOR 1990
10- TO 50-MILE RADIUS

	Distance (mi)										
Direction	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
N	0	0	0	0	0	0	22	21	41	722	307
NNE	0	0	0	34	35	39	67	98	38	39	52
NE	0	59	47	45	46	76	37	304	196	79	127
ENE	75	215	79	138	23	12	4	3	15	68	37
E	77	118	54	51	40	18	7	9	14	22	26
ESE	110	94	90	62	54	43	57	74	140	249	118
SE	97	102	140	150	191	244	338	234	279	221	221
SSE	134	121	147	174	684	1,019	2,407	2,104	270	83	877
S	171	1,339	203	165	231	324	385	242	358	62	274
SSW	182	124	141	79	48	68	110	88	275	239	153
SW	163	111	65	79	99	90	65	105	125	213	174
WSW	158	0	0	0	0	60	492	185	169	203	246
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	33	36	35
NW	0	0	0	0	0	0	0	29	31	102	73
NNW	0	0	0	0	0	0	0	0	20	60	52

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-25

POPULATION DENSITY FOR 2000
10- TO 50-MILE RADIUS

	Distance (mi)										
Direction	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
N	0	0	0	0	0	0	22	21	41	725	308
NNE	0	0	0	34	35	39	67	97	38	38	52
NE	0	67	51	46	46	76	37	304	196	79	127
ENE	86	245	90	157	26	13	5	3	15	70	40
E	88	135	62	59	45	20	8	9	14	22	29
ESE	126	107	103	71	62	48	58	73	139	247	121
SE	111	116	160	171	216	267	368	254	305	240	242
SSE	153	138	168	198	745	1,099	2,595	2,269	291	90	947
S	196	1,529	232	189	249	349	415	258	375	65	297
SSW	208	141	161	89	50	70	115	92	284	240	160
SW	186	125	70	82	106	99	72	117	138	236	194
WSW	186	0	0	0	0	65	544	205	187	224	270
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	34	36	35
NW	0	0	0	0	0	0	0	29	31	102	74
NNW	0	0	0	0	0	0	0	0	20	60	52

Nine Mile Point Unit 2 ER-OLS

TABLE 7C-26

POPULATION DENSITY FOR 2010
10- TO 50-MILE RADIUS

Direction	Distance (mi) 10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
N	0	0	0	0	0	0	23	22	42	837	354
NNE	0	0	0	35	36	40	69	100	39	40	53
NE	0	78	58	48	47	78	38	313	202	82	131
ENE	99	285	105	182	30	14	5	3	16	73	44
E	102	157	72	68	52	24	8	9	15	23	33
ESE	146	125	120	82	72	55	62	77	147	261	131
SE	128	135	186	199	251	305	420	292	351	275	279
SSE	177	160	195	230	853	1,253	2,960	2,588	332	102	1,081
S	227	1,776	270	219	283	397	471	288	398	70	333
SSW	241	164	187	101	52	73	121	97	293	244	168
SW	216	143	76	84	114	111	81	131	154	264	220
WSW	213	0	0	0	0	74	611	230	210	252	300
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	33	36	35
NW	0	0	0	0	0	0	0	29	31	101	73
NNW	0	0	0	0	0	0	0	0	19	56	49

TABLE 7C-27

POPULATION DENSITY FOR 2020
10- TO 50-MILE RADIUS

Direction	10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
	Distance (mi)										
N	0	0	0	0	0	0	23	22	44	975	409
NNE	0	0	0	37	37	41	70	103	40	40	54
NE	0	90	64	49	48	80	39	320	206	84	134
ENE	115	329	121	210	34	16	6	3	16	75	48
E	118	181	83	78	61	27	9	10	16	24	36
ESE	169	144	138	95	83	63	67	83	158	281	144
SE	148	156	214	229	289	353	486	337	405	316	321
SSE	205	184	225	265	987	1,451	3,428	2,996	385	119	1,252
S	262	2,049	311	252	327	458	543	325	426	76	377
SSW	278	189	216	115	54	76	127	102	304	252	179
SW	249	163	83	88	124	125	91	148	174	298	250
WSW	251	0	0	0	0	83	689	260	237	284	335
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	32	35	34
NW	0	0	0	0	0	0	0	28	30	97	70
NNW	0	0	0	0	0	0	0	0	17	50	44

