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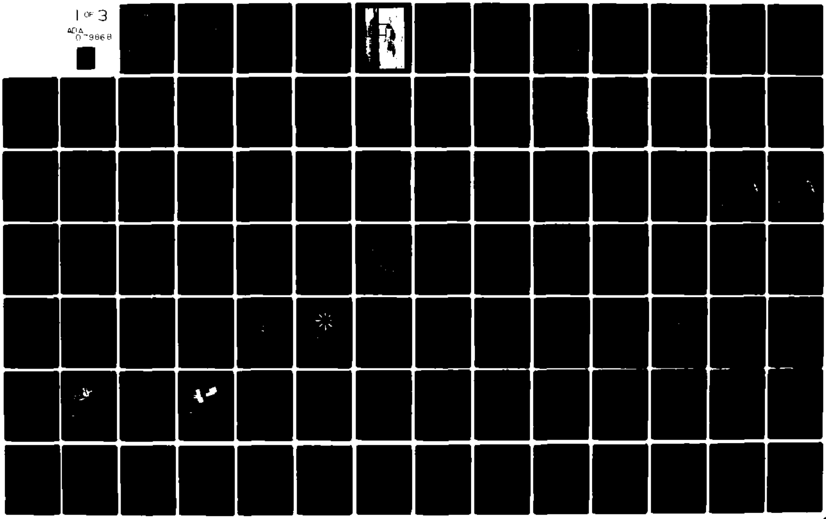

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ENVIRONMENTAL STATEMENT

OSWEGO STEAM STATION - UNIT 6

NIAGARA MOHAWK POWER CORPORATION

BASIC DATA SUBMITTED BY
NIAGARA MOHAWK POWER CORPORATION
IN CONSULTATION WITH
STONE & WEBSTER ENGINEERING CORPORATION
AND
QUIRK, LAWLER & MATUSKY ENGINEERS

IN SUPPORT OF ITS APPLICATION
DATED JULY 25, 1972 FOR
PERMIT TO CONSTRUCT INTAKE
AND DISCHARGE FACILITIES

80 1 21 026

PREPARED BY

U. S. ARMY ENGINEER DISTRICT, BUFFALO, NEW YORK

RCH 1973

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) [redacted] ENVIRONMENTAL STATEMENT, OSWEGO STEAM STATION, UNIT SIX		5. TYPE OF REPORT & PERIOD COVERED Final rept.
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Paul G. Leuchner		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, Buffalo 1776 Niagara Street, Buffalo, NY 14207		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, Buffalo 1776 Niagara Street, Buffalo, NY 14207		12. REPORT DATE 29 Mar[redacted]73
		13. NUMBER OF PAGES 279
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office) 12 285		15. SECURITY CLASS. (of this report)
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

air quality, ecological effects, energy demand, entrainment, environmental effects, fish and wildlife values, impingement, Lake Ontario, pollution control, social and economic factors, steam electric power plants, water quality

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A detailed analysis of the environmental impacts related to the construction and operation of an oil-fueled electric generating station. The proposed unit will be constructed on a 91 acre tract along the south shore of Lake Ontario in the City of Oswego, Oswego County, New York. There are several steam electric generating units already in operation at this location. Steam produced by the proposed unit will be used to generate approximately 816 megawatts of electrical power. The water intake and effluent discharge (Continued)

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20. (Continued) system will be located in Lake Ontario. Approximately nine million barrels of fuel oil will be consumed annually.

29 March, 1973

Steam Generating Station Unit 6,
Oswego Harbor, New York

( ) Draft (X) Final Environmental Statement

Responsible office: U.S. Army Engineer District, Buffalo, N.Y.

1. Name of Action: (X) Administrative ( ) Legislative

2. Description of Action: Construction of a sixth oil-fueled electric generating unit with intake and discharge structures, together with other appurtenances.

3. a. Environmental Impacts: Occupation of approximately ten acres of land, discharge of quantities of heat, air-borne emissions, liquid effluents and sound energy, and the receipt and consumption of approximately 9 million barrels of fuel oil per year.

b. Adverse Environmental Effects: All impacts listed above are to some degree environmnetally adverse except the receipt of fuel oil. The receipt and handling of the fuel oil are potentially adverse.

4. Alternatives: Another location, purchase of power, hydro-electric generation, other fuels, other types of cooling systems, and no project.

5. Comments Received:

Department of Interior, Office of Environmental Project Review
Federal Power Commission
Environmental Protection Agency, New York, N. Y.
New York State Dept. of Environmental Conservation
Federal Aviation Administration
Soil Conservation Service

6. Draft statement to CEQ 12 January, 1973
Final statement to CEQ ____________

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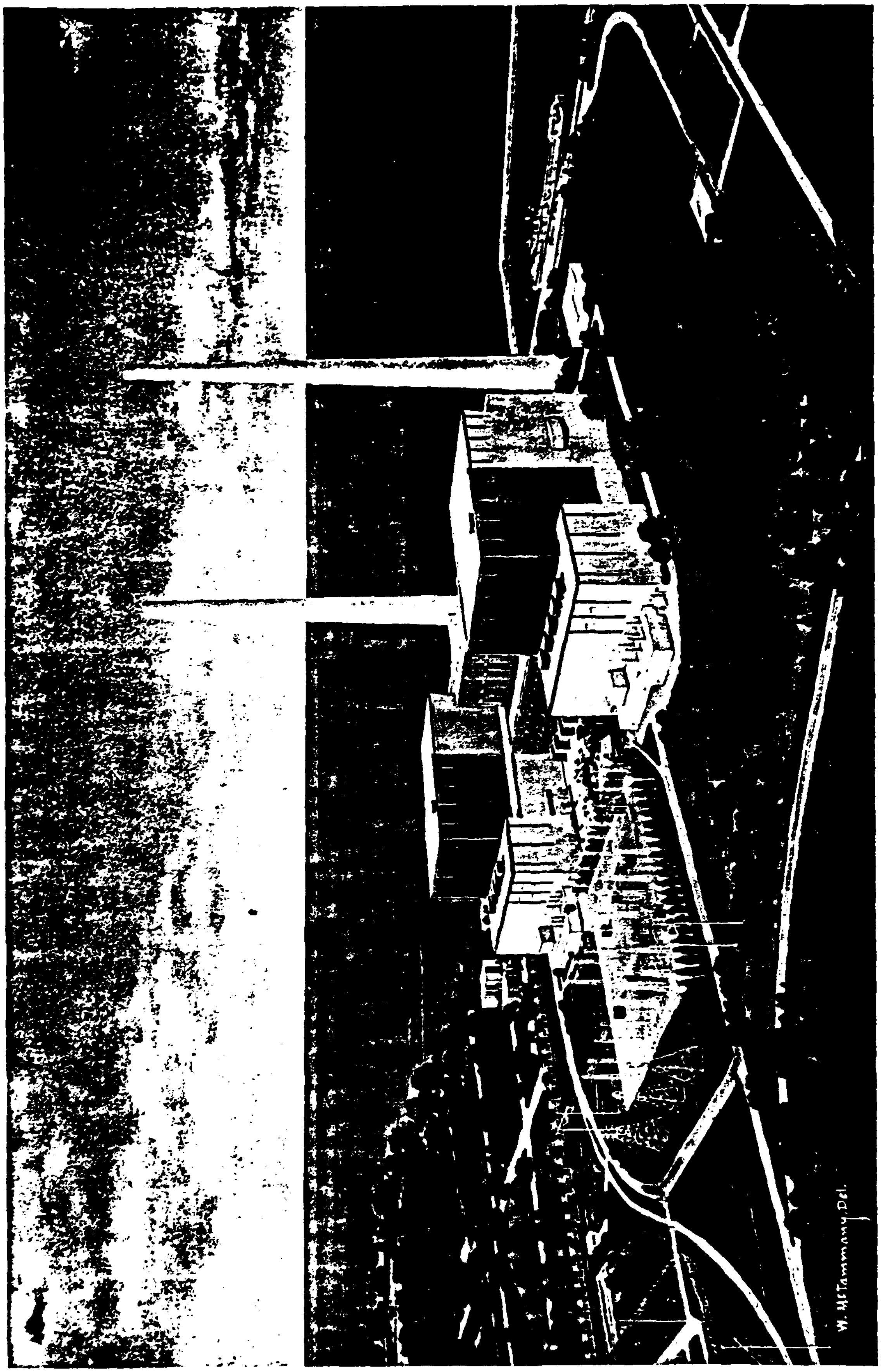

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SECTION 1

PROJECT DESCRIPTION

1.1 INTRODUCTION

The Oswego Steam Station of the Niagara Mohawk Power Corporation occupies a site containing about 91 acres in the City of Oswego, New York, on the shores of Lake Ontario. The location is shown in Figures 1.1-1 and 1.1-2.

The site now contains four fossil fuel steam electric generating units with a fifth unit, Unit 5, scheduled for commercial operation in October 1974. The construction of Unit 5 and its accompanying circulating water intake and discharge structures has received federal, state and local approvals. With the completion of Unit 5, the station will have a total nameplate rating of 1,136 megawatts (MW) and a total maximum output of 1,297 MW. The four existing units were constructed from 1938 to 1956, and were originally designed for coal firing. By November 1972, these units had been converted to oil. Unit 5 will also be oil-fired and will be provided with a 700-foot single flue stack. The existing stacks on Units 1 through 4 will be retired and the breechings connected to the Unit 5 stack when Unit 5 is completed.

The proposed Unit 6 will consist of an oil-fired steam electric generating unit, with a nameplate rating of 816 MW and a maximum output of 890 MW. The frontispiece of this report illustrates a southeast exposure of the expanded Oswego Steam Station. A plot plan of a portion of the property is shown in Figure 1.1-3.

Detailed design and engineering work will be undertaken during the next four years for completion of the project. Preliminary site preparation has been started, and it is anticipated that erection of structural steel for the building will begin in April 1973. Offshore construction work for the circulating water intake and discharge structures is scheduled to begin in March 1973. All major construction work will be completed by September 1975. After testing all systems, the unit will be placed in commercial operation in May 1976.

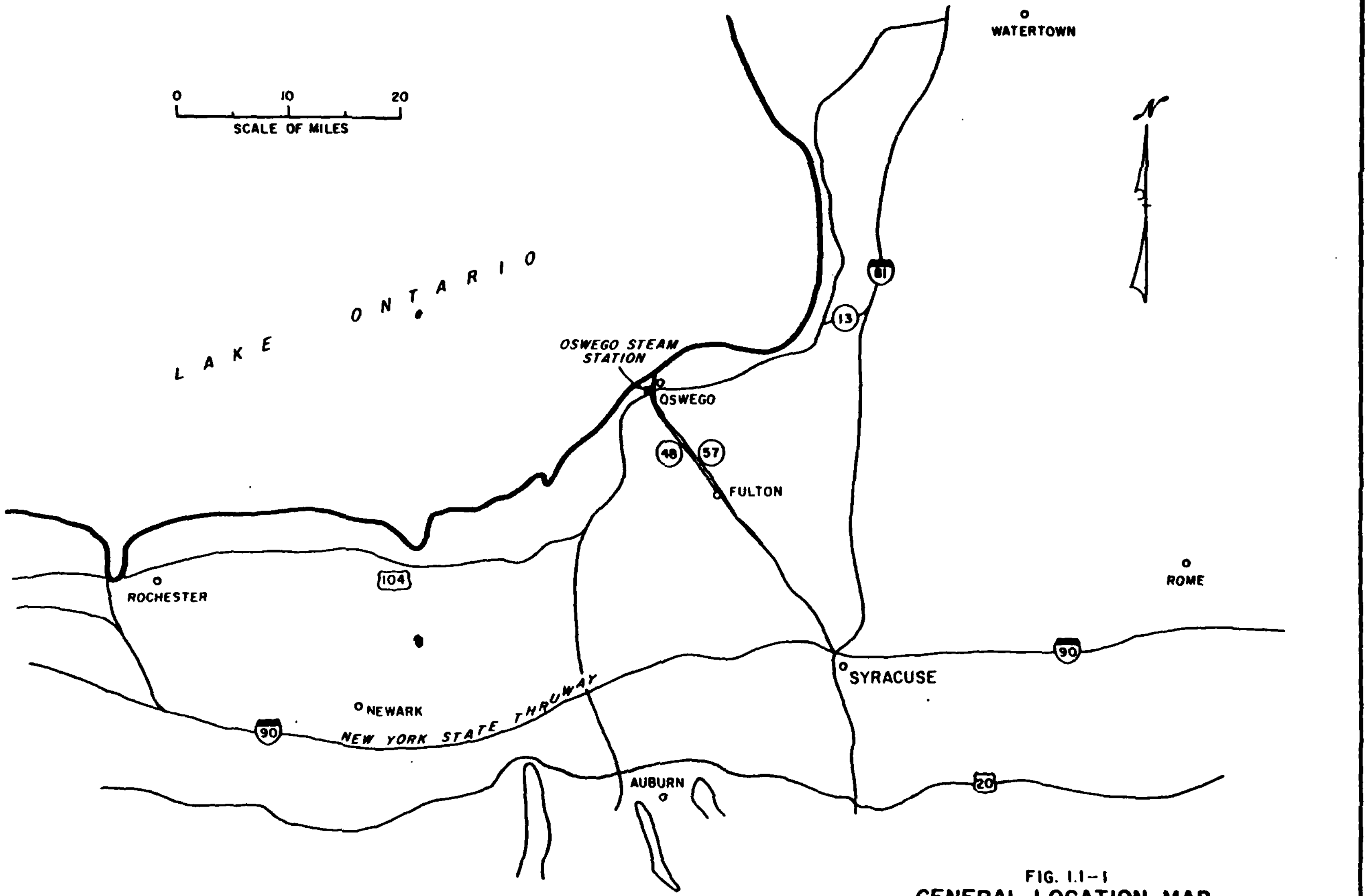

FIG. 1.1-1
GENERAL LOCATION MAP
NIAGARA MOHAWK POWER CORPORATION

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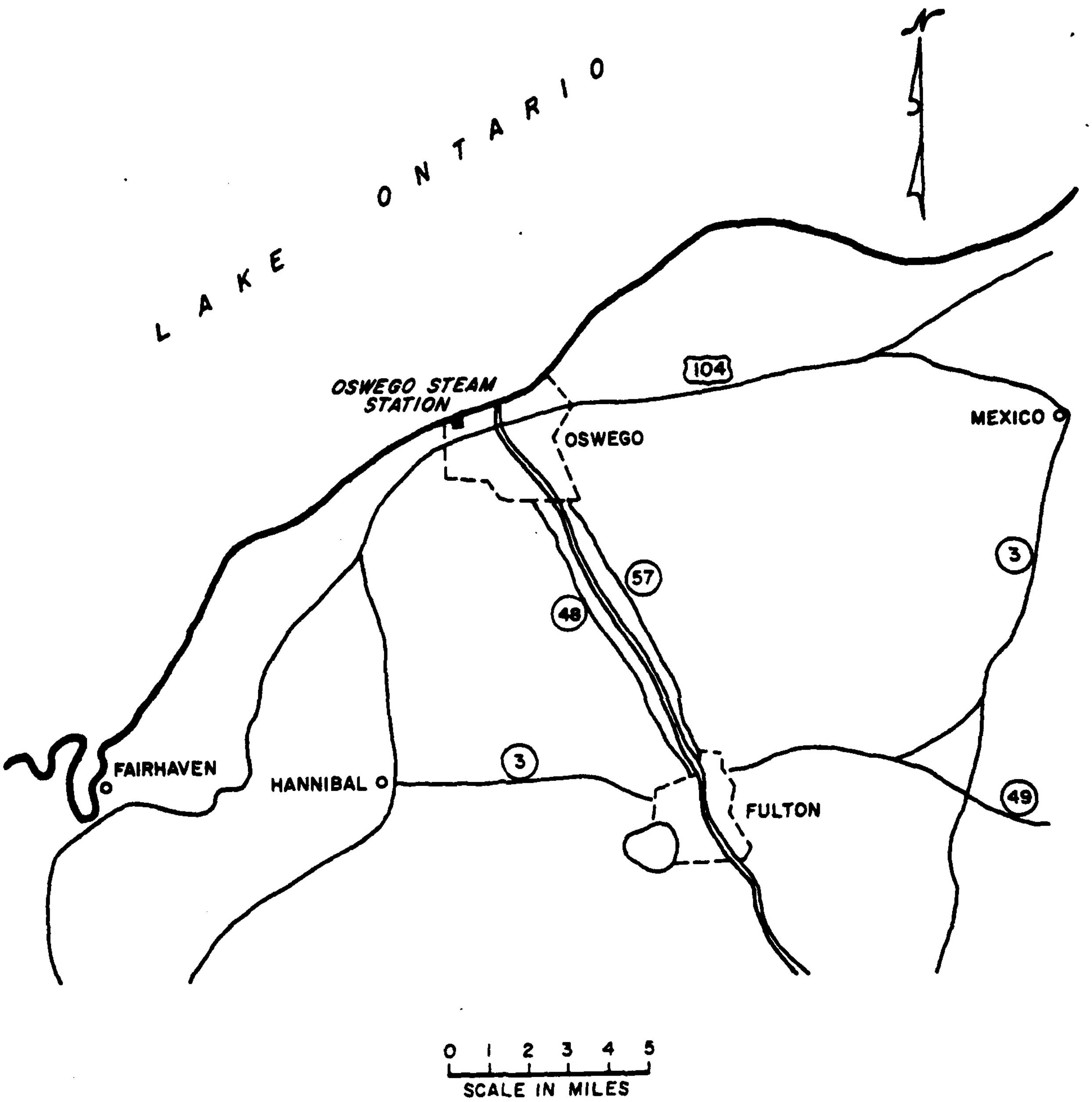


FIG. 1.1-2

VICINITY MAP
OSWEGO, NEW YORK
NIAGARA MOHAWK POWER CORPORATION

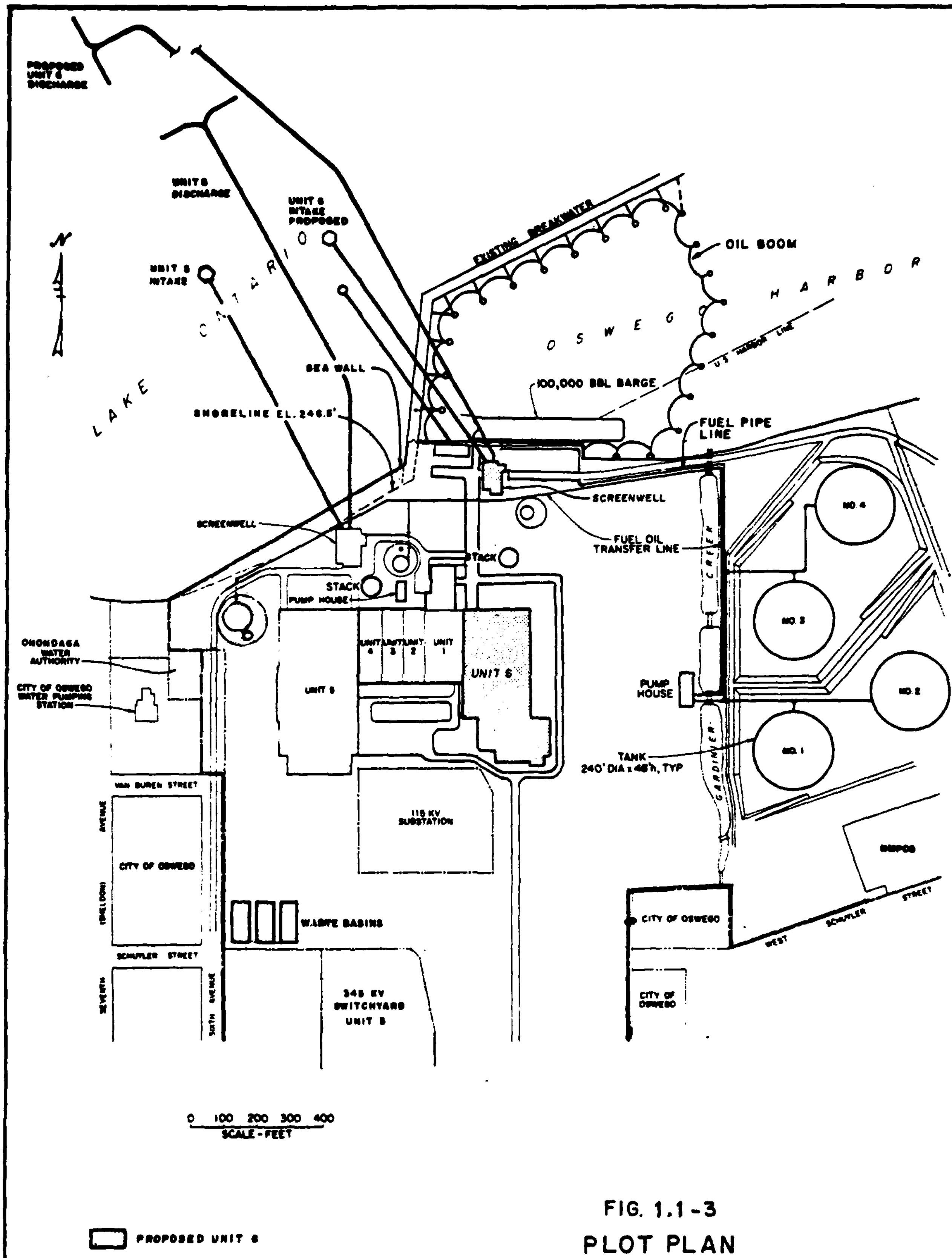


FIG. 1.1-3

PLOT PLAN

OSWEGO STEAM STATION UNIT 6

NIAGARA MOHAWK POWER CORPORATION

1.2 POWER DEMANDS AND PROJECTIONS

In 1970, Niagara Mohawk's peak load occasioned by its own customers, including minor firm sales to a few villages, was 4,614 MW. By 1977, Niagara Mohawk's peak is expected to be 6,365 MW, an increase of 1,751 MW or a growth rate of about 38 percent during the seven-year period 1970 through 1977. This 38 percent growth is quite conservative. It does not include speculative additions to Niagara Mohawk's load which might appear through demands for service by new industries with very large annual power requirements or to supply services affected by possible gas curtailments. Preliminary estimates indicate that the impact of such curtailments could increase the applicant's 1980 winter peak load by as much as 5 percent.

Niagara Mohawk's electric operations are conducted at what is probably a substantially higher annual load factor than those of the other major utilities serving the New York State area. In 1969, for example, Niagara Mohawk's load produced an annual load factor of 68 percent, and in 1970, which can be considered a recession year, its load produced an annual load factor of slightly over 67 percent. A 69 percent load factor was experienced in 1971 even though the winter was relatively warm and the economy had not fully recovered from the 1970 recession.

Niagara Mohawk and the other members of the New York Power Pool are coordinating operation of their generating facilities and planning an optimum mix of new generating units and related transmission facilities. The next few years will present problems in planning an orderly expansion of power supply facilities to meet the ever-increasing requirements of consumers in the state. These problems stem from the existing uncertainties of providing new dependable generating capabilities within the original time periods specified. Difficulties in maintaining construction schedules and optimum quality control measures are the main cause of the uncertainty.

The shortage of power availability existing in the New York Power Pool in 1970, 1971, and 1972 is expected to continue until sufficient generation and transmission can be added. This shortage of power causes an inability to meet the New York Power Pool reliability criterion which requires that available capacity exceed demand on all but one day in ten years (99.9615 percent of the time). Recent studies indicate that the state will have sufficient generation from 1973 to 1981 to meet the Power Pool reliability criterion only if proposed unit additions (including Oswego 6) are commercially in service as planned. However, the electric utility industry experience in recent years in placing new generation facilities in service demonstrates that schedule slippages of as much as six months or more are not uncommon due to difficulties in obtaining regulatory approvals and in construction and start-up delays. Further, experience has also demonstrated that large, new units are subject to a break-in period during which they may have low availability. Considering these possibilities, there is some likelihood that each of the generating units proposed by Pool members will not be available as planned. It is therefore imperative that the schedule for installation of units by the New York Power Pool member companies, including Niagara Mohawk's proposed Oswego 6 unit, be adhered to and that delays be reduced to a minimum to preclude a recurrence of capacity deficiency within the New York Power Pool.

It is necessary to carry adequate reserves in order to undertake normal yearly maintenance work. The lack of adequate reserve has made it impossible for some utilities in the Power Pool to do annual generating unit maintenance on schedule. If this situation continues for a significant length of time, the probability of forced outages of existing capacity will obviously increase.

1.3 PLANT DESCRIPTION

Unit 6 will be an extension of the Oswego Steam Station which now consists of Units 1 through 4 with Unit 5 under construction. The proposed unit will be completely enclosed and will contain an oil-fired steam generator designed to produce 6,300,000 pounds of steam per hour at 2,600 pounds per square inch gage (psig) pressure (normal operation at 2,480 psig), and 1,005 F with a single reheat to 1,005 F (1,005/1,005 F). The reheat turbine-generator has a guaranteed rating of 816 MW at 2,285 psig, 1,000/1,000 F, 2 inches of mercury (in. Hg) exhaust. The maximum capability of the unit will be 890 MW at 2,400 psig. A general cross section of the building showing major equipment is shown in Figure 1.3-1.

Steam generated in the boiler will leave the superheater section at 2,480 psig pressure and a final superheat temperature of 1,005 F. The steam will pass to the turbine where its heat energy will be converted to mechanical energy to drive the turbine shaft. The steam will then return to the steam generator and be reheated to 1,005 F. It will again pass to the turbine where additional mechanical energy will be imparted to the shaft. The mechanical energy produced in the turbine will be transmitted to the generator via a common shaft, and be converted into electrical energy.

After giving up its heat energy, the steam will pass to the single pass steam condenser where it will be cooled to its condensation temperature and converted back into water. This water will then be raised to a high pressure by the boiler feedpumps for reuse in the steam generator. A portion of the condensate will be continuously removed to prevent buildup of solids within the boiler and be replaced with treated lake water.

A circulating water system will supply relatively cool lake water to reduce the steam to condensate for reuse in the boiler. The circulating water system will be of the once-through type, taking water from and returning it to Lake Ontario via intake and discharge structures located on the lake bottom several hundred feet offshore. Water will be taken from the intake structure to the screenwell, where floating and suspended material will be removed. The water will then be pumped to the steam condenser. After receiving heat in the condenser, the water will be returned to the lake and dispersed by a submerged flow diffuser.

In the boiler, steam will be generated from the heat released by the combustion of fuel oil. Air will be taken from outside the boilerhouse and be pressurized for passage through the duct work. In the furnace section of the boiler, this air will be mixed with fuel and ignited. After transfer of its heat energy to the steam, the resulting flue gases will pass out of the boiler to the electrostatic precipitators. These precipitators will remove most of the dust and ash produced during combustion. The gases

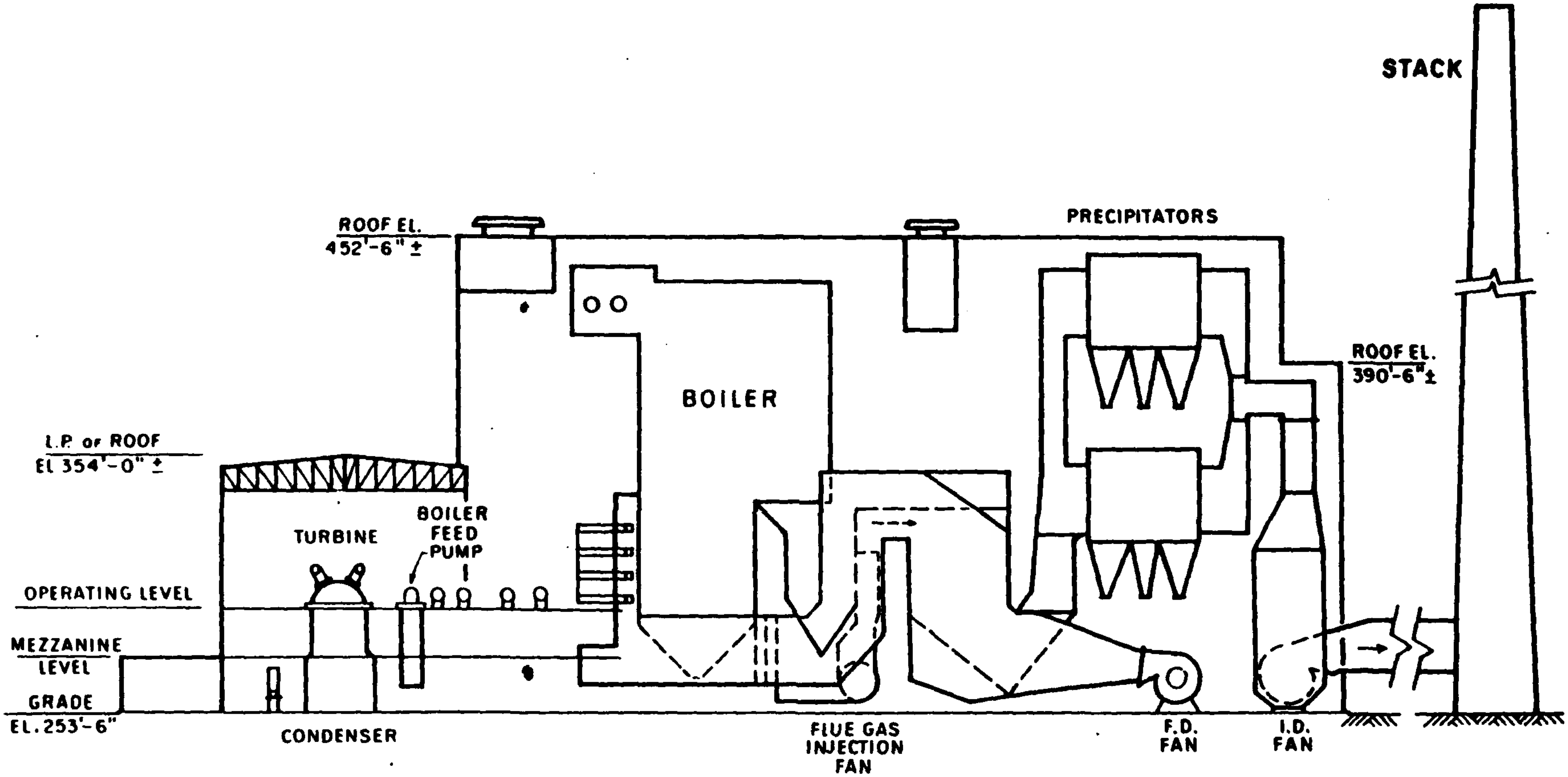


FIG. 1.3-1
EAST CROSS-SECTION
OSWEGO STEAM STATION - UNIT NO. 6
NIAGARA MOHAWK POWER CORPORATION

will then be drawn through the induced draft fans and be discharged to the atmosphere through the stack.

The primary fuel oil supply for Unit 6 will be a pipeline from a new fuel treatment plant to be built by New England Petroleum Corporation (NEPCO) 3 miles south of the Oswego Station. As the treatment plant will require about two years longer to construct than Unit 6, NEPCO will supply low-sulfur (0.75 percent maximum) crude oil by pipeline to the unit during this 24-month period. Upon completion of the treatment plant NEPCO will provide Unit 6 with 0.75 percent sulfur residual fuel oil. Unit 6 will be designed to utilize either crude oil or residual fuel oil.

In addition to the pipeline delivery system, the existing barge unloading and fuel storage system previously approved for Oswego Unit 5 will serve as an alternative fuel oil supply facility if required.

Electric power will be transmitted from the turbine-driven generator to the step-up transformers which will increase voltage from 21,000 to 345,000 for transmission. The power will then be sent to the switchyard and finally to the power transmission lines. The application for the right-of-way for these transmission lines is presently under review by the New York State Public Service Commission. A portion of the generator output will be converted to 13,800 V and to lower voltages for powering all subsystems in the power plant.

A new 345-kV low profile switchyard will be connected to the Unit 6 generator via two half-size step-up transformers with three outgoing lines.

Of the 91 acres of property, approximately 53 acres will be landscaped or planted. The remaining area is occupied by the facilities. Specimen trees will be used to screen and outline the perimeter and interior spaces. In addition, some group plantings of small trees and large growing shrubs will be used to achieve solid effects and to break up wide areas. The principal open areas will be planted with grasses and hardy vegetative ground cover. Public approaches will be treated formally with lawns and shrubs.

1.3.1 Main Powerhouse

The turbine and boiler rooms will have a structural steel frame enclosed with insulated metal siding. Concrete block masonry will be used as required for heat retention, sound attenuation, or fireproofing. A 3-ft high concrete wall will be used above the ground level around the perimeter of the building. Walls above this level will be of colored insulated metal siding, augmented with colored trim. The roofs will consist of precast concrete panel decking, insulated as required for temperature or sound attenuation, and finished with asphalt smooth-surface roofing.

Foundations for the powerhouse will be of reinforced concrete. Major column and equipment foundations will be founded on the sandstone rock formation which lies about 10 ft below ground grade. Minor foundations will be founded on compacted fill or suitable undisturbed materials.

1.3.2 Circulating Water System

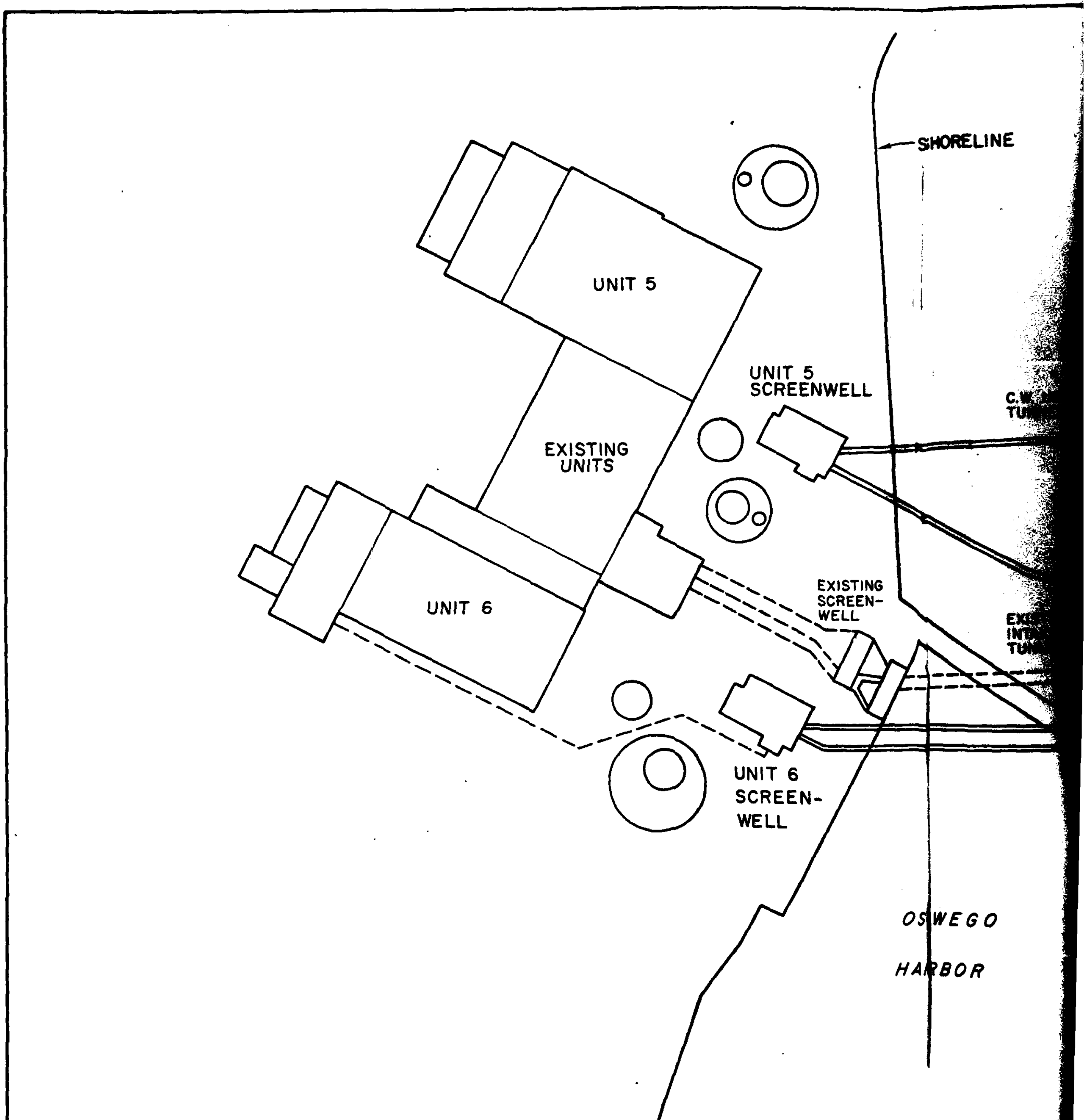
Total circulating water flow for Unit 6 will be 635 cubic ft per second (cfs) when the plant is generating at maximum output with all circulating water and service water pumps operating. The total flow of 635 cfs consists of a condenser cooling water flow of 546 cfs and a service water flow of 89 cfs. Temperature rises associated with the condenser cooling water and the service water are 32.4 F and 5.0 F, respectively. Thus, the total 635 cfs will be discharged from the unit at a maximum temperature rise above lake ambient of 28.6 F with a total heat emission to the lake of 4.09 billion per hour.

Circulating water for Unit 6 will be taken from Lake Ontario via a submerged intake structure, circulated through the condensers and returned to the lake through a submerged jet diffuser. Figure 1.3-2 shows the proposed locations for Unit 6 intake and discharge structures in Lake Ontario.

The intake structure will be hexagonally shaped and will be located about 1200 ft offshore. Measured from the low water datum of 242.8 ft (International Great Lakes Datum, 1955), the water depth at the intake is 22 ft and the clearance between the top of the structure and the water surface will be 12 ft. Details of the intake structure are shown in Figure 1.3-3.

Pertinent dimensions of the intake structure include a 3-ft sill at the bottom to prevent silting, a 2-ft roof thickness and a 5-ft high by 21.2-ft aperture on each of the six sides. The intake aperture will be equipped with bar racks which will be heated to prevent the formation of frazil ice. The intake is designed so that the horizontal approach velocity will be 1.0 ft per second (fps) when the generating unit is operated at maximum output. There will be negligible vertical approach velocity.

After being withdrawn from the lake through the intake structure, the circulating water will be conveyed to the combination pump house and screenwell structure through a 9-ft by 9-ft concrete lined rock tunnel drilled about 100 ft below the lake bottom. The pump house will contain trash racks and travelling screens in addition to two circulating water pumps. A fish refuge area will be provided in the forebay of the pump house to allow fish which may enter the intake structure to be collected and returned to the lake.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UNIT 5
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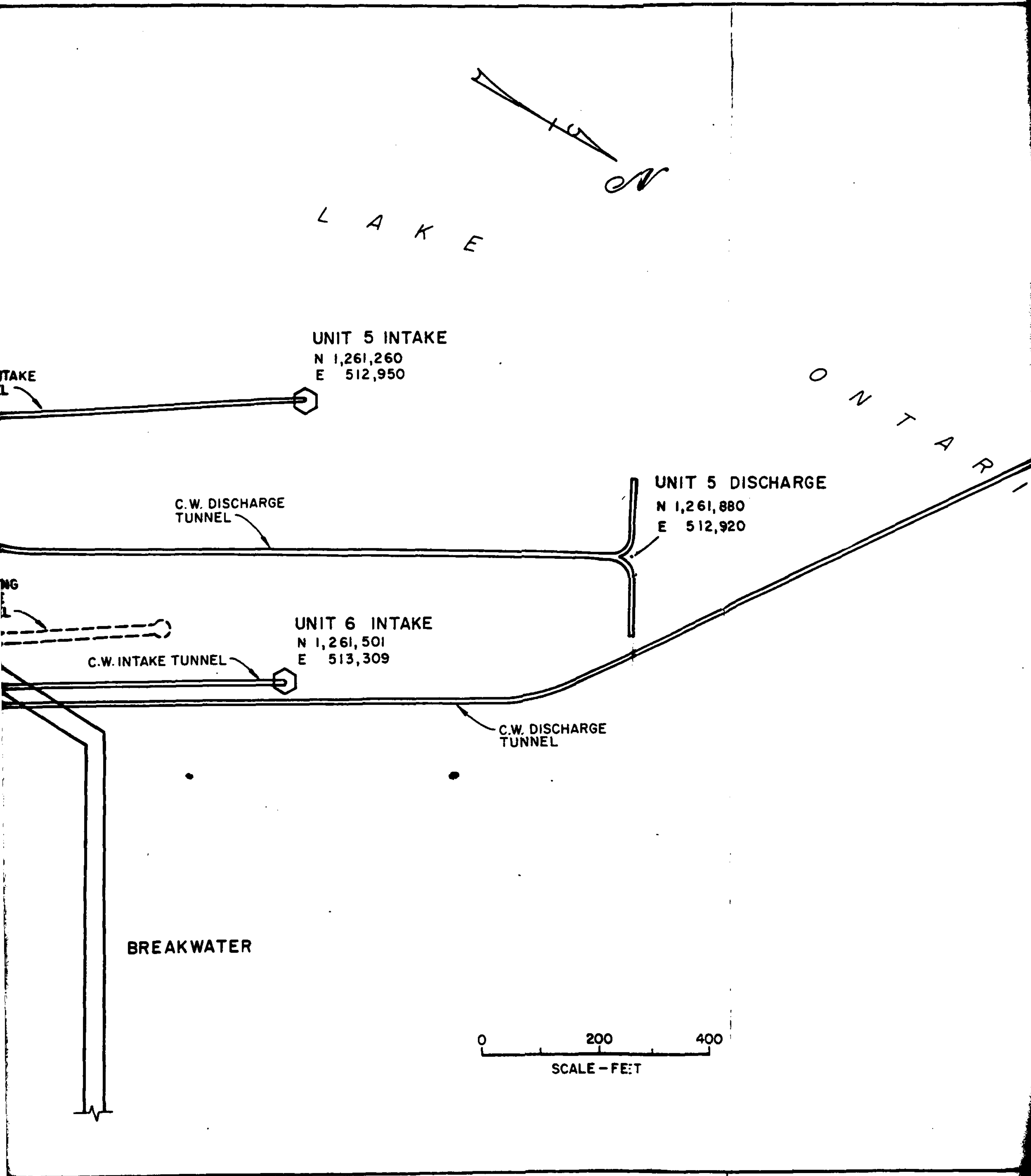
OSWEGO
HARBOR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LAKE ONTARIO
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E 512,950
C.W. DISCHARGE TUNNEL
UNIT 5 DISCHARGE
N 1,261,880
E 512,920
UNIT 6 INTAKE
N 1,261,501
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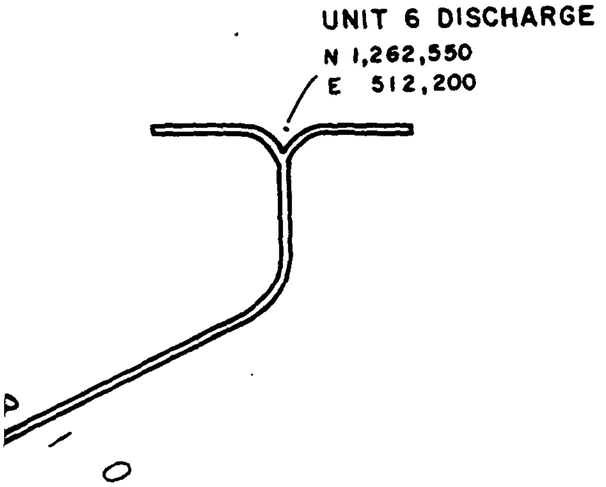

FIG. 1.3-2
LOCATION OF INTAKE
AND DISCHARGE STRUCTURES
OSWEGO STEAM STATION-UNIT 6
NIAGARA MOHAWK POWER CORPORATION

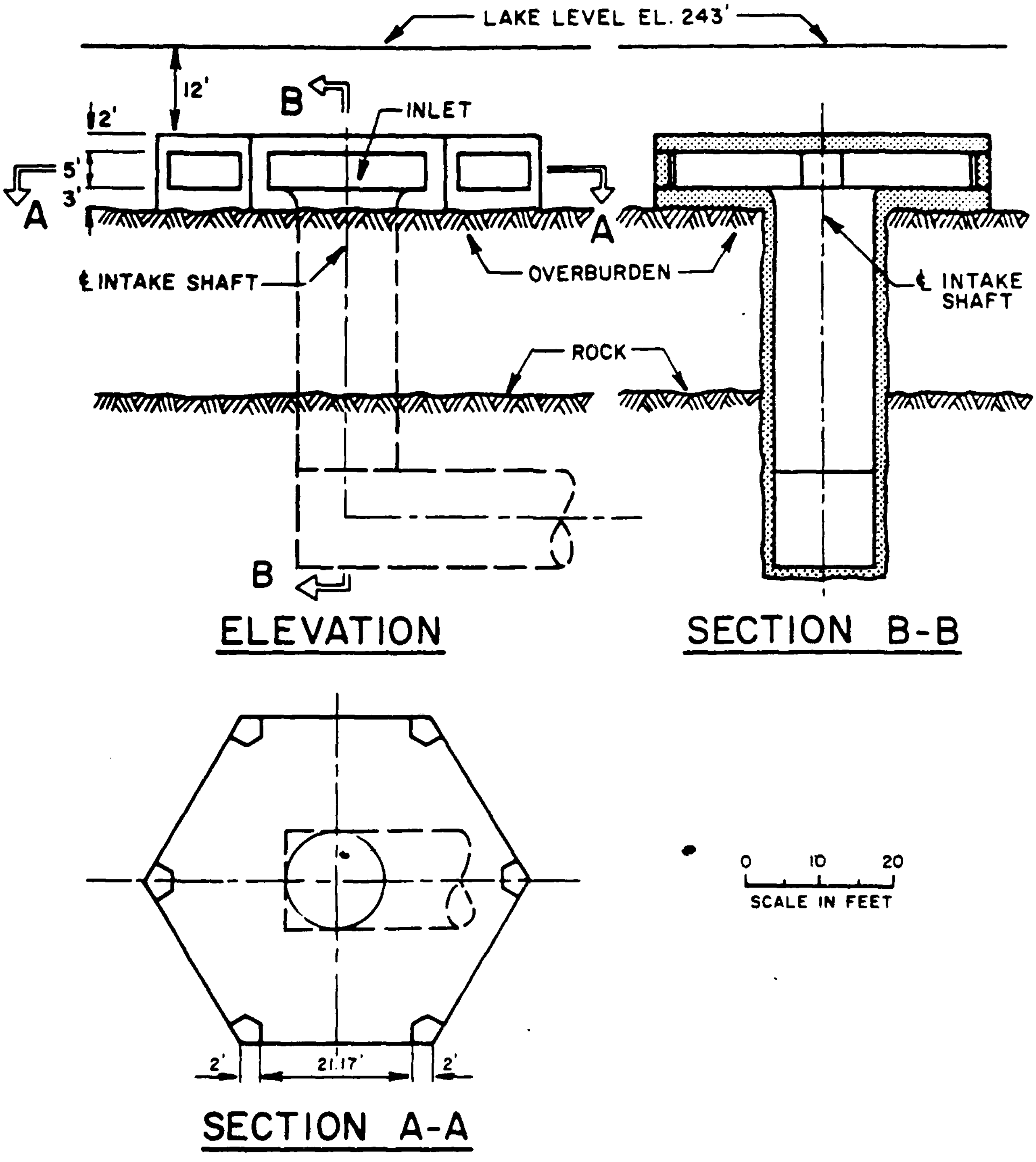

FIG. 1.3-3
INTAKE STRUCTURE
NIAGARA MOHAWK POWER CORPORATION

After passing through the condenser, the circulating water will be conveyed from the screenwell structure into Lake Ontario through a second 9-ft by 9-ft concrete lined rock tunnel located about 100 ft below lake bottom to a submerged diffuser.