TABLE 7C-28

POPULATION DENSITY FOR 2030
10- TO 50-MILE RADIUS

Direction	Distance (mi) 10.0-12.5	12.5-15.0	15.0-17.5	17.5-20.0	20.0-25.0	25.0-30.0	30.0-35.0	35.0-40.0	40.0-45.0	45.0-50.0	Average 0-50.0
N	0	0	0	0	0	0	24	23	45	1,153	480
NNE	0	0	0	37	37	42	72	105	41	41	56
NE	0	104	72	51	49	82	39	327	211	86	138
ENE	132	377	139	241	38	17	6	3	17	77	53
E	135	208	96	90	70	31	10	10	16	25	41
ESE	194	165	159	109	95	72	75	92	174	310	161
SE	170	179	246	263	333	411	566	393	469	365	372
SSE	235	212	259	305	1,151	1,698	4,011	3,506	450	139	1,464
S	301	2,352	357	290	382	535	633	371	460	83	430
SSW	319	217	248	130	56	79	134	108	316	265	191
SW	286	186	90	91	135	142	103	167	196	337	283
WSW	288	0	0	0	0	94	780	294	268	322	376
W	0	0	0	0	0	0	0	0	0	0	0
WNW	0	0	0	0	0	0	0	0	30	32	31
NW	0	0	0	0	0	0	0	26	28	89	64
NNW	0	0	0	0	0	0	0	0	15	39	35

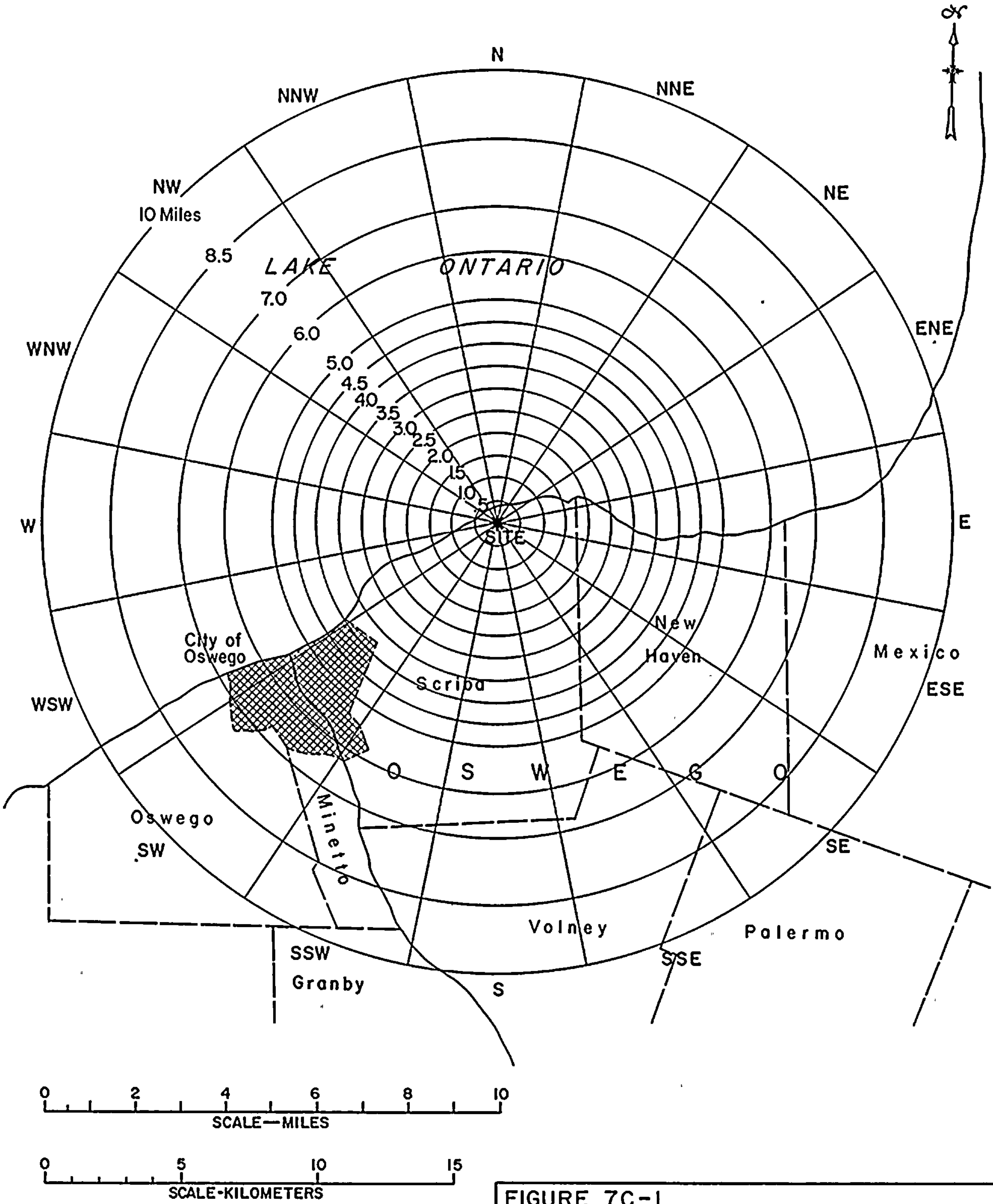
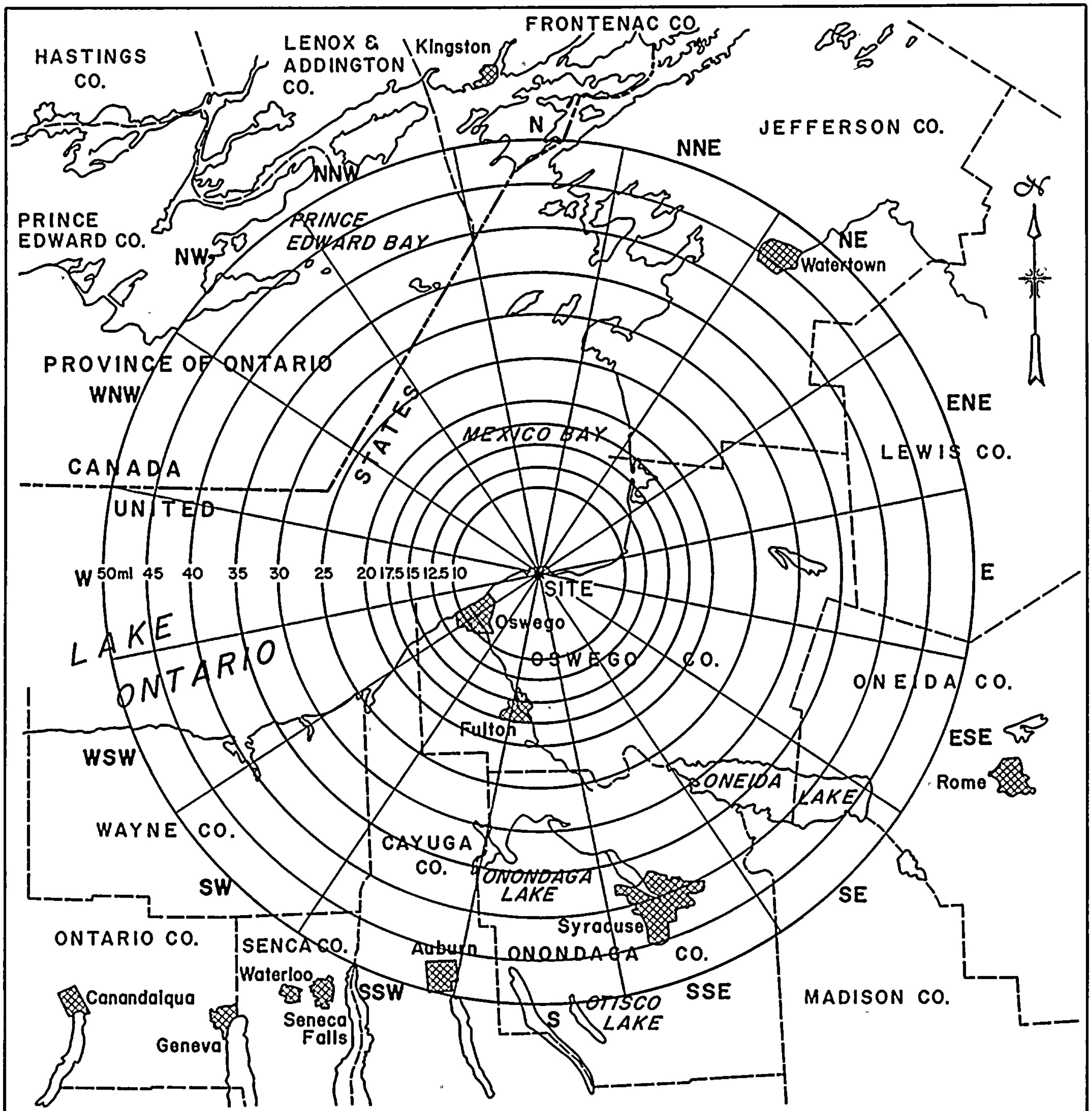