The intake and discharge tunnels will be constructed in rock for their entire length. The minimum rock cover over each tunnel will be approximately three tunnel diameters. Each tunnel will be excavated using the conventional drill and blast technique to an excavated size of approximately 11.5 ft by 11.5 ft. Rock support will consist primarily of grouted rock bolts. If very poor quality rock is encountered at any time during the excavation, permanent steel sets and logging will be installed for support. Both tunnels will be concrete lined mainly for hydraulic reasons and not for tunnel support. The lining will be either formed concrete of shotcrete (gunite) producing a finished maximum tunnel dimension of approximately 9 ft to 11 ft, depending upon the type of lining used.

The Unit 6 discharge diffuser will consist of two branch tunnels (similar to Unit 5) and will be located farther out in the lake than the existing Unit 5 diffuser, as shown in Figure 1.3-2. The diffuser will contain vertical steel risers, each riser having a double port diffuser head with a 20-degree angle between ports and a horizontal jet discharge. The port centerlines will be elevated 5 ft above the lake bottom to minimize bottom scour and to maintain ambient water below the jet.

Circulating water will be discharged from each port at an initially high velocity. The relatively high velocities at the port, as compared to those in the branch tunnel, and in conjunction with the symmetrical geometry of the diffuser head, will produce approximately equal discharge flow from each port.

1.3.3 Stack and Flue Gas System

A schematic of the flue gas system is shown in Figure 1.3-4. Combustion air will pass through two vertical shaft regenerative air preheaters. The preheaters will be fitted with steam cleaning and water washing devices and Cor-Ten steel cold end baskets. Flues immediately downstream from the air preheater will be provided with fixed water sprays for cleaning.

Flue gases will pass from the air preheaters through two high efficiency electrostatic precipitators, each capable of handling 1,070,000 cubic ft per minute (cfm) at 284 F. An ash handling system will be installed to convey ash from the precipitator and economizer hoppers.

Two motor-driven, half-capacity, inlet vane controlled, induced draft fans will take flue gases from the precipitator and discharge to the stack. Each fan will be capable of handling 1,510,000 cfm at 32.9 inches water pressure (in. H_2O) with an

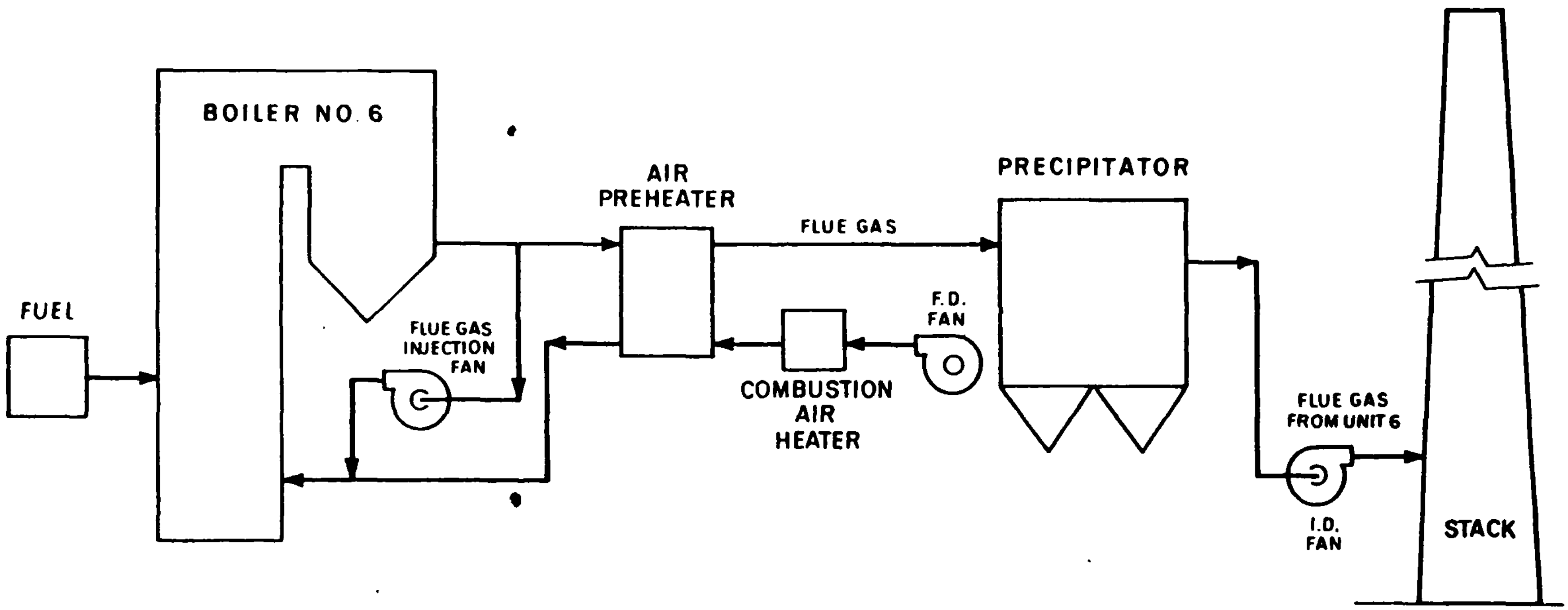

FIG. I.3-4
FLUE GAS SYSTEM
OSWEGO STEAM STATION-UNIT 6
NIAGARA MOHAWK POWER CORPORATION

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8,000 hp motor. The fans will be enclosed and suitably sound attenuated.

A 700-ft high, reinforced concrete chimney will discharge the flue gas from the proposed Unit 6. The chimney will be supported on a heavy reinforced concrete mat, bearing on rock. The chimney shell will be about 65 ft in diameter and will contain a single insulated steel liner. The total gas flow through the stack will be 2,140,000 cfm from Unit 6 generating unit.

Sampling ports for particulate measurement and for sulfur dioxide and nitrogen oxides concentration monitoring will be provided at the stack breeching. The chimney will be equipped with approved aircraft warning systems and a lightning protection system.

1.3.4 Fuel Storage and Transfer System

Niagara Mohawk has contracted with the New England Petroleum Company (NEPCO) to supply the fuel oil requirements for Unit 6 at the Oswego Steam Station. NEPCO will construct a fuel treatment plant 3 miles south of the station which will process crude oil and supply the residual fuel oil by pipeline to the power station. The oil treatment plant will require about 90 acres of a 450-acre site lying south of Maple Avenue between Ridge and Rathburn Roads.

The fuel treatment plant will have a throughput of 100,000 bbls/day of crude and will produce naptha, distillates, S.N.G. and 50,000 bbls/day of No. 6 fuel oil. Initially the treatment plant will receive crude oil for storage and pipeline shipment to Oswego Station Unit 6. Upon completion of the processing units within the fuel treatment plant, NEPCO will furnish No. 6 fuel oil to Unit 6. Eventually, all six of the Oswego Station's generating units will be supplied from this fuel treatment plant thus eliminating deliveries of oil to the power plant by barge. The existing onsite barge unloading and fuel storage facilities will be maintained as an alternative system.

The routing of the 16-inch oil pipline below ground from the oil treatment facility to the Oswego Steam Station is described below. At present there are two alternative routes being considered for pipeline placement. For the first route the pipeline will leave the north corner of the treatment facility heading due north for about 1/3 mile. The pipeline will then veer to the east crossing a narrow band of low-lying marshland and extend northeasterly for about 1/2 mile before tying into the existing transmission line right-of-way. The pipeline will then follow the right-of-way into the station complex. The second alternative route will utilize the new proposed Oswego-Dewitt 345 kV transmission line right-of-way. The new transmission line will generally parallel the existing right-of-way. As with the first alternative the pipeline will exit at the northeast corner of the treatment plant and extend northeasterly to the new transmission line right-of-way. From here it will follow the lines into the station complex. These two alternative pipeline routes are shown in Figure 1.3-5.

In order to minimize the impact of an oil leak or spill, pipeline design and material selection will comply with the regulations of the Office of Pipeline Safety, Department of Transportation. Accordingly, the pipeline will be buried and marked to provide maximum physical protection and furnished with protective coatings, wraps, and cathodic protection to minimize corrosion. To detect leaks or pipeline failures, an accurate flow and pressure measurement system will be furnished. Electrically operated isolation valves will be provided at frequent intervals to minimize the volume of oil loss in the event of a leak. At critical terminal points and pumping stations, special dikes and basins will be constructed to contain spills.

The existing fuel storage and onsite barge unloading facilities at Oswego Steam Station, which will be retained as an alternative system, are described below:

Two hydraulically operated marine unloading arms, located at the existing dock, receive oil pumped from barges delivered to the dock by tugboat. The oil is transferred from the unloading arms to any one of four 240-ft diam by 48-ft high fuel oil storage tanks via a 16 in. fuel oil fill line.

The four storage tanks will be surrounded by 12-ft high earthen dikes with a 15-ft wide access road on top. The tanks will be diked in groups of two. All diked areas are sized in accordance with Bulletin NFPA-30 of the National Fire Protection Association which states that dikes be able to contain the contents of the largest tank enclosed within them.

A fuel oil transfer pumphouse will be located outside the diked area. The pumphouse will contain three 3,000 gpm transfer pumps for transferring oil from the storage tanks via 24 in. suction lines from the tanks to the pumps and a 14 in. fuel oil transfer line from the pumps to the day tanks.

A 50-ft diam by 48-ft high fuel oil day tank inside a 100-ft diam by 12-ft high steel dike will be located between the north wall of Units 1 through 4 and the shoreline to provide one day's storage for these units.

A pumphouse will be located between the day tank and the north wall of Units 1 through 4 and will contain the burner supply pumps and heaters for Units 1 through 4.

Two 67-ft diam by 48-ft high day tanks will be located adjacent to Unit 5. Each tank will be located inside a 135- ft diam by 12-ft high steel dike. One tank will provide one day's storage for Unit 5; the other will provide one day's storage for Unit 6.

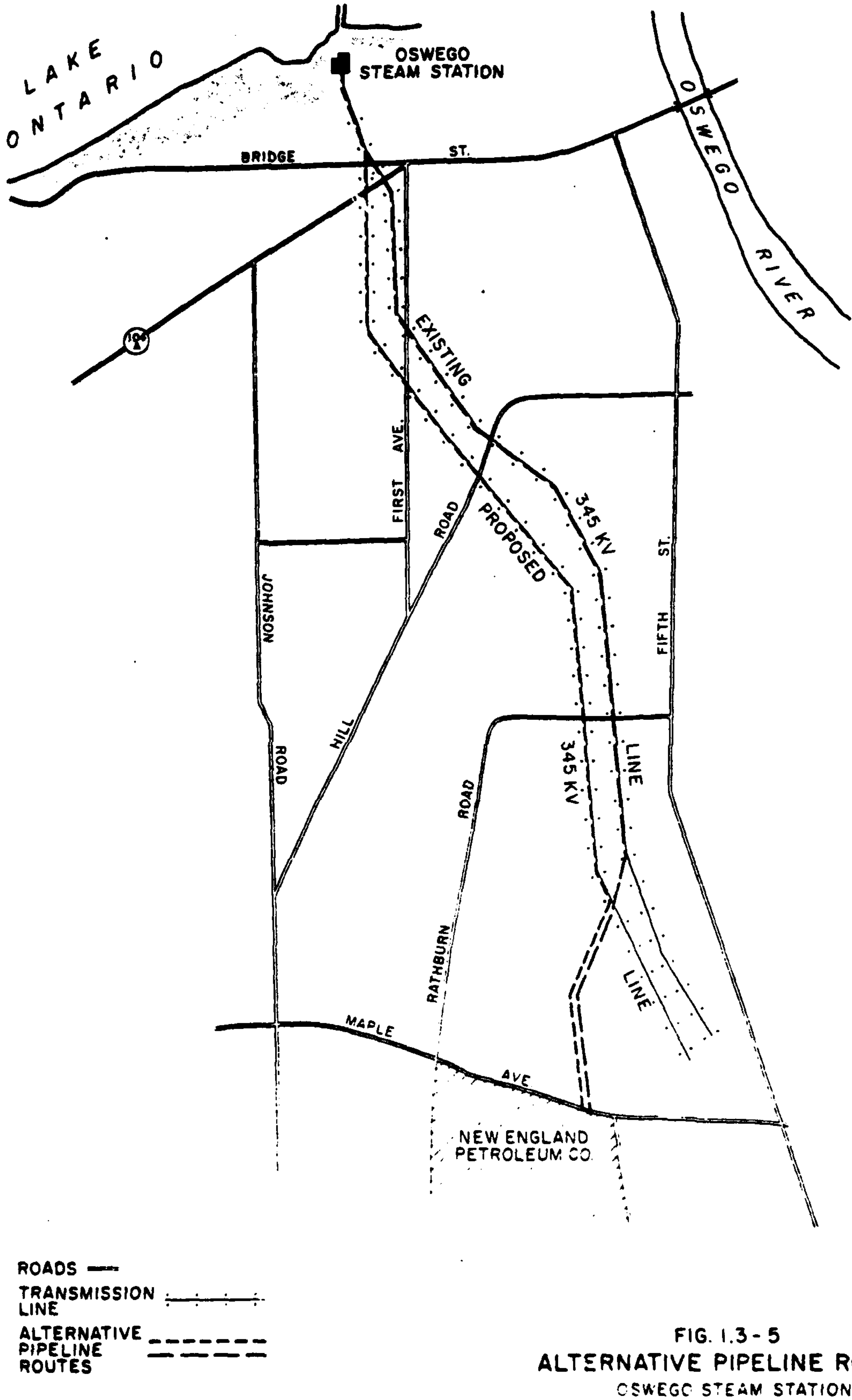


FIG. 1.3-5
ALTERNATIVE PIPELINE ROUTES
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

Ignition oil for Units 1 through 4 will be stored in existing ignition oil storage tanks. Ignition oil for Unit 5 will be stored in a 21-ft high tank inside the 135-ft diam by 12-ft high steel dike provided for the Unit 5 day tank. Ignition oil for Unit 6 will be stored in a 21-ft high tank inside the 135-ft diam by 12-ft high steel dike provided for the Unit 6 day tank.

Oil spill control equipment will consist of approximately 800 ft of rubberized fabric, foam filled oil boom with flexible skirt, floating oil skimmers, slop water receivers and approved commercial oil absorbents or straw. This equipment will be stored at the Oswego Steam Station for use in the event of an oil spill. The location where the boom would be deployed is shown in Figure 1.1-3. A 14-ft boat with a 75-hp extended shaft motor will be on hand for deployment of oil spill control equipment.

An additional 800 ft of oil boom is stored at the Oswego Port Authority by the Oswego-Fulton Oil Pollution Project Committee. A contingency action plan for containment and removal of oil spills in Oswego Harbor is being developed.

All oil unloading procedures will be under the constant supervision of trained personnel. In the event of an oil spill into Oswego Harbor, the U.S. Coast Guard, Captain of the Port will be informed and the floating oil boom stored at the Oswego Steam Station will be deployed using station personnel, from the northwest corner of Sundown Park to the existing breakwater, to contain the spill. Since harbor currents are slow and wave action from Lake Ontario is blocked by the breakwater, this oil boom will prevent any oil from entering Lake Ontario by isolating the west basin of Oswego Harbor. Deployment of the boom comprises the initiation of Niagara Mohawk's contingency action plan to contain the oil spill. When the oil spill has been contained, means of removing the oil spilled into the harbor can proceed.

Floating head skimmers and slop water receivers will be provided for this purpose. The slop water will be trucked out for disposal at the sanitary landfill site or other acceptable location. An approved oil absorbent material will be kept on hand in the vicinity of the unloading dock to help remove minor oil spills.

If an oil spill extends beyond the plant boom, the station shift superintendent in charge will inform the U.S. Coast Guard, Captain of the Port, and the Oswego Port Authority and the Port Authority contingency action plan will be carried out. This contingency action plan consists of placing the booms now at the Oswego Port Authority Terminal at the harbor entrance and from the shoreline to the breakwater opening at the northeast end of the harbor for containment, and subsequent removal with floating skimmers and absorbents.

Excess rain water that may accumulate around the oil storage tanks will be pumped from the diked areas to Gardinier Creek with portable pumps provided the water is not contaminated with oil. If it is determined by visual inspection that the water is contaminated, it will be pumped from the diked areas to tank trucks for disposal as described above. Portable heaters and pumps will be used to remove major oil spills contained within the diked area. The oil would be transferred from the diked area to one of the storage tanks via connections provided on the fuel oil fill lines located outside the diked area. Areas within the dike that have been contaminated by a major spill will be replaced with clean soil.

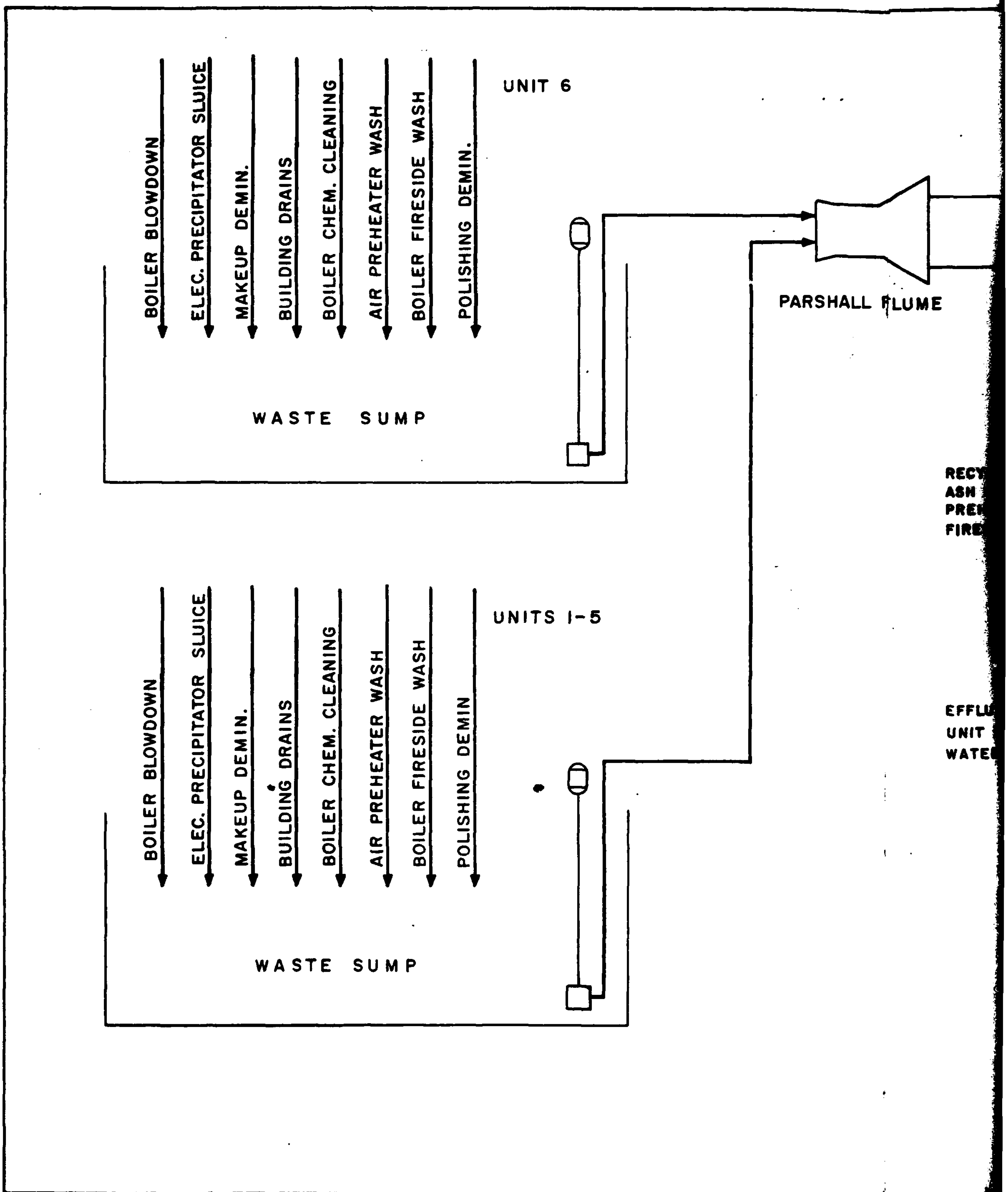
If minor oil leaks or accidental spills occur at the inlet or outlet connections, sand beds will absorb the oil and eliminate the possibility of contaminating runoff water. Contaminated beds will be replaced with clean sand. Oil-contaminated sand will be trucked out for disposal at the sanitary landfill site.

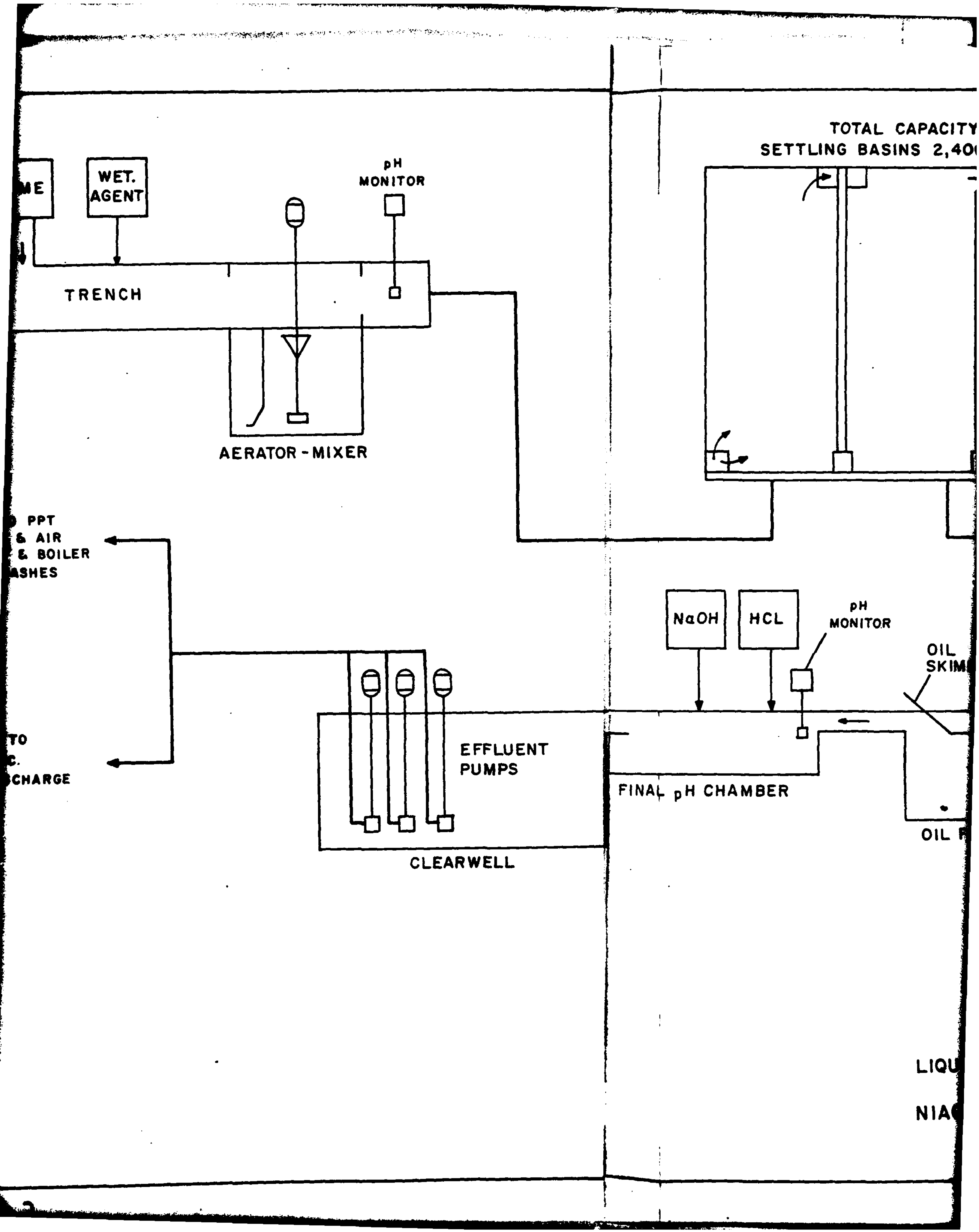
1.3.5 Liquid Waste Treatment

All liquid waste discharges associated with the operation of Unit 6 at the Oswego Steam Station will be collected, treated and monitored prior to dilution and discharge to Lake Ontario via the Unit 5 condenser cooling water discharge. Liquid waste treatment includes provision for:

1. Flow equalization
2. Lime addition, aeration and mixing for the removal of phosphates and metallic ions
3. Clarification for the removal of suspended solids
4. Oil separation and disposal
5. Final pH adjustment.

The liquid waste treatment equipment for the existing Units 1-4 and Unit 5, has been designed to incorporate the increased flows from Unit 6. A second waste sump and a third settling basin will be added in series with the first two basins to complete the treatment system for Unit 6. The entire system for treating liquid waste from Units 1-6 is shown in the flow diagram, Figure 1.3-6. A description of the estimated flows and composition of the various waste streams before and after treatment is presented in Section 3.5.


UNIT 6
BOILER BLOWDOWN
ELEC. PRECIPITATOR SLUICE
MAKEUP DEMIN.
BUILDING DRAINS
BOILER CHEM. CLEANING
AIR PREHEATER WASH
BOILER FIRESIDE WASH
POLISHING DEMIN.
WASTE SUMP
PARSHALL FLUME
UNITS 1-5
BOILER BLOWDOWN
ELEC. PRECIPITATOR SLUICE
MAKEUP DEMIN.
BUILDING DRAINS
BOILER CHEM. CLEANING
AIR PREHEATER WASH
BOILER FIRESIDE WASH
POLISHING DEMIN
WASTE SUMP



TOTAL CAPACITY
SETTLING BASINS 2,40
ME
WET. AGENT
pH MONITOR
TRENCH
AERATOR - MIXER
PPT
& AIR
& BOILER
ASHES
NaOH
HCL
pH MONITOR
OIL
SKIM
TO
C.
CHARGE
EFFLUENT PUMPS
FINAL pH CHAMBER
OIL
CLEARWELL
LIQU
NIA

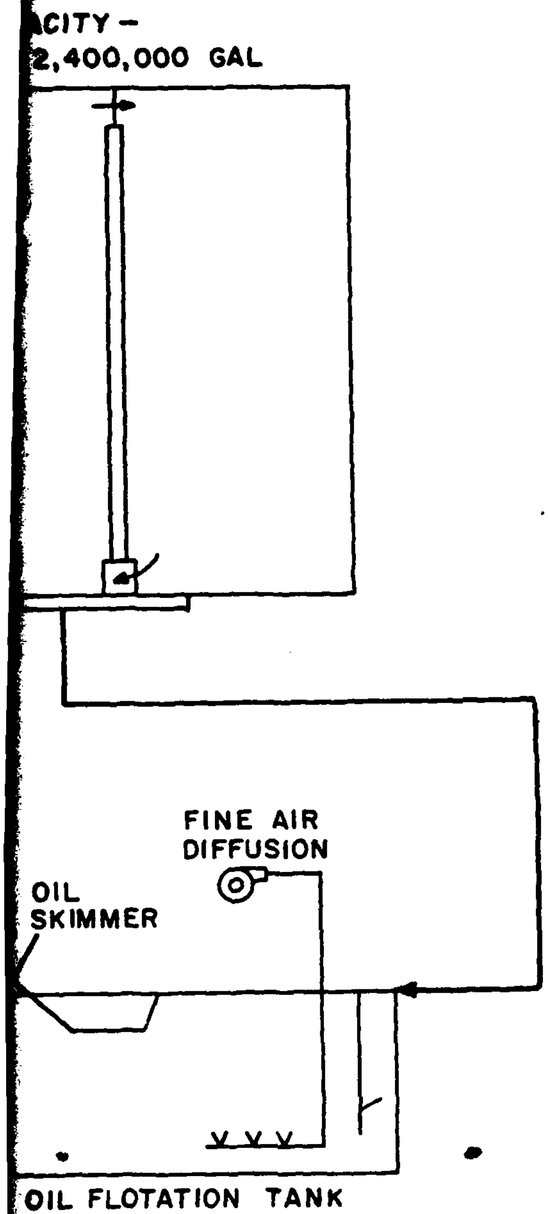


FIG. 1.3-6
LIQUID WASTE HANDLING FLOW DIAGRAM
OSWEGO STEAM STATION UNIT 6
NIAGARA MOHAWK POWER CORPORATION

Liquid wastes from Unit 6 may be categorized as being either continuous or intermittent:

Continuous Liquid Waste Flows (Excluding condenser cooling water)

1. Boiler Blowdown.

2. Electrostatic precipitator ash sluice.

Intermittent Liquid Waste Flows

1. Condensate polishing demineralizer.

2. Makeup water filter and demineralizer.

3. Air preheater and boiler fireside washes.

4. Boiler chemical cleaning.

5. Boiler precleaning.

Liquid wastes from Unit 6 will be conveyed to a new 40,000 gallon waste sump for flow equalization. The waste will be mixed with the equalized waste flow from Units 1-5 and will be pumped through a Parshall flume for flow monitoring. The waste flow, reduced in velocity from its passage through the flume, will pass through a concrete trench where lime will be added to adjust the pH of the waste stream to 9.5 to 10.5. A surface active agent will also be added to enhance the sedimentation characteristics for the waste. The trench will convey the waste into a tank provided with a surface aerator-mixer, where phosphates and dissolved metals, such as manganese and iron, will be precipitated out of solution.

The pretreated wastes from the mixing tank will flow to three settling basins arranged in series, having a total capacity of 2,400,000 gallons. In the settling basins, suspended solids from the electrostatic precipitator sluice system and lime-flocculated metallic ions and phosphates will be removed by sedimentation.

The periodic cleaning operations for Units 5 and 6, i.e., boiler chemical cleaning, air preheater and boiler fireside washes, will be scheduled during separate intervals to reduce the temporary load on the treatment system. The settling basins will be provided with stop-logs so that at any time one basin may be drained and mechanically cleaned. The solids will be disposed of by trucking to an offsite landfill owned by Niagara Mohawk.

Overflow from the settling basins will pass to an air flotation system. Skimmed material from the surface of the flotation unit will be collected and incinerated in the boiler or trucked offsite to a landfill owned by NMPC. The pH of the effluent will be readjusted to 6.5 to 8.3 downstream of the air flotation system, and will pass to a final effluent clearwell.

A portion (500 gallons per minute) of the treated waste will be continuously recycled to the precipitator ash sluicing system. In addition, a portion of the effluent will be used for the periodic air preheater and boiler fireside washes. The remainder of the treated waste (approximately 2,500 gallons per minute during normal operation, with a maximum of 6,500 gallons per minute during water treatment equipment regeneration and the periodic air preheater wash) will be discharged to Lake Ontario after complete mixing with the condenser cooling water from Unit 5.

SECTION 2

ENVIRONMENTAL SETTING WITHOUT THE PROJECT

2.1 TOPOGRAPHY AND GEOLOGY

The Oswego Steam Station project area lies in the Erie, Ontario lowland physiographic province shown in Figure 2.1-1. This province is bounded by upland on the south and east and by the Canadian shield to the north.

Within the lowland province, the terrain is generally flat and gently rolling and is controlled by an irregular bedrock surface of low relief. Thin glacial deposits cover most of the area. Post-glacial weathering and stream erosion have not significantly modified the terrain. The land surface rises gradually to the south and southeast away from Lake Ontario. The lowland extends 30 to 40 miles in the southerly direction to the Portage Escarpment (an erosional feature) which forms the boundary with the Appalachian uplands.

Regional geologic features are shown in Figure 2.1-2. At the site, about 1,700 feet of Cambrian or Ordovician strata overlie Pre-Cambrian basement rocks.

Bedrock of the Oswego formation lies at a depth of 20 feet or less over much of the site. It consists of greenish-grey to light grey, hard to moderately hard, medium-bedded, medium-grain sandstone. Shale interbeds occasionally occur, increasing in thickness and frequency with depths. No major faults are known in the Oswego area, although minor small displacement faulting has been encountered in excavations near the plant. Joint systems in the area strike north 55 to 70 degrees east and north 30 to 50 degrees west with near vertical dip angles. Joints are of limited vertical extent and show no evidence of movement. Natural fractures are few and the shale units are more susceptible to fracturing than the sandstone. The shales may also be susceptible to some slaking action when exposed to the air.

The immediate site is located in the City of Oswego on the shore of Lake Ontario. The surface grade in the project area is at an average elevation of 254 ft, about 8 ft above lake level.

Locally, the area has been artificially graded for the Oswego Steam Station and adjacent facilities, resulting in a leveling of the terrain which, in its natural state, is a very low undulating relief. The site is surrounded on three sides by developed portions of the City of Oswego and on the fourth side by Lake Ontario. Natural drainage at this site is very good with a large

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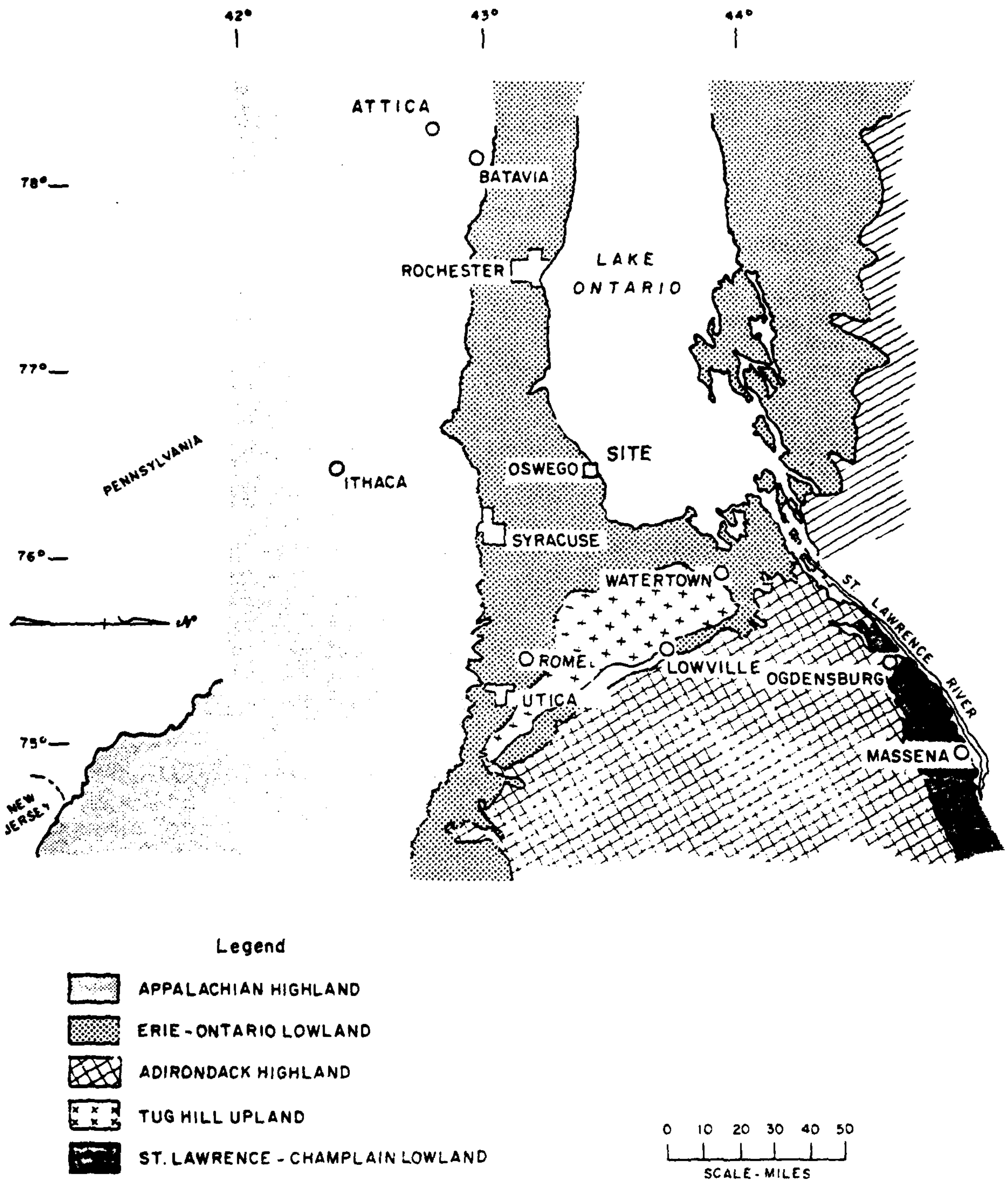

FIG. 2.1-1
REGIONAL PHYSIOGRAPHIC MAP
PORTION OF NEW YORK STATE
NIAGARA MOHAWK POWER CORPORATION

1893

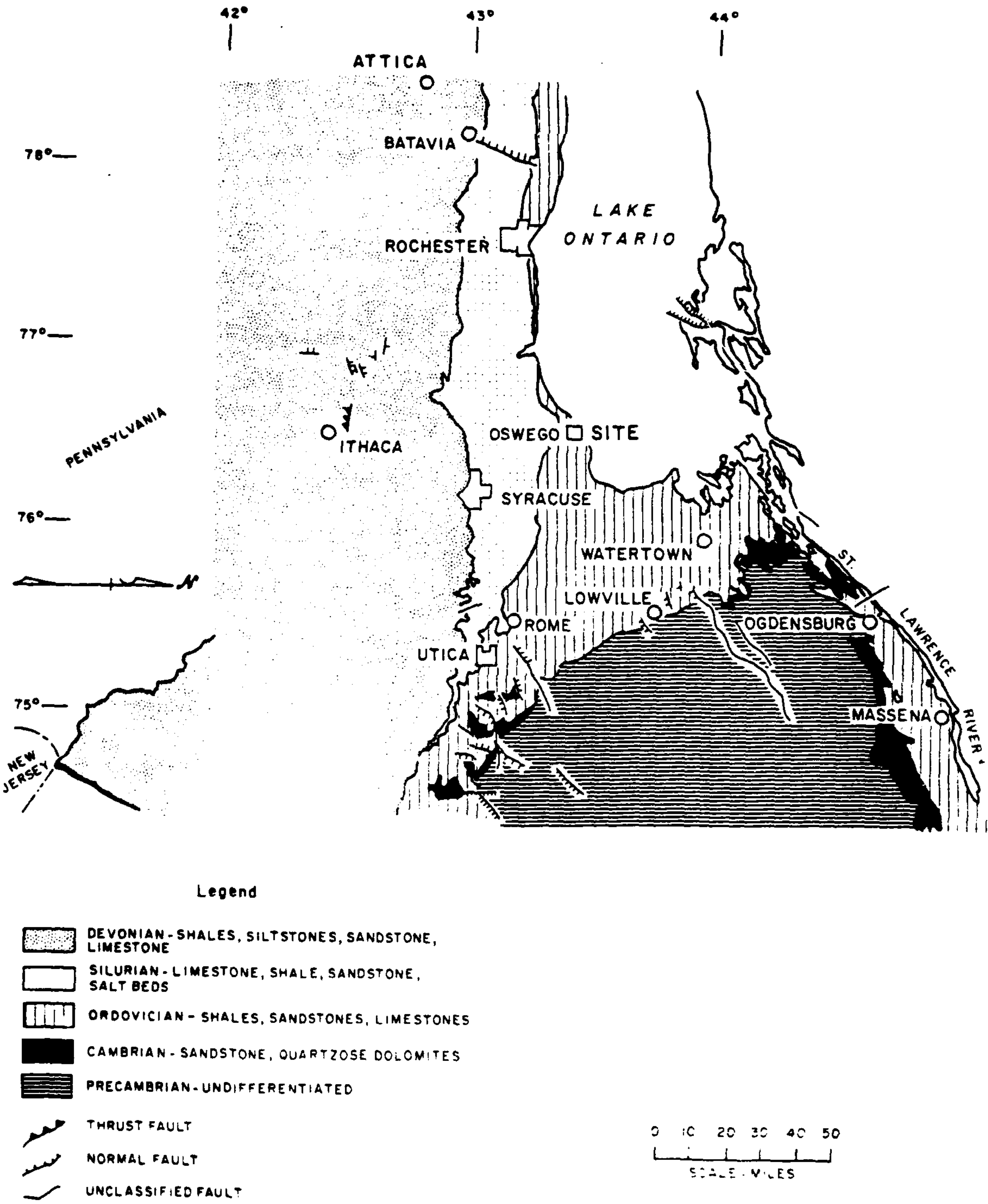

FIG. 2.1-2

REGIONAL GEOLOGIC MAP

PORTION OF NEW YORK STATE

NIAGARA MOHAWK POWER CORPORATION

drainage channel, Gardinier Creek, crossing the plant property. Rain water runoff flows either to the creek and then to Oswego Harbor or directly to Lake Ontario.

The project site is overlaid by artificial fills which include waste ash from the existing units of the Oswego Steam Station and sands and gravels. Some natural alluvial sands and silts are present in the area. Commonly, the fill materials and the alluvial materials overlie dense glacial tills which in turn overlie the Oswego sandstone. The bedrock surface beneath Lake Ontario is typically covered by a layer of till which is overlaid by a thin shifting layer of recent lacustrine sand.

The site is located in a region which can be considered seismically inactive. Earthquake activity within 50 miles of the site has been infrequent and minor, and no earthquake damage has resulted. Table 2.1-1 shows the history of earthquakes in an area within 350 miles of the site.

The site is located within the Erie-Ontario Lowland Physiographic Province which has a generally flat to gently rolling terrain, controlled by an irregular bedrock surface of low relief. The Erie-Ontario Lowlands border Lake Ontario to the north and east, as well as to the south. The bedrock of the area is early Paleozoic (Ordovician). It is flat lying, dipping less than 2 degrees to the south-southwest and is essentially undeformed. There is no evidence of east-west structural deformations in the Erie-Ontario Lowlands.

The closest major structural system to the site is the eastern St. Lawrence and Ottawa River Valleys in which major faulting is known. Significant earthquake activity has occurred in these areas. The fault systems extend southward from Quebec City, a center of seismic activity, along the St. Lawrence River to Montreal and then up the Ottawa River Valley. In this area, the fault system is known as the Ottawa-Bonnechere Graben and approaches the site no closer than about 135 miles. All available data indicated that this zone of deformation does not extend southwestward along the St. Lawrence Valley beyond Montreal.

A seismic reflection survey (by others) was recently completed along a 110-mile stretch of the St. Lawrence River Valley from Montreal, Quebec to east of Ogdensburg, New York. The study revealed that the Ottawa-Bonnechere Graben extends from a zone of complex structural deformity near Montreal westward along the Ottawa River Valley. Relatively minor faulting, trending nearly normal to both the Ottawa-Bonnechere Graben and the St. Lawrence River, is associated with the formation and extends southeastward from the Ottawa-Bonnechere Graben. Some of this faulting crosses the St. Lawrence between Montreal and the Massena, New York-Cornwall, Ontario area.

Table 2.1-1

Significant Earthquakes Within 100 Miles of Site

Year	Date	Time	Epicentral Intensity	Approximate Location	N. Lat.	W. Long.	Approximate Perceptible Area, Sq Miles	Distance From Site, Miles
1663	Feb. 5	1730	IX - X	St. Lawrence River Valley near Quebec, Canada	47.6	70.1	750,000	350
1853	March 12	0200-0300	VI	Near Lowville, New York	43.7	75.5	Local	50
1857	Oct. 23	1515	VI	Near Buffalo, New York	43.2	78.6	18,000	100
1903	Dec. 25	0730	V	Near Ogdensburg, New York	44.7	75.5	1,500	100
1922	Dec. 8	1624	V	Near Canton, New York	44.6	75.5	Local	100
1925	Feb. 28	2119	IX - X	St. Lawrence River Valley near Quebec, Canada	47.6	70.1	2,000,000	350
1925	April 7	1518	I - III	Near South Syracuse, New York	43.0	76.2	Local	35
1925	May 23	-	I - III	Near Sodus Point, New York (near Lake Ontario)	43.4	77.1	Local	30
1927	March 29	1530	I - III	Near South Syracuse, New York	43.0	76.2	Local	35
1927	March 21	1600 1630	I - III	Near Syracuse, New York	43.0	76.2	Local	35
1929	Aug. 12	0625	VIII	Near Attica, New York	42.9	78.3	100,000	100
1941	Oct. 9	2207	I - III	Near Watertown, New York	44.0	76.0	Local	45
1941	Oct. 20	2129	I - III	Near Watertown, New York	44.0	76.0	Local	45
1944	Sept. 5	2339	VIII	Cornwall, Ontario-Massena, New York	44.9	74.9	175,000	120
1945	April 15	1315 1420 1530	I - III	Near Auburn, New York	43.0	76.4	Local	30
1952	Nov. 20	-	I - III	Near Auburn, New York	42.9	76.6	Local	35
1954	Feb. 1	0037	I - III	Near Montezuma, New York	43.0	76.7	Local	35
1954	Sept. 29	2250	I - III	Near Watertown, New York	44.0	75.9	Local	45
1966	Jan. 1	0823	VI	Near Attica, New York	42.8	78.2	3,500	100

1878

Regional gravity anomaly survey results tend to confirm the complexity of the basement and indicate that no general orientation of the basement features exists on the St. Lawrence River area southwest of Montreal. In addition, the existence of the stable Frontenac Axis, crossing the St. Lawrence River in the Thousand Islands area, clearly reinforces the conclusion that a major structure trending along the St. Lawrence River toward the site does not exist. The Frontenac Axis is a narrow isthmus of uplifted Pre-Cambrian rock which extends across the upper end of the St. Lawrence River Valley. The Frontenac Axis has existed since Cambrian time and while it has undergone several cycles of uplift and erosion, no offsets to the axis have ever been postulated.

Thus, there is no reason to postulate any significant geologic structure extending southwestward into the Erie-Ontario Lowlands where the site is located. Stratigraphically, structurally, and tectonically, the site and the St. Lawrence Valley north of Montreal are in entirely different regions. Thus, St. Lawrence earthquake activity cannot be postulated in the vicinity of the site.