FIGURE 7C-1

0-10 MILE POPULATION ROSE

NIAGARA MOHAWK POWER CORPORATION
NINE MILE POINT-UNIT 2
ENVIRONMENTAL REPORT-OLS



0 10 20

SCALE - MILES

0 10 20 30

SCALE - KILOMETERS

FIGURE 7C-2

50 MILE POPULATION ROSE

NIAGARA MOHAWK POWER CORPORATION

NINE MILE POINT - UNIT 2

ENVIRONMENTAL REPORT - OLS

CHAPTER 8

THE NEED FOR THE PLANT

The need for the power to be generated by Unit 2 was assessed in detail in the construction permit stage[1].

The relevant sections of the ER-CPS which address this topic are as follows:

Reference	Title
Section 1.2	Need for Locating the Power Station at the Site
Section 8	Alternatives to the Proposed Power Station
Section 9	Benefit Cost Analysis

The discussion of the need for the plant and the need for power pertains specifically to CPS review. These issues are not addressed in this report in accordance with a 10CFR51 rule change as presented in 47FR12940, which provides for the deletion of this discussion in the ER-OLS[2].

<u>References</u>

1. Nine Mile Point Nuclear Station Unit 2, Applicant's Environmental Report - Construction Permit Stage, NRC Docket No. 50-410, Niagara Mohawk Power Corporation, June 1972.

2. Office of the Federal Register. Need for Power and Alternative Energy Issues in Operation License Proceedings. 47FR12940, General Services Administration, Washington, DC, March 26, 1982.

CHAPTER 9

ALTERNATIVES TO THE PROJECT

Alternative energy sources and sites and alternative station designs were evaluated in the construction permit stage[1].

The relevant sections of the ER-CPS which address this topic are as follows:

Reference	Title
Section 8	Alternatives to the Proposed Power Station
Section 9	Benefit Cost Analysis

These issues are not addressed in this report in accordance with the amendment to 10CFR51 as cited in 47FR12940, which provides for the deletion of this discussion in the ER-OLS[2].

References

1. Nine Mile Point Nuclear Station Unit 2, Applicant's Environmental Report - Construction Permit Stage. NRC Docket No. 50-410, Niagara Mohawk Power Corporation, June 1972.

2. Office of the Federal Register. Need for Power and Alternative Energy Issues in Operating License Proceedings. 47FR12940, General Services Administration, Washington, DC, March 26, 1982.

CHAPTER 10

EVALUATION OF THE PROPOSED ACTION

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CHAPTER 10

EVALUATION OF THE PROPOSED ACTION

10.1 SUMMARY OF UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

10.1.1 Impacts of Construction

The impacts of construction were addressed in the Environmental Report - Construction Permit Stage and are not addressed here.

10.1.2 Impacts of Operation

The impacts associated with the operation of Unit 2 are identified and discussed in Chapter 5. The measures and controls utilized to limit adverse operational impacts are discussed in Section 5.10. Many features of the design and operation of Unit 2 act to limit environmental impacts. The estimated impacts that remain, while relatively minor, can be considered adverse and unavoidable. These impacts are summarized in Table 10.1-1.

TABLE 10.1-1

SUMMARY OF UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Category	Unavoidable Adverse Impacts
Hydrological and Water Use (Sections 5.2 and 5.3)	Relatively low generation of effluent from two waste streams: combined plant discharge (i.e., cooling tower blowdown, water treatment system discharge, liquid radwaste, and service water discharge) and sanitary effluents, with impact limited to a small area of Lake Ontario. A small volume of water will be removed from Lake Ontario for plant operation. Similarly, a relatively small volume of heated water will be returned to the lake.
Ecological (Section 5.3)	
Terrestrial	Minimal impact to plants or animals is expected due to plant operation. Projected impact is limited to loss of a small number of birds resulting from collisions with transmission towers and lines and the power plant cooling tower, stack, and buildings.
Aquatic	The small volume of water utilized for plant operations and the incorporation of a fish diversion system as part of the plant design are anticipated to result in undetectable impacts to Lake Ontario aquatic populations. The transmission system maintenance program has been designed so that there will be little or no impact on the few aquatic habitats crossed by the transmission line corridor.
Socioeconomic (Section 5.8)	Limited impact will result from visibility of cooling tower and plume under certain meteorological conditions.

TABLE 10.1-1 (Cont)

Category	Unavoidable Adverse Impacts
Radiological (Section 5.4)	Small quantities of radionuclides will be released to the environment during routine operation of the station. These releases result in doses lower than the design objectives established in Appendix I of 10CFR50 and thereby meet the as-low-as-is-reasonably-achievable philosophy.
Atmospheric and Meteorological (Section 5.3)	Limited shadowing and cloud cover modification due to the visible plume will result from operation of the natural-draft cooling tower.

10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

10.2.1 Irreversible Resource Commitments

The commitment of an environmental resource in such a manner that the resource cannot return in the future to its original state is considered irreversible. On this basis, the only resource committed in a manner considered irreversible is a portion of land at the site that contains the substation switchyard and transmission corridors, which may remain in Niagara Mohawk Power Corporation's electrical grid (Section 5.9.2). These areas total 1.9 ha (4.6 acres), or less than 1 percent of the 364-ha (900-acre) site (Section 5.1.1).

10.2.2 Irretrievable Resource Commitments

The commitment of a material resource in such a manner that, after its use by Unit 2, it cannot be recycled or restored by practical (or economical) means for another function is termed irretrievable. These commitments are identified in Table 10.2-1.