The closest known faults of any significance are encountered near Syracuse, about 40 miles southeast of the site. These are minor structures and are local in character. The undeformed bedrock strata of the site area extend southward to the Appalachian Uplands, eastward to the Adirondack Highlands, and northward, beyond Lake Ontario where they lap onto the Canadian Shield.

Minor faulting in Ordovician rocks has been reported near Lowville, New York, about 50 miles northeast of the site. The faults are oriented in a northeast-southwest direction and downthrown on the southeast side. This faulting is probably related to the formation of the Adirondack structural complex some 250 million years ago.

To the west, the closest significant structure is the Claredon-Linden Fault, 90 miles from the site. The maximum displacement along this fault is on the order of 200 ft, in the vicinity of Batavia, New York. It is a north-south trending fault with displacement diminishing both upward along the fault and northwards towards the lake. Minor faulting is reported in the Wellington-Prince Edward Bay area on the north side of Lake Ontario and in the western portion of the St. Lawrence River Valley. The trend of these faults is roughly northwest-southeast perpendicular to the river. The largest of these features is the Gloucester Fault which can be projected through the Massena, N.Y.-Cornwall Ontario area.

None of the recognized faults in the regions surrounding the site can be projected into the site area.

1898

Tectonic features more regional in character, such as the postulated St. Lawrence Rift and the Ottawa-Bonnechere Graben, occur in distinctly separate geologic provinces and do not project into or towards the site area. Recent investigations by others indicate that no zone of structural deformation similar to the Ottawa-Bonnechere Graben extends along the St. Lawrence River toward the site area. The structural complexity of the Adirondack Highlands is restricted to the upland area, and the associated faulting in that area dies out rapidly to the west.

A possible alignment or lineation connecting the seismically active eastern St. Lawrence River Valley with the seismically active area in the vicinity of New Madrid, Missouri near the extensively faulted southern end of the Illinois Basin has been postulated. Evidence developed during recent geologic and geophysical studies in and along the St. Lawrence River Valley as having north-south trends refutes this postulation. The New Madrid, Missouri, area is extensively faulted; however, geologically it is not possible to extend the area of faulting to the northeast toward the St. Lawrence River Valley. The seismicity of the area between the St. Lawrence River Valley and the New Madrid, Missouri area is confined to minor earthquake activity, for the most part associated with well-documented local seismic-tectonic sources such as those near Lima, Ohio and Attica, New York, and occasional minor shocks, probably resulting from post-glacial crustal rebound.

The significant earthquake activity in central New York and surrounding regions can be related to known faulting or other documented geologic features. A conservative estimate of earthquake intensity at the site can be made by moving the largest regional shocks along the associated tectonic structure to the closest approach to the site.

The most significant historical earthquakes in the region were located near 1) Attica, New York; 2) Cornwall, Ontario - Massena, New York; 3) Buffalo - Lockport, New York; 4) Lowville, New York.

The shocks near Attica, New York, approximately 110 miles southwest of the site are related to the Clarendon-Linden Fault, a local geologic feature, the main branch of which trends roughly north-south. The closest portion of the structure is to the west of the site at a distance of 90 miles. The eathquake of 1929 (Intensity VII-VIII) damaged some structures at the epicenter, near Attica, and may have been perceptible in the vicinity of the site. The conservative hypothesis has been made that a shock similar to the largest of the Attica series could occur at this closest approach to the site of the Clarendon-Linden Structure. Based on attenuation curves for the northeast U.S. such a shock would be felt at the site with an intensity of about IV.

The 1944 Intensity VIII earthquake at Cornwall-Massena probably was felt at the site with an intensity of about V. This shock has recently been associated with the extension of the Gloucester Fault that has recently been mapped through the epicentral area of the Cornwall-Massena shock. A recurrence of this shock at any location above the Gloucester Fault would result in site intensities of not more than V.

Some minor earthquake activity, which has not been related to known geologic structure, has occurred in the vicinity of Buffalo, New York, to the west of the site. Satellite photos indicate a lineation likely due to subsurface expressions of faulting, through the epicentral areas of these shocks. It is likely that these earthquakes result from crustal readjustment in the areas of local stress concentrations assocaited with rebound of the general area following removal of the continental glaciers.

The closest earthquake to the site which caused any damage at its epicenter occurred near Lowville, New York in 1853 (Intensity VI), approximately 50 miles east-northeast of the site. This shock can be related to identified faulting in sedimentary strata at the western edge of the Adirondack Dome in the Lowville area. These faults are oriented in a northeast-southwest direction.

Several minor shocks (Intensity generally less than III) have been reported within about 30 miles of the site. These shocks were relatively insignificant and it is probable that none were felt in the site area.

The records of the area, which extend over a 200-year period, illustrate that, historically, the site has not experienced earthquake motion exceeding Intensity V.

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2.2 HYDROLOGY

2.2.1 Ground Water

Ground water in the vicinity of the Oswego Steam Station is at approximately El. 250 and appears to stay within 4 to 6 ft of the ground surface across the entire site. The upper layers of soil are relatively heavy and percolation rates are expected to be slow. The interaction of on-site activities with surrounding water tables will be minimal.

The City of Oswego makes use of Lake Ontario for its public water supply. Few private wells for potable water are found within the city, and none is situated near the power plant site. Municipal water supply wells for towns near Oswego are shown in Figure 2.2-1.

2.2.2 Surface Water

Lake Ontario, the easternmost of the Great Lakes, is an international body of water forming part of the border between the United States and Canada. The lake is 193 miles long and is 53 miles wide at its widest point; its surface area is 7,340 square miles (4.7 million acres). It has a maximum depth of 802 ft, an average depth of about 283 ft, and a volume of 393 cubic miles or 1.34 billion acre-feet.

Inflow into the western end of Lake Ontario averages about 205,000 cubic feet per second (cfs). Runoff directly into Lake Ontario from 27,300 sq miles of watershed in New York State and the Province of Ontario amounts to an additional 36,000 cfs. The combined outflow from the lake averages about 241,000 cfs. Annual rainfall into the lake, averaging 34 inches per year, is almost balanced by annual evaporation of about 30 inches per year.

Prior to the beginning of flow regulation, the elevation of the lake surface was controlled by a natural rock weir located about 4 miles downstream from Ogdensburg, New York in the Galop Rapids reach of the St. Lawrence River. The 111-year record of the U.S. Lake Survey from 1860 to 1970 indicates a mean lake surface elevation of 246.00 (Ref. 2) above mean tide at New York City, 1935 datum.*

Over this period, the maximum monthly lake surface elevation was 249.29 ft, and the minimum was 242.68 ft, a range of 6.61 ft. The annual range of elevations varies between 3.58 and 0.69 ft.

*All elevations in this report are referred to the U.S. Lake Survey 1935 Datum. To convert elevations to 1955 International Great Lakes Data, subtract 1.23 ft from 1935 Datum (at Oswego).

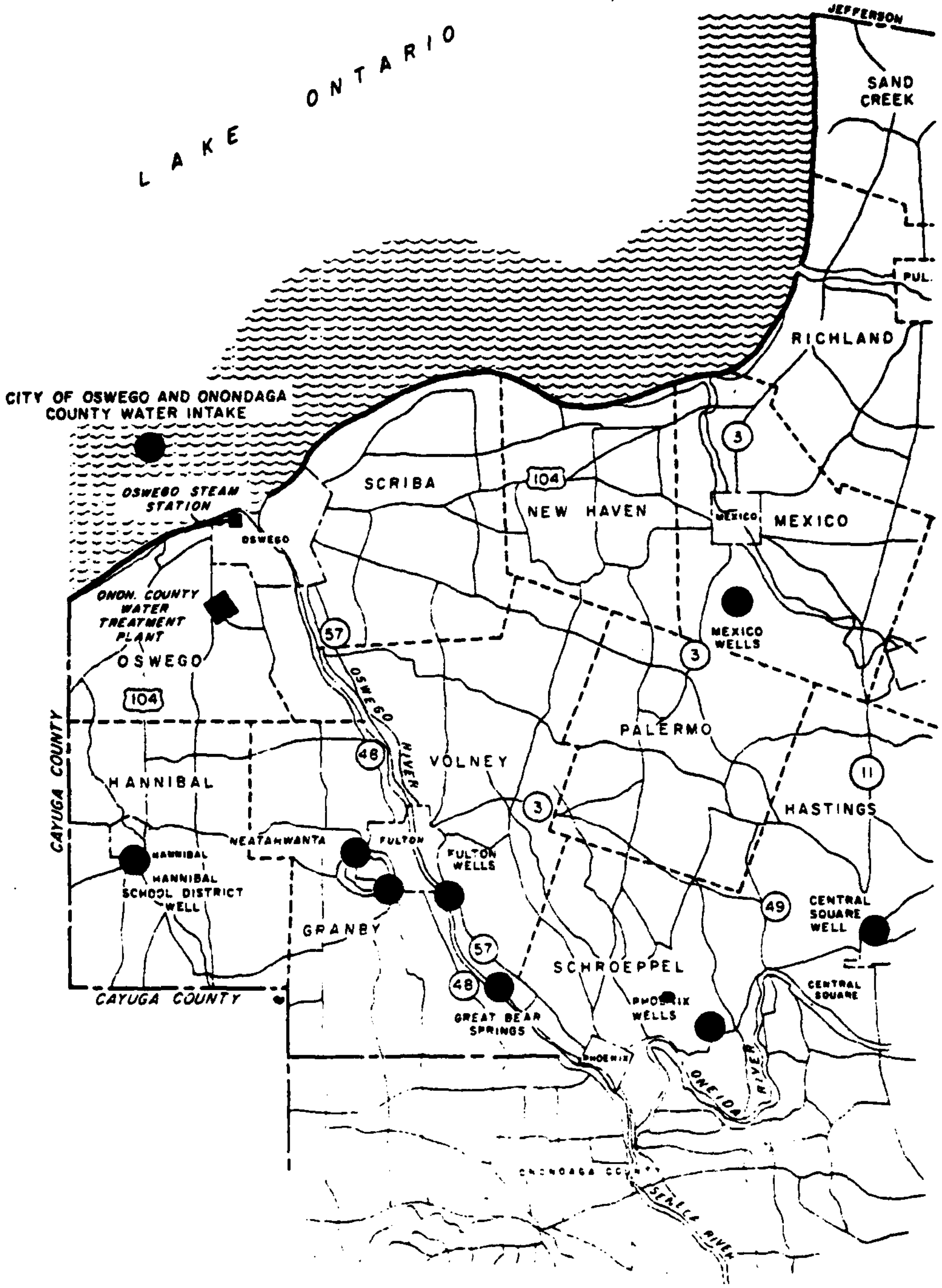


FIG. 2.2-1

MUNICIPAL WATER SUPPLIES

VICINITY OF OSWEGO, NEW YORK

NIAGARA MOHAWK POWER CORPORATION

Dams on the St. Lawrence River, under the supervisory authority of the International St. Lawrence River Board of Control, are now used to regulate the lake level. The lower limit is set for El. 244 on April 1 and is maintained at or above El. 244 for the navigation season from April 1 to November 30. The upper limit of the lake level is El. 248.

Investigators (Ref. 3) have agreed that tidal elevations of the surface of Lake Ontario are of negligible importance amounting to 1/10 of an inch or less. Changes in lake levels of greater magnitude result from seiche activity. Typically, a seiche develops when the wind, having piled up water on the lee shore, falls off rapidly so that the unbalanced water wedge sets up an oscillation. In the region of Oswego, 1.7-ft variations of lake level caused by a seiche have been noted with a recurrence interval of 10 years. (Ref. 4).

Currents within Lake Ontario are produced by the interaction of Coriolis forces operating on the liquid mass in the lake, the topography of the lake bottom and shoreline, density gradients due to temperature variation or to dissolved or suspended materials and the direction, force, and duration of the wind blowing over the lake. Drift bottle studies by Harrington (Ref. 5) in 1895, and a drift card survey by Storr (Ref. 4) in 1963 indicate that the general direction of the surface circulation, under conditions of summer stratification is easterly and northeasterly along the New York shore with a small counterclockwise return flow along the Canadian shore. These observations have been extensively confirmed by measurements at temporary and permanent current metering stations operated cooperatively by the New York State Department of Health (now New York State Department of Environmental Conservation) and in 1968, by the Federal Water Quality Administration (1968)(now Office of Water Quality of Environmental Protection Agency).

The general flow pattern is extensively modified at specific spots by local conditions. Studies of lake currents of the shore area at the site out to the 40-ft depth contour were conducted in October and November 1970 (Ref. 1). Current profiles with depth were made under two conditions: (1) when the sampling area was thermally stratified, and (2) when the water in the sampling area was essentially isothermal. These studies showed that the wind is the predominant factor in determining the speed and direction of lake currents in the region of Oswego. Cumulative wind rose data show that these winds have a westerly component a high percentage of the time. Moreover, while light winds of 0 to 12 mph are most prevalent, winds reaching the 12 to 25 mph range almost invariably blow from the northwest, west, or southwest.

From theoretical studies of Lake Ontario conditions, a graphic relationship between wind speed and current velocity was developed. This relationship proved to be conservative when the predicted current velocities, based on 6-hour average wind speed, were compared with measured lake currents.

In the Northern Hemisphere, lake currents set up by these winds normally move 45 degrees to the right of wind direction. In the Oswego region, the direction of the shoreline and the shallow average slope of the lake bottom modify this predicted direction and lake currents are often deflected no more than 10 degrees to the right.

The following general comments describe the wind-current combinations found in the lake area studies:

> During periods of southeast winds the water on the surface moves out in a north-northeast direction eventually causing counter movement below the surface. Usually, light southerly winds will cause a general upwelling along the shore (Figure 2.2-2a).
>
> With westerly winds, the surface water piles up against the shoreline. Eventual sinking of water occurs along the shore and a north flowing current is evident on the bottom. After a period of time, the surface currents set up in the direction of the wind (Figure 2.2-2b).
>
> Winds from the east cause a surface water movement away from shore, setting up a countercurrent with resultant upwelling near shore (Figure 2.2-2c).
>
> North or northeast winds generate complex current patterns in the Oswego area, with surface water being driven against the shore and westward.

Temperature-depth profiles in the lake were recorded for a 12-month period (1970-1971). The instability of successive weekly profiles demonstrated the effectiveness of the wind, wind-induced currents and upwelling of shoreward waters in preventing the development of a thermocline.

After a period of calm days, a thermocline appeared to form at the 7 to 9-ft depth. Within a week, wind-induced mixing destroyed this apparent stratification and the temperature became uniform to a depth of 40 feet .

Thus, it was demonstrated that thermocline formation within the 40-ft depth contour of the Oswego section of the Lake Ontario shoreline is a transitory phenomenon and that the characteristic condition in this zone is one of wind-stirred uniform temperature. The maximum surface temperature recorded was 77.9 F.

The ecology of the southern and eastern shorewaters of Lake Ontario is largely determined by the water quality of the rivers

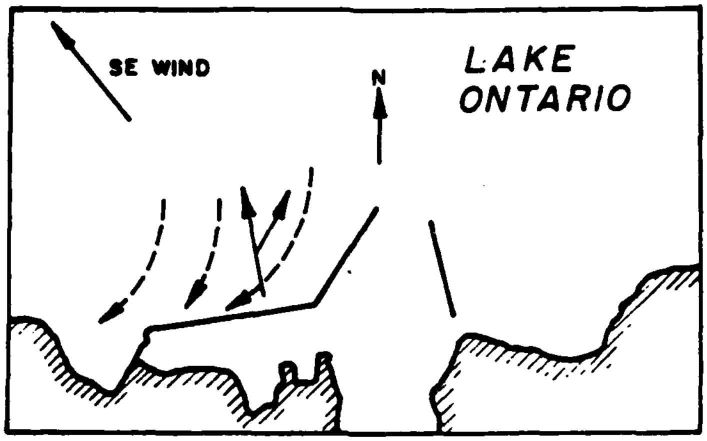


FIG. 2.2-2a

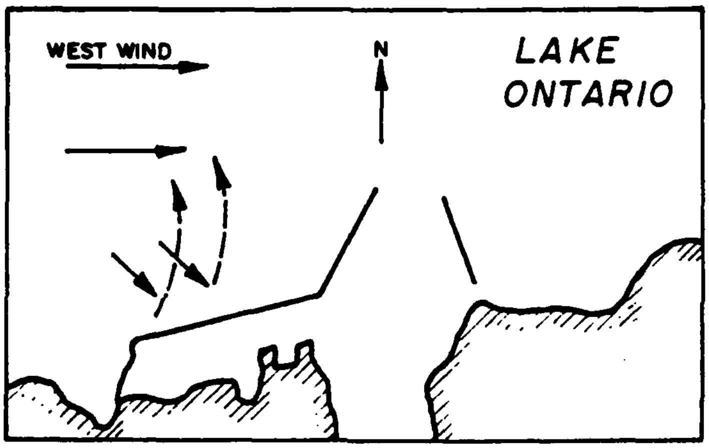


FIG. 2.2-2b

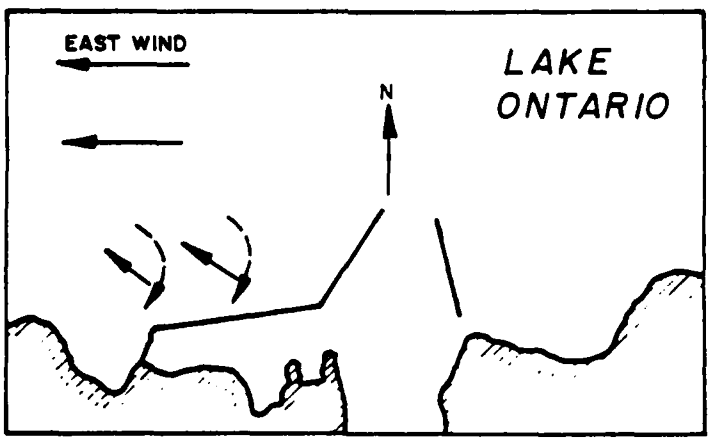


FIG. 2.2-2c

NOTE:

SOLID ARROWS = SURFACE CURRENTS
DASHED ARROWS = SUBSURFACE CURRENTS

FIG. 2.2-2

WIND INDUCED CURRENTS
LAKE ONTARIO

NIAGARA MOHAWK POWER CORPORATION

discharging into the lake from New York State. The principal rivers are the Genesee River at Rochester, the Oswego River at Oswego, and the Black River at Watertown (Figure 2.2-3). The combined drainage area of these three rivers (9,431 square miles) constitutes 34.5 percent of the area tributary directly to Lake Ontario.

The combined average flow of the three rivers (12,624 cfs) represents 35.1 percent of the additional 36,000 cfs that Lake Ontario contributes to the flow from the Great Lakes system to the St. Lawrence River.

The Oswego River is formed by the confluence of the Oneida and Seneca Rivers, the latter being the drainage outlet of the Finger Lakes region of New York State. The United States Geological Survey (USGS) records note that "a large amount of natural storage and some artificial regulation (of the Oswego River) is afforded by the many large lakes and the Erie (Barge) and Oswego (Barge) Canal System in the river basin." The 211 miles of barge canals represent a considerable portion of the flow channels of the basin.

The average daily flow of the Oswego River during the 33-year period from 1933 to 1967 amounted to 6,137 cfs. Maximum flow of record was 37,500 cfs on March 28, 1936.

The minimum daily flow of 353 cfs was recorded on August 14, 1949, but the minimum average seven-consecutive-day flow, having a once-in-10-year frequency (MA7CD/10) is 720 cfs (Ref. 6).

Surface runoff from the western portion of the City of Oswego and the eastern slope of Gardinier Hill flows into Gardinier Creek and passes through Niagara Mohawk property at the Oswego Steam Station. The creek flows into Lake Ontario about 500 feet west of Units 1 to 4.

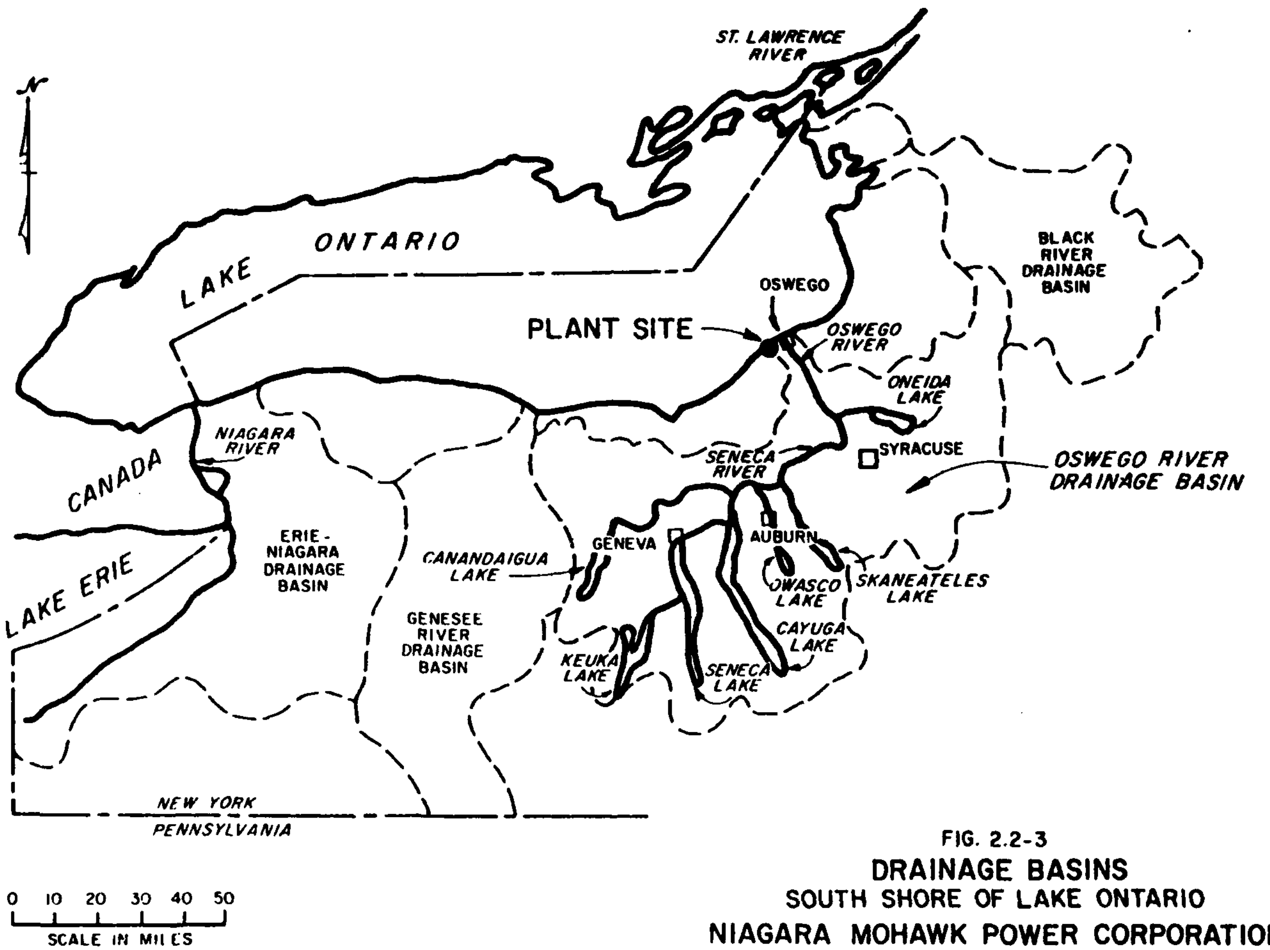


FIG. 2.2-3
DRAINAGE BASINS
SOUTH SHORE OF LAKE ONTARIO
NIAGARA MOHAWK POWER CORPORATION

1905

1906

2.3 CLIMATOLOGY

2.3.1 Data Sources

Average and extreme values of standard meteorological parameters were obtained from the U.S. Weather Bureau Station in Oswego, which ceased operations in 1960, and from the U.S. Coast Guard Station at Oswego (wind observations 1936 to 1945). Knowledge of the micrometeorology near the site was obtained from an instrumented tower which was operative during 1963-1964 at Nine Mile Point, seven miles east of the Oswego Steam Station. The instruments measured temperature at 30 ft, 64.5 ft, 196.5 ft and 202 ft above grade, wind speed and direction at 31 ft and 203 ft, and wind fluctuation at 31 ft.

Ten years of wind, temperature, and humidity observations taken at Rochester (1955-64), 55 miles to the west-southwest of Oswego were used to estimate an hour-by-hour climatologic record at Oswego. Rochester climatology is considered more representative of Oswego than Syracuse data because Rochester is located near the shore of Lake Ontario which has a profound influence on the climate.

Relative humidity observations were taken at 3-hour intervals during the months of December 1967 through February 1968 at the residence of Professor R. B. Sykes, located 3.15 miles west-southwest of the site.

Both the Nine Mile Point and R. B. Sykes residence locations are near enough so that the data collected can be considered representative of the site.

Wind and temperature recorded at Nine Mile Point and humidity recorded at the R. B. Sykes residence were compared statistically with equivalent data taken at Rochester. Only minor variations were found between temperature and wind data at the two locations. Humidity at Oswego was slightly higher than at Rochester.

2.3.2 General Climatology

Oswego is in a zone frequented by cyclones from varying directions. These cyclones result in frequent air mass changes, stronger than average winds, a relatively uniform distribution of precipitation throughout the year and generally favorable diffusion conditions.

Summer weather is generally pleasant, with daytime temperatures averaging about 80 F. Only a few days of above-90 F temperature with high humidity occur each year. Thunderstorms occur on the average of one day in five and result in most of the summer rainfall of about 3 inches per month.

Winters are frequently severe. Average temperatures are below freezing from the first of December to mid-March. Winds are relatively high due to the exposure of the site to Lake Ontario.

The most outstanding characteristic of the Oswego climate is the heavy snowfall which averages 1 to 2 ft per month from December through March. The prevailing wind over Lake Ontario, convergence of air near the shoreline, and topographical factors combine to produce the heavy snow. Lake Ontario affects temperatures by delaying the onset of cold weather in late fall and winter and the onset of warm weather in late spring and summer.

2.3.3 Average and Extreme Weather Conditions

Average monthly values of temperature, precipitation and snowfall are shown in Table 2.3-1. Extreme temperatures during the 90-year period ending in 1960 were -23 F and 100 F. The maximum three-day snowfall, 75 to 90 inches, was recorded in 1966. High winds in the Lake Ontario area result from intense winter storms, remnants of tropical storms and severe thunderstorms. A review of wind data recorded at official stations around the lake indicates that the following wind climatology is representative of the site:

Estimated Maximum Winds at Site, mph, Measured 30 Ft Above ground

Return Period (Yr)	5-Min Average	Fastest Mile	Peak Gust
10	60	62	81
50	70	75	95
100	76	82	102

Observed Maximum Winds

Location	5-Min Average	Fastest Mile	Peak Gust
Rochester	60 in 1946	-	-
Buffalo	78 in 1900	-	-
Toronto	-	58 in 1954	78 in 1954
Site	-	-	73 in 1963

Table 2.3-1

Meteorological Averages

Month	Temperature, F*	Precipitation, In.**	Snowfall, In.**
January	25.1	2.70	23.6
February	25.4	2.62	21.4
March	32.6	2.80	12.7
April	44.0	2.72	2.3
May	54.6	2.97	-
June	64.5	2.28	-
July	70.5	2.74	-
August	69.4	2.51	-
September	62.3	2.78	-
October	52.2	3.26	0.4
November	40.8	3.01	7.3
December	29.0	3.17	20.4
Annual	47.5	33.56	88.1

*U.S. Weather Bureau, Rochester, N. Y., 1931-1960.
**U.S. Weather Bureau, Oswego, N. Y., 1884-1960.

2.3.4 Tornado Occurrence

Tornadoes rarely occur in upper and central New York State. Consequently, it is impossible to define a meaningful probability for such an occurrence at the site. All investigators treat the area as substantially devoid of these storms, although a single occurrence is shown on a tornado summary map of the area (Ref. 7). The nearest tornadoes listed as significant occurred in Jamestown in 1945 and in Allegany County in 1920, both about 150 miles to the southwest.

2.3.5 Turbulence Classes

The classification system used to differentiate stack effluent dispersion regimes was based on the directional fluctuations (Brookhaven type) of an aerovane wind instrument mounted at the 203-ft level on the Nine Mile Point meteorological tower. The four turbulence classifications are related to other descriptions of turbulence in the following way:

Niagara Mohawk Class	Pasquill Type	Brookhaven Type	Qualitative Description
I	B	B2	Very Unstable
II	C	B1	Unstable
III	D	C	Neutral
IV	F	D	Stable

The Brookhaven classification is based on turbulence measurements from strip charts of the wind speed and direction. In the absence of onsite wind measurement, the Pasquill classification is widely used as an approximation of turbulent conditions. The Pasquill classification is based on wind speed and cloud cover parameters that are routinely measured at most airports. Of the seven Pasquill classifications (A through G) the four listed above most closely correspond to the four Brookhaven types, except that Brookhaven Class B2 and B1, actually correspond to Pasquill Classes A and B. The modification to B and C is reasonable because turbulence is typically less at the elevation of effective stack effluent release (plume rise plus a physical stack height of 700 ft) than at those heights (30 ft to 200 ft) from which atmospheric stability was determined.

The Niagara Mohawk classifications are defined to be the same as the corresponding Pasquill and Brookhaven classes as listed in the above table. Stability frequency as a function of wind direction is shown in Table 2.3-2.

1910

Table 2.3-2

Annual Stability Frequency of Occurrence
With Respect to Wind Direction

Wind Direction	Frequency of Occurrence of Stability - Percent				
	B	C	D	F	Total
N	0.14	2.60	0.07	0.74	3.55
NNE	0.09	3.62	0.32	0.70	4.73
NE	0.12	2.64	0.23	0.67	3.66
ENE	0.11	1.10	0.03	0.61	1.85
E	0.08	1.34	0.16	0.66	2.24
ESE	0.12	2.70	0.95	0.74	4.51
SE	0.47	4.55	3.62	2.01	10.65
SSE	0.74	3.17	1.74	1.07	6.72
S	0.95	3.31	1.78	0.64	6.68
SSW	0.44	4.04	1.95	0.42	6.85
SW	0.25	4.48	2.81	0.38	7.92
WSW	0.25	7.42	6.12	0.52	14.31
W	0.17	8.15	1.82	1.88	12.02
WNW	0.05	5.12	0.34	0.70	6.21
NW	0.07	3.81	0.22	0.53	4.63
NNW	0.11	2.78	0.06	0.52	3.47
Total	4.16	60.83	22.22	12.79	100.00

2.3.6 Lapse Rates

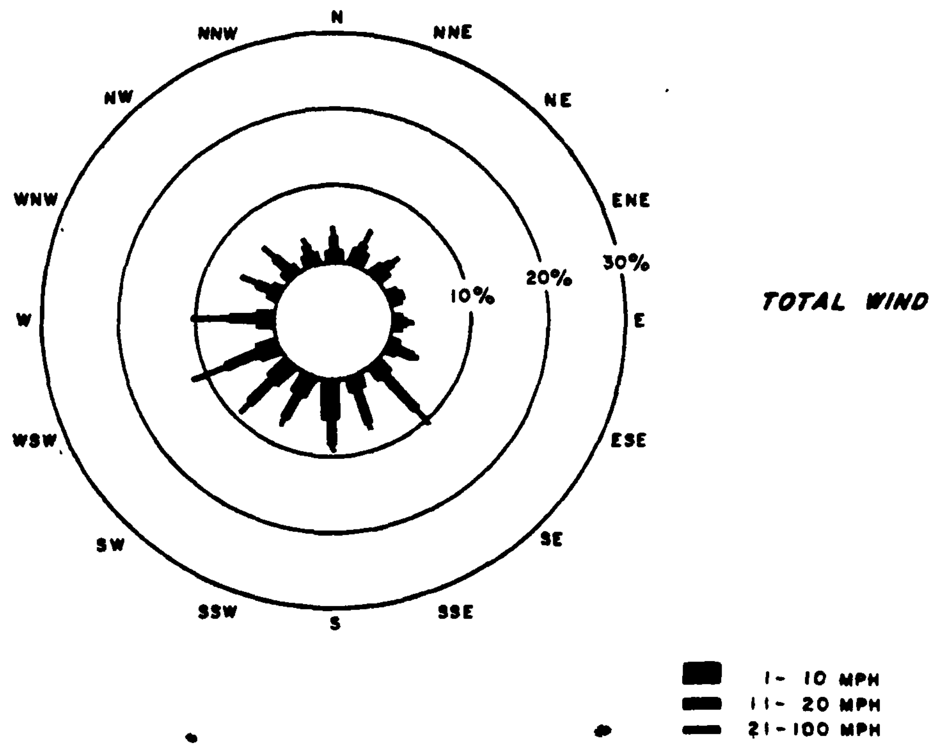
Another measure of stability is the lapse rate measurements taken between the 30- and 203-ft levels on the tower. These are summarized as mean diurnal lapse rates for each month in Appendix B at the end of this Report.

These figures reflect the importance of the lake-land relationship. In the winter months (December, January and February) the mean diurnal lapse rate never passes into the inversion regime. However, in May and June the mean diurnal lapse rate lies in the inversion regime close to 75 percent of the day.

2.3.7 Wind Direction and Speed Distributions

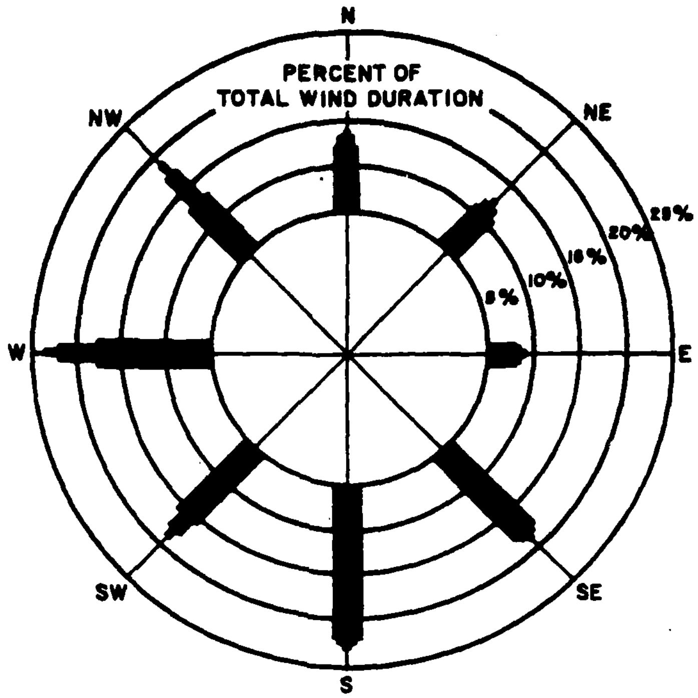
The wind direction and speed distributions are shown in Figure 2.3-1 (based on observations taken on the meteorological tower) and Figure 2.3-2 (based on Coast Guard data). Monthly wind roses based on observations from the meteorological tower are shown in Appendix B at the end of this report.

The overall wind roses, both annual and for individual months, show a decided preference for directions ranging from west through southeast in the southerly sector. No northerly compass point has a frequency as high as 10 percent, except northwest during December. The most prominent peak in the distribution is west-southwest, which becomes especially marked in May and June when the overall frequency reaches more than 20 percent from this direction.



NOTE:
NINE MILE POINT WEATHER DATA

FIG. 2.3-1
AVERAGE WIND ROSES
1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



LEGEND

- ■ 0-12 M.P.H.
- ▬ GREATER THAN 12 M.P.H. AND LESS THAN 25 M.P.H.
- — 25 M.P.H. OR GREATER

WIND DATA BASED ON RECORDS OF THE U.S. COAST GUARD AT OSWEGO, NEW YORK, FOR THE PERIOD JANUARY 1935 TO DECEMBER 1945.

FIG. 2.3-2

WIND ROSE FOR 1936-1945
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

2.4 HISTORY, AND HISTORICAL AND SCENIC SITES

The location of the mouth of the Oswego River on Lake Ontario has made the site significant for commerce ever since Europeans settled in the New World. The first white man to visit the site was Samuel de Champlain in 1616; in the 1650's it served as a station for French Jesuit missionaries. The British established a trading post in 1722 and fortified it in 1727. In 1755 they built Fort Ontario on the lake shore to the east of the river mouth. After being destroyed by the French the following year, Fort Ontario was restored by the British in 1759 and, together with Fort George, which was located on the opposite side of the harbor, dominated the river mouth. Fort George no longer exists, but Fort Ontario was ceded to the United States in 1796 and continued in service as an important U.S. Army post until 1946. It is now a state-owned historic site and museum.

The Port of Oswego was established in 1799. The settlement was incorporated as a village in 1828 and became a city twenty years later. It thrived as the Lake Ontario port of the Erie Canal until the growth of railroads reduced canal and lake traffic in the last quarter of the nineteenth century. The completion of the New York State Barge Canal System in 1917 revived the port activities and, with the opening of the St. Lawrence Seaway in 1959, Oswego became a world port. Oswego is now the steam electric power center of central New York with excellent water supplies for industrial and other uses.

The Oswego City Library, located on East Second Street, was designated a National Register Property in the Federal Register of November 2, 1971. The library, given to the city by Abolitionist Gerrit Smith in 1855, is of architectural interest and is one of the oldest buildings in continuous use as a public library in the country. As of July 1972, there were no registered National Historic Landmarks in Oswego County or in the northern part of Cayuga County, although the Oswego Market House, Fort Ontario, and several other sites are being considered for designation. A list of other historic sites and scenic attractions within ten miles of Oswego follows, based on information from the New York State Historic Trust and the Oswego County Planning Board.

Site Name	Distance from the Plant (Approximately)	Description
Fort Ontario	One mile east on E. 7th St.	Built in 1755, first English foothold in entire Great Lakes region. Rebuilt 1759 and 1839. Just to the east is old military cemetery dating from French and Indian War.

Site Name	Distance from the Plant (Approximately)	Description
Fort Oswego (Fort George)	One mile east	Built by British in 1727 and destroyed by French in 1756. Site marked with stone marker.
Oswego Harbor	One mile east	Most important port on U.S. side of Lake Ontario. Water commerce and milling industry thrived here in latter half of 19th century.
Fruit Valley Community	Five miles west on U.S. Highway 104	Community contains graveyard and burial place of Doctor Mary Walker, noted feminist and winner of Congressional Medal of Honor for serving as Civil War nurse, and also a house reputed to have been a station for the Underground Railroad aiding the escape of fugitive slaves.
The Oswego County Historical Society Museum (Bates House)	One mile east 135 E. 3rd St., at Mohawk St.	Collection of local historical military relics, Victorian furnishings and Civil War period gowns.
Battle Island State Park	Ten miles south on Route 48 in Granby	Site of skirmish between British supply force and a French and Indian scouting force attempting to cut off the forts at Oswego in 1756. Now a State Park with an 18-hole golf course.
The Van Buren House and Van Buren Tavern	Ten miles south off Route 57 in Volney	John Van Buren, a cousin of Martin Van Buren, built a tavern and a brick neoclassical structure in 1796.
State University College	Adjacent to western part of site	Founded in 1861.

No known archeological excavations exist near Oswego.

2.5 TRANSPORTATION

Trasportation facilities serving Oswego, New York are shown in Figure 2.5–1. Docking facilities on Lake Ontario afford easy access to the St. Lawrence Seaway and to the New York State Barge Canal System.

Light planes are available at Fulton Municipal Airport in the Town of Volney, about 10 miles southeast of the plant site. The nearest commercial airport, Hancock Field near Syracuse, is about 35 miles southeast of the plant.

U.S. Route 104 passes through Oswego several hundred yards south of the plant, proceeds eastward to Interstate Highway 81, and westward to Rochester and Niagara Falls. Interstate Route 90 (the New York State Thruway) passes 30 miles south of Oswego, and Interstate Highway 81 passes 20 miles east. Both routes are accessible to Oswego by primary state roads. Future highway plans for the area include an expressway connection from Oswego to Syracuse, although no specific alignment has been selected.

Penn Central Railroad routes from Syracuse and Rochester and an Erie-Lackawana route from Syracuse provide rail service to Oswego. A spur of the Penn Central Railroad provides rail access on the site of the Oswego Steam Station.

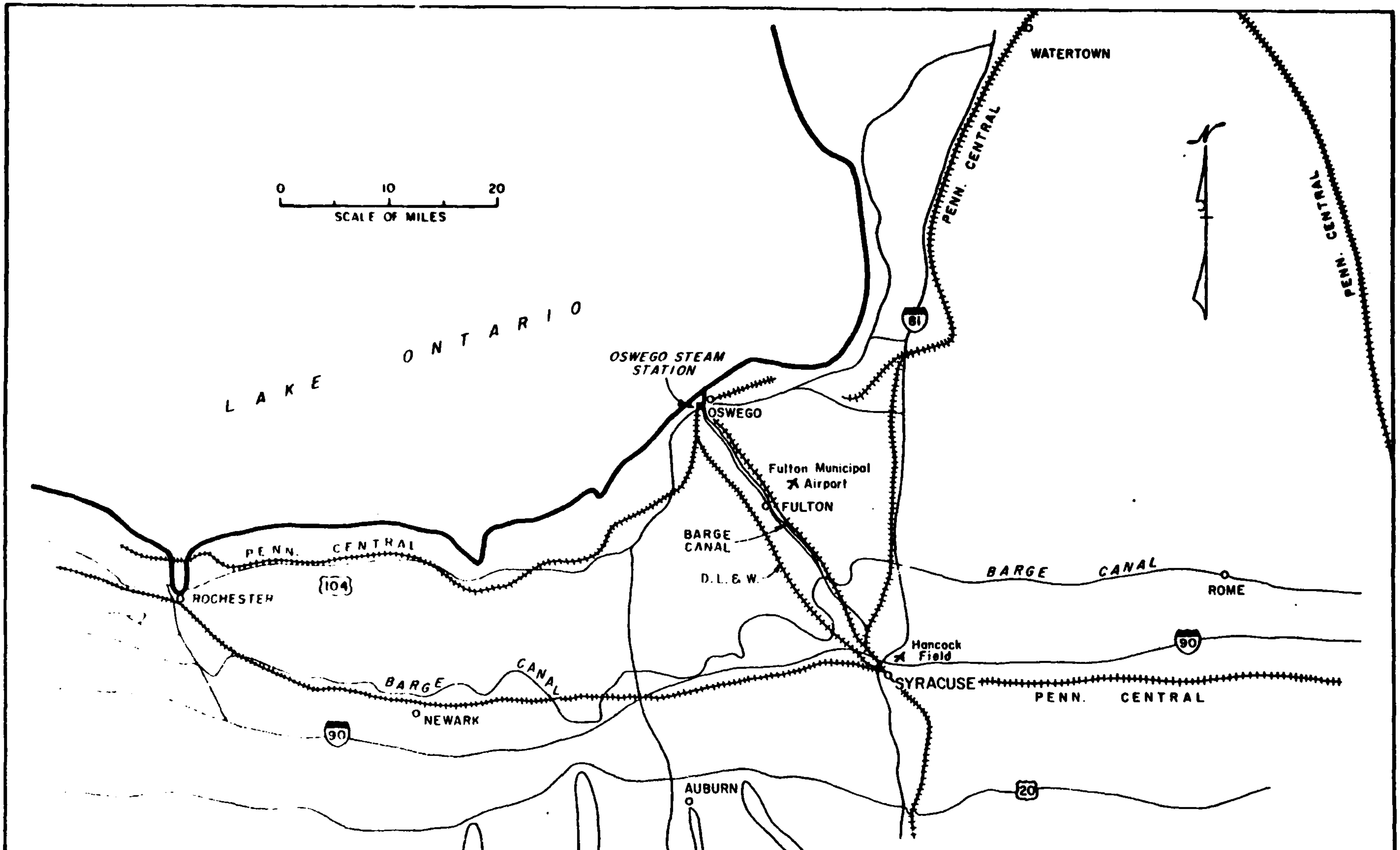


FIG. 2.5-1
TRANSPORTATION MAP
OSWEGO, NEW YORK
NIAGARA MOHAWK POWER CORPORATION

1917

2.6 POPULATION AND LAND USES

2.6.1 Population

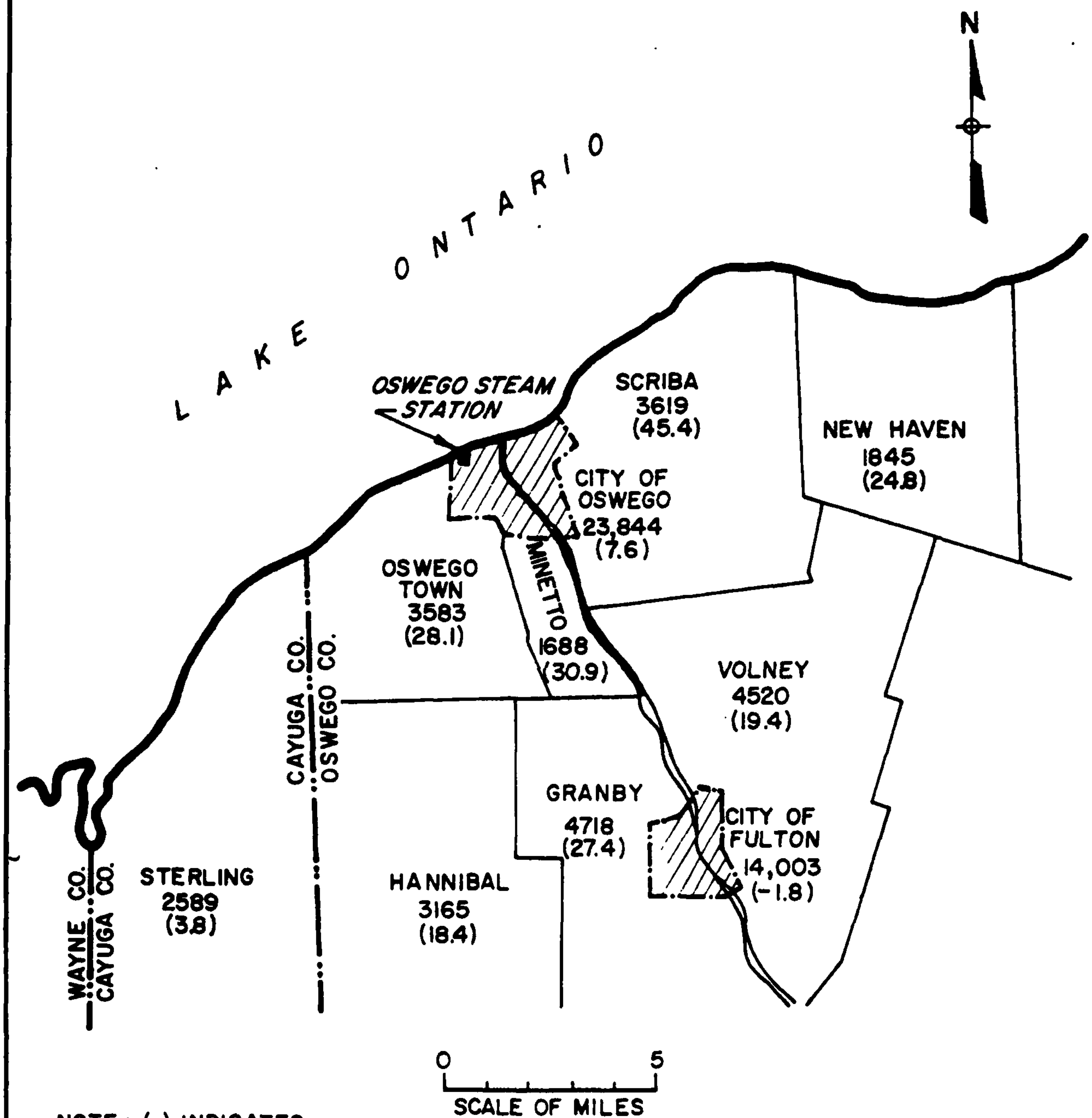
The area surrounding the Oswego Steam Station is neither densely populated nor rapidly increasing in population. All towns within ten miles of the plant lie within Oswego County with the exception of Sterling, which is located to the west in Cayuga County. The 1970 populations of these towns and their locations are indicated in Figure 2.6-1 (Ref. 8).