TABLE 10.2-1

ESTIMATED QUANTITIES OF MATERIALS IRRETRIEVABLY COMMITTED TO THE CONSTRUCTION AND OPERATION OF UNIT 2

Material	Quantities Used	Resources
Cement	9.4×10^4 metric tons (1.03×10^5 short tons)	U.S. production of cement (1980): 6.97×10^7 metric tons (7.68×10^7 short tons)[1]
Structural steel	1.60×10^4 metric tons (1.76×10^4 tons)	U.S. raw steel production (1980): 1.01×10^8 metric tons (1.12×10^8 tons)[1]
Electrical cable	1.98×10^6 lin m (6.35×10^6 lin ft)	NA
Sulfuric acid	11.01 metric tons/day maximum (12.14 short tons/day)	U.S. production (1979): 3.9×10^7 metric tons (4.3×10^7 short tons)[1]
Sodium hydroxide	0.76 metric tons/day maximum (0.84 short tons/day)	U.S. production (1979): 1.16×10^7 metric tons (1.28×10^7 short tons)[1]
Petroleum products[2]		U.S. proved reserves of crude petroleum (1979): 4.30×10^{12} l (1.14×10^{12} gal)[1]
Diesel fuel	5.08×10^6 l (1.34×10^6 gal)	
Gasoline	2.55×10^6 l (6.75×10^5 gal)	
Fuel oil	3.31×10^5 l (8.75×10^4 gal)	

TABLE 10.2-1 (Cont)

Material	Quantities Used	Resources
Uranium[2]	6.73×10^3 metric tons (7.41×10^3 short tons)	Free world production of U_3O_8 (1980): 5.14×10^4 metric tons (5.67×10^4 short tons)[1]

[1] Source: Bureau of the Census. Statistical Abstract of the United States - 1981. U.S. Department of Commerce.

[2] Based on one half of the totals estimated for River Bend Station, Units 1 and 2. Environmental Report - Operating License Stage, Section 10.2.

10.3 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF MAN'S ENVIRONMENT

The local use of man's environment by the project can be summarized in terms of the unavoidable adverse environmental impacts of operation discussed in Section 10.1 and the irreversible and irretrievable commitments of resources discussed in Section 10.2. Except for the consumption of depletable resources resulting from plant construction and operation, these uses may be classified as short term (i.e., over the life of the plant). The principal short-term benefit of the plant is the production of electrical energy. When used for this purpose, the economic productivity of the site will be extremely large compared with the productivity from agriculture or other probable uses.

The maximum long-term impact to productivity will result from the permanent removal of 1.9 ha (4.6 acres) of land that will not be available for any other use after decommissioning (Section 10.2.1). However, the short-term enhancement of regional productivity resulting from the electrical energy produced by the plant is expected to result in a correspondingly large increase in regional long-term productivity that probably would not be equaled by any other long-term use of the site. Most long-term impacts resulting from land-use preemption will be eliminated by conversion of the site to other uses following Unit 2 decommissioning (Section 5.9.2).

Thus, the negative aspects of plant construction and operation as they affect man's environment are outweighed by the positive, long-term increase in regional productivity caused by short-term enhancement of productivity resulting from the generation of electrical energy.

10.4 BENEFIT-COST BALANCE

10.4.1 Benefits

10.4.1.1 Direct Benefits

The primary benefit of Unit 2 is the generation of electric power to meet the growing demand in the co-owner electric system. The approximately 7.13 billion kWh/yr of energy that Unit 2 will produce will go to residential, industrial, and commercial customers throughout the service area.

10.4.1.2 Indirect Benefits

Indirect benefits associated with the construction and operation of Unit 2 (described in detail in Section 5.8.2) are primarily economic in nature and include tax payments, increased employment, and expenditures for engineering, materials, and fuel processing which will be made in New York State as well as other parts of the country. Additional benefits incident to the construction and operation of Unit 2 include the extensive studies of the ecology, geology, hydrology, archeology, and meteorology of the area which have contributed significantly to man's knowledge of the environment. Finally, the Energy Information Center, presently operated at the Nine Mile Point site by Niagara Mohawk Power Corporation and the Power Authority of the State of New York, will continue to provide educational and recreational benefits for thousands of visitors annually.

10.4.2 Costs

10.4.2.1 Direct Costs

The cost to construct Unit 2 is estimated to be $3.7 billion. The estimated annual cost to operate Unit 2 for the first full year of operation (1987), including fixed charges, fuel costs, operation and maintenance costs, overhead, insurance costs, and decommissioning costs, is $890 million. Total operating costs over the lifetime of the plant are estimated to be $42 billion.