The populations of nearby communities in Oswego County compiled from U.S. Census Bureau reports for the past 30 years are given below. The area surrounding the City of Oswego is growing somewhat more rapidly than Oswego County as a whole, although the population of the city itself is almost constant. The City of Fulton population has declined in the last ten years.

Oswego County Population Changes

Town	1950	1960	1970
Oswego County	77,181	86,118	100,897
City of Fulton	13,922	14,261	14,003
Granby	2,775	3,704	4,719
Hannibal	2,230	2,673	3,165
Minetto	1,025	1,290	1,688
New Haven	1,259	1,478	1,845
City of Oswego	22,647	22,155	23,844
Town of Oswego	2,106	2,796	3,583
Scriba	2,248	2,489	3,619
Volney	3,106	3,785	4,520

1919



NOTE: ( ) INDICATES PERCENTAGE INCREASE FROM 1960 TO 1970

FIG. 2.6-1

POPULATIONS OF TOWNS AND CITIES WITHIN 10 MILES OF PLANT SITE
1970 FINAL CENSUS COUNTS

NIAGARA MOHAWK POWER CORPORATION

In 1972, the New York State Office of Planning Coordination projected the populations of Oswego and Cayuga Counties (Ref. 9) as follows:

Year	Oswego	Cayuga
1977	101,000	77,000
1980	122,000	82,000
1990	147,000	87,000
2000	178,000	91,000

The 1970 populations were, in fact, 100,897 and 77,439 for Oswego and Cayuga Counties, respectively.

2.6.2 Present and Future Development

The Syracuse Metropolitan area, consisting of Madison, Onondaga and Oswego Counties, is one of the fastest growing areas in upstate New York. The New York State Department of Commerce index of business activity for the area has been rising at an annual average rate of 3.7 percent since 1957 and reached an all time high of 155 in the third quarter of 1969.

In addition to continuing increases in manufacturing activity, the retail and wholesale trade and services, and the transportation, communication and public utility sectors moved upward to meet the needs of increasing population. Figure 2.6-2 compares the growth in the Syracuse Metropolitan Area business activity index with statewide increases and upstate areas generally and Figure 2.6-3 depicts historical and projected employment trends for Oswego County (Ref. 10).

The City of Oswego lies on the south shore of Lake Ontario in Oswego County about 35 miles north of Syracuse. The 1970 population was 23,844 and the land area is about 8 square miles. Frontage along Lake Ontario is about 2 1/2 miles. The Oswego River, which provides a navigable link between Lake Ontario and the Erie Barge Canal across central New York State, divides the city about in half.

Land use within city limits is generally mixed, with retail and commercial use concentrated along West First and Second Streets and East First and Second Streets on either side of the river and along Bridge Street (U.S. Route 104) which passes east and west through the central city about 1/2 mile south of the plant.

The outer portions of the city and the surrounding county land are predominantly rural with flat to moderately rolling terrain and scattered villages and townships. A generalized land use map for the City of Oswego is shown in Figure 2.6-4.

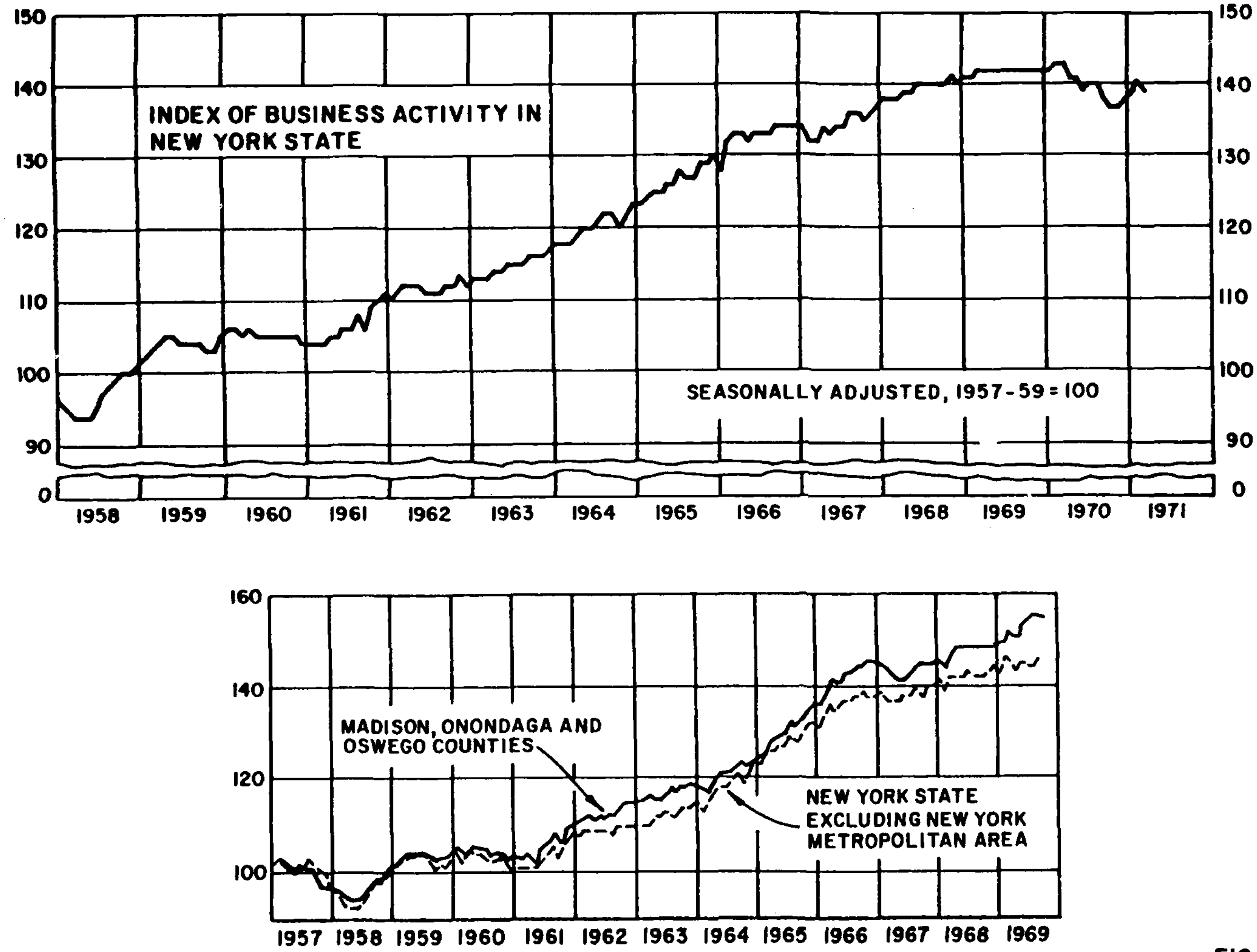


FIG. 2.6-2

INDEXES OF BUSINESS ACTIVITIES
NEW YORK STATE

NIAGARA MOHAWK POWER CORPORATION

1921

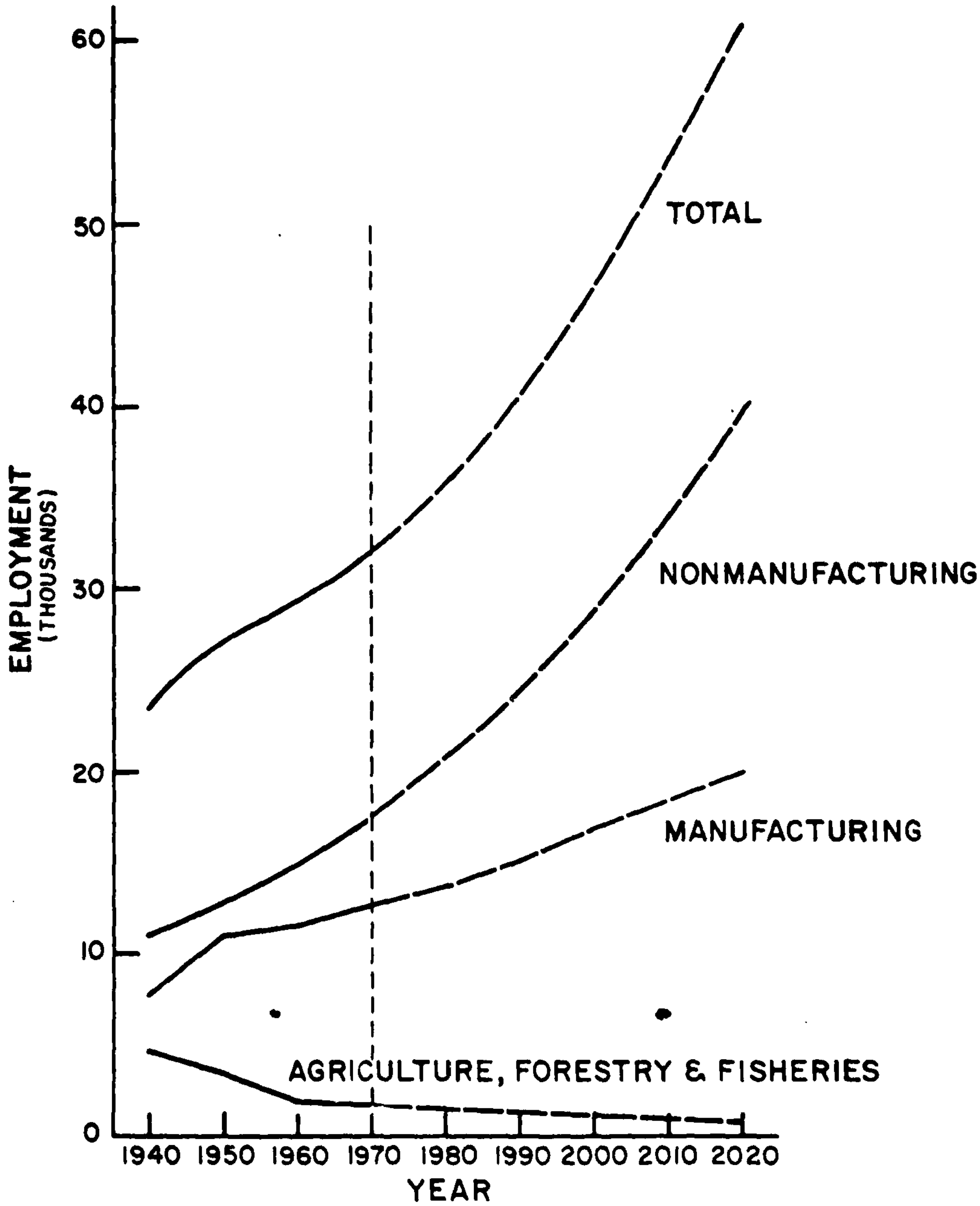


FIG. 2.6-3
HISTORICAL & PROJECTED EMPLOYMENT
OSWEGO COUNTY
NIAGARA MOHAWK POWER CORPORATION

1423

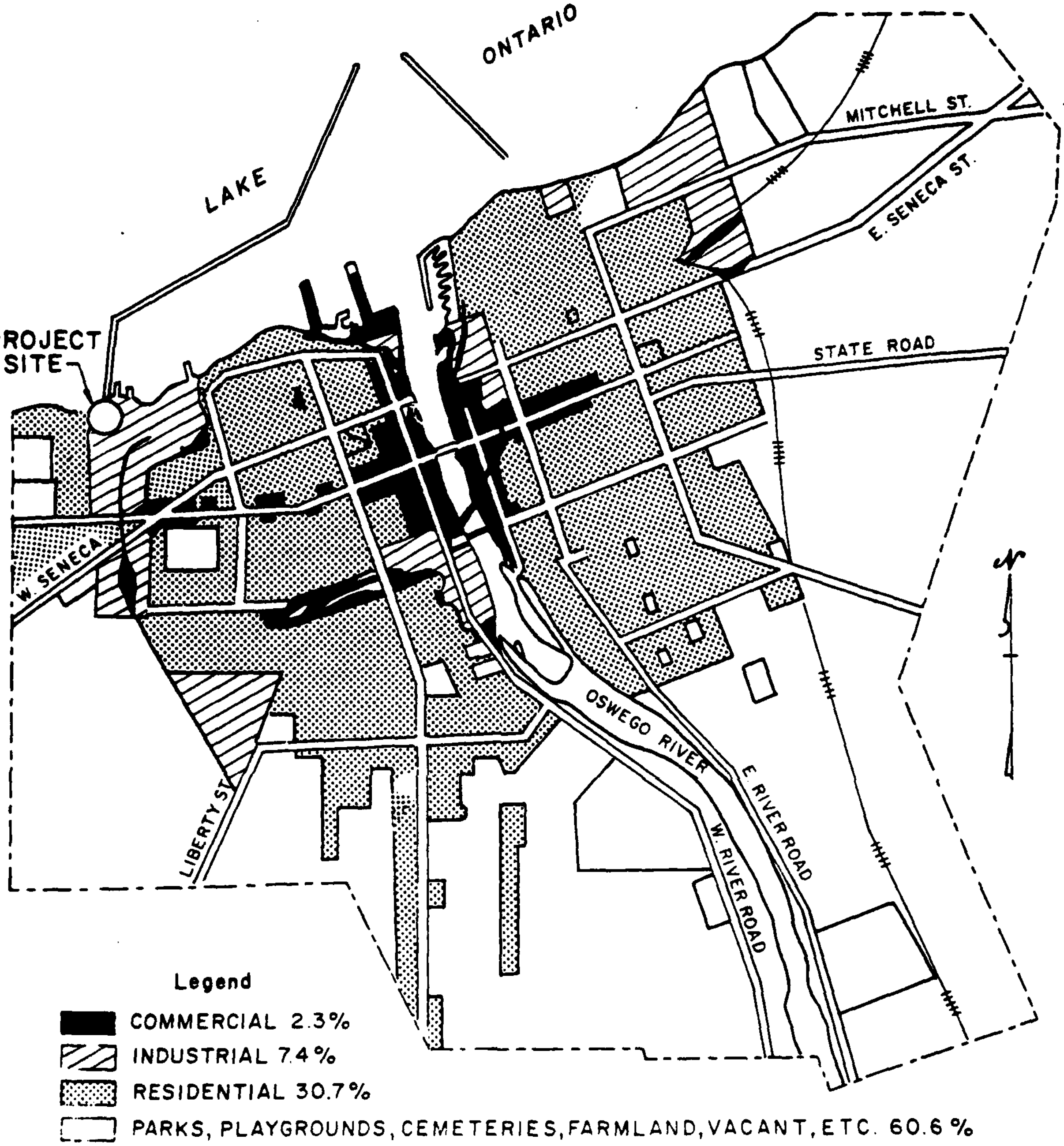


FIG. 2.6-4

GENERALIZED EXISTING LAND USE

CITY OF OSWEGO, NEW YORK

NIAGARA MOHAWK POWER CORPORATION

2.6.3 Industrial

Except for a relatively small area in the southwest section of the city, most of the industrial activity in Oswego is concentrated along or adjacent to the Lake Ontario waterfront and at the mouth of the Oswego River. Types of industry vary, with metal processing and power production predominating.

Industrial use in the city totaled 7.4 percent of the land area in 1957 (Ref. 11).

The U.S. Census Bureau lists 103 industrial establishments in Oswego County in 1967 with a payroll of 48.5 million.

2.6.4 Residential

The heaviest concentrations of population in the city are adjacent to and east and west of the central business district as shown in Figure 2.6-5 (Ref. 11). Residential properties of the lowest values generally are adjacent to land in industrial use. In addition, a relatively large rural nonfarm population is characteristic of this county. About 31 percent of Oswego's area is in residential use. The only apartment-type facility is a State Housing Authority low rent project, Hamilton Homes, which houses 766 persons in 186 units in 28 two-story buildings located southeast of the central business district. Oswego's first high-rise apartment, a 10-story, 100-unit facility for senior citizens, to be located within the Central Business District urban renewal project, is in the preliminary planning stages.

In 1970, there were 6,879 housing units in the city; 4,348 were owner-occupied and 4,614 were single-unit structures. Median value of owner-occupied units was $11,800.

2.6.5 Commercial

Retail sales in the City and County of Oswego in recent years have increased as follows:

	1963 (Ref. 12)		1967 (Ref. 12)		1969 (Ref. 13)	
	City	County	City	County	City	County
Number of Establishments	267	948	252	975	N.A.	N.A.
Sales (Millions of Dollars)	29.6	99.4	38.6	124.7	40.0	127.9

Buying income per household in the city in 1969 was $9,128 (Ref. 13).

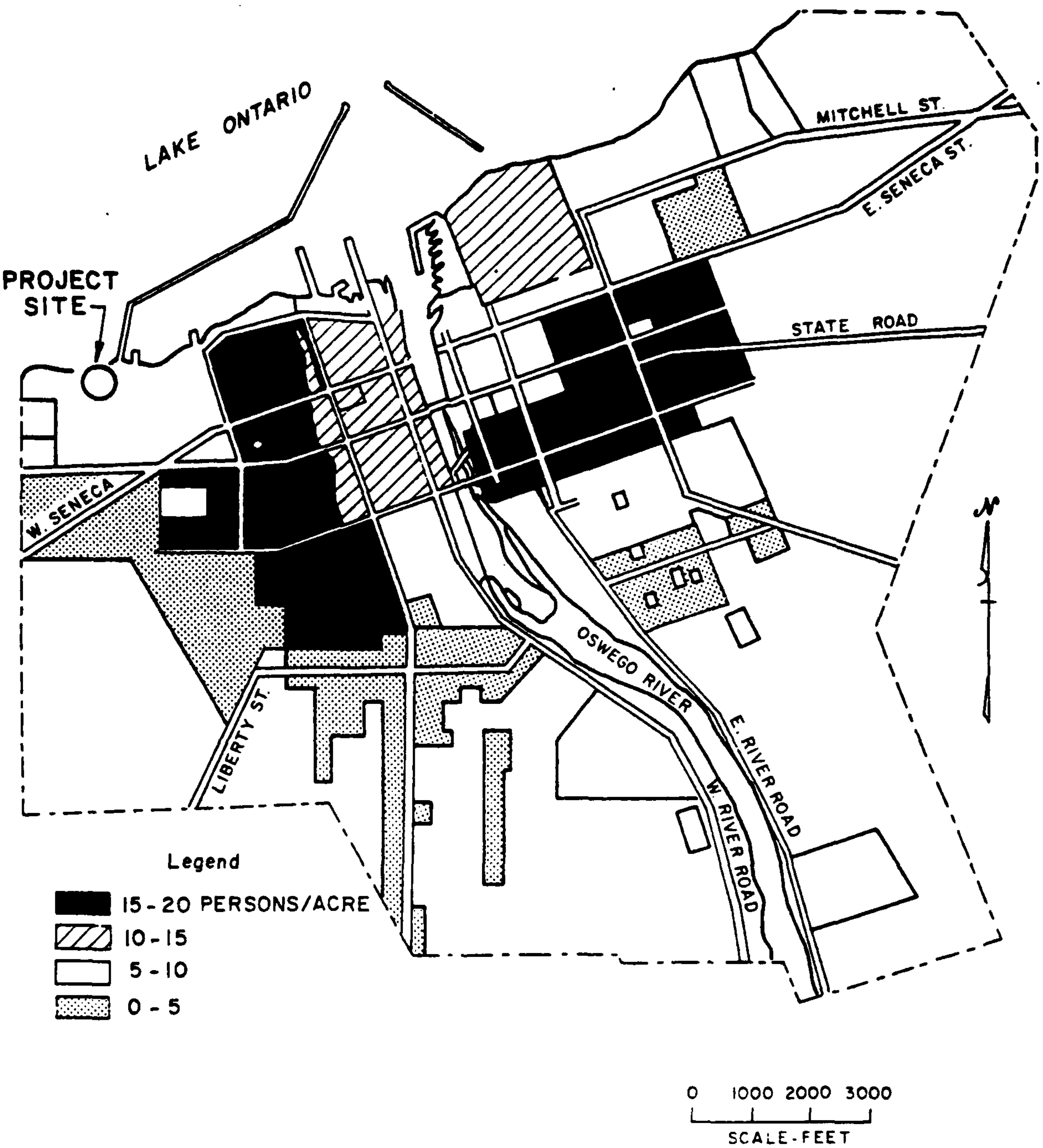


FIG. 2.6-5
POPULATION DENSITY
CITY OF OSWEGO, NEW YORK
NIAGARA MOHAWK POWER CORPORATION

In addition, wholesale sales in the city and county in 1967 amounted to $22 million and $45 million, respectively, according to the U.S. Census Bureau.

2.6.6 Agriculture

Although a small portion of the city remains in agricultural use, the county area surrounding the city contains the primary agricultural activity in the region.

In the last 90 years, land use for farms and agricultural employment has steadily decreased. In 1964, which was the most recent census of agriculture, there were 1,592 farms covering 210,555 acres, which is 34 percent of the county area. The 1960 census indicated that only 1,643 persons were employed in agriculture, which was 8.4 percent of total county employment.

Land use for agriculture is expected to decline further in the future because of increasing urbanization. A study of the economic viability of farm areas published by the New York State Office of Planning Coordination indicates that only limited portions of the county, most of which surround the City of Fulton, nine miles south of Oswego, have high or medium viability. Except for a small area southeast of the city boundary, the land surrounding Oswego has either low viability or is not commercially farmed.

A similiar condition exists in the Lake Ontario waterfront areas west of the city in Cayuga County. Except for apple and pear orchards, a large percentage of land previously farmed has reverted to a natural state. However, the remaining farms produce good yields of onions, lettuce, and strawberries. In the bordering township of Sterling, cropland area is below 23 percent, the lowest in Cayuga County.

2.6.7 Recreation

The Oswego County Planning Commission lists 11 public parks, playgrounds and recreational areas in the city, as shown in Table 2.6-1.

Table 2.6-1

Principal Existing Recreational Facilities

City Of Oswego

Facility	Approximate Acreage	Activities
Fort Ontario	15	Baseball, playground, track, swimming pool, tennis
Leighton School	7	Baseball, football, playground
Fitzhugh Park	3	Baseball, tennis, playground, ice skating
Riley School (Peglow Park)	2	Ballfield, playground, ice skating
East Park	7	Playground
Kingsford Park	5	Ballfield, playground, ice skating rink and pavilion
South Park	4	Baseball, playground
West Park	7	Ballfield, playground
Charles C. Crisafulli Park	3	Ballfield, playground
Veterans Park	3	Passive
Municipal Beach	N.A.	Swimming

Facilities for boating are provided at the privately owned and operated Oswego Marina which has 68 berths and can handle boats up to 100 ft long. During the peak pleasure boating season, from July 15 to August 15, an average of 30 boats stop for overnight berthing. For the remainder of the boating season, average overnight stops vary from 10 to 20 boats.

One campsite is in operation immediately beyond the west boundary of the city on County Route 89.

The nearest State parks to Oswego are all more than five miles distant:

Park	Location	Acreage	Activities
Battle Island	7.5 miles south	240	Golf
Fair Haven Beach	13 miles southwest	861	Beach Picnicking Play fields Camping Boating Fishing Hiking
Selkirk Shores	18 miles northeast	980	Beach Hiking Picnicking Play fields Camping Fishing

There are no Federal or County parks or recreational areas in the vicinity of Oswego and none is planned for the future. However, the Cayuga County Planning Board, in a recent report (Ref. 14), recommends that a conservation strip be established along the Lake Ontario waterfront from Fair Haven to the Oswego County line 6 miles west of the project site.

Figure 2.6-6 shows principal recreational areas and other points of interest in the city.

2.6.8 Institutional and Cultural

The State University of New York has established the State University College at Oswego, at the western edge of the city and situated partly within the city and partly within the Town of Oswego. Before 1948, the University was known as Oswego State Teachers College.

During the past decade, the institution has expanded its programs to function as a general-purpose college of arts and sciences.

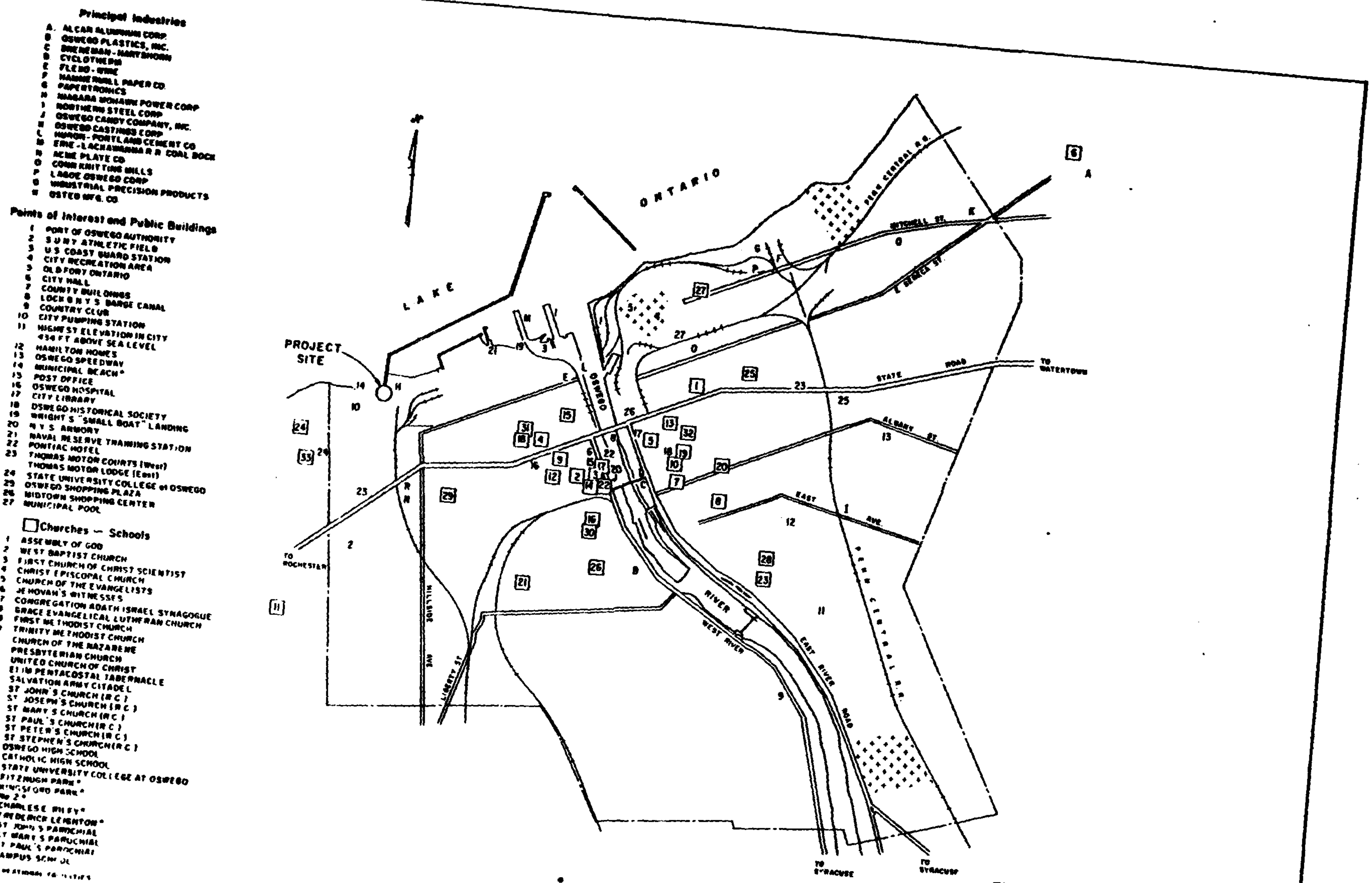


FIG. 2.6-6
COMMUNITY FACILITIES, POINTS OF INTEREST AND INDUSTRIAL ACTIVITIES
OSWEGO, NEW YORK
NIAGARA MOHAWK POWER CORPORATION

1929

The campus now consists of a complex of 32 buildings and related facilities with a total enrollment of 8,650 students, of which 6,000 are full-time and 4,000 are residents.

Three additional residence halls and two dining halls are scheduled for future construction and it is anticipated that enrollment will continue to increase to a projected 11,000 by 1974.

To serve its approximately 24,000 population, there are ten public and parochial schools in the city, including one public and one Catholic high school. Twenty churches and one synagogue are located in or adjacent to the central business district. In addition to the 260,000-volume library at the State University College at Oswego, the city maintains a centrally located, 51,000-volume public library.

There are two hospitals with 236 beds in Oswego County. The Oswego Hospital at 100 W. 6th St. presently has 176 beds and will soon open a 38-bed extended care unit. The Lee Memorial Hospital, with 60 beds, is located in Fulton, about 11 miles south of the plant.

Cultural activities in the City of Oswego include the Oswego Historical Society and the Oswego Arts Center located in the former Quartermaster's Building at Fort Ontario. The Oswego Art Guild, which furthers art appreciation in the City, sponsors several art shows during the year.

2.6.9 Other Community Facilities

The Federal Government maintains a Coast Guard Station in Oswego Harbor and there is also a Naval Reserve Training Station on the Lake Ontario waterfront. A New York State Armory is located in the Central Business District and the Oswego County Office Building and County Courthouse are also in the city.

At the river mouth, the Port of Oswego Authority provides facilities for the docking of ocean vessels and the transfer of cargo for highway and rail shipment. Annual net tonnage handled by the facility for the years, 1968 - 1970, during the shipping season is as follows:

	General Cargo	Bulk Cargo
1970	10,734	56,967
1969	9,421	38,208
1968	18,548	67,846

The recently constructed docks are capable of servicing vessels which can navigate the St. Lawrence Seaway.

2.7 TERRESTRIAL ECOLOGY

2.7.1 Plant Site

The Oswego Steam Station site is located in an industrially zoned area of the city adjacent to Oswego Harbor. Most of the surrounding land has been developed. There is an open field on the site south of the main powerhouse buildings of about 20 acres which is covered with low grassy and herbaceous vegetation.

2.7.2 City of Oswego Environs

The area surrounding the City of Oswego supports diverse vegetative species and associated animal species.

The plant site is located in a portion of Oswego County referred to as the Oneida Plain, which is characterized by low undulating land comprised of heavy soils. Much of the land has been cleared in the past for farming but over half of the farm land in the county has been abandoned. The vegetation of the region provides an ideal habitat for woodcock (Philohela minor), cottontail rabbits (Sylvilagus floridanus), ruffed grouse (Bonasa umbellus) and gray squirrel (Sciurus carolinensis). There are a few white-tail deer (Odocoileus virginianus) and ring-neck pheasant (Phasianus colchicus). Furbearers, including raccoon (Procyon lotor), muskrat (Ondatra zibeticus), mink (Mustela vison), red fox (Vulpes fulva), and skunk (Mephitis mephitis) are also found in the area.

The area up to a few miles from the plant site was examined to determine qualitative descriptions of the dominant habitat types in the vicinity of Oswego. Three principal stages of secondary land succession could be identified in the area: abandoned pasture or field in the early stages of succession, overgrown pasture or field in later stages of succession, and mature forested areas. In addition to these broad land groupings, four areas of special interest were identified: powerline rights-of-way, marshland, the campus of the New York State University College at Oswego, and muck farms.

2.7.2.1 Abandoned Pastures and Fields

In past years dairy farming was a primary industry on the uplands, but the farms did not prosper due to the relatively poor soil conditions, and the pastures were abandoned. Many of the pastures, instead of supporting edible grasses, are being invaded by various undesirable species, such as thistle (Cirsium), blackberry (Rubus allegheniensis), and hawthorn (Crataegus). The pasture edges support varied trees and shrubs which, in the absence of domestic animals, invade the open areas. Poplar (Populus), black cherry (Prunus serotina), American elm (Ulmus americana), and staghorn sumac (Rhus typhina) are typical of the woody species encountered in hedgerows surrounding the fields.

Much of the land surrounding Oswego is in this early stage of succession. When open land is abandoned, a great variety of herbaceous plants invade the area. The exact species composition will vary slightly from field to field but some of the following dominant species can be identified at most sites: Chicory (Cichorium intybus), goldenrod (Solidago), asters (Aster) and Queen Anne's lace (Daucus carota). In fields that have been abandoned for a longer time, some low woody species can be seen along with the herbaceous growth: blackberry, raspberry (Rubus sp.), wild grape (Vitis) and purple nightshade (Solanum dulcamara). This stage of vegetation is low and dense and is used extensively by insects. Some of the plant species are in flower during most of the summer and fall, providing pollen and nectar for food as well as protection for insects.

2.7.2.2 Overgrown Pastures and Fields

There is no distinct separation between abandoned and overgrown pastures and fields in this stage of succession but rather a gradual transition from one to the other. Woody vegetation becomes dominant, shading the herbs and grasses causing many to die out due to lack of sunlight. Some of the small transition trees that invade the open areas are hawthorn, poplar, staghorn sumac and alder (Alnus sp.). Young trees of the species that will comprise the mature forest in the area are also evident at this stage and include black cherry, red maple (Acer rubrum), sugar maple (Acer saccharum), white ash (Fraxinus americana), American elm, and basswood (Tilia americana).

2.7.2.3 Powerline Right-of-Way

The existing transmission line right-of-way from Maple Avenue to the station was examined to determine the major plant communities occupying this area. Two stages of plant succession, abandoned pasture and fields, and overgrown land, characterize the vegetation on most of the area. The abandoned pasture and fields are characterized by low (2-4 ft high) perennial vegetation. Some of the dominant plant species in this type of habitat include goldenrod, asters, chicory and Queen Anne's lace. The woody species in this successional stage include black-cap rasberry (Rubus occidentalis), red rasberry (Rubus idaeus), blackberry and grape. The overgrown land stage is a transitional stage following abandoned fields and is characterized by more shrubs, and young trees. Many of the perennial species found on abandoned pasture and fields are also present but are gradually replaced by shrubs, such as gray dogwood (Cornus racemosa), arrowood (Viburnum sp.), staghorn sumac and buckthorn (Rhammus sp.). These areas are also being invaded by young tree species including apple (Pyrus malus), white ash (Fraxinus americana), black cherry, and red maple (Acer rubrum).

The transmission line also passes through a low area of cattail (Typha latifolia) marsh. Other abundant plant species include sensitive fern (Onoclea sensibilis), jewelweed (Impatiens capensis) and sedges (Cyperaceae). Shrubs surrounding the marsh include alder and buttonbush (Cephalanthus occidentalis). Higher areas support some large trees including red maple, willow (Salix sp.) and white ash.

The terrestrial areas adjacent to the existing right-of-way are very similar in species composition to the right-of-way. The topography, soil, and climate in this section of the county are very similar as well as having been previously cleared for farming. As such, the adjacent lands are primarily in the abandoned pasture and field and overgrown land stages of succession.

2.7.2.4 Mature Forests

Very few mature forested areas exist within two miles of the plant site. Of these, two distinct forested areas were examined and probably represent the later stage of succession for this region. The more upland, drier sites are dominated by species of red oak (Quercus rubra), American beech (Fagus grandifolia), white ash, basswood, and black cherry. Ground cover in this forest was moderate, consisting primarily of bracken fern (Pteridium aquilinum), false Solomon's seal (Smilacina racemosa), and greenbriar (Smilax rotundifolia).

The more poorly drained, wetter areas are dominated by red maple forest, a tree that is able to tolerate flooding for part of the year. White ash, sugar maple, cherry, basswood, and elm are also represented in these areas. The groundcover consists of sarsaprilla (Aralia nudicaulis), sensitive fern, and partridge berry (Mitchella repens).

2.7.2.5 Marsh Lands

There are many marshy areas in the region which support distinct species of vegetation adapted to living in shallow water. Vegetation was examined at the lower end of Rice Creek two miles west of the site and on the marshy site between the Penn Central and the Erie-Lackawanna railroad tracks, 1 1/2 miles south-southeast of the site. These two areas had many plant species in common. The major difference was that the Rice Creek area was dominated by buttonbush (Cephalanthus occindentalis) while the marsh between the railroad tracks was dominated by cattails.

Other important species found in the marsh areas were rushes (Juncareae) and sedges (Cyperaceae), sensitive fern, purple loosestrife (Lythrum salicaria), red osier dogwood (Cornus stolonifera), pickerelweed (Pontederia cordata), arrowhead (Sagittaria), and the tiny floating aquatic duckweed (Lemna minor).

1934

2.7.2.6 College Campus

The college campus borders the west side of the plant site and is of particular interest due to the altered condition of the landscape. The campus is a man-made setting of spacious mowed lawns which are interspersed with a great variety of native and exotic trees and shrubs. The most abundant trees are the Norway maple (Acer platanoides) and the Lombardy poplar (Populus nigra), which is represented by mature poplars and extensive plantings of young trees. Sugar maple, white oak (Quercus alba), red pine (Pinus resinosa) and Scotch pine (Pinus sylvestris) are also growing on the campus.

2.7.2.7 Muck Farms

Muck soils derive from accumulated decomposing marsh vegetation. Their extreme fertility permits cultivation of high cash crops. Onions are the primary crop grown on muck soils in the Oswego area. Several small muck farming operations are found west and south of Oswego.

A complete list of plants and animals identified in the site area is given in Table 2.7-1.

Table 2.7-1

List of Identified Plants and Animals

Abandoned Pastures and Fields

milkweed	(Asclepias sp.)
chicory	(Cichorium intybus)
buttercup	(Ranunculus sp.)
daisy	(Chrysanthemum leucanthemum)
Queen Anne's lace	(Daucus carota)
goldenrod	(Solidago sp.)
aster	(Aster sp.)
ragweed	(Ambrosia artemisifolia)
day-lily	(Homerocallis fulva)
black-eyed susan	(Rudbeckia hirta)
mullein	(Verbascum thapsus)
thistle	(Cirsium sp.)
pokeweed	(Phytolacca americana)
purple-flowering raspberry	(Rubus odoratus)
grape	(Vitis sp.)
purple nightshade	(Solanum dulcamara)
blackberry	(Rubus allegheniensis)
raspberry	(Rubus sp.)
yarrow	(Achillea millefolium)

Table 2.7-1 (Continued)

Overgrown Pasture and Field

The previously mentioned plants are being dominated by the following woody species.

alder	(*Alnus sp.*)
hawthorn	(*Crataegus sp.*)
poplar	(*Populus sp.*)
staghorn sumac	(*Rhus typhina*)
apple	(*Pyrus malus*)
pear	(*Pyrus communis*)
ironwood	(*Ostrya virginiana*)
willow	(*Salix sp.*)

Young trees of the species listed in the following section are starting to appear.

Mature Forest

Upland mixed hardwood forest

a. trees

red oak	(*Quercus rubra*)
beech	(*Fagus grandifolia*)
black cherry	(*Prunus serotina*)
white ash	(*Fraxinus americana*)
basswood	(*Tilia americana*)
red maple	(*Acer rubrum*)
sugar maple	(*Acer saccharum*
cottonwood	(*Populus deltoides*)
American chestnut	(*Castanea dentata*)
American elm	(*Ulmus americana*)
willow	(*Salix sp.*)

b. ground cover

bracken fern	(*Pteridium aquilinum*)
false-Solomon's seal	(*Smilacina racemosa*)
greenbriar	(*Smilax rotundifolia*)

1936

Table 2.7-1 (Continued)

Lowland forest

a. trees

red maple	(*Acer rubrum*)
white ash	(*Fraxinus americana*)
black cherry	(*Prunus serotina*)
apple	(*Pyrus malus*)
basswood	(*Tilia americana*)
sugar maple	(*Acer saccharum*)
American elm	(*Ulmus americana*)
beech	(*Fagus grandifolia*)
hemlock	(*Tsuga canadensis*)
hawthorn	(*Crataegus sp.*)

b. ground cover

sarsaprilla	(*Aralia nudicaulis*)
sensitive fern	(*Onoclea sensibilis*)
other ferns	(*Driopteris sp.*)
bracken fern	(*Pteridium aquilinum*)
partridge berry	(*Mitchella repens*)

Marsh areas

buttonbush	(*Cephalanthus occidentalis*)
pickerelweed	(*Pontederia cordata*)
sedges	(*Cyperaceae*)
arrowhead	(*Sagittaria sp.*)
cattail	(*Typha latifolia*)
duckweed	(*Lemna minor*)
purple loosestrife	(*Lythrum salicaria*)
sensitive fern	(*Onoclea sensibilis*)
rush	(*Juncus effusus*)
willow	(*Salix sp.*)
alder	(*Alnus sp.*)
red osier dogwood	(*Cornus stolonifera*)
water plantain	(*Alisma plantago-aquatica*)
horsetail	(*Equisetum sp.*)
touch-me-not	(*Impatiens capensis*)

Table 2.7-1 (Continued)

State University College Campus

trees

Lombardy poplar	(*Populus nigra*)
Norway maple	(*Acer platanoides*)
tulip tree	(*Liriodendron tulipifera*)
paper birch	(*Betula papyrifera*)
willow	(*Salix sp.*)
basswood	(*Tilia americana*)
red oak	(*Quercus rubra*)
white ash	(*Fraxinus americana*)
Scotch pine	(*Pinus sylvestris*)
red pine	(*Pinus resinosa*)
scarlet oak	(*Quercus coccinea*)
cottonwood	(*Populus deltoides*)
American elm	(*Ulmus americana*)
white cedar	(*Thuja occidentalis*)
spruce	(*Picea sp.*)
domestic cherry	(*Prunus sp.*)
red maple	(*Acer rubrum*)
white oak	(*Quercus alba*)
sugar maple	(*Acer saccharum*)

open field (Plant proper)

orchard grass	(*Dactylis glomerata*)
timothy	(*Phleum pratens*)
chicory	(*Cichorium intybus*)
red clover	(*Trifolium pratens*)
white clover	(*Trifolium repens*)
dandelion	(*Taraxacum officinale*)
mullein	(*Verbascum thapsus*)
goldenrod	(*Solidago sp.*)
aster	(*Aster sp.*)
ragweed	(*Ambrosia artemisifolia*)
Queen Anne's lace	(*Daucus carota*)
sedges	(*Cyperaceae*)
thistle	(*Cirsium sp.*)

Animals

Birds

bluejay	(*Cyanocitta cristata*)
barn swallow	(*Hirundo rustica*)
catbird	(*Dumetella carolinensis*)
kingfisher	(*Megaceryle alcyon*)
red-winged blackbird	(*Agelaius phoeniceus*)
purple grackle	(*Quiscalus quiscula*)

Table 2.7-1 (Continued)

canada goose	(*Branta canadensis*)
house sparrow	(*Passer domesticus*)
kingbird	(*Tyrannus tyrannus*)
robin	(*Turdus migratorius*)
killdeer	(*Charadrius vociferus*)
goldfinch	(*Spinus tristis*)
herring gull	(*Laurus argentatus*)
crow	(*Corvus brachyrhynchos*
rock dove	(*Columbo livia*)
wood thrush	(*Hylacichla mustelina*)
starling	(*Sturnus vulgaris*)
yellow shafted flicker	(*Colaptes auratus*)
mourning dove	(*Zenaidura macroura*)
red-tailed hawk	(*Buteo jamaicensis*)
little green heron	(*Butorides virescens*)
downy woodpecker	(*Dendrocopos pubescens*)
black capped chickadee	(*Parus atricapillus*)
eastern meadowlark	(*Sturnella neglecta*)
sparrow hawk	(*Falco sparverius*)
ringneck pheasant	(*Phasianus colchicus*)
Mammals	
cottontail rabbit	(*Sylvilagus floridanus*)
red squirrel	(*Tamiasciurus hudsonicus*)
chipmunk	(*Tamias striatus*)
muskrat	(*Ondatra zibethicus*)
woodchuck	(*Marmota monax*)
Reptiles	
eastern painted turtle	(*Chrysemys picta*)
Amphibians	
grass frog	(*Rana pipiens*)
bull frog	(*Rana catesbeiana*)
green frog	(*Rana clamitans*)
pickerel frog	(*Rana palustris*)

2.8 WATER USES

2.8.1 City of Oswego

The major user of Lake Ontario water in the vicinity of Oswego, other than the Oswego Steam Station, is the City of Oswego. The city's water supply intake is located about a mile from the proposed Unit 6 intake and about 6,500 ft out in the lake at a depth of 54 ft. Average 1970 water withdrawal from the lake for city use was 17 million gallons per day (mgd). The City of Oswego plans to continue using this source to supply the Oswego area through the year 2020. About 6,300 of the population of the City of Oswego and a 4,000 resident college population are now served by the City's 1.6 mgd West Side Sewage Treatment Plant which discharges directly into the harbor area after primary treatment of the effluent (Ref. 15). A new eastside treatment plant with a 3-mgd capacity has recently been placed in operation. The facility provides secondary treatment and serves a population of 9000. The remainder of the effluent from the City's combined storm and sanitary system is discharged directly into the Oswego River and Lake Ontario. However, complete renovation and expansion to a plant capacity of 4 mgd is now under construction at the westside plant, and secondary treatment, as well as phosphate removal, will be provided when this work is completed.

2.8.2 Metropolitan Water Board

The Metropolitan Water Board of Onondaga County is permitted by agreement with the city to draw up to 62.5 mgd through the city intake. By about 1980 the Onondaga County Water District (OCWD), administered by the Metropolitan Water Board, is expected to exceed its agreed-upon maximum supply through the Oswego intake. The Onondaga County Water Report recommends that a second intake, to be constructed off Burt Point west of the existing intake, be available for use by that date.

Furthermore, the construction of a third intake to meet Onondaga County demands by the year 2020, to be located at West Nine Mile Point in Cayuga County, about 7-1/2 miles northeast of the Oswego Steam Station is recommended. No schedule for construction of this intake is given, but presumably it would begin about 1990, when the capacity of the second intake off Burt Point will have been reached.