10.4.2.2 Indirect Costs

The indirect costs of Unit 2 anticipated to result from the environmental impacts summarized in previous sections of this chapter, while difficult to quantify, have been investigated and are believed to be minor relative to the benefits derived from the project.

CHAPTER 11

SUMMARY OF ACTIONS TAKEN

During the construction permit stage, several commitments were made and requirements were imposed to protect the environment during the construction and operation of Unit 2. These commitments/requirements are described in the Unit 2 Environmental Report-Construction Permit Stage (ER-CPS), Final Environmental Statement (FES), and the Construction Permit. Environmental commitments and requirements pertinent to the operation of Unit 2 are summarized in this chapter. The following summaries provide a reference to the source(s) of the commitment/requirement, identify the nature of the commitment/requirement, and describe the action taken by NMPC to satisfy the commitment/requirement:

1. As Low As Practicable (ALAP) Discharge Criteria.
2. Landscaping Program.
3. Dike.
4. Planting Along Transmission Line Corridor.
5. Equipment Cleaning.
6. Aquatic Monitoring and Impact Assessment Programs.
7. Thermal Monitoring Program.
8. Radiological Monitoring Program.
9. Liquid Discharges Containing Oil.
10. Permit to Operate Standby Diesel Generators.
11. Disposal of Miscellaneous Solid Waste.
12. Meteorology Data.
13. Water Quality of Discharge During Operation.

1. As Low As Practicable (ALAP) Discharge Criteria

References: FES Section 3.5

Commitment Requirement/Action Taken:

The radwaste system as designed will utilize the equipment described in Section 3.5 of the FES to meet the ALAP discharge criteria, which will be described in the appropriate technical specifications. See ER-OLS Section 3.5 and FSAR Chapter 11 for a description of the Unit 2 radwaste systems.

2. Landscaping Program

References: FES Section 4.1

Commitment Requirement/Action Taken:

A landscaping program shall be implemented after construction is complete, as discussed in ER-OLS Section 3.1.

3. Dike

References: FES Section 4.1 and ER-CPS Section 4.4

Commitment Requirement/Action Taken:

A dike shall be constructed to prevent shoreline erosion and advancing wave runup. Details of the revetment-ditch (dike) system are presented in FSAR Section 2.4.2.

4. Planting Along Transmission Line Corridor

References: FES Section 4.1, 4.12

Commitment Requirement/Action Taken:

Baseline environmental studies conducted along the Unit 2-Volney 345-kV transmission line corridor are described in ER-OLS Sections 2.4.1.2, 2.4.2.2, and 6.5.1 and in NMPC's Article VII Application to the New York State Public Service Commission. Measures that NMPC proposes to employ to avoid or minimize adverse environmental effects during transmission line operation and maintenance are

identified in ER-OLS Sections 3.7, 5.1.2, 5.6.1, and the Article VII application.

5. Equipment Cleaning

References: FES Section 4.2 and ER-CPS Section 3.8

Commitment Requirement/Action Taken:

Chemicals used for cleaning equipment will be handled in accordance with the SPDES permit requirements.

6. Aquatic Monitoring and Impact Assessment Programs

References: FES Sections 5.5.2 and 6.1 and ER-CPS Sections 5.1.1, 5.5.6.1, 5.5.6.2, and the Construction Permit.

Commitment Requirement/Action Taken:

Aquatic Monitoring Program

Preoperational aquatic monitoring programs were conducted for Unit 2 to determine the taxonomic composition of the biota and to characterize the temporal/spatial abundance and distribution of major groups and selected species in the Nine Mile Point vicinity of Lake Ontario. The biotic groups studied include phytoplankton, microzooplankton, macrozooplankton, icthyoplankton, benthic invertebrates, periphyton, and nekton (fish). The methodologies employed during these monitoring programs and the results of the studies are presented in ER-OLS Sections 6.5.2.1 and 2.4.2.1, respectively.

Entrainment Effects

Fish eggs and larvae were collected offshore of the site and at the intake and discharge of Unit 1. In 1972, a program was conducted to measure fish collected on trash racks and traveling screens. The studies are discussed in ER-OLS Sections 5.3.1.2 and 6.5.2.1.

Impingement Survey

Monitoring was performed to determine the number, species, and size of fish impinged at Unit 1 and the James A. FitzPatrick plant. The results of this study and its relevance to the Unit 2 intake design and field sampling

program are discussed in ER-OLS Sections 2.4.2.1, 3.4, 5.3.1.2, and 6.5.2.1.

<u>Screenwell Fish Removal and Diversion System</u>

The screenwell for Unit 2 allows for the installation of fish removal equipment which will remove fish from in front of the traveling screens. The screenwell also contains a fish diversion system, returning the fish to the lake. The fish diversion system is described in ER-OLS Section 5.3.1.2.

7. Thermal Monitoring Program

References: FES Section 6.2 and ER-CPS Sections 5.5.6.4 and 5.5.6.5.

Commitment Requirement/Action Taken:

Field investigations of the thermal plumes from Unit 1 and the James A. FitzPatrick plant were conducted in order to correlate the data obtained from the aquatic environment program. The field investigations, which were carried out during different seasons using a variety of measuring techniques, are reported in ER-OLS Sections 2.3.1 and 6.1.1.

Field investigations of temperature and current patterns were also performed at the location of the Unit 1 intake and discharge. These investigations were conducted to verify modeling predictions and are reported in ER-OLS Sections 2.3.1, 6.1.1, 6.3.1, and 6.3.2.

A comprehensive preoperational water quality monitoring program was conducted in the Nine Mile Point vicinity. The methodologies associated with the monitoring program and the results of the studies are reported in ER-OLS Sections 6.6.2 and 2.3.3, respectively.

8. Radiological Monitoring Program

References: FES Section 6.3, ER-CPS Section 5.5.6.7, and the Construction Permit.

Commitment Requirement/Action Taken:

The preoperational radiological monitoring program will be supplemented to be usable for operational monitoring. Details are provided in ER-OLS Section 6.2.

9. Liquid Discharges Containing Oil

References: ER-CPS Section 3.7.1

Commitment Requirement/Action Taken:

Unit 2 operational discharges which may potentially contain oil, such as those from the main and reserve station transformer area and the diesel generator building drains, will be routed to an oil/water separator prior to discharge. See ER-OLS Section 3.6.3 for additional details.

10. Permit to Operate Standby Diesel Generators

References: ER-CPS Section 3.8

Commitment Requirement/Action Taken:

The New York State Department of Environmental Conservation (NYSDEC), by letter dated January 7, 1982, notified NMPC that the standby diesel generators (emergency diesels) are exempt from the permitting process.

11. Disposal of Miscellaneous Solid Waste

References: ER-CPS Section 5.4.7

Commitment Requirement/Action Taken:

Solid waste generated onsite, such as lunchroom waste, office wastepaper, machine shop scraps, and trash collected on the cooling water inlet trash racks, will be hauled offsite for disposal at an approved landfill site.

12. Meteorology Data

References: ER-CPS Section 5.5.6

Commitment Requirement/Action Taken:

Meteorological data have been routinely collected at the Nine Mile Point site since 1974. The meteorological monitoring program is described in ER-OLS Section 6.4. Meteorological data for the periods January 1974 through December 1976 and November 1978 through October 1980 were used to assess operational impacts related to Unit 2. These

data are presented in ER-OLS Section 2.7 and FSAR Section 2.3.

13. Water Quality of Discharge During Operation

References: Construction Permit

Commitment Requirement/Action Taken:

NMPC will comply with the water quality standards, effluent limitations, monitoring and reporting requirements pursuant to the requirements of the NYSDEC 401 Water Quality Certification and SPDES permit issued for Unit 2. Copies of these documents are included in ER-OLS Chapter 1. A further discussion of compliance with water quality standards and effluent limitations is presented in ER-OLS Section 5.5.2.1.