Present and projected peak public water demands to be supplied through these intakes by both Onondaga County (Ref. 16) and the City of Oswego (Ref. 17) are as follows:

User	Peak Water Demand (mgd)		
	1970	1990	2020
City of Oswego	17	27	43
Metropolitan Water Board	36(1)	164(2)	416(3)

(1) Present capacity of water delivery system

(2) 62.5 mgd from Oswego intake, remainder from Burt Point

(3) 62.5 mgd from Oswego intake, remainder from Burt Point and West Nine Mile Point

2.8.3 Existing Power Generation

The existing generating Units 1 through 4 at the Oswego Power Station draw a total of 492 mgd of Lake Ontario water for cooling and other needs. A flat, octagonal intake structure is located about 550 feet offshore at a depth of about 13 feet, with an intake tunnel running beneath the harbor breakwater to the station. With the completion of Unit 5 in October, 1974, an additional 410 mgd of water will be drawn from the lake. A circulating water intake structure similar to that for Units 1-4 will be situated 850 feet from the lake shoreline to serve Unit 5.

The heated water from the Units 1-4 condensers is discharged into the harbor at low velocity from a sluice gate located at the shoreline. This discharge provides substantial dilution to the Oswego West Side Sewage Treatment Plant primary effluent which is discharged to the west basin. Furthermore, the discharge velocity is sufficient to scour light organics contained occasionally in the effluent. The buildup of inorganic silt in the harbor area is also limited as a result of scouring from the station discharge jet, thus reducing the amount of periodic dredging required to maintain navigable channel depths. The circulating water discharge structure for Unit 5 will consist of 12 diffuser nozzles located about 1,400 feet from the shoreline.

In addition to the Oswego Station, Niagara Mohawk has a nuclear power station at Nine Mile Point, about 7-1/2 miles northeast of the Oswego River, which requires a maximum of 388 mgd withdrawal and return to Lake Ontario. The unit has been operating since 1969 and has a net electrical output of 610 MWe. An additional nuclear-fueled unit having an electrical generating capacity of 1,100 MWe has been proposed; it would begin commercial operation in 1978 and utilize 711 mgd of lake water.

The Power Authority of the State of New York is also constructing a nuclear power plant on the shore of Lake Ontario 8 miles northeast of Oswego River to be called the James A. FitzPatrick Nuclear Power Plant. When this plant begins operation in 1973, it will generate about 820 MWe of electricity and will draw 533 mgd from Lake Ontario for its circulating water system.

2.8.4 Industrial

Of the 42 industrial establishments in the City of Oswego, only the Alcan Aluminum Corporation draws any significant amount of water directly from the lake. Alcan's plant is located about 4 miles east of the Oswego River, and normal use is 8.5 mgd. Alcan provides secondary sewage treatment through a 10,000-gpd plant prior to discharge to Lake Ontario for removal of chemical wastes and plant sanitary wastes. The remainder is discharged to the lake without treatment at a mean temperature rise of 5 F above ambient.

1942

2.9 AQUATIC ECOLOGY

The geology and topography of the shore of Lake Ontario have a marked bearing on the ecology of the lake in the Oswego area. Borings, fathometric surveys, and direct observation by divers were made at seven transects perpendicular to the shore from a point 6,000 ft west of the existing steam station to the outer end of the turning basin breakwater, 6,000 ft east of the station. These transects were extended a distance of 2,000 ft offshore where the lake depth is about 40 ft and are shown in Figure 2.9-1.

Bedrock in this area is Oswego sandstone which is covered in some places with an overburden of glacial till which is a preconsolidated heterogeneous mixture of gray brown silt, sand, gravel and boulders. In some places, the exposed bedrock has weathered to broken rhomboidal slabs, roughly 4 ft by 5 ft.

Immediately to the west of Oswego Steam Station, the bottom is composed of rounded glacial boulders up to 12 inches in diameter. In some places, notably near the eastern end of the breakwater, the combination of river and lake currents has deposited considerable amounts of sand.

From the standpoint of the ecology of the lake, the area is unproductive of rooted vegetation. As will be detailed in a subsequent section, the rock surfaces provide attachment for some filamentous algae down to depths at which reduced light penetration limits growth.

The west (turning) basin and harbor area within the Corps of Engineers' breakwater act as a mixing area for Oswego River inflow and for condenser cooling water (lake water) discharged from Units 1 to 4. The ecology of Oswego Harbor and the west basin is determined in large measure by the water quality of tne Oswego River discharge.

Stream pollution surveys, conducted during 1954-57 by the New York State Department of Health on the various streams and lakes in the Oswego Basin indicated widespread discharges of sanitary sewage, industrial wastes, and partially treated sewage and industrial waste effluents (Ref. 18). In some of the smaller streams, the development of septic conditions indicated that the waste assimilative capacity of the stream had been exceeded.

The Water Quality Surveillance Unit of the New York State Department of Environmental Conservation (DEC) monitors the water quality of the Oswego River at Hinmansville, midway between Baldwinsville and Fulton. The cumulative record of the principal parameters determined by this monitor for the period January 1, 1964, to August 1, 1970, is summarized in Table 2.9-1. The tabulated values are the median and decentile observations. In the following paragraphs the interdecile range (10 percent -

90 percent values) has been used to characterize the variability of certain constituents. Certain parameters, like total alkalinity, that are characteristic of the natural surface water runoff show a narrow spread (103 to 134 milligrams per liter [mg/l]). Other parameters show a marked variation and can probably be related to flow. The suspended solids that are erosional products, including scoured sludge banks of polluting material, vary by more than a factor of 4, from 10 to 46 mg/l. Dissolved solids do not respond as widely to flow variation and vary by a factor of 2, from 489 to 1,067 mg/l.

The upstream contamination of the river with sewage discharges is evidenced by total coliform bacteria counts, ranging from a most probable number (MPN) of 930 to 4,600 organisms per 100 ml. The concomitant chemical parameters of previous pollution, notably nitrates (0.15 to 0.69 mg/l) and phosphates (0.08 to 0.21 mg/l), vary by about a factor of four. These constituents represent the principal nutrients upon which the productivity of the harbor and west basin depend. A survey of the river conducted between July and November 1970 indicated that the daily weight of nitrates discharged to the harbor varied from a low of 35 to a high of 244 tons per day.

The New York State Department of Environmental Conservation monitors the water quality of the lake as drawn into the Oswego City water supply intake 6,500 ft offshore at a depth of 40 ft. The 6-year cumulative record of this monitor is shown in Table 2.9-2. The same water quality parameters and the same median and percentile concentrations are tabulated as in Table 2.9-1.

Additional water samples were collected monthly from Lake Ontario from April through November 1972 from the surface and bottom at two stations and from the intake and discharge bays of the existing steam station. The location of these stations in the lake as well as the location of the gill nets and trawls are shown in Figure 2.9-1. Water quality data available from the 1972 survey are presented in Table 2.9-3. The data in this table are the high and low values for each parameter measured from April through August 1972.

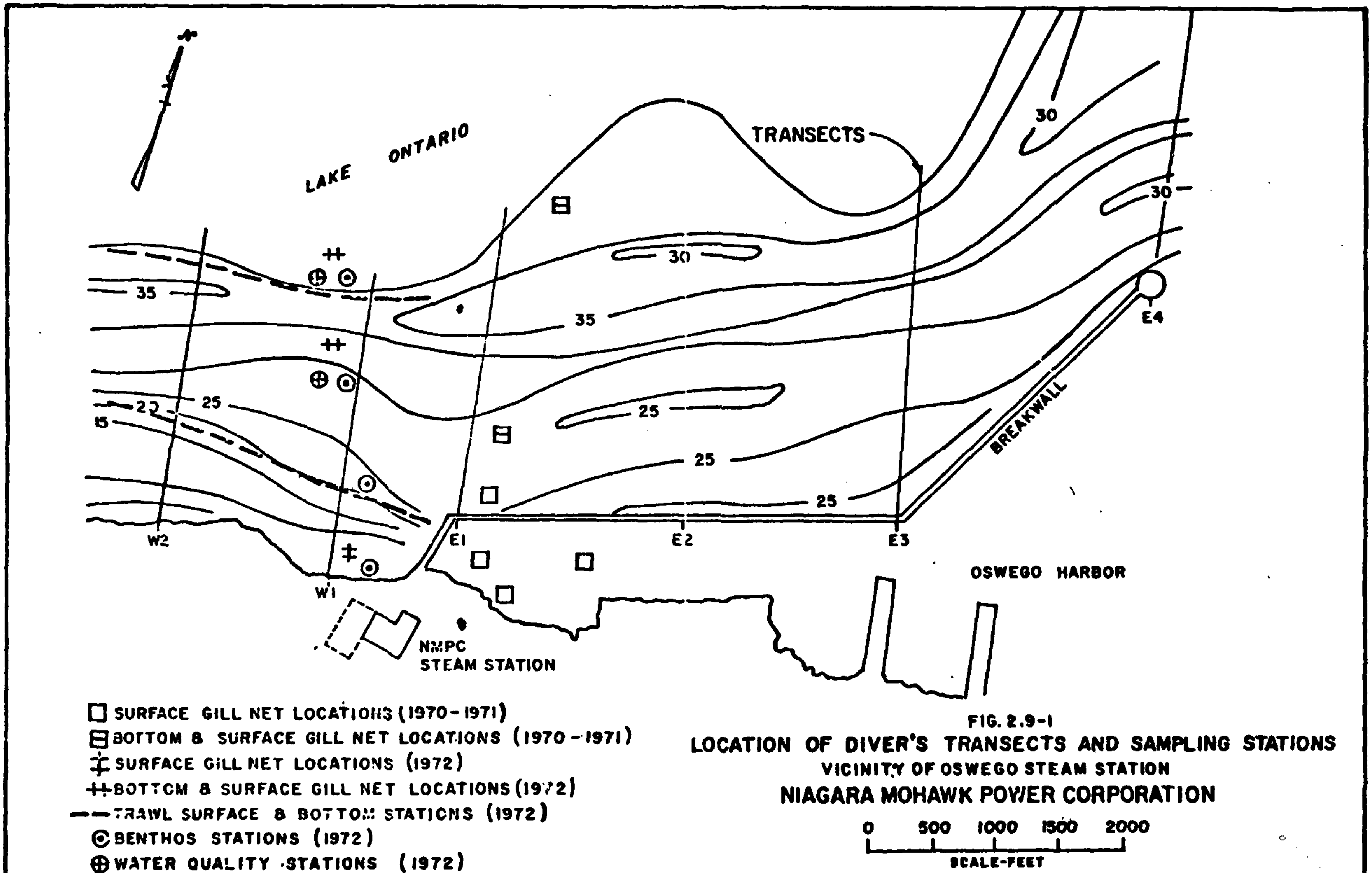


FIG. 2.9-1

LOCATION OF DIVER'S TRANSECTS AND SAMPLING STATIONS

VICINITY OF OSWEGO STEAM STATION

NIAGARA MOHAWK POWER CORPORATION

1944

1945

Table 2.9-1

Oswego River Water Quality at Hinmansville,
Midway Between Baldwinsville and Fulton

Cumulative Record: 1964 to 1970

Parameter	Percentage Frequency of Observations 10%	Median 50%	90%
Color	11	25	35
Turbidity	6.4	15.0	21.6
Water Temperature, F	33.8	59.5	75.8
DO, mg/l	7.5	9.7	11.8
DO, % saturation	79.0	90.0	105.5
BOD (5 Day)	1.5	2.5	4.0
Total Hardness, mg/l	221	320	394
Total Alkalinity, mg/l	103	114	134
Ammonia Nitrogen (N), mg/l	0.108	0.600	1.108
Organic Nitrogen (N), mg/l	0.32	0.56	1.01
Nitrite Nitrogen (N), mg/l	0.012	0.021	0.044
Nitrate Nitrogen (N), mg/l	0.15	0.32	0.69
Phosphates (PO4), gm/l	0.08	0.16	0.21
Sulfates (SO4), mg/l	57.8	78.0	110.2
Total Solids, mg/l	509	750	1,081
Suspended Solids, mg/l	10	24	46
Dissolved Solids, mg/l	489	738	1,067
Coliforms, MPN	930	2,400	4,600

1946

Table 2.9-2

Lake Ontario Water Quality:
Oswego City Water Intake

Cumulative Record: 1964 to 1970

Parameter	Percentage Frequency of Observations 10%	Median 50%	90%
Color	5	7	15
Turbidity	5.0	8.0	15.0
Water Temperature, F	35.6	48.2	67.3
DO, mg/l	8.0	11.2	13.6
DO, % saturation	81.5	92.3	103.9
BOD (5 Day)	0.5	1.2	2.3
Total Hardness, mg/l	128	138	162
Total Alkalinity, mg/l	86	95	104
Ammonia Nitrogen (N), mg/l	0.002	0.185	0.659
Organic Nitrogen (N), mg/l	0.00	0.23	0.53
Nitrite Nitrogen (N), mg/l	0.000	0.003	0.009
Nitrate Nitrogen (N), mg/l	0.02	0.13	0.24
Phosphates (PO), mg/l	0.06	0.14	0.27
Sulfates (SO), mg/l	24.0	29.0	41.0
Total Solids, mg/l	185	248	287
Suspended Solids, mg/l	2	8	22
Dissolved Solids, mg/l	171	236	283
Coliforms, MPN	3	23	93

1947

Table 2.9-3

Lake Ontario Water Quality

Offshore of Oswego Steam Station

April to August 1972

Parameter	Locations of Sampling Stations Surface	Btm (40' Depth)	Intake*	Discharge*
Color	20-40	20-50	20-40	20-40
Turbidity	2.3-5.5	2.3-5.5	3.0-4.5	2.3-4.0
Alkalinity, mg/l	71-82	83-91	.82-85	84-91
Total Kjeldahl Nitrogen (N), mg/l	0-5.5	0-4.3	0-1.4	0-3.2
Ammonia Nitrogen (N), mg/l	0-3.9	0-1.8	0-0.6	0-1.0
Nitrate Nitrogen (N), mg/l	0.05-0.30	0.01-0.47	0.05-0.40	0.04-0.40
Total Phosphorous (P), mg/l	0.03-0.54	0.03-0.59	0.01-0.08	0.03-0.08
Sulfates (SO4), mg/l	16.6-30.2	17.5-32.0	18-74	25-330
Total Solids, mg/l	166-238	192-214	202-242	183-222
Suspended Solids, mg/l	1.1-4.8	1.6-9.8	1.0-6.5	3.0-7.0
Volatile Solids, mg/l	29-128	45-118	50-109	98-124
Phenol, mg/l	0-0.01	0	0-0.8	0-0.07
BOD (5 day), mg/l	0.8-3.8	0.4-2.6	1.0-3.6	1.0-3.3
COD, mg/l	0-49.7	1.1-28.8	1.0-41.3	0.9-46.6
Chloride, mg/l	24.5-54.5	22.3-51.5	25.5-56.7	24.5-49.4

*Existing Units 1 to 4

1948

In all essential characteristics, the lake water has lower concentrations and the range of concentrations for various water quality parameters is generally smaller than that in the Oswego River. This signifies that, in terms of ecology, the lake is less fertile and will support a less abundant biota than the harbor area. It is worth noting that bacterial die-away of coliform organisms in the lake reduces the median bacterial density by two orders of magnitude.

Ecological investigations conducted in 1970 in the harbor area included sampling for benthic organisms with a 2-inch diameter corer as well as with a 6-inch by 6-inch by 9-inch Eckman dredge. Species of oligochaetes identified from these samples included *Ilyodrilus templetoni*, *Limnodrilus hoffmeisteri* and *Limnodrilus cervix* variant. Each of these organisms is characteristic of organically enriched waters. The amphipods, *Gammarus lacustris limnaeus* and *Hyalella azteca*, were found to be abundant on rooted vascular plants in shallow water areas of the turning basin. *Gammarus* was subsequently identified in the stomach contents of fish taken from the harbor as the preferred food of 17.8 percent of the fish.

Diptera identified in benthic samples included species of *Chironomus* and *Procladius*. Tubellarians of the genus *Dugesia* and *Hydrolimax grisea* were found in the river channel and near the Oswego Station discharge.

Snails and organisms inhabiting the shells of dead snails were recovered in the November Ekman haul on the edge of the channel of the Oswego River. Snails were also observed visually by a diver at several places in the harbor where the bottom is rocky or crevices exist in solid rock substrate. *Bithinia tentaculata* make up 95 percent of the gastropods at the river channel station. Other gastropod species collected included *Valvata sincera*, *V. tricarinata* and a species of *Amnicola*. Sphaerids were the only pelecypods found, of which nine species have been recorded in the ecological literature on Lake Ontario. (Ref. 19).

Lake Ontario supports commercial and sport fisheries of considerable magnitude. Whitefish, carp, bullhead, yellow perch, rainbow smelt, American eel, sunfish, and walleye dominate the commercial landings. Smallmouth bass, yellow perch, walleye, bullhead, northern pike, and coho salmon are the principal sport fishes, although other species are present in the lake. However, commercial fishing along the southern end of Lake Ontario is small with only one or two commercial fisheries in operation. The New York State Department of Environmental Conservation lists the blue pike and the lake sturgeon as rare or endangered species that are found in Lake Ontario.

Collections of the fish population in the west basin were made by gill nets set at distances of 100 and 700 ft from the Oswego

Steam Station discharge during the months of August through December 1970. It should be noted that the 700-ft sampling section was near the point of discharge of the Oswego Sewage Treatment Plant. Gill net sets were made for a 12-hour overnight period and the fish were removed onshore, identified, measured and weighed as quickly as possible.

In terms of total numbers of fish caught, there was no significant difference in the catches at 100 ft and 700 ft from the Oswego Steam Station outfall, as summarized in the following tabulation:

Month	Avg. Temp. C	Top-to-Bottom Gradient, C	Fish in Overnight Gill Net Set 100 ft	700 ft
August	25.4	2.6	272	291
September - October	21.1	0.6	142	147
November	10.8	2.3	226	213
December	9.0	2.3	78	212

Except for the near-uniform top-to-bottom temperature gradient in the September-October sample, the bottom temperature averaged about 2.4C cooler than the surface temperature. Although the overall collections indicate little about temperature preferences and acclimation of the species collected, more fish were caught near the bottom than near the top of the nets.

A total of 17 genera of fish as listed below in Table 2.9-4 was collected in the eight gill net samples but only white perch (Morone americana) and gizzard shad (Dorosoma cepedianum) were present in all eight samples. The alewife (Alosa pseudoharengus) was represented in seven of the eight collections. White perch constituted 61 percent of the total collection, gizzard shad, 10 percent and alewife, 20 percent, for a total of 91 percent of the total catch. The remaining 9 percent were made up of species of the other 13 genera.

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ENVIRONMENTAL STATEMENT, OSWEGO STEAM STATION, UNIT SIX.(U)
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1950

Table 2.9-4

Fish Species From Turning Basin
Gill Net Samples

	Scientific Name	Common Name
1.	_Alosa pseudoharengus_	Alewife
2.	_Ambloplites rupestris_	Rockbass
3.	_Amia calva_	Bowfin
4.	_Catostomus commersoni_	Sucker
5.	_Coregonus_ sp.	Whitefish
6.	_Cyprinus carpio_	Carp
7.	_Dorosoma cepedianum_	Gizzard Shad
8.	_Esox lucius_	Northern Pike
9.	_Ictalurus catus_	White Catfish
10.	_Ictalurus nebulosus_	Brown Bullhead
11.	_Lepomis_ sp.	Sunfish
12.	_Notropis hudsonius_	Shiner
13.	_Osmerus mordax_	Smelt
14.	_Perca flavescens_	Yellow Perch
15.	_Pomoxis nigromaculatus_	Strawberry Bass
16.	_Morone americana_	White Perch
17.	_Stizostedian vitreum_	Walleye

1951

Stomach contents of 53 fish from the August sample were examined as a means of relating food preference to the available biota production in the west basin. The stomachs of white perch contained mainly amphipods and oligochaetes, with some specimens containing in addition diptera larvae, cladocerans and algae. Unidentifiable fish remains were found in two stomachs. Stomachs of 14 brown bullheads (Ictalurus nebulosus) were shown to contain amphipods, oligochaetes, and algae. Stomachs of other species examined yielded no identifiable material.

It is not clear whether fish stay in the west basin for extended periods, but it appears that many of them are feeding on the abundant benthos and on the organisms associated with rooted aquatic plants in shallow water margins of the west basin. Condition of the fish caught was good. Lamprey scars were observed on a few fish but no other wounds were seen nor was there evidence of bacterial or fungal infection.

The biological productivity of Lake Ontario outside of Oswego Harbor was studied extensively. Attached filamentaneous algae were found to grow in diminished amounts on hard surface down to 15 ft. Measured in terms of organic weight, a 10-ft deep sample was only 36 percent as abundant as a sample taken at 5 ft; a 15-ft sample was only 14 percent as abundant as the 5-ft one.

Similarly, the numbers of amphipods (Gammarus) at the 10-ft and 15-ft depth were only 23 percent and 3 percent as abundant, respectively, as at the 5-ft depth. Larva of the midge fly declined in numbers even more markedly with depth, being only 5 percent and 7 percent as prevalent, respectively, as at the 5-ft depth. Snail populations based on the small number collected, were as numerous at 10-ft depth as at the 5-ft but were reduced by about 50 percent at the 15-ft depth.

The benthic survey along the transects illustrated in Figure 2.9-1 has shown that the lake bottom in the vicinity of the intake and discharge structures is generally composed of dense glacial till almost completely free of sediment. Rooted aquatic plants are absent owing to storm action and lack of suitable substrate. Most of the benthic organisms are found as residents of the algae Cladophora which, in the intake area, fringes the lake to a water depth of only 15 ft. This faunal association with Cladophora represents a transient food supply for fish because the algal growth periodically breaks away from the lake bottom during storms. These morphological lake characteristics do not combine to provide an environment capable of supporting dense polulations of fish. This is borne out by results from gill netting and echo sounding (fathometric) studies conducted in Lake Ontario from June 1970 through June 1971. These investigations showed that the numbers of fish in this area were low and that there is no pronounced pattern to their distribution.

The lake fish populations were sampled in 1970, 1971, and 1972 with gill nets placed along a line perpendicular to the breakwater at the Oswego Steam Station. One net was set close to the breakwater in 15 ft of water; two nets were set offshore in 30 ft of water, one near the surface and one near the bottom; and another pair, near surface and bottom, in 40 ft deep water (Figure 2.9-1). In 1972 a control was added at Burt Point about 2 miles to the west of the station. The gill nets were placed in a similar manner at the control as at the Oswego Steam Station. In addition to gill netting, fish were collected by trawling at the surface and bottom along the 20-ft and 40-ft contour at the Oswego Steam Station and the control at Burt Point during 1972.

A total of 12 species of fish was collected in 1970-71 (Table 2.9-5) and 20 species in 1972 (Table 2.9-6). The additional species recorded during the 1972 surveys are probably due to the fact that two fish collection methods were employed during these surveys, while only gill nets were used in 1970-71. The use of more than one type of equipment tends to eliminate the selectivity exhibited by any single particular type of equipment.

Table 2.9-5

Fish Species From Lake Ontario
Gill Net Samples
1970

	Scientific Name	Common Name
1.	*Alosa pseudoharengus*	Alewife
2.	*Ambloplites rupestris*	Rockbass
3.	*Catostomus commersoni*	Sucker
4.	*Esox lucius*	Northern Pike
5.	*Ictalurus* sp.	Bullhead
6.	*Lepomis* sp.	Sunfish
7.	*Micropterus dolomieui*	Smallmouth Bass
8.	*Notropis* sp.	Minnow
9.	*Osmerus mordax*	Smelt
10.	*Perca flavescens*	Yellow Perch
11.	*Morone americana*	White Perch
12.	*Stizostedian vitreum*	Walleye

1953

Table 2.9-6

Fish Species from Lake Ontario
Gill Net and Trawl Net Samples

1972

Scientific Name	Common Name
1. Alosa pseudoharenqus	Alewife
2. Ambloplites rupestris	Rock Bass
3. Anquilla bostoniensis	American Eel
4. Catastomus commersoni	Sucker
5. Coreqonus artedi	Shallow-water Cisco
6. Cottus bairdi	Mottled Sculpin
7. Cyprinus sp.	Carp
8. Dorasoma cepedianum	Gizzard Shad
9. Etheostona nigrum	Johnny Darter
10. Gasterosteus aculeatus	Three spined Stickleback
11. Hybopsis plumbea	Lake Northern Chub
12. Micropterous dolomieui	Smallmouth Bass
13. Morone americana.	White Perch
14. Notropis atherinoides acutus	Lake Emerald Shiner
15. Notropis cornutus	Common Shiner
16. Notropis hudsonius	Spottail Shiner
17. Osmerus mordax	Rainbow Smelt
18. Perca flavescens	Yellow Perch
19. Percopsis omiscomaycus	Trout Perch
20. Roccus chrysops	White Bass

The August 1970 net setting over a period of fo. ys w collected daily. A total of 10 species was captured w: le and rock bass accounting for 69 percent of the numbe t In terms of absolute numbers, the catch per day was ver: a this apparent low density was confirmed by fathometr made in the area.

The same placement of gill nets in September caught c i species of fish. Alewife (35 percent), yellow perch (16 p and rock bass (10 percent) accounted for 61 percent of th a. catch. The total number of fish taken was nearly six time as great as in the August sampling.

For the October-November 1970 sample, the first pair of nets was set in 30 ft of water and the second pair was moved offshore into 40 ft of water. Again, nine species were taken but the numbers were markedly lower than the previous month.

The surface nets caught practically no fish. It was concluded that fish had left the area and the fathometric traces confirmed that there were few fish above the bottom of the lake.

The food preference of the fish taken in the September sample was determined by examination of stomach contents. Of the 135 fish examined, 46 percent of the stomachs were empty, 17.8 percent had been feeding strictly on Gammarus, 15.5 percent on crayfish and 12.6 percent showed only fish remains. The remaining 8.1 percent had either a mixture of foods or unidentifiable material in the stomach.

Few fish were collected in the October-November sample. Examination of stomach contents indicates that the declining fall temperatures had reduced the numbers of Gammarus available and that small fish became the predominant food available in the area.

The results of the fish population surveys conducted from April through August 1972 are summarized in Table 2.9-7. At the control station, the alewife made up 94 percent of the sample in May and 88 percent of the sample in June. In July and August the alewife accounted for 18 and 55 percent of the sample, respectively. The July alewife catch, however, was only 1/8 as large as the May or June catch and the August catch was 1/4 as large. Spottail shiners made up 58 percent of the July fish sample.

At the Oswego Steam Station sampling sites, 90 percent of the May sample were alewives, while only 57 percent of the June and 23 percent of the August catch were alewives. The total catch at the Oswego sampling sites for the months of April through August was only 1/2 as large as the control site. In July there was a marked increase in the number of spottail shiners caught at the

1955

Table 2.9-7
Fish Collections from Lake Ontario—1972

Oswego Control

Species	April	May	June	July	August	Total
Alewife	4	394	399	50	89	936
American Eel		2				2
Carp				1		1
Common Shiner				3		3
Emerald Shiner			12			12
Gizzard Shad					9	9
Johnny Darter				1		1
Lake Northern Chub				10		10
Mottled Sculpin	1					1
Rainbow Smelt	4	13	15			32
Rock Bass				5	18	23
Shallow-water Cisco				1		1
Smallmouth Bass				6	13	19
Spot Shiner			1	209	15	225
3 Spined Stickleback		8	24			32
Trout Perch				2		2
White Bass					1	1
White Perch	2			51	12	65
White Sucker				6	6	12
Yellow Perch				15	11	26
Total	11	417	451	360	174	1413

Oswego Plant Site

Species	April	May	June	July	August	Total
Alewife	6	221	87	74	3	391
American Eel						0
Carp				1	2	3
Common Shiner			14	51		65
Emerald Shiner					3	3
Gizzard Shad					3	3
Johnny Darter	3		12			15
Lake Northern Chub						0
Mottled Scupin	4			2		6
Rainbow Smelt	2	12	4		1	19
Rock Bass				6	13	19
Shallow-water Cisco						0
Smallmouth Bass				13	7	20
Spot Shiner				91	8	99
3 Spined Stickleback		12	34			46
Trout Perch				1		1
White Bass						0
White Perch			2	48	2	52
White Sucker				11	7	18
Yellow Perch				19	16	35
Total	15	245	153	317	65	795
Sampling Method	6 trawls	12 trawls	8 trawls	8 trawls 10 gill nets	8 trawls 10 gill nets	

1956

Oswego site over the previous month. In August the number of spottail shiners again declined.

The overall trends of the Oswego site and the control site are similar. Although twice as many fish were collected at the control site than the Oswego Steam Station site, the overall number at both sites were low.

The ecology of the area covered varies markedly. To the west of the station, the lake bottom slopes unevenly downward to the 40-ft contour. To the east, the base of the breakwater is in 15 to 20 ft of water. The 40-degree slope of the large rocks of which it is comprised, with the interstices between them, afford hiding and resting places for fish and other organisms. These unique features make the nearshore area of the lake, east of the station, ecologically different from the area to the west.

Fathometric surveys were conducted on July 10, September 3, September 21-27 and October 28-29 in 1970 along seven transects offshore from the Oswego Steam Station (bearing 340 degrees). The number of fish in the area was low and their distribution over the area was patternless. In 24-hour studies, with fathometric traverses made at 4-hour intervals, it was apparent that a good deal of gathering, movement en masse and dispersal of fish was taking place within a 24-hour period, but no consistent repetition of a diurnal pattern was discernible. Fathometric surveys conducted in April through August of 1972 confirmed the previous findings on low fish populations.

1957

2.10 AMBIENT AIR QUALITY

The City of Oswego is located in an air quality area designated as Level III by the New York State Department of Environmental Conservation. This signifies that the air quality levels in the city should be consistent with those of a small metropolitan area comprised primarily of commercial office buildings, department stores and light industries.

Sampling of the ambient air for sulfur dioxide was conducted by Niagara Mohawk in Oswego during one summer month in 1970 and during a six-week winter period in 1970-71. During the summer sampling period, one sulfur dioxide sampler was used in the following manner: the analyzer was situated at a fixed location and operated continually for two days and nights. For the next five days, the analyzer was used for a mobile survey during daytime hours and returned to the fixed site during the night. During the winter sampling period, a sampler was fixed at a location about one-half mile east-northeast of the power station and was operated continually. The locations of the sampling stations are shown in Figure 2.10-1. The sulfur dioxide samplers used were the electro-conductivity type which operate on the action of the contaminant impinging onto the surface of a conductivity cell containing acidified hydrogen peroxide solution. From the data collected, the following background sulfur dioxide concentrations were determined:

SO_2 Concentration, Average	Ambient Value (ppm)	Comparative State Standard for Level III (ppm)
Annual	0.02 (estimated*)	0.03
Maximum 1-hr	0.12 (measured)	0.50
Maximum 24-hr	0.075 (measured)	0.14
One month summer	0.01 (measured)	
Six-week winter	0.035 (measured)	

*Projected Annual Average from Limited Sampling Data

Ambient sampling for suspended particulates was conducted in the City of Oswego from May 1970 through April 1971 by the New York State Department of Environmental Conservation. Fifty-one 24-hr high volume samples were taken at two locations and results indicate that the ambient particulate level is within the limits set by the state. The location of the particulate samplers are shown in Figure 2.10-1.

1958

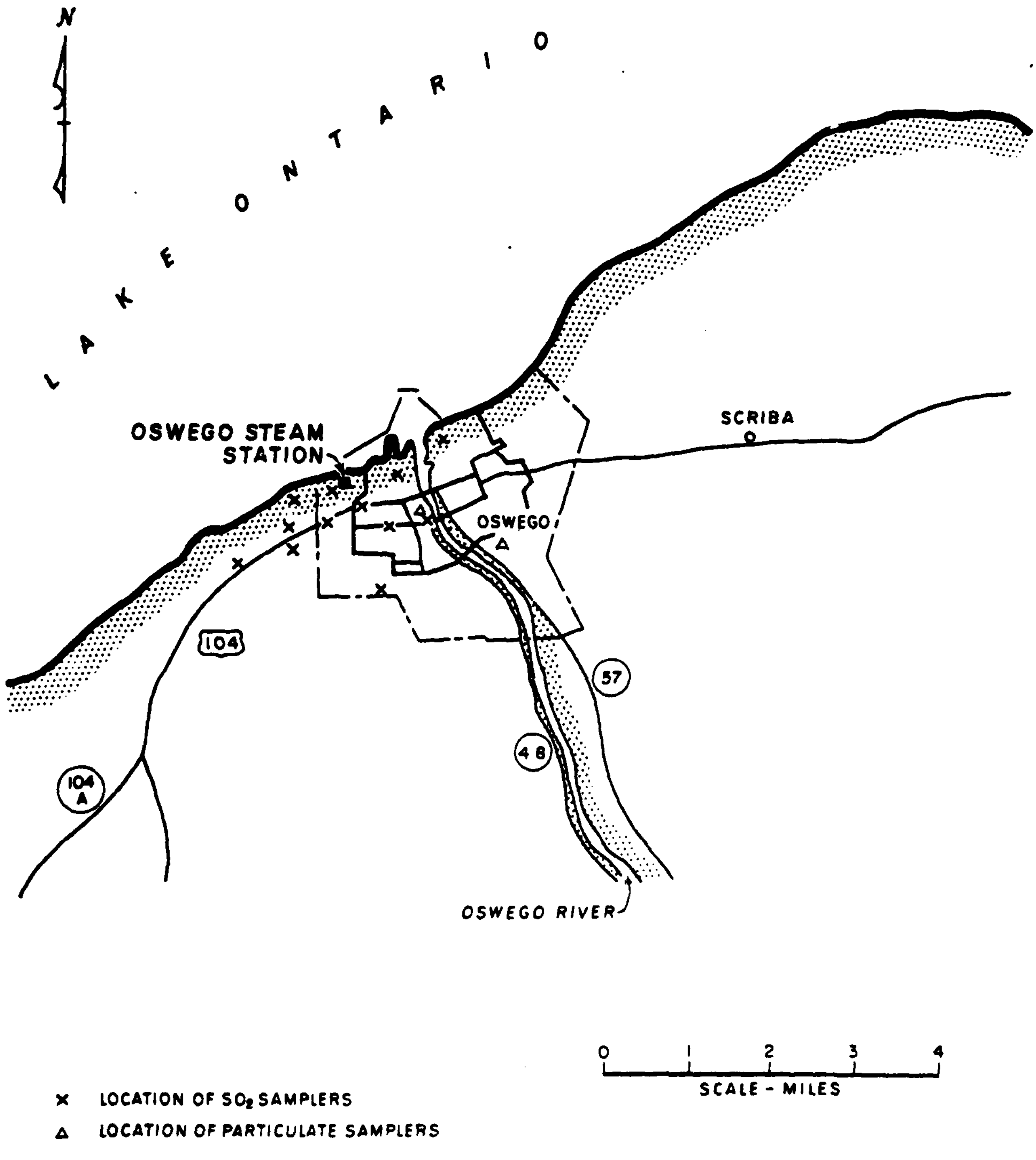


FIG. 2.10-1
LOCATION OF AMBIENT AIR MONITORS
NIAGARA MOHAWK POWER CORPORATION

The following particulate concentrations were derived from the study:

At the Oswego Post Office

	Measured (ug/m³)	State Standard for Level III (ug/m³)
Arithmetic mean	52	65
Geometric mean	47	-
84 percent of the values were less than	75	100
Maximum 24-hr average	142	200

At the Riley School	Measured (ug/m³)	Comparative State Standard for Level II (ug/m³)
Arithmetic mean	36	55
Geometric mean	32	-
84 percent of the values less than	51	85
Maximum 24-hr average	97	200

The predicted effects of Units 1 through 5, burning 1.85% sulfur oil, on the air quality surrounding the Oswego Steam Station in 1976 are as follows:

Sulfur Dioxide	Concentrations From Units 1-5	Percent of the Secondary Federal Air Quality Standard Contributed by Power Plant
Maximum annual average con-tration, ppm	0.0022	11
Maximum 24-hour concentration, ppm	0.031	31
Particulate Matter		
Maximum 24-hour value, ug/m³	3.2	2.1

1960

Maximum annual average concentration, ug/m³	0.23	0.38
Nitrogen Oxides		
Max. annual average conc., ppm	0.00095	1.9

1961

SECTION 3

ENVIRONMENTAL IMPACT OF THE PROPOSED ACTION

3.1 CIRCULATING WATER

The narrative which follows simultaneously interrelates the selection of a specific design with the environmental impact in terms of the objective of minimizing adverse effects.

3.1.1 Intake and Screenwell

As described in Section 1.3 under "Circulating Water System," the intake aperture is designed so that water velocities at maximum station output will be 1.0 ft per second (fps) and the flow into the intake structure will be in the horizontal plane. This latter point is significant because investigations have shown that fish can better avoid horizontal inflows than vertical ones (Ref. 20, 21). In addition to controlling the approach velocity to the intake and the flow patterns into the structure, other precautions were taken in the design and location of the intake structure in order to ensure adequate fish protection.

Location of the intake structure relative to the discharge diffuser has a direct effect on plant efficiency. If heated discharge water recirculates to the intake structure and the intake water is significantly warmed, the result could be a decrease in plant efficiency as well as attraction of fish to the intake area. It is consequently necessary to locate the intake and discharge structures relative to each other to minimize recirculation.

In hydraulic model studies conducted for Oswego Unit 5 (Ref. 22), it was determined that with the intake structure located about 600 ft inshore of the discharge no measurable recirculation of heated discharge water would occur. The proposed location for the Unit 6 intake structure is about 600 ft inshore of the Unit 5 discharge and will be separated by about 1,500 ft from the Unit 6 discharge. The hydraulic model results showed that, with the intake located in relation to the discharge as shown in Figure 1.3-2, recirculation of heated water to the intake is minimal. The conditions simulated in the model included lake currents from the west, zero lake current, mean and low Oswego River flows and full load operating conditions of all units (Units 1-6) with summer lake temperature conditions.

It was recognized in the design of the circulating water system that, even though the intake structure is designed and located to minimize the possibility of fish entering it, fish may still enter and become trapped in the forebay of the screenwell structure. These fish could be injured on the traveling screens if a refuge area were not provided. This problem would tend to be most critical during the winter months when fish that gain entry to the screenwell may reduce their activity and, due to their winter semi-dormant physical state, would be less likely to resist water movement toward the traveling screens.

The intake system for the existing four units at Oswego withdraws as much as 762 cubic ft per second (cfs) from Lake Ontario and is located in the vicinity of the proposed location for the Unit 6 intake. In addition, since the flows through existing and proposed intakes are comparable, conditions at the existing intake are indicative of conditions that will be found at Unit 6 intake. Consequently, the intake system for the existing plant was studied to determine whether significant numbers of fish could gain entrance to this structure.

The maximum approach velocity to the existing intake ranges between 1.30 and 1.75 fps with a maximum velocity through the intake bars of 3.2 fps. Since investigations of the existing intake revealed that these velocities do not result in significant numbers of fish entering the structure, a maximum approach velocity to the Unit 6 intake of 1 fps and a maximum velocity through the intake bars of 1.2 fps appear reasonably conservative.

Biologists, using scuba techniques, observed the screenwell forebay area of the existing intake during the winter of 1970-71. These investigations indicated that few fish entered the intake during the winter. Furthermore, the fish population in the screenwell remained concentrated in a still, dark section. Few fish were found in front of, or forced against, the traveling screens. These observations indicate that the approach velocity to the traveling screen is low enough to permit fish to escape this area and find refuge in the quiescent area of the screenwell. The maximum approach velocity to the traveling screens for the existing intake is 0.94 fps.

The screenwell of the Unit 6 intake is designed so that the maximum approach velocity to the traveling screens is 0.97 fps. In addition, a refuge area for fish, comparable in size to the area where fish are found concentrated in the existing screenwell, will be provided. The layout of this refuge area is shown in Figure 3.1-1.

Although relatively few fish should find entrance to the intake structure, the screenwell is designed to allow for the installation of fish transfer devices in the future to remove fish from the refuge area and the area in front of the traveling screens. This will be monitored by Niagara Mohawk and the Division of Fish and Wild Life of the New York State Department of Environmental Conservation. If it becomes necessary to install the transfer facilities, the fish would be removed on an intermittent basis and returned to Lake Ontario.

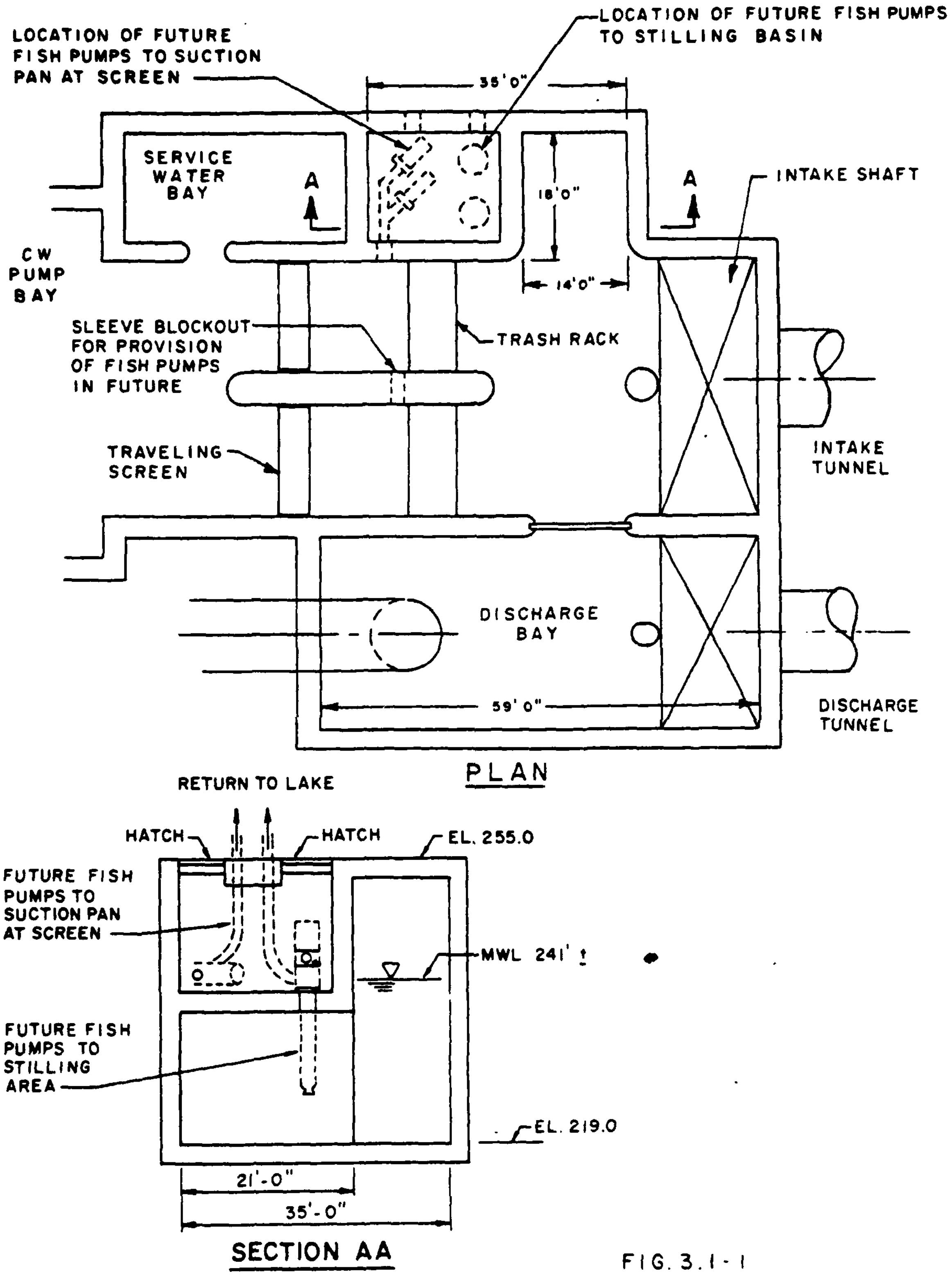


FIG. 3.1-1
FISH PROTECTION FACILITIES
OSWEGO STEAM STATION UNIT 6
NIAGARA MOHAWK POWER CORPORATION

3.1.2 Discharge

Heat Dissipation and Criteria

The outfall facility is designed to meet the New York State standards and criteria applicable to the discharge of heated liquids to Lake Ontario. Lake Ontario, in the vicinity of Oswego, is designated water quality Class "A." Section 701.3, 6NYCRR defines the best usage for this class as a source of water for drinking, culinary or food processing purposes. The quality standards for Class "A" waters include the following specifications regarding heated liquid discharges:

> "None alone or in combination with other substances or wastes in sufficient amounts or at such temperatures as to be injurious to fish life, make the waters unsafe or unsuitable as a source of water supply for drinking, culinary or food processing purposes or impair the waters for any other best usage as determined for the specific waters which are assigned to this class."

Application of this standard is interpreted in a quantitative manner in thermal discharge criteria adopted by the New York State Water Resources Commission in July 1969. For lakes, the applicable criteria are as follows:

> "The water temperature at the surface of a lake shall not be raised more than 3 F over the temperature that existed before the addition of heat of artificial origin, except that within a radius of 300 ft or equivalent area from the point of discharge, this temperature may be exceeded. In lakes subject to stratification, the thermal discharges shall be confined to the epilimnetic area."

In compliance with these rules and regulations, extensive engineering investigations were conducted to establish that the design of the circulating water system for the new unit will conform with the aforementioned criteria. Moreover, ecological investigations were carried out in Lake Ontario in the vicinity of the proposed discharge in order to delineate the biota of the area and to determine the probable effects of the discharge from Unit 6 on these biota. These latter investigations were performed in recognition of the fact that, in addition to adhering to the appropriate specific numerical criteria, the intake-discharge system must be designed and located to protect the standard.

The effects of the plant discharge on the temperature distribution in Lake Ontario will be minimized by the use of the submerged multiport outfall described previously. The following discussion is a synopsis of the basic concepts of this design.

1965

When a jet of heated effluent is discharged into a receiving water body at some depth below its surface, it rises, as a plume, to the surface, and then spreads laterally and longitudinally at the free surface. This rising behavior is caused by both initial momentum flux and the net buoyant force due to the lower density of the jet. The initial momentum flux is due to the fact that the jet has a higher velocity than the surrounding ambient water. The buoyant force is caused by the difference in density between the heated effluent and the surrounding ambient water.

Reduction in temperature occurs by entrainment of ambient water into the jet as it approaches the surface. This dilution proceeds until the relative velocity between the jet and surrounding water is reduced to zero. This phenomenon is called jet dilution and occurs by turbulent transport mechanisms.

The relative motion between the plume and the ambient water develops shear stresses. Turbulence is generated and mixing takes place first around the periphery of the column and finally throughout the whole column. This results in a continual growth in jet size, a decrease in jet temperature, and an increase in density of the heated jet as it nears the surface.

Entrainment of ambient water which possesses horizontal momentum causes the plume to move in the direction of the predominant current. The introduced heat is then ultimately lost to the atmosphere through the water surface.

The design of the Unit 6 discharge system is based on analytic and hydraulic model investigations conducted specifically for Unit 6 and on those conducted previously for Unit 5. Since the circulating water flow rate and heat load is the same for both Units 5 and 6, the studies conducted for Unit 5 can be used to supplement the additional studies conducted for Unit 6.

Hydraulic model studies to determine an acceptable design for the Unit 6 discharge consisted of both undistorted and distorted scale testing. The undistorted scale model tests were conducted at a scale which reduced the vertical and horizontal dimensions to 1/60th of the prototype dimensions. The purpose of the undistorted tests was to study the effect of discharge velocity, port diameter, water depth and lake current on dilution of the Unit 6 discharge. The distorted scale model reduces the vertical and horizontal dimensions of the prototype by 1/40th and 1/250th, respectively. The actual prototype dimensions modeled are about 15,000 ft of shoreline and 10,000 ft extending offshore into the lake. Distorted scale model tests included Oswego River discharges in conjunction with intake and discharge operation of all six units at Oswego.

Based on results from the undistorted scale model testing program, it was determined that Unit 6 could be placed at Oswego with a once-through cooling water system and not cause contravention of the applicable thermal criteria and standards.

Tests conducted for Unit 6 in the undistorted scale model indicated that the near field thermal effects were maximum at lake conditions of 0.5 fps drift with the diffuser oriented perpendicular to the direction of the drift current. To minimize the translation effects of the drift currents on the discharge and to better utilize the drift flow as a source of ambient dilution water, the Unit 6 discharge diffuser will be oriented approximately perpendicular to the existing Unit 5 diffuser. Since Unit 6 will be located farther offshore than Unit 5, this orientation can be used without adversely affecting the near shore waters.

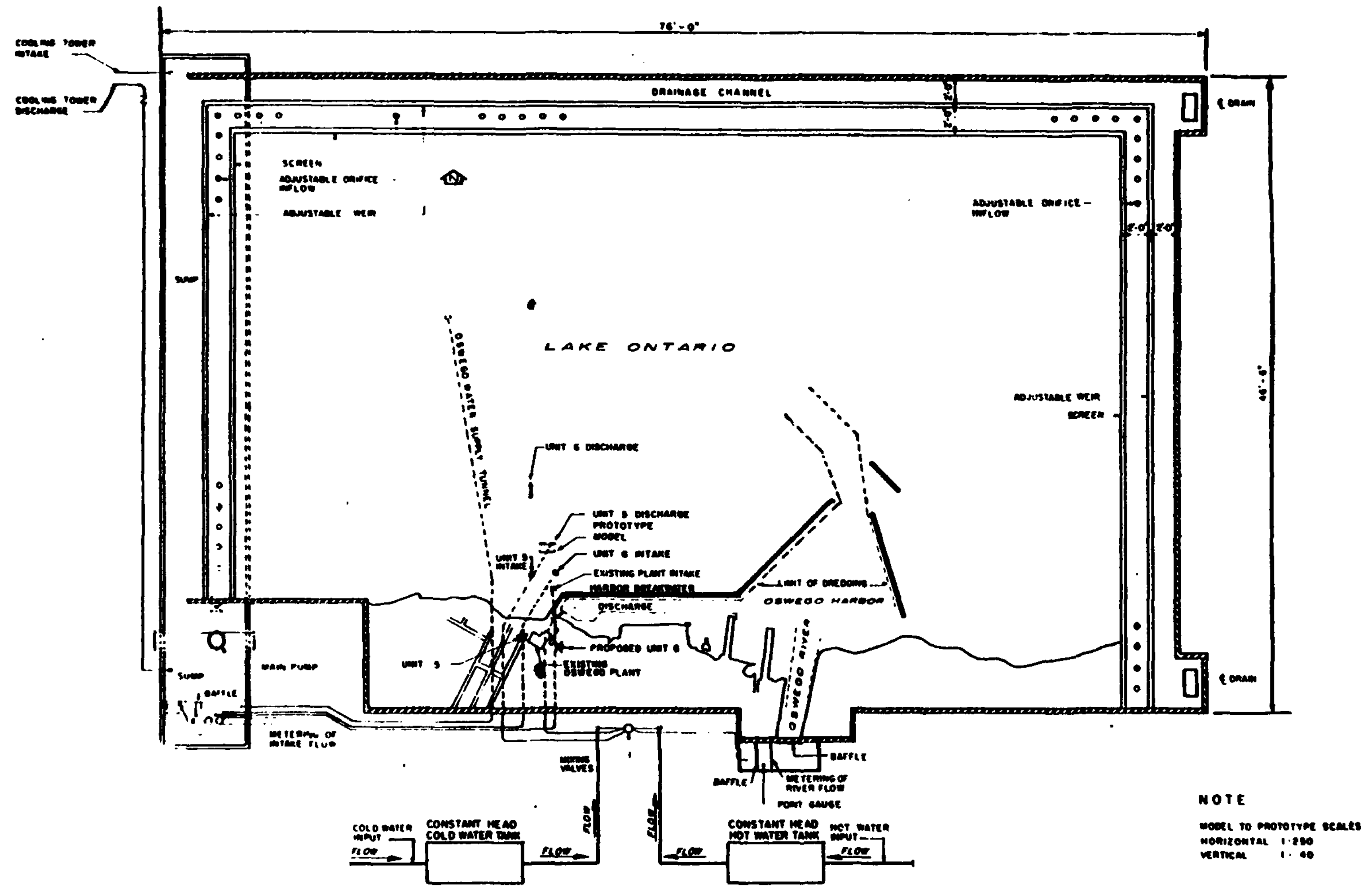
By orienting the Unit 6 diffuser so the discharge is directed parallel to the lake currents, the critical conditions for both the near field Unit 6 thermal effects and the combined effects of Units 5 and 6 will be stillwater lake conditions. To minimize the interference between Unit 5 and the proposed Unit 6 discharges, the diffuser for Unit 6 will be located about 900 ft beyond the Unit 5 diffuser and will discharge in a westerly direction into a water depth of about 39 ft. The diffuser chosen for Unit 6 discharge system consists of six risers spaced 40 ft on center, each riser contains two 2 ft diameter ports elevated 5 ft above the lake bottom.

The undistorted scale hydraulic model test results for the final design under critical stillwater conditions are summarized in the following table:

Surface Isotherm, F	Area Enclosed by Isotherm (Acres)
3.0	0
2.5	1.1
2.0	8.0
1.5	33.8

The results of the undistorted scale testing indicate that Unit 6 operating alone will not contravene the applicable New York State thermal criteria or standard.

Since the undistorted scale model was not sufficiently large to include the discharges from all six units at Oswego, the effects of the operations of all units were evaluated in the distorted scale model. As shown in Figure 3.1-2, this distorted scale model was sufficiently large to include the mouth of the Oswego River, The Oswego Harbor, the intakes and discharges of the existing four units and the fifth unit at Oswego and the City of Oswego's water supply intake. Lake drift currents, Oswego River flows and locations for Unit 6's intake/discharge system were simulated in the model to assess the effects of these variables



NOTE

MODEL TO PROTOTYPE SCALES
HORIZONTAL 1:250
VERTICAL 1:40

MODEL SCALE IN FEET
0 10 20
0 2500 5000
PROTOTYPE SCALE IN FEET

FIGURE 3.1-2
DISTORTED SCALE MODEL
GENERAL LAYOUT

NIAGARA MOHAWK POWER CORPORATION

1967

on temperature patterns in the lake. These tests were also used to locate the Unit 6 structures to minimize recirculation and interference among discharges.

Figure 3.1-3 presents the surface isotherms as predicted by the distorted scale model for Units 1-6 operating and stillwater lake conditions. As indicated on Figure 3.1-3, even though there is some minor plume interference between Units 5 and 6, the New York State thermal criteria is not contravened for the combined effects of all six units operating at full capacity. Since the discharge from Units 5 and 6 is confined to the epilimnetic layer, is diluted about ten-fold, and surfaces about 300 ft from the point of discharge, the jet discharge will not result in hypolimnetic waters being drawn to the surface. The jet discharge from Units 5 and 6 will entrain the lower waters adjacent to the discharge structures and thereby bring this water to the surface. However, water quality data collected at the surface and at a 40-ft depth in the vicinity of the discharges show that the water quality at the site is fairly uniform with depth. Consequently, flow patterns induced by the circulating water system for Units 5 and 6 will have a minor and only local effect on the water quality and stratification in this area.

As described in Section 1, the discharge nozzles for Unit 6 are located so that their centerlines are 5 ft above lake bottom. Experience with the undistorted hydraulic model showed that the plume touched bottom at about 30 ft from the ports and removed 1 to 2 ft of lake bottom material. These results are conservative on two counts. First, the model lake bottom was horizontal, whereas under actual conditions, the bottom slopes downward away from the discharge. Secondly, the model used fine, noncohesive sand, whereas the lake bed is dense glacial till. Little, if any, bottom scour is to be expected.

In accordance with New York State thermal discharge criteria, both the intake and discharge structures are located in the epilimnion of the lake. A comparison of water quality data collected at the surface and at a 40-ft depth shows that the water quality at the site is fairly uniform with depth. Consequently, flow patterns induced by the circulating water system for Unit 6 will have little effect on the redistribution of nutrients in this area.

Measurements of dissolved oxygen offshore of the site revealed that the water is at or near saturation throughout the year. A 6-year record of the New York State Department of Environmental Conservation water quality monitor on the Oswego City water intake (6,500 ft offshore, 40 ft deep) shows that dissolved oxygen exceeds 8.0 milligrams per liter (mg/l) (81.5 percent average saturation) 90 percent of the time; that the median dissolved oxygen is 11.2 mg/l (92.3 percent average saturation); and that, as a result of algal oxygen production, exceeds 13.6 mg/l (103.9 percent average saturation) 10 percent of the time

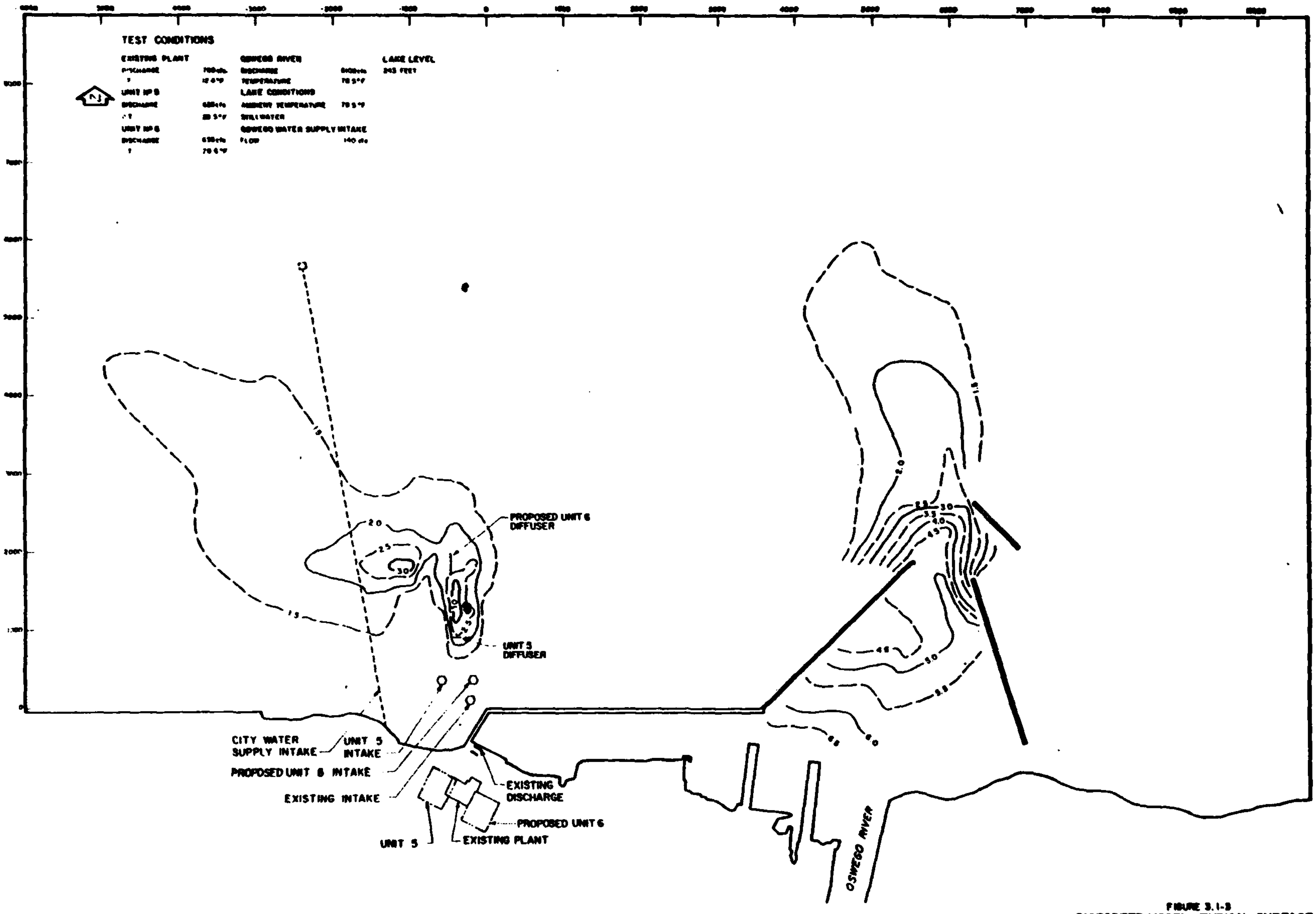


FIGURE 3.1-3
DISTORTED MODEL - TYPICAL SURFACE TEMPERATURE ISOTHERM PLOT

NIAGARA MOHAWK POWER CORPORATION

1969

1970

(See Section 2). Since the discharge is designed to achieve rapid dilution of the heated effluent and will be located in about 39 ft of water, little if any oxygen loss is expected.

The hydraulic model tests were conducted under the most critical conditions from the viewpoint of extent of temperature rise effect. These conditions included capacity operation of both Units 5 and 6 and the existing four units at Oswego, maximum observed lake ambient temperature, maximum lake currents, still water conditions and high or low Oswego River flow.

The foregoing discussion shows the consideration that has been given to the design of the intake, screenwell, and discharge structures to minimize adverse environmental effects. Low intake velocity, the fish refuge area with provision for possible future installation of fish removal devices, and the multiport discharge have all been specifically selected to provide a high degree of protection to the aquatic environment. In addition to the detailed engineering and ecological studies performed for Oswego 6, the operation of Oswego Unit 5, which utilizes intake and discharge systems similar to those for Unit 6, will provide verification of the acceptability of the circulating water system design prior to actual operation of Unit 6.

3.1.3 Effects on Aquatic Biology

Potential objectionable effects on the lake biology are considered in three categories: (1) those that occur between the intake and discharge of the circulating water system (entrainment) (2) those that take place in the lake in the region of the plant, and (3) those that occur at the intake as a result of the passage of water through fixed or traveling screens (impingement).

The evaluation of Category (1) is based on a field search for demonstrable biological changes at Units 1 to 4, between intake and discharge. The maximum temperature rise across the condensers of the existing station is 12 F, whereas that of the proposed Unit 6 is 32 F. The time of cooling water passage is short, only 4 minutes being required for the existing units and 11 minutes for Unit 6.

Ecologists have generally agreed that evaluation of Category 1 effects must take into consideration: (a) mechanical impairment or destruction of biological organisms by shear forces in the region of circulating water pump impellers, (b) tissue rupture of organisms in sections of the circulating water system where negative pressures prevail and (c) thermal shock (Ref. 23).

The seriousness of deleterious effects by any of these mechanisms is variable with the generation time of the species under consideration. Bacterial species that multiply by cell division will double their numbers in an hour or less at optimum

1971

temperature. Zooplankton that produce two or three generations in 24 hours will take several days to re-establish their normal population density in any volume of water in which their numbers have been markedly depleted. If fish eggs or larval fish are adversely affected in the circulating water system, their numbers will not be replaced until the next spawning season.

Clearly, the impact of entraining suspended organisms, i.e., larval fish, in the cooling water flow (assuming some damage is incurred thereby) will depend upon the proportion of total volume of receiving waters that is diverted through the condensers (Ref. 24).

No evidence of spawning was observed in the lake in the vicinity of the intake and discharge of the plant during April, May, and June, 1971, as evidenced by repeated plankton tows, sampling about 1,000 cubic meters of water. In July, the first fish larvae captured in a plankton tow proved to be alewives (Alosa pseudoharengus). Repeated tows during July in the area of the existing intake indicated a larval density of 2.3 per cubic meter at the lake surface. Similar tows in the intake channel averaged only 0.7 larvae per cubic meter, which appears to indicate that the larvae are less concentrated in the lower layers of the water column where the intake draws water.

An evaluation of the Category 1 effects between the existing intake and discharge provided the basis for a projection of the environmental impact of the proposed new circulating water system on plankton.

It is recognized that some fish eggs and larvae may be entrained in the circulating water system, although the intake location has been chosen in an area generally considered to be relatively devoid of these stages of the fish life cycle. University, government, and consulting biologists were contacted to ascertain what is known about the distribution and concentration of larval forms in Lake Ontario. Little quantitative data were available, but there is general agreement that significant concentrations of fish eggs and larvae might be expected to be found as far as ten miles from the shore due to the upwellings in this area. The effect of larval entrainment on fish population at the Oswego Station was evaluated, based on limited available data. The results of this analysis are summarized in Table 3.1-1.

1972

Table 3.1-1

Effect of Entrainment on Fish Larvae Population

Case	Reduction of Population (%) 1 100% mortality	2 30% mortality	3 30% mortality with selective withdrawal
Direct Discharge			
1 Entire Lake	.008	.002	.0007
2 Ten Mile Inner Lake	.014	.004	.0013
3 One Mile Inner Lake	.160	.048	.0144

The effect of entrainment and passage through the Unit circulating water system using three different models for a once-through cooling system is presented in this table. The assumptions of the various models are as follows:

1. Model of Entire Lake:

   Fish eggs and larvae are equally distributed throughout the entire lake. Water containing these stages of fish life will pass through the condenser system during the approximately 90-day spawning season.

2. Ten-Mile Inner Lake

   Fish eggs and larvae are found equally distributed in the water within a ten-mile limit from the shore all around the lake, and none are found in the rest of the lake. All water passing through the plant is withdrawn from this ten mile inner lake. Passage of biota same as in previous model.

3. One-Mile Inner Lake

   Similar to second model, except the larval forms are found only within a one-mile inner lake.

For each of the models, three cases were investigated, as recorded in the columns labeled "100 percent mortality," "30 percent mortality," and "30 percent mortality with selective withdrawal." The results in the first column are for the case where it is assumed that all forms of fish life passing through the cooling water system will be destroyed. Preliminary data indicate that approximately 30 percent mortality of larval forms occurs as a result of passage through the cooling water systems for the existing units. This mortality rate may be high since it was not possible to determine the mortality which occurred as a direct result of the sampling technique. These results are not directly applicable to Unit 6, but they do provide a basis for a lower limit on the mortality rate.

Similarly, preliminary data indicate that surface water contains higher concentrations of fish eggs and larvae than at lower depths. The intake for Unit 6 is designed to draw water selectively from the deeper water and the results listed in column (3) of Table 3.1-1 reflect this factor.

Despite many detailed model studies of mortality to fish eggs and larvae by passage through condenser cooling water systems, no long-term studies have been conducted at operating power plants; thus the extent of mortality cannot be predicted at this time, although it is expected to be low.

A careful study was made of the zooplanktons over a 5-month period. Samples from the existing units discharge were returned to the laboratory, kept in 225—milliliter (ml) widemouth jars at room temperature, and examined at 24-, 48-, and 72—hour intervals. No detrimental effects on organisms that passed through the cooling water system of the power plant were observed.

The production of phytoplankton was somewhat higher inside the west basin than in the lake. This appears to be a manifestation of the organic enrichment of the harbor and west basin rather than a temperature effect.

The evaluation of the second category of effects (lake region) is based on ecological studies of the Oswego shore of Lake Ontario out to the 40—ft depth contour. The design, orientation, and placement of the discharge diffuser jets will be such that no deleterious effects are expected to result. The jet nozzles will be placed in 39 ft of water at a point above the lake bottom to minimize scour. By placing the jets far enough off-shore to prevent warmer water from being carried on shore by currents, no alteration of the present littoral productivity or the spawning potential of the shore areas will occur.

Results of benthic surveys along transects in Lake Ontario have shown that the lake bottom in the vicinity of intake and discharge structures is generally composed of dense glacial till almost completely free of sediment. Only in scattered pockets are bottom deposits found, notably near the eastern end of the breakwater where the river and lake waters combine. Since the area in the vicinity of the intake and discharge structures is

1974

nearly free of sediment, no quantitative samples of bottom sediment could be collected. The design of the intake with a 3-ft sill and the discharge with ports elevated 5 ft off the bottom will minimize the velocity at which water moves across the bottom surface of the lake. In addition, the discharge jets will surface a few hundred feet from the points of discharge and residual velocities near the bottom will be negligible at that point. Therefore, little or no redissolving or resuspension of nutrients or other materials is expected as a result of the operation of Oswego Unit 6. Since the surface and bottom water quality at the 40-ft depth contour are not significantly different, the lower waters entrained into the discharge jet and brought to the surface will not result in a change in the water quality.

Aerial observation flights along the southern shore of Lake Ontario, from eastern Mexico Bay to the Oswego-Cayuga County line showed that the filamentous alga, Cladophora, grows in shallow water along this stretch of shoreline. Most satisfactory growth occurs in alkaline waters at a temperature of about 65 F. The phosphate concentration in Lake Ontario appears to be the limiting nutrient. The growth season begins in late April or early May, continues through the summer months, and ceases about the end of October. Cladophora grows best in waters with a current that continually transports a nutrient supply to this attached photosynthetic organism. The limiting depth to which growth is achieved is determined by light penetration of the lake water. Within the project area, the intensity of production decreases rapidly with depth, with little production occurring at depths greater than 12 ft. Placing the centerline of the discharge diffuser nozzles an average of 32 ft below the lake surface and directing the discharge plumes away from shore ensures that the condenser discharge will have no effect upon production of this alga.

Gammarus, which were observed to be the preferred food of a sizeable fraction of the fish in the shallower waters of the study area, were found to grow most abundantly on the attached biota of the shallow water margins. Fish netted at depths down to 40 ft were found to have fed on crayfish and small fish. The depth, orientation, and off-shore direction of the discharge diffusers will have no effect on these sources of fish food.

Samples of the benthos at various depths out from the lake shore showed that the algae, amphipods, fly larvae and snails that make up this community decreased markedly with depth and reached very low densities at depths greater than 15 ft. Therefore, this portion of the lake biota will not be affected by the cooling water discharge.

Fish density surveys in the areas of the proposed Unit 6 intake and discharge locations were made by both gill netting and electronic fathometric studies. Gill netting was conducted during a five-day period each month from June through November 1970 and in May and June of 1971. Fathometric studies extending over 24-hour periods were conducted from July through October 1970 and coincided with gill netting operations. Analyses of data from these surveys showed that the character of this area of the lake bottom is not productive enough to support a large fish population. By comparison, the west basin supported a fish population six times as dense as the lake during the period sampled.

Trawling and gill-netting were conducted each month from April to August, 1972. Samples were collected during the day and night, during each sampling period. Fathometric surveys were done simultaneously. The 1972 surveys support the earlier finding. Few fish were captured using either sampling method. It is fairly evident, therefore, that the proposed discharge will affect relatively small numbers of fish.

The existing heated water discharge to the west basin is not the sole physical difference between it and the lake. Other factors that produce a different ecology in the west basin are bottom topography, bottom sediments, shelter from storms behind the breakwater and soluble nutrients, particularly nitrates and phosphates. In order to compare the physical condition of the fish populations living in these two ecosystems, condition factors were used.

The condition factor, ratio of weight-to-length, is a quantitative parameter of the plumpness or well-being of the fish (Ref. 25). This factor was used as a basis for comparison of two species, white perch (Morone americana) and gizzard shad (Dorosoma cepedianum), that were found to spend more time in the west basin than any other species collected there. Mean condition factors for these two species and for yellow perch (Perca flavescens), together with the number of specimens available, are shown below:

	Lake Ontario		West Basin	
Species	Mean Condition Factor	No.	Mean Condition Factor	No.
White Perch	1.71	29	1.71	212
Gizzard Shad	-	None	1.28	81
Yellow Perch	1.45	97	1.37	55

The observations indicate that the condition of these species varied little between the lake and the west basin.

The comparison of the condition of the fish populations of the west basin and Lake Ontario showed no discernible effects from the thermal discharge into the west basin. Numerous ecological factors relevant to fish population dynamics have been taken into

1976

consideration in the positioning of the proposed discharge diffuser, and little effect from this thermal discharge on the number and density of the native fish species or on their mean condition factor is expected to result.

At Units 1 to 4, the use of algicides has not proven necessary, a fact variously attributable to the low level of nutrients in the lake intake water and to the abrasive effect on the condenser tubes of fine suspended particles of glacial till in the cooling water. In any event, it is concluded algicides will probably not be required at Unit 6 and therefore no environmental impact from the use of such agents will arise at this station.

The third category of concern, that of fish impingement, can be evaluated from preliminary results of field investigations conducted at the existing Oswego Steam Station from June through August, 1972. Preliminary results, based on collections made during the day and night at the station, indicate that a significant impingement problem will not occur.

The fish of greatest abundance in all samples was the alewife. A maximum of 457 alewives per hour were captured during the June collections and a minimum of one every 4 hours were captured during the August collections. All other species collected averaged less than 1 per hour. These data indicate that impingement at the Unit 6 intake will not be significant. The impingement study will be conducted for one complete year.

3.1.4 Effects on Other Water Uses

The detailed studies on Lake Ontario hydrodynamics carried out by means of hydraulic model studies are discussed in this section under "Discharge." The results indicate that cooling water intake and discharge for the proposed Unit 6 will have negligible effects on any other water user in the area.

Results of the hydraulic model shown in Figure 3.1-2 show that the heated discharge from Unit 6 will not have any effect on the temperature of the water entering the City of Oswego's intake. In addition, these tests indicated that the temperature rises at the intakes for the existing four units, Unit 5 and Unit 6 are expected to be less than 1.0° F, 0.3° F, and 0.7° F, respectively.

Other water users in the area are Alcan Aluminum Corporation, about 4 miles to the east, and Nine Mile Point Nuclear Power Station 1, about 7-1/2 miles to the northeast. Based on model studies described above they will experience no change in water temperature as a result of the Unit 6 discharge.

The proposed cooling water intake structure is designed to conform to the U.S. Coast Guard's requirements of a minimum 12-ft depth above any submerged construction outside shipping lanes.

1977

The discharge diffuser will be located farther offshore, in deeper water. Neither structure is located in shipping lanes, nor will these structures constitute a hazard to navigation of pleasure craft. Marker buoys will be used as required to mark the location of the diffuser.

1978

3.2 ATMOSPHERIC DISCHARGES

It is expected that neither the New York State nor the national primary ambient air quality standards will be exceeded after Unit 6 begins operation in 1976. Furthermore, the concentrations of air contaminants due to the Oswego station are expected to be lower than the national secondary ambient air quality standards which were promulgated "to protect the public welfare from any known or anticipated effects of a pollutant."

When Unit 6 is operating in 1976, ground level concentrations of air contaminants emitted by the Oswego Steam Station are estimated to increase by no more than 25 percent over the contribution of the existing five units. Figure 3.2-1 depicts the predicted annual average concentrations expected to be produced by Units 1 through 6. The technical approach to estimating these concentrations and summaries of meteorological data are given in Appendixes A and B, at the end of this report.

A list of predicted maximum ground level concentrations of sulfur dioxide, nitrogen oxide and particulate matter from the plant is presented in Table 3.2-1. These concentrations were calculated under the assumption that no capping inversion is present to limit plume dispersion. The impact of inversions is discussed later in this section. The applicable New York State and national primary and secondary ambient air quality standards are also listed in this table for comparison. The percent of the national secondary ambient air quality standard contributed by the operation of the expanded power station is listed in Table 3.2-2.

Emissions from the auxiliary generator and the fire pump diesel will be minor and will have negligible effect on the environment.

Vapors from the storage, handling, and transport of the fuel oil will be effectively treated to eliminate odors that are objectionable beyond the property lines. The plant contribution to concentrations of hydrocarbons is expected to be well within the limitations of air quality standards.

3.2.1 Stack Emissions

Expected contaminant quantities produced during full load operation of Units 1 through 5 on a common stack and Unit 6 are listed in Table 3.2-3. The total emission of particulates, sulfur dioxide, sulfur trioxide, and nitrogen oxides are also presented in this table. These values are based on compliance with all applicable state and federal emission control regulations, effective in May, 1976.

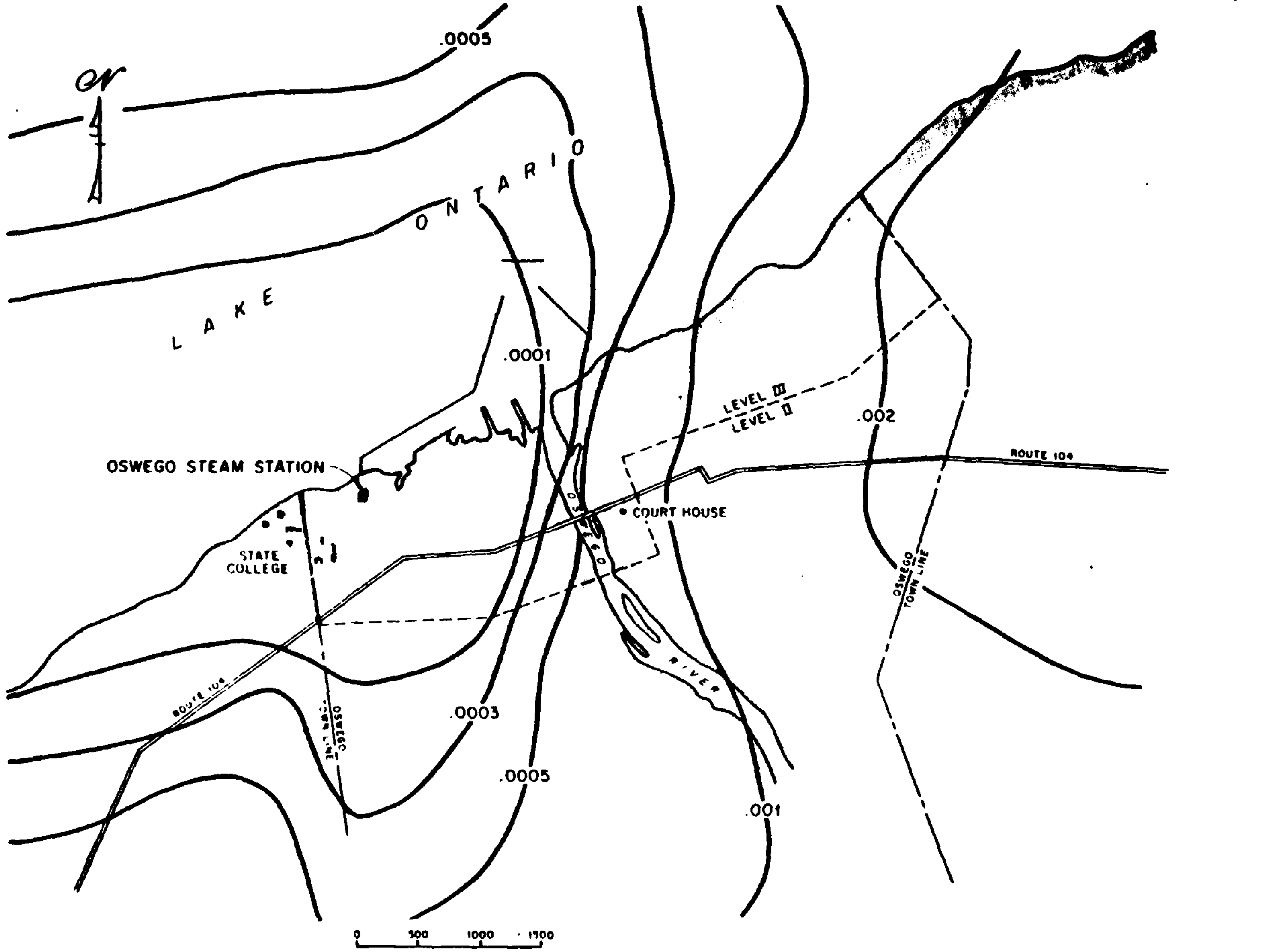


FIG. 3.2-1
PREDICTED ANNUAL AVERAGE
SO_2 CONCENTRATION
UNITS 1-6

OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

NOTE
CONCENTRATIONS ARE GIVEN IN PPM

1979

Table 3.2-1

Comparison of Air Quality Standards and Predicted Ground Level Concentrations

Sulfur Dioxide	Units 1-6	Est. Concurrent Background Level	Maximum State Standard	Federal Standard Primary	Federal Standard Secondary
Maximum annual average concentration, ppm	0.0027	0.02	0.03	0.03	0.02
Maximum 24-hr concentration, ppm	0.038	0.03	0.14	0.14*	0.10*
Maximum 3-hr concentration, ppm	0.171	-	-	-	0.5
Maximum 1-hr concentration, ppm	0.173	0.12	0.50	-	-
Particulate Matter					
Maximum annual average concentration ug/m	0.28	-	45	75	60
Maximum 24 hr concentration, ug/m³	3.9	70	250	260	150
Nitrogen Oxides					
Maximum annual average, concentration ppm	0.0014	-	-	0.05	0.05

Note: Each concentration produced from the power station is estimated at the position where it will be a maximum value at zero elevation above the stack base.

*This concentration not to be exceeded more than once per year.

1981

Table 3.2-2

Contribution of Units 1-6
As a Percentage of Secondary
Federal Air Quality Standard

Sulfur Dioxide	Concentrations From Units 1-6	Percent of the Secondary Federal Air Quality Standard Contributed by the Power Plant
Maximum annual average concentration, ppm	0.0027	14
Maximum 24-hr concentration, ppm	0.036	36
Particulate Matter		
Maximum 24-hr concentration, ug/m^3	3.9	2.6
Maximum annual average concentration, ug/m^3	0.28	0.47
Nitrogen Oxides		
Maximum annual average concentration, ppm	0.0014	2.9

1982

Table 3.2-3

Contaminants Produced at Full Load By Units 1-6

		Units 1 Through 5		Unit 6
Fuel rate, gal/hr		82,800		56,730
Flue gas rate, lb/hr		11,044,000		7,000,000
Flue gas temperature, F		287		280
Gas flow rate, acfm		3,400,000		2,140,000
Particulates Produced				
Ash, lb/hr		606		416
Carbon, lb/hr		1,035		884
Additive rate, lb MgO/hr	266		234	
Conversion of MgO, lb/hr	133		117	
Weight of magnesium sulfate		399		351
Unconverted MgO, lb/hr	133	133	117	117
Total particulates produced, lb/hr	(Units 1-5)	2,173		1,768
	(Units 1-4)	508		
	(Unit 5)	1,665		
Collector efficiency, %	(Units 1-4)	15		95
	(Unit 5)	95		
Weight emitted, lb/hr	(Units 1-5)	515		88
	(Units 1-4)	432		
	(Unit 5)	83		
Stack emission, lb/10⁶ Btu	(Units 1-5)	0.042		0.011
	(Units 1-4)	0.10		
	(Unit 5)	0.01		
Gaseous Contaminants Produced				
Nitrogen oxides, lb/10⁶ Btu	(Units 1-5)	0.41		0.30
	(Units 1-4)	0.62		
	(Unit 5)	0.30		
Sulfur dioxide, lb/10⁶ Btu		2.20		0.8

*Units 1-5 discharge through a common single flue stack; therefore, combined emissions are reported.

On December 23, 1971, the Environmental Protection Agency promulgated the National Performance Standards for New Stationary Sources. In order to comply with emission standard for sulfur dioxide, the Unit 6 boiler will be fired with 0.75 percent sulfur oil, and controls have been designed to meet the performance standards for new sources for particulates and nitrogen oxides. These performance standards are listed below:

	Emission Standards New Stationary Sources* $lb/10^6 Btu$ heat input
Sulfur dioxide	0.80
Nitrogen oxides	0.30
Suspended particulates	0.10

*when liquid fuel is burned

Acidic matter is produced when sulfur trioxide condenses on particulates. The sulfur trioxide and particulate emission controls that will be used when the expanded plant is placed in operation should effectively prohibit the emission of acidic material.

Controls over both the formation, emission, and distribution of air contaminants have been incorporated into the proposed unit. Descriptions of these controls are given below.

Stack

The proposed Unit 6 at the Oswego Power Station will discharge exhaust gases through a 700-ft stack. The height and diameter of the stack and the subsequent rise of the plume are significant factors in the dispersion of contaminants.

The diameter of the stack for Unit 6 has been designed such that a high flue gas exit velocity is maintained even when Unit 6 is not operating at full load. This feature is important since high exit velocities generally maintain plume rise during adverse meteorological conditions; hence, resulting ground level concentrations of contaminants will be lower.

Fuel Oil Additive System

A commercially available magnesium-based additive will be added to the fuel of the Unit 6 boiler in sufficient quantities to reduce emissions of sulfur trioxide. This additive inhibits the catalytic formation of sulfur trioxide and neutralizes sulfur trioxide that is produced.

Electrostatic Precipitator

To provide for maximum removal of particulate matter, an electrostatic precipitator will be installed on Unit 6. The outlet grain loading will be guaranteed not to exceed 0.01 grain (gr) per actual cubic foot (acf) during all normal operating conditions. This emission rate will meet New York State and federal regulations for new oil-fired boilers.

Flame Temperature Control and Low Excess Air Operation

Temperatures in the flame zone in the boiler of Unit 6 will be controlled by the injection of up to 15 percent of the flue gas into the combustion air. Fans, ductwork and a specially designed compartmentalized wind box will be furnished with the boiler to permit this injection of flue gas. Additional air ports will be provided over the burners to introduce overfire air, thus permitting two-stage combustion. The combustion controls on the boiler of Unit 6 will enable an excess air rate of 5 percent to be maintained during operation above 67 percent of full load. These control measures will inhibit formation of both nitrogen oxides and sulfur trioxide.

Flue Gas Temperature Control

Heating coils will be added to the forced draft air ducts of Unit 6 to prevent overcooling of the flue gases in the air heater with a resulting loss of gas buoyancy. The coils on Unit 6 will be sized to maintain a 280 F gas temperature at design load. The coils will be used during startups and low capacity operation to maintain flue gas temperature.

Light Oil Storage

Light fuel oil, Grade 2 will be stored on the site and used for boiler startups to reduce the excessive smoke usually present during boiler ignition.

3.2.2 Emissions From Other Sources

A 225-hp diesel engine will be used to operate the fire pumps. Small engine size and infrequent use will result in insignificant atmospheric discharges.

1985

An auxiliary internal combustion generator rated at 750 KW is now located at the plant site. This generator will be used to provide power to the pumps and fans during shutdown operations. The expected continuous operation of the generator is less than five hours annually. A brief generator test will be conducted once a week. Emissions from this source will be minor.

Steam from the active units will be used to heat the station and no additional combustion equipment will be required for this purpose.

3.2.3 Inversions

The effect of inversions on emissions from Oswego Units 1 through 5 and Unit 6 relative to resulting ground level concentrations of sulfur dioxide, was analyzed using the following: observations from vertical soundings taken twice daily at Buffalo, New York during the period September 1, 1960 through December 31, 1969; plume rise estimates based on calculation procedures suggested by Briggs (Appendix A: Ref. A-10); a plume trapping model described by Turner (Appendix A: Ref. A-1); and a computer program developed by Stone & Webster to analyze the frequency of occurrence of inversions relative to inversion type (ground based or elevated), inversion strength, inversion depth, wind speed, and lapse rate beneath an elevated inversion layer (Appendix A). For the analysis, all units were considered to be operating at 100 percent capacity. Fuel containing 2.00 and 0.75 percent sulfur was assumed for Units 1 through 5, and Unit 6, respectively.

Of the 6,771 Buffalo soundings analyzed, about half showed that an inversion (ground based or elevated) existed at the time of the sounding (either 0700 or 1900 hours EST). Of these, about 61 percent were ground-based inversions and 39 percent were elevated.

Relative to effluent from tall stacks serving large point sources such as those at Oswego, ground-based inversions do not generally cause significant increase in ground-level concentrations of sulfur dioxide. The reasons for this are twofold. First, regardless of how strong an inversion is, the buoyancy of the plume and the momentum from its initial exit velocity cause the plume to rise to significant heights in the atmosphere. Second, during inversions the state of the atmosphere is non-turbulent, hence downward dispersion of the plume towards the earth's surface is very small. Maximum hourly average concentrations of sulfur dioxide resulting from Units 1 through 6 during ground-based inversions are estimated to be no more than about 0.025 ppm.

Elevated inversions sometimes pose a somewhat more significant problem than do ground-based inversions regarding sulfur dioxide emissions from large elevated fixed point sources. The basic reason for this is that an elevated inversion can trap a significant fraction of a plume beneath it, provided its height corresponds approximately to the height at which the plume levels off in the atmosphere. In this case above upward dispersion of the plume is limited due to the stable air above, and downward dispersion is enhanced because air beneath an inversion can range from slightly stable to unstable, thereby providing the potential for rapid mixing of the plume downward.

Plume rise estimates for the Oswego units based on Briggs' equation indicate that significant plume trapping would not occur except for inversions based at heights of about 450 meters and higher. From analyses of the Buffalo sounding data, it was evident that of the 1289 elevated inversions identified, 163 were based at heights between 400 and 500 meters. Of the 163, an unstable layer beneath an inversion was identified on only one occasion.

Using 450 meters as the minimum inversion base height capable of trapping a significant portion of the plume, a 12 meter per second value to represent the corresponding wind speed, a Pasquill stability class C to represent the maximum degree of instability beneath the inversion layer, and the plume trapping model suggested by Turner, the maximum hourly average ground-level concentration of sulfur dioxide resulting from Units 1 through 6 was estimated to be 0.17 ppm. More commonly, neutral lapse rates (Pasquill class D) will occur beneath elevated inversions based at heights on the order of 400–500 meters. Using the above mentioned criteria with stability class D, similar resulting sulfur dioxide concentrations were estimated to be 0.066 ppm.

Since maximum hourly average values of sulfur dioxide resulting from Oswego Units 1 through 6 during inversions rarely approach the State of New York standards for sulfur dioxide, it may be concluded that inversions pose no significant problems regarding operation of the Oswego units. However, in compliance with NYSDEC regulations concerning control of atmospheric emissions during emergency conditions, a four–day supply of 1 percent sulfur oil for all units normally using 2.00 percent sulfur oil will be stored on site. Upon notification by the DEC that atmospheric conditions warrant a reduction of emissions, Units 1 through 5 will be switched over to this lower sulfur fuel. This change in fuel will result in a calculated reduction of over 50–percent in the maximum ground level concentrations of SO_2 contributed by the Oswego Steam Station.

3.2.4 Effects on Elevated Terrain Features

Terrain features which are at a higher elevation than the stack base may experience higher concentrations of a contaminant than those at lower ground elevations since they will be closer to the stack top. For this reason sulfur dioxide concentrations which

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may occur at an elevation 150 ft above stack base were examined and are listed in Table 3.2-4 along with the flue gas exit velocity and wind speed necessary to produce the peak concentrations at different station load conditions. All peak hourly concentrations were found to be less than the New York State allowable 1-hour maximum concentration.

Table 3.2-4 illustrates that the peak concentration for each stability class is constant over a range of station load conditions. This is because an increase in load and contaminant emissions will increase the stack exit velocity and require a corresponding increase in the wind speed necessary to inhibit plume rise and produce peak concentrations. These peaks can occur only when all conditions (load, wind speed, and stability) are those shown in the table. If these conditions do not occur simultaneously, significantly lower concentrations would be expected. It is important to note that the downwind distance to the peak concentration is different for each stability class.

Table 3.2-4
Peak Hourly SO2 Concentration
150 Ft Above the Stack Base

Percent Load	Exit Velocity, fps	Wind Velocity, mph	Concentrations, ppm Stability B	Stability C	Stability D
20	17.4	7.9	0.33	0.28	0.13
30	26.1	11.9	0.33	0.28	0.13
40	34.8	15.8	*	0.28	0.13
50	43.5	19.8	*	0.28	0.13
60	52.2	23.7	*	0.28	0.13
70	60.9	27.7	*	0.28	0.13
Downwind location of peak concentrations (miles)			0.75	1.13	4.5

* B stability does not occur at these wind velocities.

3.3 NOISE

Unit 6 will contain several noise sources, but is designed to reduce noise from inside and outside the building and to minimize noise impact on the surrounding area.

Design sound levels for Unit 6 and Unit 5 were set at approximately 10 dB beneath the combined sound levels for Units 1 through 4 to prevent an increase of plant noise. Because of the barrier effect of Unit 6, the sound level at Site 4 (see below) and in much of the adjacent residential neighborhood should decrease with the addition of Unit 6.

3.3.1 Noise Surveys

Noise surveys were conducted for Niagara Mohawk on August 17 (Ref. 26) and September 9, 1970 (Ref. 27) in the neighborhood of the present power station. The measurements were taken by the Noise Services Group of Bolt Beranek and Newman Inc. Each survey consisted of a series of octave-band, sound-pressure level measurements, taken during the afternoon and early the next morning. The early morning sound-pressure levels (SPL) are representative of minimum ambient sound levels when plant noise will have its greatest effect. They will be used exclusively in this discussion to determine plant noise impact. During the first survey, noise measurements were made at each of the locations shown in Figure 3.3-1. The second survey included only the property line locations of Sites 1, 4 and 10, but these measurements were very similar in both surveys. Figure 3.3-1 presents sound levels given in decibels "A" scale (dBA) that were computed from octave-band sound level measurements. The underscored values indicate sites where the plant noise predominates. Peripheral measurements generally typify background levels unaffected by the plant. The noise level at Site 7 is controlled by a nearby university power plant.

3.3.2 Noise Criteria

Many noise sources contribute to the ambient noise levels in the vicinity of the plant. These include lake surf, insects, traffic, commercial business, factories, college power plant, and air-conditioning equipment. The present overall plant noise from the operation of Units 1 to 4 may be defined by the nighttime ambient noise levels at the property line locations 1, 4 and 10 located west, east, and south of the plant. The octave-band sound pressure-level for these locations appears in Figure 3.3-2. Because of the 46- to 50 - dBA noise levels at the edge of the residential area east and south of the plant, and the 54 dBA at the college property line, a criterion of inaudibility was chosen for Unit 6. The overall ambient noise levels of the plant are not expected to increase by the addition of Unit 6.

1989

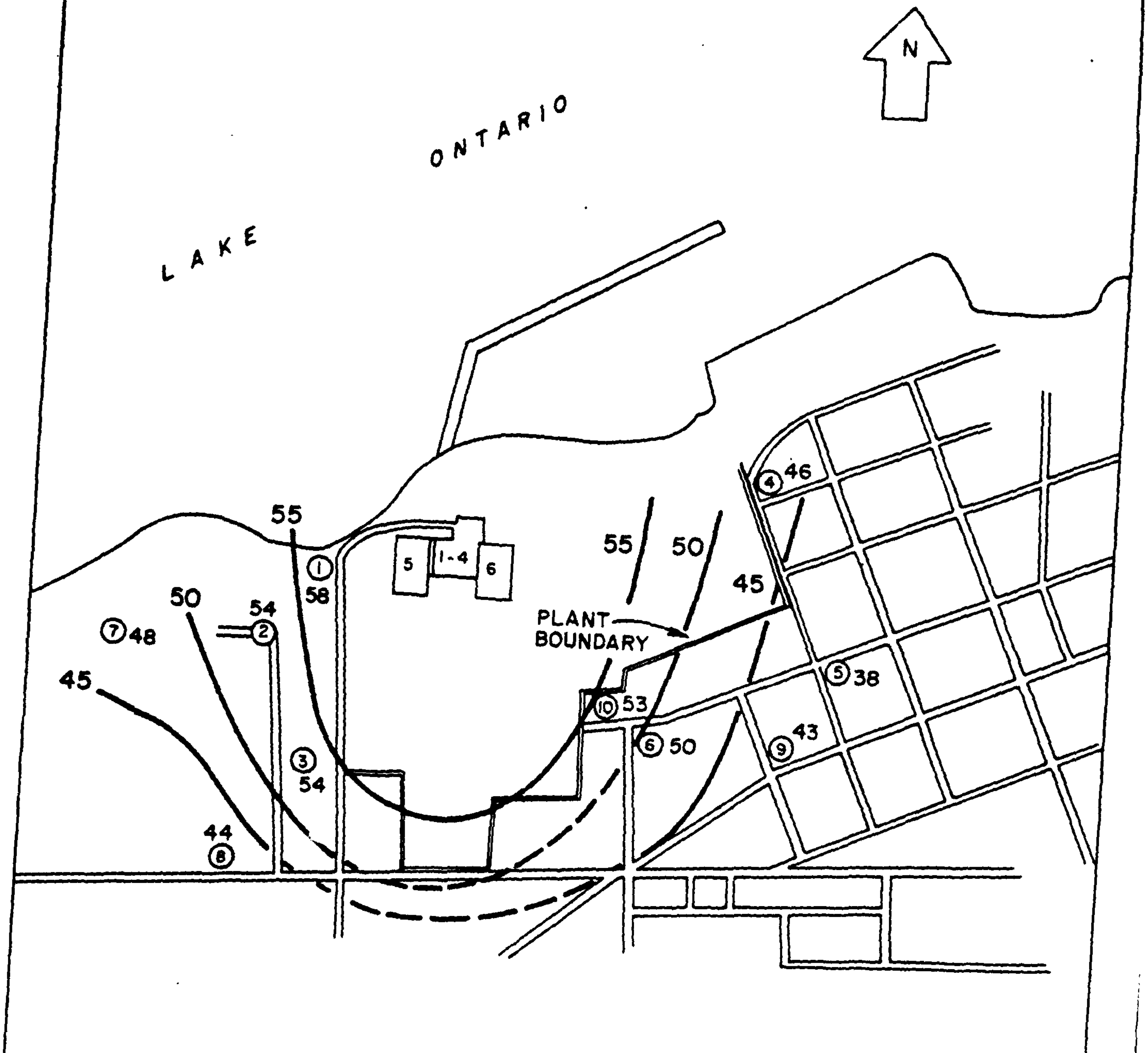
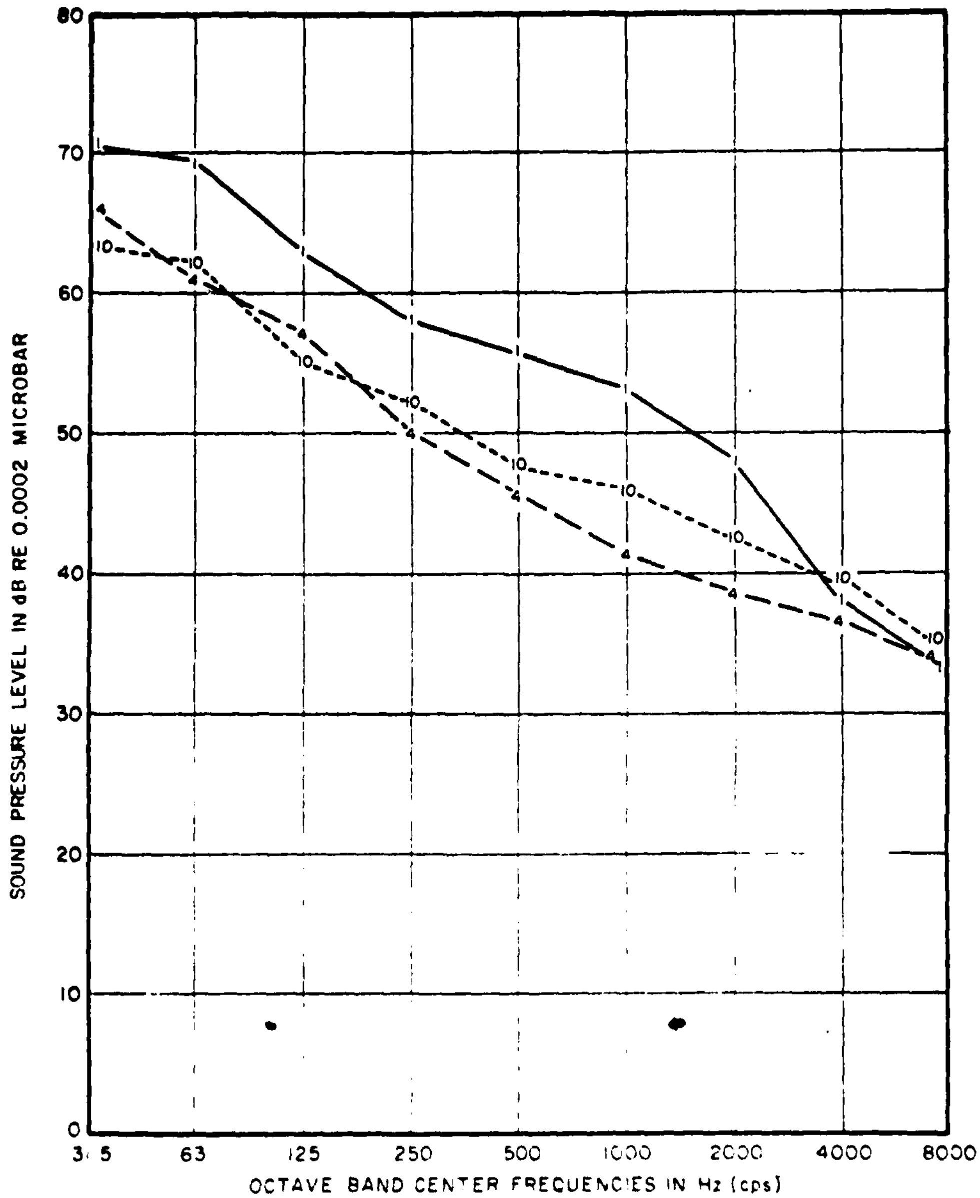


FIG. 3.3-1

SOUND LEVEL - DECIBELS, A SCALE

NIAGARA MOHAWK POWER CORPORATION



NOTE:
NUMBERS 1, 4, 10
INDICATE MEASUREMENT SITE

FIG. 3.3-2
OSWEGO SOUND LEVELS
NIGHTTIME AVERAGES
NIAGARA MOHAWK POWER CORPORATION

3.3.3 Noise Control Techniques

The noise levels produced by Unit 6 will be reduced through the use of several noise control techniques. The forced draft, induced draft and flue gas injection fans will all be housed in separate acoustically treated rooms for noise reduction. Heavy duct lining will be applied downstream of the fans to reduce duct noise radiation. Silencers will be used at the forced draft fan air intake.

The boilerhouse and the turbine hall will be totally enclosed with double wall siding to restrict internal noise. All windows will be fixed sash, double-glazed and the building will be ventilated by the use of fans with silenced intakes and exhausts as necessary. The boiler safety valves will also be silenced. The plant main transformer will be housed in a sound attenuating enclosure.

These noise control techniques should reduce noise produced by Unit 6 sufficiently to prevent audibility at all points on the property line with the present four units in operation. After Unit 6 is in operation, a post-operational survey will be conducted at the three property line locations indicated above to verify that the plant meets the specified noise criteria. If necessary, adjustments or modifications will be made.

1992

3.4 SANITARY WASTE

Sanitary waste from proposed Unit 6 results from conventional water closet and washing facilities. The sanitary waste system is isolated from the process and storm drainage systems. This liquid waste will first discharge to the sanitary sewer system in the present powerhouse, and then to the Oswego municipal sewage system. During periodic plant maintenance activities, short periods of greater flow may occur due to the increase of personnel.

This quantity of sewage will have a negligible effect on the total contributory flow to the municipal waste treatment system. The average design flow rate of the Oswego City treatment plant will be about 4 million gallons per day (mgd).

1993

3.5 LIQUID WASTES

The environmental impact of Oswego Steam Station liquid wastes, including the liquid wastes from Unit 6, will be controlled by the proposed system of collecting, treatment, and recycling where possible, and dilution prior to discharge to Lake Ontario. Table 3.5-1 shows the sources and flow data from Units 1-6. The composition of the liquid waste from Units 1-6 before treatment, and the composition of the combined condenser cooling water and treated liquid waste to be discharged to Lake Ontario is presented in Table 3.5-2. The composition of the discharge waste was conservatively determined by combining all waste flows which have a frequency greater than 1 discharge volume per week.

The composition of the combined condenser cooling water and treated chemical waste discharge to be released to Lake Ontario, as presented in Table 3.5-2, shows a maximum theoretical increase in total dissolved solids above ambient of about 50 parts per million (ppm), made up chiefly of sodium chloride and magnesium sulphate. This 50-ppm increase in dissolved solids would only occur during a condition of simultaneous discharge of all liquid waste streams to the liquid waste treatment system. Under normal operation, the variability in the frequency of discharge, as shown in Table 3.5-1, would realistically preclude the occurrence of this condition. Since heavy metals, phosphates, and suspended solids will be removed from the liquid waste, the composition of these substances in the combined condenser cooling water and treated chemical waste discharge will be slightly lower than the ambinet concentrations.

Liquid waste streams resulting from (1) equipment cleaning operations every 3 to 12 months, and (2) chemical cleaning performed once prior to start-up and as conditions require, (experience indicates chemical cleaning will be required once every 2 to 4 years) will be treated for removal of suspended solids, heavy metals, and phosphates prior to discharge to Lake Ontario. These effluents will contain only small quantities of dissolved solids, mainly sodium chloride. In addition, the concentrations of the surface active agents (0.1 to 0.2 ppm) proposed for use at the Oswego Steam Station are not toxic to aquatic life.

Other continuous and intermittent liquid wastes associated with normal operation of Units 1-6 will be treated and recycled where possible. Only those treated effluents listed in Table 3.5-1 will be discharged to Lake Ontario. The solid chemical wastes recovered from the settling basin will either be sold for metals recovery, or properly disposed of at an existing sanitary landfill site on Niagara Mohawk property 2.5 miles east of the plant. Oil collected from the oil floatation tank skimmer will be returned to the fuel oil tanks, as described in Section 1.3.5.

Table 3.5-1

Liquid Wastes - Units 1-6

Source	Frequency	Duration (Minutes)	Average Flow (Gpm)	Maximum Flow (Gpm)	Total Volume Per Cycle (Gallons)
Unit 6:					
Boiler Blowdown	Continuous	-	60	60	-
Electrostatic Ppt. Ash Sluice	Continuous	-	175	250	-
Building Drains	Intermittent	-	350	600	-
Make-up Demineralizer Regen.			(Uses Unit 5 Available Capacity)		
Make-up Filter Backwash			(Uses Unit 5 Available Capacity)		
Air Preheater Wash	1 per 3 months	8 hr	600	1,000	288,000-480,000
Boiler Fireside Wash	1 per year	8 hr	325	400	156,000-192,000
Boiler Chemical Cleaning	1 per 3 years		400	500	1,112,000
Condensate Polishing Demineralizer Regeneration	1 per week	6 hr	330	560	32,280
Boiler Precleaning	1 for start-up		400	500	496,000
Unit 5:					
Boiler Blowdown	Continuous	-	60	60	-
Electrostatic Ppt. Ash Sluice	Continuous	-	175	250	-
Chemical Area Drains	Continuous	-	5	5	-
Make-up Filter Backwash	2 per day	10	1,260	1,260	12,600
Make-up Demineralizer Regen.	2 per day	1-60	260	365	15,350
Condensate Polishing Demineralizer Regeneration	1 per week	6 hr	330	560	32,280
Air Preheater Wash	1 per 3 months	8 hr	600	1,000	288,000-480,000
Boiler Fireside Wash	1 per year	8 hr	325	400	156,000-192,000
Boiler Chemical Cleaning	1 per 3 years	10 hr	400	500	1,120,000
Building Drains	Intermittent	-	350	600	-
Boiler Precleaning	1 for start-up		400	500	496,000
Units 1-4:					
Make-up Demineralizer Regen.	3 per day	120	30	30	3,600
	9 per week	40	150	150	6,400
	4 per year	75	8	10	600
Carbon Filters	1 per week	10-15; 15-25	20; 40	20; 40	200-300; 600-1,000
	2 per week	15-25; 10-15	160; 80	160; 80	2,400-4,000; 800-1,200
Softeners	6 per month	40	25	25	1,050
	2 per week	20	50	50	1,000
Anthracite Filters	1 per day	15-25; 10-15	300; 100	300; 100	4,500-7,500; 1,000-1,500
	1 per week	15-25; 10-15	150; 50	150; 50	2,250-3,750; 500-750
	2 per week	15-25; 10-15	400; 120	400; 120	6,000-10,000; 1,200-1,800
Boiler Blowdown (for 4 Boilers)	3 (x 4 units) per month	120	40	40	4,800

1994

Table 3.5-2

Liquid Waste Composition - Units 1-6

	Water Quality - Lake Ontatio, Ppm(1)		Estimated Waste Composition - Average, Ppm(2)	Estimated Waste Composition - Maximum, Ppm(2)	Estimated Composition of Circulating Water and Treated Waste Average Ppm(3)	Estimated Composition of Circulating Water and Treated Waste Maximum, Ppm(3)
	Mean	Max				
Alkalinity ($CaCO_3$)	94	101	340	470	100	110
Ammonia-N (N)	0.47	1.31	1.0	2.8	0.48	1.3
Calcium (Ca)	44.0	54.0	120	150	46	56
Chlorides (Cl)	30.3	55.5	550	580	41	66
Hardness ($CaCO_3$)	146	240	420	680	190	250
Iron (Fe)	0.6	0.9	3.3	3.9	0.6	0.9
Magnesium (Mg)	8.9	29.0	130	180	11	32
Nitrate-N (N)	0.14	0.51	0.30	1.1	0.14	0.52
pH	7.9	9.0	11.9	12	7.5	8.5
Phosphates (PO_4)	0.19	1.65	0.68	3.4	0.19	1.6
Potassium (K)	1.6	11.4	3.5	25	1.6	12
Sodium (Na)	16.6	45.0	600	660	28	58
Sulfates (SO_4)	30.1	50.0	470	510	39	60
Suspended Solids (Total)(4)	10.5	44.0	2,000	2,600	10	43
Total Dissolved Solids (Calculated)	232	489	2,300	3,000	280	540
Vanadium (V)(4) (No data available)	-	-	48	48	0.0	0.0

(1)Data recorded by the New York State Department of Environmental Conservation
(2)Flow equals 5,915 gpm (maximum weekly flows)
(3)Flow equals 635 cfs
(4)Precipitated and/or settled out in settling basin

1995

3.6 FUEL OIL PIPELINE

As described in Section 1.3, there are two alternative routes for oil pipeline installation. One will utilize the existing transmission line right-of-way and the other will tie into the new proposed transmission line right-of-way. As discussed in Section 2.7, the terrestrial regions of the existing and new right-of-way are very similar due to the past history of land use and the present practice of allowing low-lying vegetation to vegetate the right-of-way. Considering the similarity of the two proposed routes, it is therefore believed the impact of pipeline installation on either route will be comparable.

The installation of the pipeline will necessitate cutting a trench from the oil treatment facility to the station complex. Following placement of the line the soil will be replaced and allowed to vegetate to an early successional stage. During the period of construction, the existing vegetation will be destroyed and the associated wildlife displaced to nearby habitats to either fill vacant "niches" or compete with other individuals if the surrounding habitat is filled to its carrying capacity. If the soil were allowed to vegetate naturally the stages of succession would proceed from the invasion of annual weeds, with gradual replacement by perennial species. Herbaceous plants would be replaced by woody shrubs and eventually young trees culminating in a northern hardwood forest. The climax community in this region is dominated by sugar maple, beech, yellow birch, and hemlock. In order to provide access for pipeline maintenance and inspection it will be necessary to periodically mow this area. As a result the vegetation will be limited to low-lying stands of ground cover. Although this habitat will be limited with respect to providing shelter for many animal species, it will provide seeds and forbs for forage. Considering the relatively small area being disturbed and abundance of similar habitat in this region, the overall impact on the terrestrial ecology of the area is believed to be small.

3.7 CONSTRUCTION

3.7.1 Impact On Land

Construction of Unit 6 will take place during the period 1972 through 1976. All feasible measures for limiting the environmental impact of construction activities will be taken.

A considerable amount of rock and earth excavation will be required. Excavated material will be disposed of at an offsite location owned by Niagara Mohawk.

Excavation will be with conventional earth-moving equipment and rock blasting where necessary. Dust and flying debris from blasting will be controlled by the generally damp condition of the underground surfaces and by protective mats over the blasting zone. Some additional surface blasting and subterranean blasting for cooling water tunnels will occur throughout the foundation construction period ending about November 1973.

During plant construction, heavy equipment and trucking noises will be experienced. Material deliveries to the site will be via an existing rail spur or by truck. Unloading will be performed west or south of the present building. Primary road access will be via Lake Street at the east side of the property. All unstabilized access roads will be treated with water to minimize dust formation. Secondary access to the construction site will be via Sixth Avenue at the west of the site.

The plant property is essentially devoid of woods or marshlands. No trees or significant vegetation must be removed to provide access or for site preparation. The construction techniques employed will provide for the control of erosion and sedimentation. Due to the industrialized character of the plant site, minimal ecological impact is expected during construction. No permanent alteration to the environmental setting, other than the existence of the new facilities, will result. A description of site landscaping is presented in Section 8.2, in a response to DEC comment on aesthetic impact.

During construction public access to the existing breakwater will be blocked for safety reasons. The area which is now used for fishing and recreation will again be accessible after completion of construction.

3.7.2 Impact On Water

Water oriented construction to be undertaken relative to Unit 6 consists of the following items:

- Circulating water intake structure
- Discharge diffuser for circulating water
- Tunnels to intake and discharge structures

The intake and discharge structures will be outside the west basin bounded by the harbor breakwater.

The intake structure will cover a lake bottom area of less than 2,000 sq ft and disturbance of the very firm glacial till overburden on sandstone bedrock will be minimal. No disturbance of beaches along Lake Ontario is expected during offshore construction.

Similarly, the drilling of the rock tunnels including the branch tunnels which will be up to 100 ft below lake bottom will result only in very minor disturbance of the lake water at the points of entry of the intake and diffusers.

Excavated material resulting from the construction of the tunnels will be disposed of at the offsite location owned by Niagara Mohawk.

3.7.3 Socio-Economic Impact

Construction of Unit 6 will result in total expenditures estimated at $200,000,000. Approximately $45,000,000 will be spent locally. The remaining amount will cover material costs and miscellaneous indirect expenses which will have no impact on the local economy.

Local labor expenditures will be distributed over the period 1972 through 1976. Peak employment amounting to approximately 1,000 jobs will occur during 1975. For comparison, the largest employer in the City of Oswego (The State University College) employs about 1,300. The largest industrial employer, "Alcan" has about 750 employees. Based on anticipated average wage rates, the maximum weekly payroll will exceed $250,000. In 1969, prior to start of construction at this plant, retail sales in the City of Oswego were approximately $40,000,000 and in Oswego County were approximately $125,000,000. The corresponding figures for total spendable income were approximately $67,000,000 and $250,000,000. It is expected that a significant increase in each of these figures will result from the construction payroll.

Other construction projects in the Oswego area have resulted in relatively high employment for the heavy construction trades. For this reason, some influx of transient labor is expected. Based on labor patterns at similar project sites, most of these workers will maintain permanent residences elsewhere. Some will obtain temporary quarters for themselves, but will not relocate their families. A small percentage are expected to relocate their families to permanent residences in the Oswego vicinity.

3.8 SCENIC AND AESTHETIC IMPACT

The proposed Unit 6 of the Oswego Steam Station will be constructed on a site that presently contains four units totalling 320 MW and a fifth 816-MW unit that is under construction. The new unit will be placed such that the station building will be symmetrical and the shape and the architectural treatment will be consistent with the present structures. This design will create a unified appearance and an impression of stability that is appropriate for a power generation station. Landscaping and plants will be used to create a pleasing appearance. The location of the power station is in keeping with the industrial zoning of the area.

Unit 6 will be provided with a 700-ft concrete chimney. The appearance of the two 700-ft stacks is not expected to be detrimental to the land use of the surrounding area. The frontispiece of this report illustrates the visual impact of the proposed action on the environment.

3.9 MONITORING PROGRAMS AND FUTURE STUDIES

3.9.1 Water Quality Studies

Preoperational fathometric, hydrodynamic, and ecological investigations are being conducted in Lake Ontario in the vicinity of the Oswego Steam Station. The objectives of these studies are: (1) to provide a better base from which facilities can be designed such that the adverse environmental effects of discharges from Unit 6 will be minimized, and (2) to establish the status of the aquatic environment prior to operation of the new unit.

Ecological investigations were initiated offshore of the existing station in June, 1970 and continued through November, 1970, and from April through June, 1971. These investigations constituted the first year of preoperational study at the site. A report on the findings of these investigations was prepared by Quirk, Lawler, and Matusky Engineers (QLM) for Niagara Mohawk (Ref. 28) and submitted to the New York State Department of Environmental Conservation in support of an application for a permit to construct discharge facilities for Unit 5.

The studies included the collection and analysis of fish, benthos, and plankton. Fish were collected and analyzed for food preferences and condition. Echo sounding techniques were used to conduct fish distribution studies at the site and scuba methods were employed to collect benthic samples and determine the extent of cladophora growth in the area.

Water samples were collected at various locations in the lake and subjected to complete water quality analyses. In addition, temperature surveys were conducted to determine ambient conditions and the degree of stratification in the lake. Bottom contours and characteristics, current behavior, and other physical characteristics of the area, which are important elements of the ecosystem, were also investigated in the first year of preoperational survey.

Another period of ecological studies was initiated in April, 1972 and completed in November, 1972. This program was similar in scope to the June - November, 1970 and the April - November, 1971 surveys but modified to reflect improved techniques and procedures. Additional studies will be performed during 1973 to further substantiate the conclusions reached from the previous studies.

Postoperational ecological studies similar in scope to the preoperational ones will be conducted in order to evaluate the effects of plant operation on the aquatic environment. Hydrothermal studies to be undertaken after Unit 6 is operational will determine the characteristics of the discharge plume and verify compliance with the thermal standards and criteria it was designed to meet.

3.9.2 Air Quality Studies

Several air monitoring efforts were conducted during 1970 and 1971 to evaluate and characterize the stack effluent of the existing four coal-fired units and measure ambient air quality. Data acquired from these programs were employed to estimate background concentrations of sulfur dioxide due to other sources and therefore estimate the total effect upon ambient air quality of both a four- and a five-unit oil-fired station. Additional testing will be conducted to measure specific (SOx, NOx, CO, particulate) stack emissions and measure the ambient air quality levels to verify the effluent dispersions predicted for the expanded oil-fired station.

The emissions testing—ambient air sampling efforts will be expanded upon completion of the fifth unit scheduled for late 1974, at which time the stack effluents from the existing four units will be combined with the exhaust of the fifth unit to exit via a single 700-ft stack. This stack will be equipped with sampling ports and instrumentation equipment capable of sampling and measuring SOx, NOx, CO emissions, and plume opacity.

Data collected from these emission and ambient air sampling efforts will be employed to establish preoperational conditions for the Oswego 6 unit. It is planned to equip this stack with sampling-monitoring equipment similar to that on the Unit 5 stack.

During the start-up and early operating phase of the six-unit, oil- fired station, a program of sampling and monitoring of ambient air quality will be initiated. The major objective of this program will be to measure and evaluate the effect of the station upon ambient air quality and verify the concentration level predictions developed during the preoperational phase.

SECTION 4

UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED SHOULD THE PROPOSAL BE IMPLEMENTED

Two general criteria have been used in determining what ought to be defined as adverse effects. The first criterion is the application of existing local, state and federal numerical or otherwise well defined standards. The second guideline involves the recognition that not all environmental effects are always included in regulatory standards and consequently, consideration must also be given to qualitative, less well defined concepts of effects that can be environmentally damaging.

4.1 AQUATIC BIOTA

The anticipated impact on aquatic organisms from the proposed discharge in Lake Ontario is described in Section 3.1.

Preliminary data taken from water samples indicate that a small percentage of fish larvae will be destroyed as a result of passage through the circulating water system. Because of the paucity of fish in the vicinity of the proposed intake structure and the precautions taken in the design of the lake structures, no significant loss of more mature fish is anticipated in proportion to the fish population as a whole.

4.2 AIR QUALITY

The impact of air discharges is described in Section 3.2.

The Oswego Steam Station will add relatively small concentrations of air contaminants to the atmosphere. The resulting ambient levels of contaminants are expected to be well below those levels considered by the Federal government to be harmful.

4.3 FUTURE ADJACENT LAND USES

Land uses immediately adjacent to the plant site include institutional and public to the west, residential, commercial and light industry to the south, and residential and heavy industry to the east. The Comprehensive Zoning Map of the City of Oswego, adopted in July 1959, indicates that these uses conform to the zoning now in effect. Furthermore, the most recent Master Plan for the city, dated July 1958, proposes continued use as described above for the areas adjacent to the Oswego Steam Station.

2003

SECTION 5

ALTERNATIVES TO THE PROPOSED ACTION

5.1 NOT PROVIDING THE POWER

The Public Service Law of New York State, under which the applicant operates as a public utility, requires that the applicant must adequately supply electricity to its customers, the bulk of upstate New York's residential, commercial and industrial consumers. Applicant has discontinued the advertising of electricity, except that used for safety reasons, such as street and highway lighting.

Because of the long lead times necessary for sitings and construction of major power facilities, electric utilities must project plant expansion programs on demand forecasts based on historical growth trends adjusted for expected changes in consumer requirements. In many areas, including upstate New York, previous forecast figures have been exceeded. The applicant's most recent prediction of demand on its system indicates that its load will reach 6,105 megawatts (MW) by the winter of 1976, and 6,365 MW by the winter of 1977.

Without the addition of the power producible by Oswego Unit 6, the applicant's generating resources in 1977 including firm purchased power will amount to 7,282 MW. A peak demand of 6,265 MW will leave a reserve of 917 MW, or about 14.4 percent. Experience shows that this margin is insufficient to ensure continuous adequate service when essential scheduled maintenance and forced outages are taken into account.

The applicant is a participating member of the New York Power Pool, an association of the electric utility companies of New York State, one of the principal functions of which is to conduct studies to optimize system design and operation of the interconnected facilities of the member companies.

To meet the reliability objectives of the pool, the applicant intends to provide capacity in excess of peak load. To meet the projected 1976 winter peak load and maintain the desired reserve margin, the applicant must have 7,204 MW of generating capacity in service or available for service by November of that year. During the winter of 1971, the applicant had 5,671 MW of generating resources of which 4,003 MW were installed capacity. The remaining 1,668 MW were purchased from others. An additional 1,330 MW are presently under construction, and purchases will increase by 432 MW, making available a total of 7,433 MW of generating resources by the winter of 1976.

Without taking into consideration the expected loss of additional capacity caused by scheduled maintenance and forced outages, this total of 7,433 MW will be reduced by a minimum of 663 MW due to day-to-day short-time unavailability of generating capacity. The resulting 6,770 MW fall short of the projected peak load plus desired reserve margin and indicates that additional generating capacity must be available.

5.2 PURCHASED POWER

The New York Power Pool and its members have found that realistic possibilities for additional power purchases in the mid-1970's do not exist. Both the Pennsylvania-Jersey Maryland Interconnection (PJM) and the New England Power Pool (NEPOOL) are experiencing capacity shortages similar to those of the New York Power Pool.

In order to maintain reliability in the New York Power Pool each member is expected to maintain capacity at least 18 percent in excess of anticipated peak load. The lack of adequate reserve capacities currently has made it impossible for some members to undertake usual yearly maintenance. A continuation of this situation would result in an increased number of forced outages and lowered reliability. To allow all pool members opportunity for required maintenance, and to enable the pool to have sufficient capacity to meet load requirements, each member must meet his capacity obligation to the pool.

5.3 ALTERNATIVE MEANS OF GENERATION

Coal-fueled unit

Several factors must be considered reqarding expansion of the Oswego Station with additional coal-fired capacity. Among these are:

(a) Increased solid waste associated with the higher percentage of ash in coal fuel.

(b) Onsite railroad delivery for the formerly coal-fired units which disrupted residential highway traffic in the Oswego area and which would cause much greater disruption if coal trains were employed as a supply for Unit 6.

(c) Balance of fuel concept and availability of low-cost coal. Niagara Mohawk has attempted to establish a balance of fuels throughout its system which would provide quality power if severe shortages occur from one source or another. In keeping with this philosophy, the following quote from testimony by F. S. Brown of the Federal Power Commission at hearings by the Joint Committee on Atomic Energy held in November 1969 is appropriate to the coal versus oil situation: "with the exception of Central and Western Pennsylvania, where low-cost coal is abundantly available, the New England and Middle Atlantic States do not have access to low-priced coal. The competitive fuels are the imported low-sulfur residual oils in locations with deepwater port facilities, and nuclear fuels."

(d) The use of coal would produce greater emissions of sulphur dioxide and oxides of nitrogen than oil, resulting in increased adverse environmental impact on the Oswego area.

Natural gas fueled unit

The quantity of natural gas necessary to generate the required amount of electricity from this site is not available in the Niagara Mohawk system and it cannot presently be obtained and delivered to the site.

Nuclear fueled unit

A minimum of six years is necessary to license and construct a nuclear plant on an approved site.

The fossil-fired unit (oil-fired was the only viable alternative method of generation at the Oswego Steam Station. The limited amount of land available at the Oswego site and the large population of the nearby City of Oswego precluded a nuclear unit at the Oswego Station. A nuclear unit at the oswego site would violate the AEC siting criteria for exclusion radius and population density surrounding the plant.

Gas turbines

Gas turbines are generally unsuited for the continuous operation required of base-loaded units. They are known to have a relatively low availability due to maintenance requirements and to have a high fuel cost. Significant environmental impact would be experienced due to sound levels emitted by the large number of units (16 to 40) required to generate the required amount of electric power.

Hydroelectric facility

Niagara Mohawk's system and franchise territory does not include sites which possess the hydroelectric potential which could supply the electrical output necessary to meet 1974 load demands. Niagara Mohawk has 81 hydroelectric plants throughout its system which presently account for about 20 percent of the installed system capacity. Most of these are comprised of small supervisory load controlled units with the largest being 50 MW. A large pumped storage project would be unsuitable because of the base load capacity required to meet Niagara Mohawk's power needs.

5.4 ALTERNATIVE SITES

Projected power demands indicate that the Niagara Mohawk system would be required to supply additional power to the eastern load center in 1974. The areas of site exploration were consequently limited to the central and eastern divisions. Major site selection efforts were concentrated on several areas within the franchised territory which provide adequate supplies of cooling water and sufficient acreage for the location of a generating station of the size required.

A number of factors were evaluated before final selection of the Oswego Steam Station site. The most important was the time which could be saved by locating the unit on an available existing site, and the joint use or sharing of existing facilities rather than building new ones. Construction of an additional large fossil fueled generating unit at this site has been found to be compatible with environmental considerations. Air quality, water quality, noise, and waste disposal criteria can be met through application of conventional technology.

Obtaining a land option, physical site field studies, environmental investigations and final land acquisition of a new, undeveloped site would necessarily entail delays of up to two years.

5.5 ALTERNATIVE COOLING METHODS

The decision to expand the Oswego Steam Station was influenced by the availability of a body of cooling water large enough to make it possible to meet New York State regulations regarding thermal discharge, which prohibit a temperature rise of more than 3 F outside a 300-ft radius mixing zone. The once-through system as described previously will meet this requirement by returning cooling water to the lake through a multiport diffuser which permits rapid dilution by entrainment of large quantities of cooler lake water.

Other methods investigated for providing cooling water included cooling ponds, lake surface discharge harbor discharge, and cooling towers. After a detailed comparison of these alternatives, the direct cooling method with a multiport diffuser was chosen, based on the following considerations:

1. Limited available land space
2. Capability of meeting New York State criteria for thermal discharges
3. Greater reliability than cooling systems with more mechanical equipment

Cooling Ponds

A cooling pond was not considered to be a feasible alternative because the pond area required for a station this size is about 800 acres. The present site is about 91.5 acres and no undeveloped land is available in the area. Furthermore, such ponds would result in environmentally objectionable ground level fog.

Surface Discharge

Alternatives to the proposed circulating water system include a surface rather than a submerged discharge configuration. A surface discharge would provide the most suitable method of handling the thermal effluent from the standpoint of heat transfer to the atmosphere. However, if the discharge enters the lake surface at a low velocity, the heated discharge may encroach on the shoreline under certain current conditions. Furthermore, this type of discharge, although satisfactory for rapid heat transfer to the atmosphere, would not provide sufficient mixing water to maintain New York State thermal discharge numerical criteria limitations. Increasing the velocity of the discharge would alleviate the former objection but not the latter.

The maximum allowable surface temperature rise of 3 F above ambient lake water temperature over an area not to exceed 300 ft in radius would be contravened by use of either a high or low velocity surface discharge for the proposed Unit 6.

Harbor Discharge

The alternative of a harbor thermal discharge from Unit 6 has also been eliminated because temperature measurements in the harbor area indicate that the New York State numerical thermal criteria would similarly be contravened as a result of the additional effluent.

Cooling Towers

Investigations have shown that wet mechanical draft cooling towers with a fog abating system or a wet natural draft cooling tower are feasible cooling system alternatives. A wet mechanical draft tower arrangement without fog abating equipment was dismissed as an alternative due to its greater potential for creating ground level fog than the towers discussed below. Ground level fog is objectionable at this site because of its proximity to the City of Oswego.

Dry cooling towers were not considered to be a practical alternative at this time because the state of the art is not sufficiently advanced for a tower of the size required for this station. The largest station utilizing this type of tower has a capacity of about 200 MW. The turbines used in these installations must of necessity operate with back pressures of 15± inches of mercury absolute pressure (in. Hg abs). Turbines manufactured at the present time for units the size of Oswego Unit 6 will not operate at back pressures higher than ±6 in. Hg abs. It is not anticipated that units operating at higher back pressures will be available in the near future.

The installation of an induced draft or natural draft cooling tower would alter the sound in the residential areas surrounding the plant. For the natural draft tower, the predominant noise is in the mid-to-high frequencies, resulting from falling water within the tower. This would cause an increase in the present sound level for the 2,000 cycles per second (Hz) frequency at the residences on the east side of the plant. The mechanical draft tower emits the sound of falling water, plus low and mid-frequency noise from the fans and motors. The sound level increase would be somewhat greater than the increase expected with the natural draft system.

Sections 5.5.1 and 5.5.2 describe the possible mechanical arrangements of both the natural draft cooling tower, and the wet mechanical draft cooling tower with fog abating apparatus. Predicted effects on the environment due to discharge of large amounts of moisture to the atmosphere are also discussed.

5.5.1 Natural Draft Cooling Tower System

The circulating water system would consist of a natural draft cooling tower, a screenwell structure housing circulating water pumps and related equipment, piping to and from the condenser, and makeup and blowdown systems. Circulating water, cooled in the tower and collected in the tower basin, would flow into a screenwell, pass through panel screens, and be pumped through a piping system to the condenser and back to the tower.

The natural draft hyperbolic cooling tower would be either of the cross-flow or counter-flow type. Based on tower optimization studies and turbine back pressure considerations, the tower would have an 18 F approach at a design wet bulb temperature of 74 F and relative humidity of 60 percent. The tower would be designed for a total circulating water system flow of 285,700 gallons per minute (gpm) and a temperature range of 28.6 F. The size of the cooling tower required to meet these criteria would be about 400 ft in diameter and 370 ft high for the cross-flow type. The counter-flow type tower would be somewhat smaller in diameter and greater in height.

In order to maintain circulating water quality at a specified level, a blowdown pipeline would discharge a regulated quantity of circulating water from the system into Lake Ontario through the discharge line of the existing circulating water system for Units 1 through 4. This water would be treated as required to meet the appropriate water quality standards in order to prevent any significant environmental impact. A separate pipeline would obtain tower makeup water from Lake Ontario to augment circulating water lost by blowdown, tower evaporation, and drift. This water would be pumped from the existing screenwell at Units 1 through 4.

<u>Environmental Effects of the Natural Draft Cooling Tower Plume</u>

Studies were conducted to determine the extent of fogging that could be created by the natural draft tower plume and to evaluate the frequency of ground level fog which might be expected as a result of the operation of a natural draft tower at the Oswego Steam Station. For this study the station was taken to be operating at the anticipated full load heat rejection of 4.08 billion British Thermal Units (Btu) per hr. The following preliminary performance data for a cross-flow type tower were obtained from a manufacturer for use as input data for tower plume analysis:

a. Top Diameter - 160 ft

b. Height - 370 ft

c. Tower exit air temperature versus ambient air wet bulb temperature curves for different ambient air relative humidities

d. Tower exit air velocity versus ambient air wet bulb temperature curves for different ambient air relative humidities

Ten years of hourly weather observations from Rochester, New York, from January 1, 1949 through December 31, 1958 were used in the analysis. Meteorological parameters used as input for the analysis were ambient dry bulb temperature, relative humidity and wind speed. The most important parameter in the analysis is ambient wet bulb temperature, which was computed based on a psychrometric chart in the mathematical analysis. The meterological parameters were grouped into the following classes:

Air Temperature, F	Relative Humidity, Percent	Wind Speed, Knots
-5 (0 to -9)	20 (0-39)	1 (0 to 2)
+5 (1 to 10)	50 (40-59)	4 (3 to 5)
+15 (etc.)	65 (etc.)	8 (etc.)
25	75	13
35	82.5	18
45	87.5	21 (21)
55	91.5	
65	95	
75	98 (97-99)	
85		

One hundred percent relative humidity was not considered, because it was assumed that natural fog would be present at this condition.

A mathematical model which takes into account the entrainment of ambient air, momentum of the balanced system, buoyancy force and heat content was used to describe the characteristics of a cooling tower plume. Equations of continuity, mass conservation, momentum conservation along the axis of the plume and in the transverse direction, conservation of heat flux, and geometrical relationships are expressed in seven ordinary differential equations. The differential equations are transformed into a series of finite difference equations for seven unkown variables: density, mean radius, moisture content, mean velocity, angle of the center line with respect to the horizontal, and horizontal distance and vertical distance with respect to the source. For given cooling tower operating conditions and specified meteorological conditions, the mathematical model determines the size and configuration of the visible plume. The plume is visible as fog when the air in the plume is at or below its saturation temperature.

The visible plume size and configuration described by the total length, trajectory, and radius were determined for all combinations of the above parameters. A separate computer program determined the number of hours of simultaneous occurrences of each possible combination of air temperature, relative humidity, and wind speed class. The results of the above analyses were combined and the number of occurrences of each characteristic plume over the 10-year period was then determined.

Typical plume configurations for three different wind speeds at 15 F ambient air dry bulb temperature are shown in Figure 5.5-1. The effect of varying relative humidity and values of pertinent parameters are also indicated in this figure. Figure 5.5-2 is included to show the plume characteristics at 55 F ambient air dry bulb temperature. Figure 5.5-3 shows the frequency and limits of fogging patterns which could result from the natural draft hyperbolic cooling water.

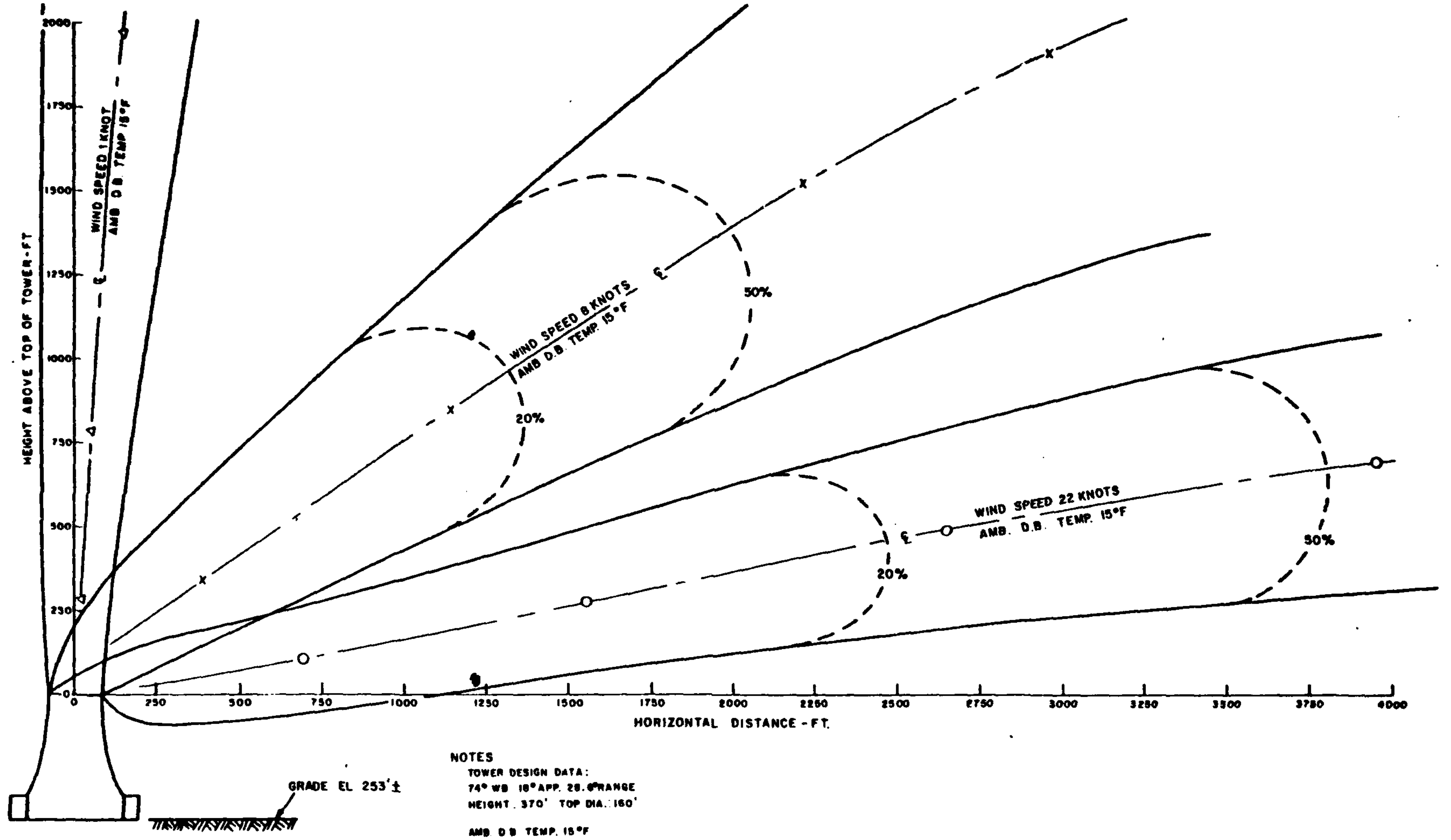
A natural draft tower would not cause any fogging problems at the ground level. However, a certain amount of cooling tower drift would probably occur. This drift (water entrained in the air flowing through the tower) would fall to the ground within a few hundred feed of the tower during calm wind periods. During high winds, the drift would tend to disperse and would not be expected to create significant problems.

5.5.2 Mechanical Draft Tower Arrangement with Fog Abating System

The circulating water system would consist of two mechanical draft cross-flow towers, each with a fog abating system, a screenwell structure housing circulating water pumps and related equipment, piping to and from the condenser and makeup and blowdown systems. Circulating water, cooled in the towers and collected in the tower basins would flow into an open channel interconnecting the basins, and then into a screenwell. The water would pass through panel screens and be pumped through a piping system to the condenser and back to the towers.

The towers would be designed for a total circulating water system flow of 285,700 gpm and a temperature range of 28.6 F and for operation with a 14 F approach at a 74 F wet bulb temperature. Each tower would consist of 11 cells 36 ft long, and would have a 30 ft high wet fill section and a 21 ft high fin tube dry heat exchanger section in parallel for the purpose of fog abatement. The towers would be equipped with dampers which may be placed against the dry section of the tower to improve tower performance when the probability of fog is slight.

Each reinforced concrete tower basin would be about 400 ft long, 55 ft wide, and 4 ft deep. The basins would be interconnected by an open channel which would carry cooled circulating water to the



NOTES

TOWER DESIGN DATA:
74° WB 18° APP. 28.0° RANGE
HEIGHT 370' TOP DIA. 160'

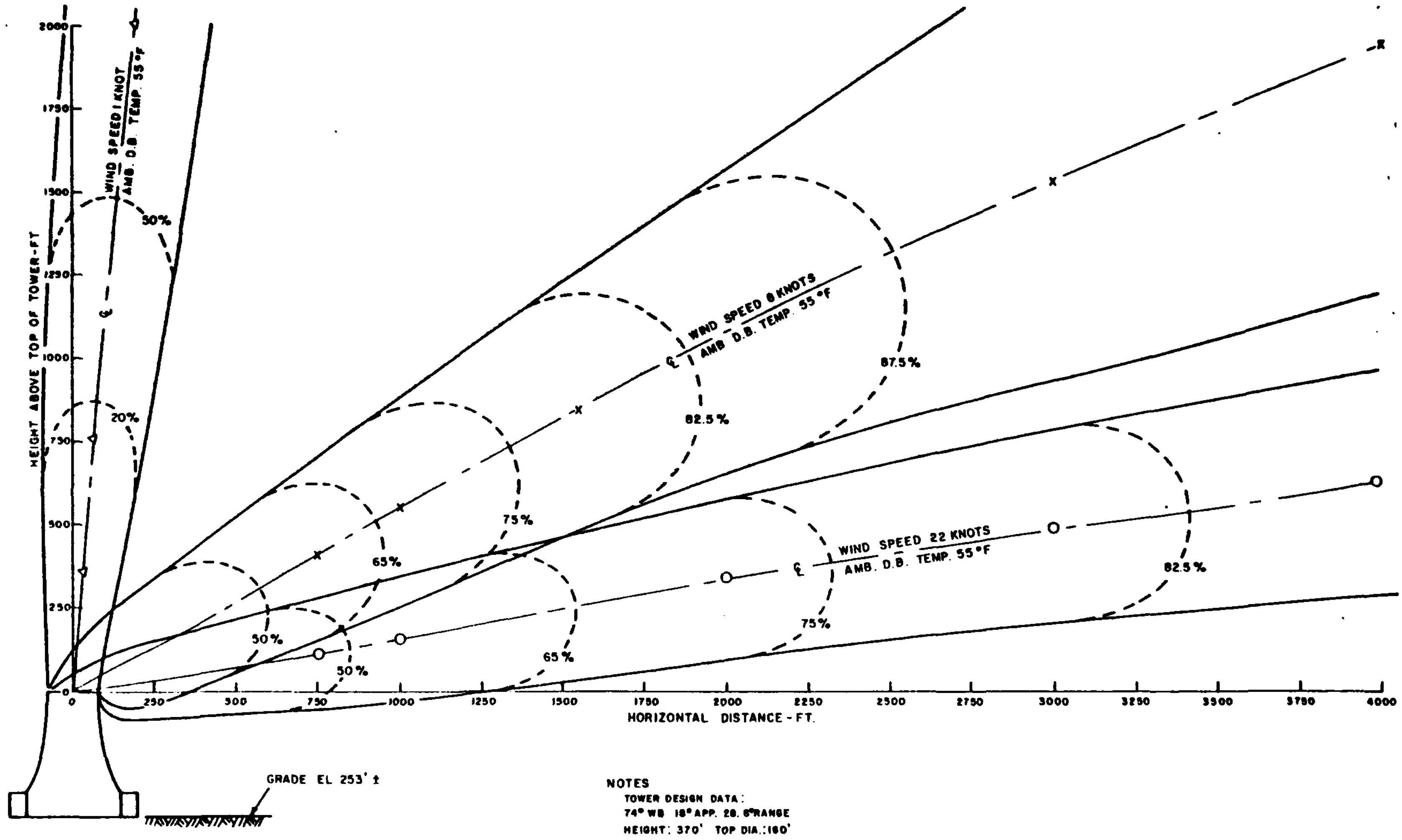
AMB. D.B. TEMP. 15°F

WIND SPEED	PLUME ℄
1 KNOT	—△—
8 KNOTS	—×—
22 KNOTS	—○—

EXTENT OF PLUME FOR INDICATED AMBIENT RELATIVE HUMIDITY
– – – –RH % – – – –

FIG. 5.5-1
PREDICTED PLUME PROFILES
NATURAL DRAFT COOLING TOWER
OSWEGO STEAM STATION UNIT 6
NIAGARA MOHAWK POWER CORPORATION

2014



NOTES

TOWER DESIGN DATA:
74° WB 18° APP. 28.6° RANGE
HEIGHT: 370' TOP DIA.: 160'

AMB. D.B. TEMP. 55°F

WIND SPEED	PLUME ℄
1 KNOT	—△—
8 KNOTS	—×—
22 KNOTS	—○—

EXTENT OF PLUME FOR INDICATED AMBIENT RELATIVE HUMIDITY
- - - - RH % - - - -

FIG. 5.5-2
PREDICTED PLUME PROFILES
NATURAL DRAFT COOLING TOWER
OSWEGO STEAM STATION UNIT 6
NIAGARA MOHAWK POWER CORPORATION

2015

TOWER DESIGN DATA:

74° WB, 10°APP., 26.6°RANGE
HEIGHT - 370FT
TOP DIA.: 100FT.

NOTES:

1. THE FIGURE DENOTES PER-CENT OF TIME THAT VISIBLE PLUME EXTENDS TO CONTOUR
2. ONLY ONE DIRECTION IS CONSIDERED FOR ALL WIND SPEEDS
3. ABOVE 1000FT FROM GROUND INVERSIONS MAY LIMIT PLUME RISE

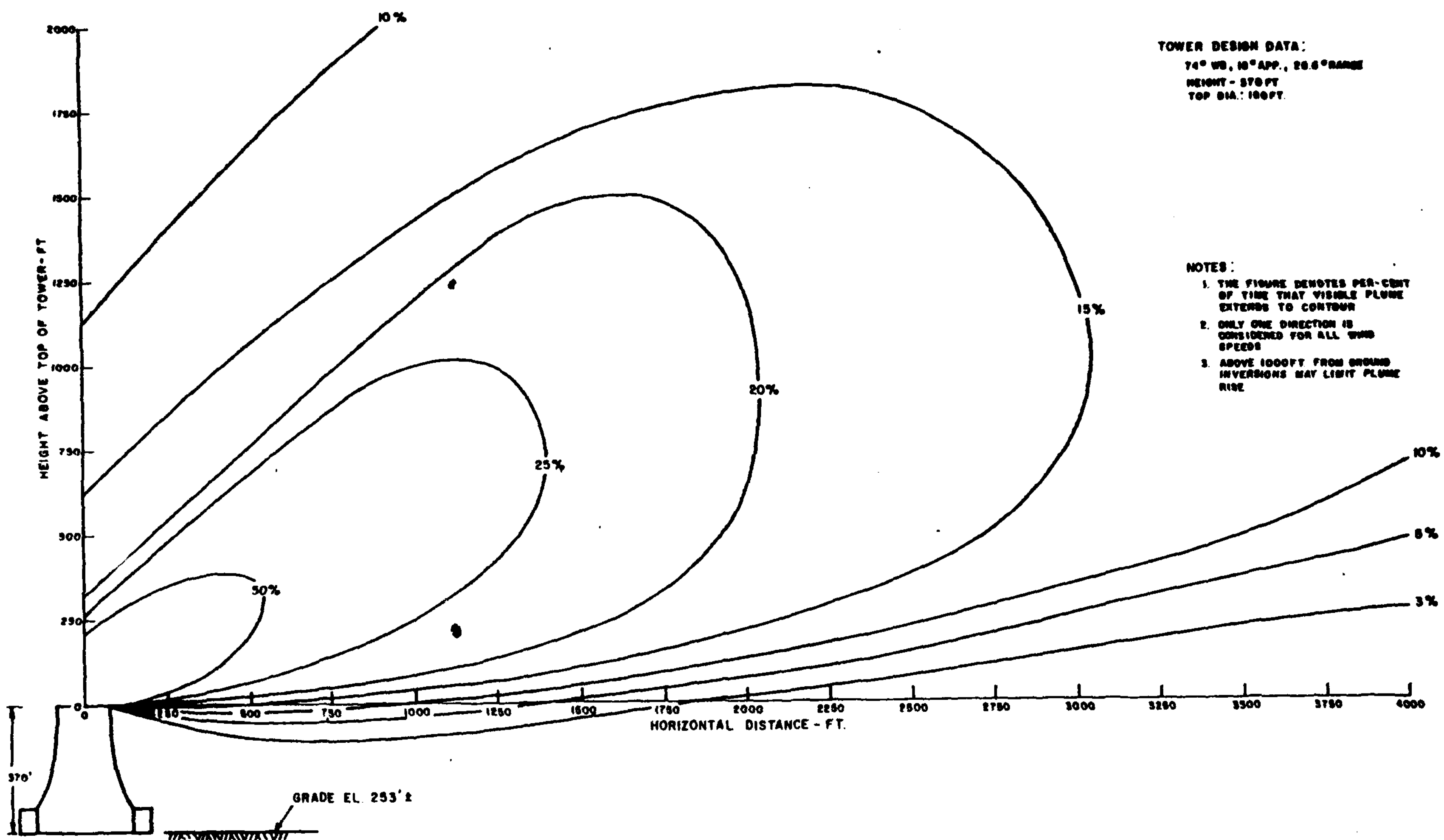


FIG 5.5-3

PREDICTED OCCURENCES OF FOG GENERATED FROM NATURAL TOWER

OSWEGO STEAM STATION UNIT 6

NIAGARA MOHAWK POWER CORPORATION

2016

screenwell. Makeup and blowdown systems would be the same as described above for the natural draft tower.

Environmental Effects of the Mechanical Draft Cooling Tower Plume

Studies were conducted to determine the extent of fogging which might be created by the operationof a mechanical draft tower with a fog abater system. As in the natural draft tower study, the station was take to be operating at the anticipated full load heat rejection of 4.08 billion Btu per hr. The following preliminary data were obtained from the manufacturer for use in the tower plume analysis:

a. Cell stack exhaust area = 22 cells at 32 ft diameter

b. Tower height - 66 ft

c. Tower exit air wet bulb temperature versus ambient air wet bulb temperature curves for different ambient air relative humidities

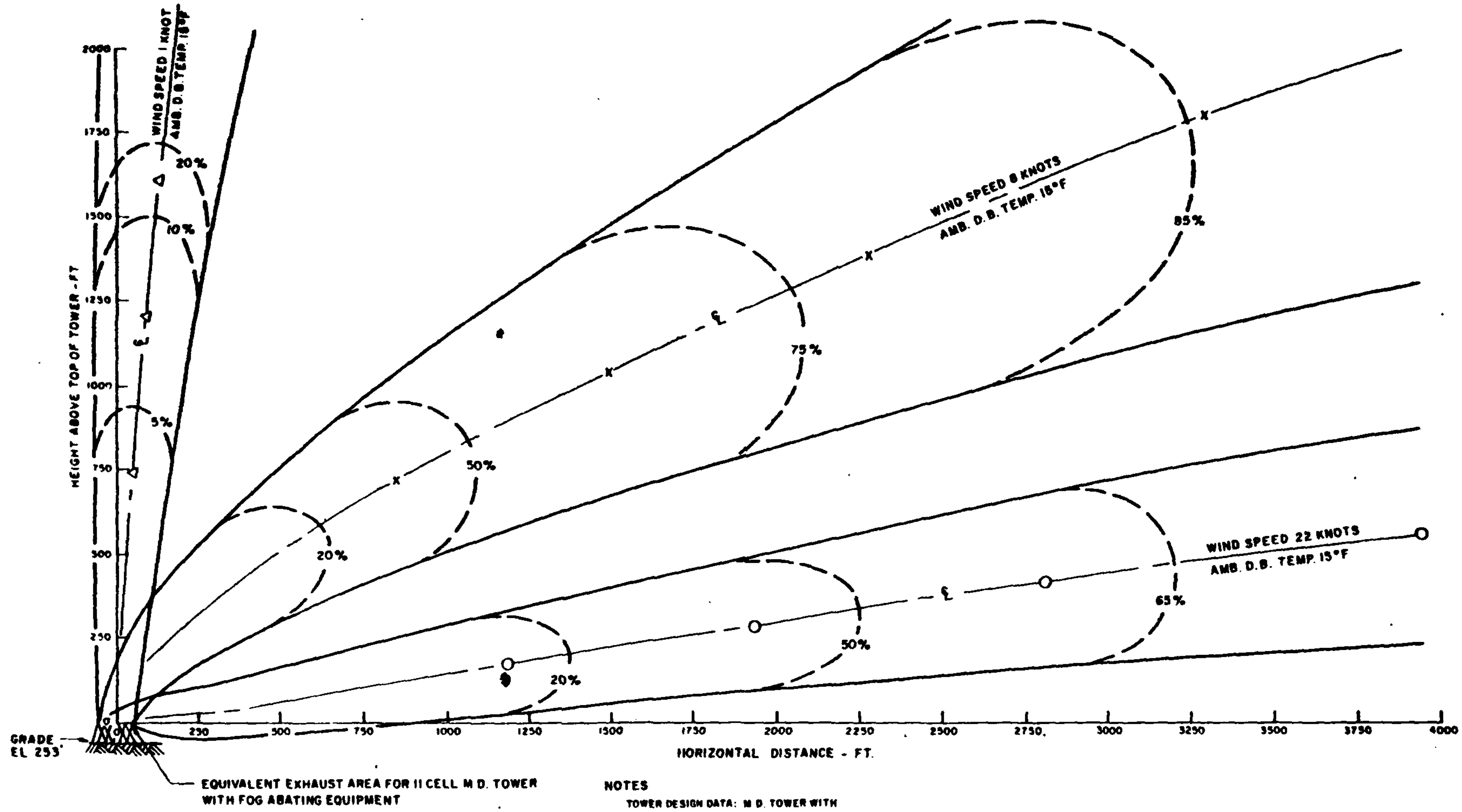
d. Tower exit air dry bulb temperature versus ambient air wet bulb temperature curves for different ambient air relative humidities

e. Tower exit air flow rates during winter and summer operations

From c and d above, tower exit air relative humidity versus ambient air wet bulb temperature curves for different ambient air relative humidities were constructed. The same weather data and grouping of meteorological parameters as described for the natural draft tower were used in this analysis. One important input parameter for this tower system is the exit air relative humidity, as the air leaving the stacks of this tower is partially saturated.

The mathematical model described for the natural draft cooling tower plume was modified to incorporate the characteristics of this tower. The 11-cell tower system was converted into a single source of equivalent diameter. It was assumed that the other equivalent tower would have an identical plume behavior. The interaction of the plumes from the two rows was not considered in the analysis.

Typical plume configurations for three different wind speeds at 15 F ambient air dry bulb temperature are shown in Figure 5.5-4. The effect of varying relative humidity is also indicated in the figure. Values of pertinent parameters are listed in the figure. Figure 5.5-5 is included to show the plume characteristics at 55 F ambient air dry bulb temperature. Figure 5.5-6 shows the frequency and limits of fogging patterns which could result from



NOTES

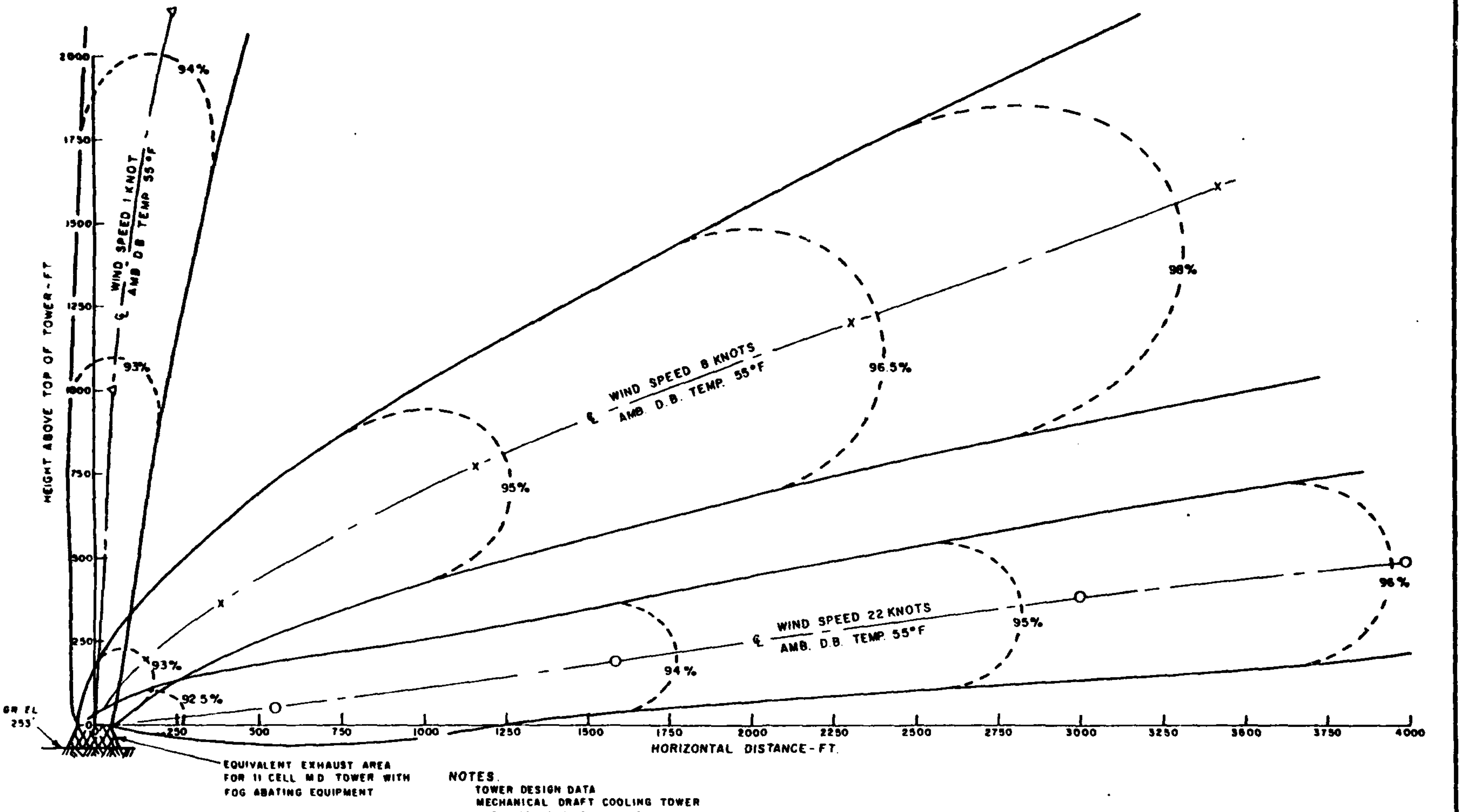
TOWER DESIGN DATA: M.D. TOWER WITH FOG ABATEMENT EQUIPMENT
74°WB 14° APP. 28.6° RANGE
HEIGHT: 65' STACK DIA.: 32'

AMB. D.B. TEMP. 15°F

WIND SPEED	PLUME ℄
1 KNOT	—△—
8 KNOTS	—x—
22 KNOTS	—○—

EXTENT OF PLUME FOR INDICATED AMBIENT RELATIVE HUMIDITY
— — — RH % — — —

FIG. 5.5-4
PREDICTED PLUME PROFILES
MECHANICAL DRAFT TOWER WITH
FOG ABATEMENT EQUIPMENT
OSWEGO STEAM STATION UNIT 6
NIAGARA MOHAWK POWER CORPORATION



NOTES.
TOWER DESIGN DATA
MECHANICAL DRAFT COOLING TOWER
WITH FOG ABATING EQUIPMENT.
74° W B. 14° APP. 28.6° RANGE
HEIGHT 65' STACK DIA 32'

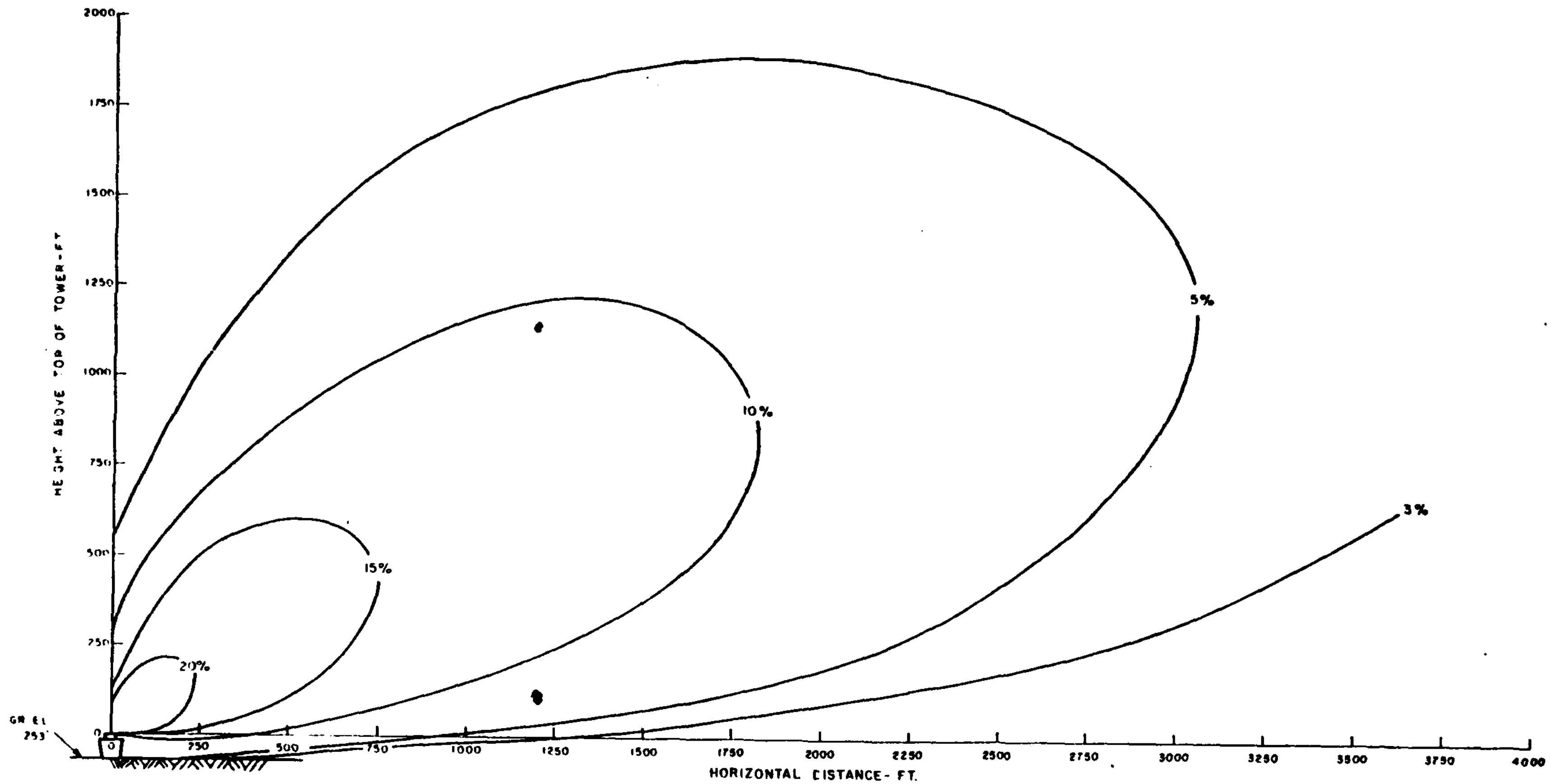
AMB. D.B. TEMP. 55°F

WIND SPEED	PLUME ℄
1 KNOT	—△—
8 KNOTS	—×—
22 KNOTS	—○—

EXTENT OF PLUME FOR INDICATED AMBIENT RELATIVE HUMIDITY
- - - - RH% - - - -

FIG. 3.5-5

PREDICTED PLUME PROFILES
MECHANICAL DRAFT TOWER WITH
FOG ABATEMENT EQUIPMENT
OSWEGO STEAM STATION UNIT 6
NIAGARA MOHAWK POWER CORPORATION



NOTES

1. THE FIGURE DENOTES PER-CENT OF TIME THAT VISIBLE PLUME EXTENDS TO CONTOUR
2. ONLY ONE DIRECTION IS CONSIDERED FOR ALL WIND SPEEDS
3. ABOVE 1000FT FROM GROUND INVERSIONS MAY LIMIT PLUME RISE

TOWER DESIGN DATA

M.D. TOWER WITH FOG ABATING EQUIPMENT
74°WB 14°APP. 28.6° RANGE
HEIGHT 65' STACK DIA 32'

FIG. 5.5-6

PREDICTED OCCURRENCES OF FOG GENERATED FROM M.D. TOWER WITH FOG ABATING EQUIPMENT

OSWEGO STEAM STATION UNIT 6

NIAGARA MOHAWK POWER CORPORATION

the mechanical draft tower with fog abating equipment. As can be seen from this figure, ground level fog can be produced infrequently by each of the two mechanical draft towers.

5.6 ALTERNATIVE AIR QUALITY CONTROLS

Unit 6 of the Oswego Steam Station will be equipped with a high efficiency electrostatic precipitator to reduce the emission of particulate matter and thereby enable the plant to meet particulate emission requirements and produce a plume opacity equivalent to number 1 or less on the Ringleman Smoke Density Chart.

Three other major types of particulate control devices are commercially available: cyclones, baghouses, and scrubbers. However, each of these methods has limitations that preclude its use on this power station.

Cyclones are less efficient in collecting small particulates. The submicron oil ash particles which contribute to plume opacity would not be sufficiently removed to produce a satisfactory plume appearance.

Baghouses have not yet been applied successfully to oil-fired power plants. The oil ash, which has a sticky characteristic, tends to blind the fabric bags and increased air resistance causes the bags to rupture frequently.

The major drawbacks of a scrubber system are costly waste water treatment, visible steam plume, and reduced plume rise. In addition, scrubber technology has not yet been sufficiently developed to justify a commitment to a full-size commercial installation.

5.7 ALTERNATIVE LIQUID WASTE SYSTEM

The proposed liquid waste system is described in Section 1.3.5.

An alternative method of treating liquid wastes was considered, which would include the use of a falling film evaporator in addition to the proposed system. Liquid wastes associated with infrequent equipment cleaning operations and intermittent demineralizer regeneration cycles would be fed into the evaporator which would produce a highly concentrated brine bottom and pure distilled overhead. The concentrated brine solution would be disposed of in an on-site lined storage pond bottom and pure distilled overhead. The concentrated brine would be sufficiently large to incorporate natural precipitation. The evaporator overhead would be recycled for reuse within the station. This alternative liquid waste system would result in a zero discharge of liquid wastes to Lake Ontario.

This alternative liquid waste system was discarded because the environmental benefits could not be justified in view of the extremely unfavorable economics associated with the high capital and operating costs of the evaporator and excessive land requirements for the disposal pond.

2024

SECTION 6

THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The local "short-term" use of the overall project involves the production of electric power for the next 35 years. Niagara Mohawk believes that there will be no negative, cumulative, long-term effects from the proposed action.

The safeguards incorporated in the plant design preclude any significant changes in aquatic species distribution and bottom productivity as a result of the proposed project.

The heat in the discharge water decays continuously to the atmosphere and will not result in cumulative effects. In considering thermal discharge effects, the question of long-term influence on the fish and other aquatic life is often raised. It is not expected that changes in fish population or condition will accrue from the thermal discharge since the temperature increases are small, and the zones within which these small changes occur are minimal.

The use of the land on which the proposed Oswego Unit 6 is to be located may be considered a short-term use for the normal 35-year life expectancy of an oil-fired generating station. Lake Ontario water is returned to the lake in essentially the same condition as that in which it is withdrawn.

Concerning the maintenance and enhancement of long-term productivity of the land and water, the presently proposed occupation of the site for purposes of power generation does not preclude its use for other productive short or long-term purposes in the future. Among these are the possibilities of development for recreational or residential use, both of which are impractical or unsuitable at present.

The resources of water and land remain without destruction regardless of the short-term use as a power generating station.

Short-term effects of discharges into the atmosphere can become less significant as feasible technological advances permit a reduction in objectionable stack emissions. Beneficial uses of the area for industrial purposes will be reduced only to the extent that the assimilative capacity of the environment is reduced.

Niagara Mohawk believes that the range of beneficial uses of the surrounding environment is not narrowed by the project. Little change, if any, is anticipated with respect to wildlife in the vicinity, boating on the lake, or the general ecosystem.

SECTION 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES WHICH WOULD BE INVOLVED IF THE PROPOSED ACTION SHOULD BE IMPLEMENTED

With Lake Ontario as the source, approximately 635 cfs of water will be circulated through the condenser cooling system of proposed Unit 6 at the Oswego Steam Station. The use of this water resource is not an irreversible procedure because plant shutdown immediately results in a return of the lake to the natural state. Discharge water from the plant operation is essentially the same in quantity and quality as that withdrawn. No chemical will be added to the Unit 6 system. Observations of the distribution of heat from the existing discharges of Units 1 to 4 indicate that with proper design of the proposed intake and discharge facilities for the new unit, deleterious effects will be negligible.

Furthermore, although about 2 percent of the ciculating water flow is evaporated into the atmosphere, even this small quantity is not irreversibly lost, but returns to the ecosystem in the form of rainfall.

In considering the use of the atmosphere for the dispersion of stack gases and other emissions, again proper design will reduce any deleterious effects and will not result in any irretrievable commitment of air resources.

Fuel oil requirements for the operation of Units 1 through 6 of the Oswego Station are estimated to be 50,000 barrels per day. Based on the present consumption of 14.7 million barrels of oil per day in the United States, the Oswego Station will use about 0.34 percent of this supply. The commitment of this energy resource is irreversible and irretrievable.

In summary, the applicant believes unalterable disruptions to the ecosystem in the Oswego Station environment are not serious enough to warrant action beyond the thorough and careful measures which have been planned. Standards and criteria limitations will be met.

2026

SECTION 8

COORDINATION WITH OTHERS

Niagara Mohawk has conducted numerous meetings, briefings, lectures, and seminars regarding plans for the expanded facilities at Oswego. Initially these meetings were directed toward discussions and informal presentations of plans for Unit 5. More recently these meetings have included discussion of Unit 6 plans and the cumulative environmental impact of two additional units at the Oswego Steam Station.

Specifically the project(s) have been discussed with the following groups and organizations:

8.1 PUBLIC PARTICIPATION AND CITIZEN GROUPS

Meetings were held with members of the public and citizens' groups as listed below. These meetings were basically informational to answer questions and disseminate information regarding construction, operation, and environmental safeguards in connection with the proposed Unit 6. Some were held jointly with New England Petroleum Co., the oil supplier for Niagara Mohawk Power Corporation that proposes to build an oil processing plant at Oswego to supply the fuel requirements. Those in attendance appeared to be satisfied with the information supplied. No comments have been received subsequent to the meetings except as noted.

(1) Public Meeting in the City of Oswego with Niagara Mohawk and New England Petroleum participating. This meeting generated a number of questions in writing from an ecology group, all of which were answered in writing after the meeting and no additional comments or questions have been received.

(2) Town of Oswego Board Meeting with Niagara Mohawk and New England Petroleum

(3) Oswego Retail Merchants Association meeting with Niagara Mohawk and New England Petroleum

(4) Town of Oswego Public meeting with Niagara Mohawk and New England Petroleum

(5) Engineering and Environmental Committee of the Chamber of Commerce of the City of Oswego and the Oswego County Environmental Management Council with Niagara Mohawk.

8.2 GOVERNMENT AGENCIES

Copies of the Draft Environmental Statement, dated November 20, 1972, were sent to the following agencies for comment:

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	Response Date
Department of Interior, Office of Environmental Project Review	5 March 1973
Genesee Finger Lakes Regional Planning Board	No comments received
Great Lakes Basin Commission	No comments received
National Resource Economics Division, Dept. of Agriculture	No comments received
Department of Commerce	No comments received
Central New York Regional Planning Board	No comments received
Ninth Coast Guard District	No comments received
Federal Highway Administration, Albany	No comments received
New York State Historic Trust	No comments received
Federal Power Commission	27 Feb. 1973
Environmental Protection Agency, New York, N.Y.	2 Feb. 1973
Environmental Protection Agency, Chicago, Illinois	No comments received
New York State Dept. of Environmental Conservation	7 Feb. and 3 April, 1973
National Marine Fisheries Service	No comments received
Federal Aviation Administration	17 Jan. 1973
Great Lakes Laboratory, State University College at Buffalo	No comments received
Center for Great Lakes Studies, University of Wisconsin, Milwaukee	No comments received
Soil Conservation Service, Dept. of Agriculture	17 Jan. 1973

All of the comments received, along with the associated responses, are given in this section. Copies of the original correspondence from each agency are included in Section 8.4.

United States Department of Agriculture,
Soil Conservation Service, Syracuse, New York

Comment

1. Page 3 - 5th paragraph - second to last sentence "Residential uses are generally...in the outskirts." To this sentence you should add - "although a relatively large rural nonfarm population is characteristic of this county."

Response

Comment refers to the text of the Draft Summary Environmental Statement. Section 2.6.4 of this final statement has been revised to reflect this comment (See p. 2.6-3).

Comment

2. Page 4 - paragraphs 3 and 4

   a. It is not completely accurate to say agricultural activity has declined because of the poor soils ... actually, the soils of this area are fairly responsive to modern farming methods.

      The organic soils in this area are largely devoted to truck crops, producing good yields of onions and lettuce.

   b. Small commercial farms, apple orchards and pear orchards, dairy and truck farms still survive.

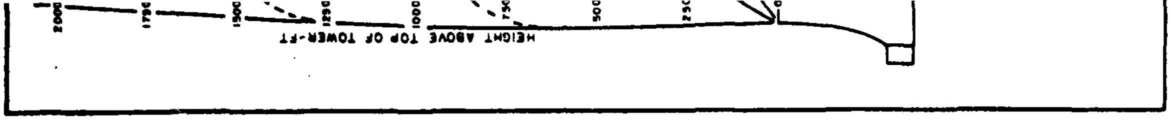
   c. This area is historically noted for the production of high quality strawberries.

   d. The abandoned field does support the plants listed. To this list, poison ivy and blackberries should be added.

   e. The dominant tree species should include sugar maple and red maple. Red oak is not as dominant as one would be led to believe by this writeup.

Response

Comments refer to the text of the Draft Summary Environmental Statement. Section 2.6.6 of this final statement has been revised to reflect these comments (See p. 2.6-4). No revision of Section 2.7 was deemed necessary.



Comment

3. Page 8 - Heading IV - 5th paragraph

   The beginning of the paragraph describes the land use near the project area. This land use statement does not appear to be an adverse effect. It would be more appropriate to place it under Heading II, page 2, which describes the area of the project.

Response

Comment refers to the text of the Draft Summary Environmental Statement. No revision of this final statement was deemed necessary.

Comment

4. As the land to be used has already been designated for industrial use, we see no incompatibility with other land uses.

Response

No revision of this final statement was deemed necessary. See Sections 2.6 and 4.3.

Comment

5. It would be appropriate to include a statement in this report that during construction activities, measures to control erosion and sedimentation will be taken. These could include prompt vegetation of denuded areas and proper salvage, storage and reuse of topsoil.

Response

Section 3.7 of this final statement has been revised to reflect this comment (See p. 3.7-1).

Department of Transportation,
Federal Aviation Administration,
Jamaica, New York

Comment

Apart from Page 8.0-3, and the statement that, we have been or will be contacted at the planning, construction and operation of Unit 6 with respect to aids to navigation - acknowledgement of stack height, marking and lighting, we find that the Station has no impact on present or planned airports.

Response

The Federal Aviation Administration will receive notification of the planning, construction, and operation of Unit 6 with respect to aids to navigation.

United States Environmental Protection Agency, Region II, New York, New York

Comment

EPA statement on page 1: "A fish refuge area will be provided in the forebay from which fish will be removed to the lake. It is hoped that the fish refuge serves its intended purpose and is assiduously attended to by the Applicant."

Response

As stated on page 3.1-2 of this report, the Unit 6 screenwell will be provided with a fish refuge area comparable in size to the area in which fish are found concentrated in the existing Units 1-4 screenwell. The quantity of fish utilizing the existing screenwell as a habitat during the winter is small. Therefore, it is felt that an area comparable in size to the existing area will be satisfactory. In addition, the Applicant's stated intention to install fish transfer devices, if necessary, to remove the fish on an intermittent basis and return them to the lake will prevent the possibility of a buildup of too many fish in the refuge area, thereby decreasing potential for any detrimental effects.

Comment

EPA statement on page 1: "The possibility exists for thermocline disruption by the heated discharge."

Response

EPA quotes the New York State Criterion as follows: "In lakes subject to stratification, the thermal discharges shall be confined to the epilimnetic area." However, New York State in Section 73.10 of 10 NYCRR 73, gives definitions for both the epilimnion and the thermocline as follows:

> Epilimnion - "Epilimnion is that layer of a stratified lake lying above the thermocline which is warm, more or less freely circulating, affected by wind action and of approximately uniform temperature."
>
> Thermocline - "A thermocline is that first seasonally stable layer of a stratified lake found between the epilimnion and the hypolimnion where the temperature drop equals or exceeds one degree C(1.8 degrees F) per meter (39.37 inches)."

Interpretation of the epilimnion is dependent on the establishment of a "seasonally stable layer" which conforms to the classical thermocline definition of 1°C per meter. As stated on page 2.2-3 of this report, a definite instability of successive weekly profiles demonstrated the effectiveness of the wind, wind-induced currents and upwelling of shoreward waters in preventing the development of a stable thermocline offshore of Oswego. As noted by the EPA and explicitly stated in this report, after a period of calm days the lake was stratified in a manner indicative of a thermocline formation. However, this is a transient condition, as shown on Figures 8.2-1 and 8.2-2.

For seventeen consecutive weeks from July through November 1970, lake temperatures were recorded off Oswego Harbor (Ref. 1)*. The results of these studies are plotted on Figures 8.2-1 and 8.2-2. As stated in this report, an apparent thermocline formed at the 7- to 9-ft depth (2 to 3 meters) on July 10, 1970. However, as indicated on Figure 8.2-1, the lake at this sampling station was essentially isothermal by July 17. Again by July 24th the lake exhibited stratification of about 0.5°C per meter through the first 4 meters of the water column, becoming nearly isothermal below the 4 meter depth. On July 31 the lake at the sampling station exhibited a near isothermal profile with an apparent thermocline in the bottom one meter of the water column. The August results are generally similar to the July results indicating a dynamic temperature regime within the water column. On August 10 an apparent thermocline existed at the one meter depth, only to disappear entirely by August 14 when the water column appeared isothermal. The September through November data indicates no thermocline formation and essentially isothermal conditions for each sampling date.

Based on these data it is concluded that the thermocline is below at least the 40-ft depth offshore of Oswego. The inshore area near Oswego is subject to temporary stratification that appears to last a maximum of two weeks. There was no evidence of any stable thermocline in this part of Lake Ontario to a depth of 12 meters (approximately 39 ft), as evidenced by the fact that the temperature differential between the surface and bottom in this depth exceeded 2.7°C on only four occasions. Earlier in 1963 and 1964, temperature surveys were performed off the western end of Nine Mile Point (about 7 1/2 miles east of Oswego) in over 100-ft of water (Ref. 2). Six traverses* were made during July through September 1963 and twelve during May through August 1964.

Vertical temperature profiles were plotted from the data collected, as shown in Figures 8.2-3 and 8.2-4. Both figures indicate a seasonal change, the lake being warmest in early August. Data for May and early June show the lake having a temperature difference of about 5°F between the surfaces and the 40-ft depth (but definitely no thermocline), and uniform temperature below that. During late June and through July

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*See references listed at the end of EPA comments and responses.

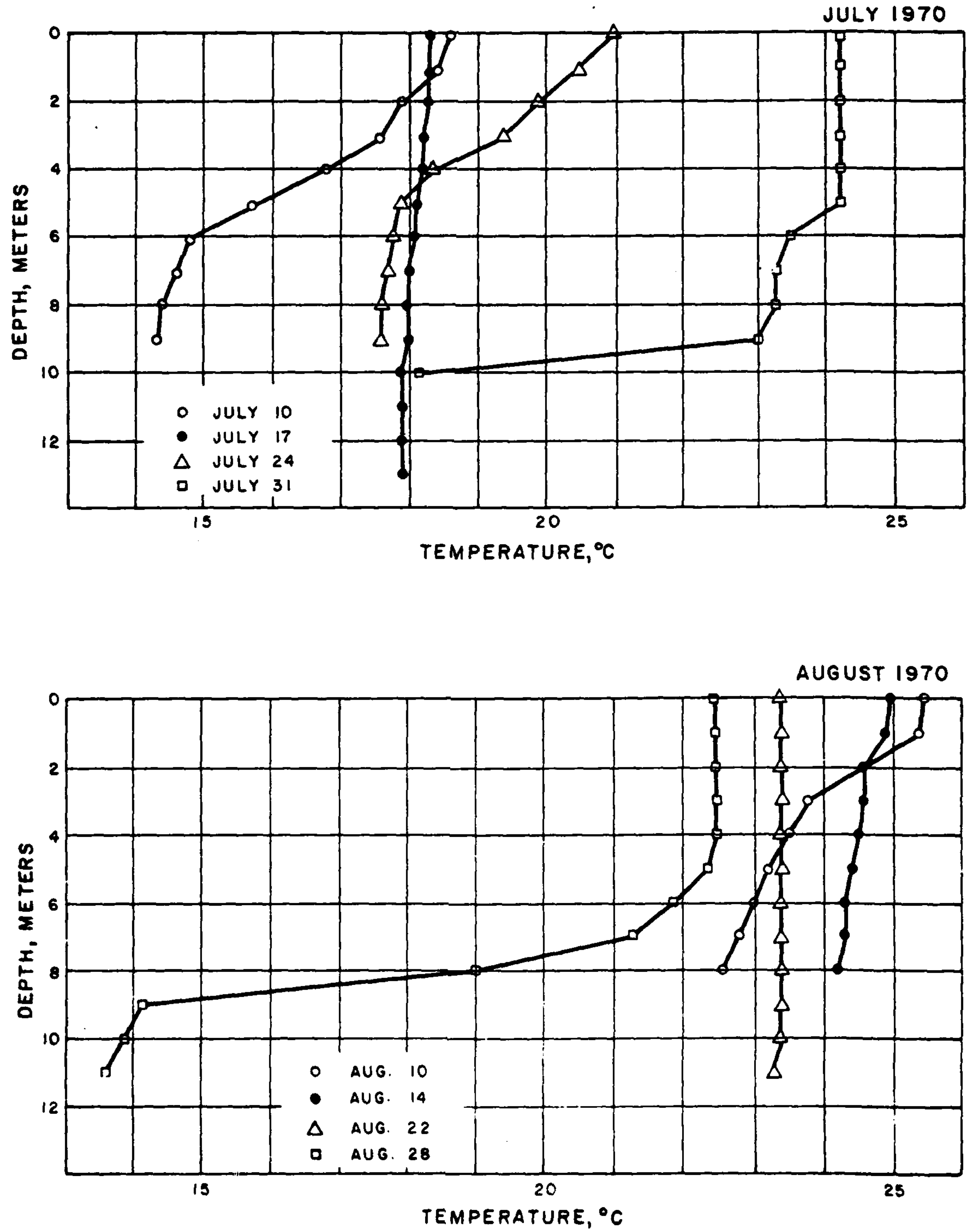
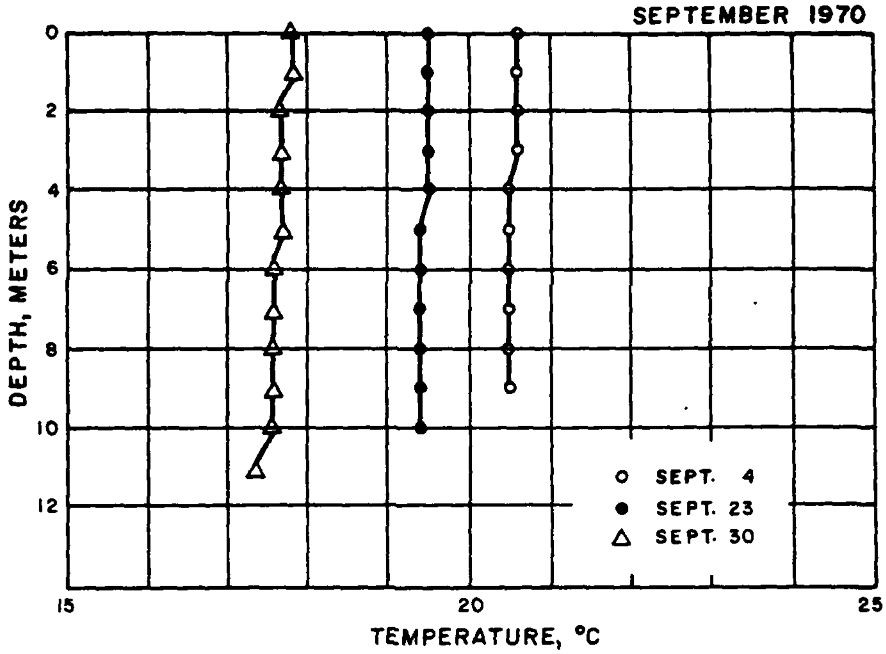


FIG. 8.2-1
LAKE ONTARIO TEMPERATURE
STRUCTURE AT STATION C, JULY-AUG. 1970
NIAGARA MOHAWK POWER CORPORATION



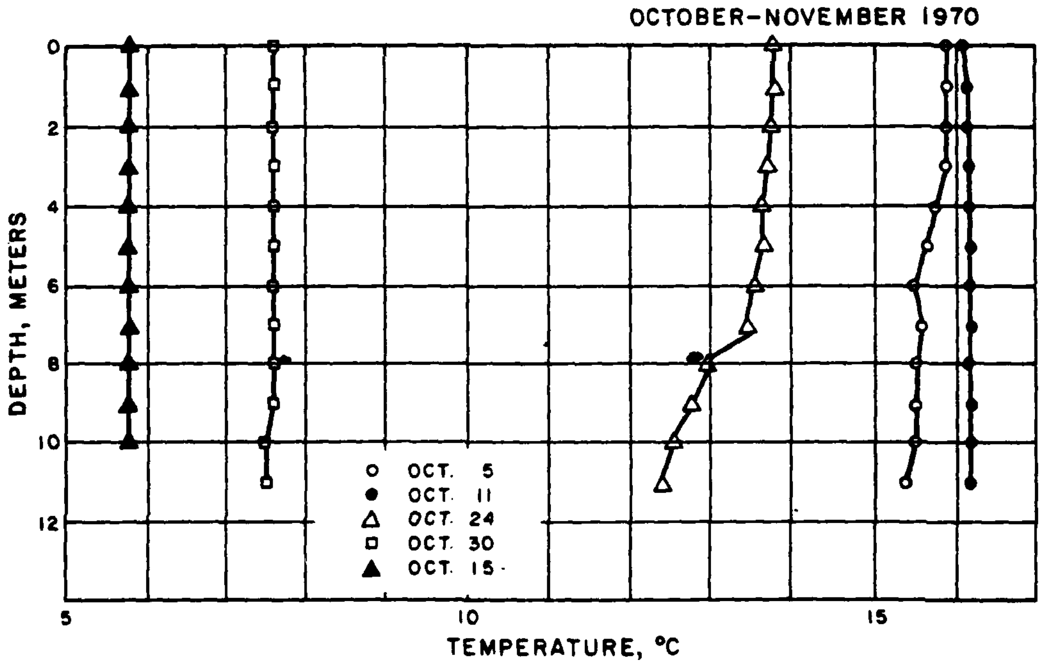


FIG. 8.2-2
LAKE ONTARIO TEMPERATURE STRUCTURE
AT STATION C, SEPT.-NOV. 1970
NIAGARA MOHAWK POWER CORPORATION

REF: STORR, J.F., "TEMPERATURE VARIATION WITH DEPTH AT NINE MILE POINT (SUMMER 1963 AND 1964)", NMPCO, JUNE 1968

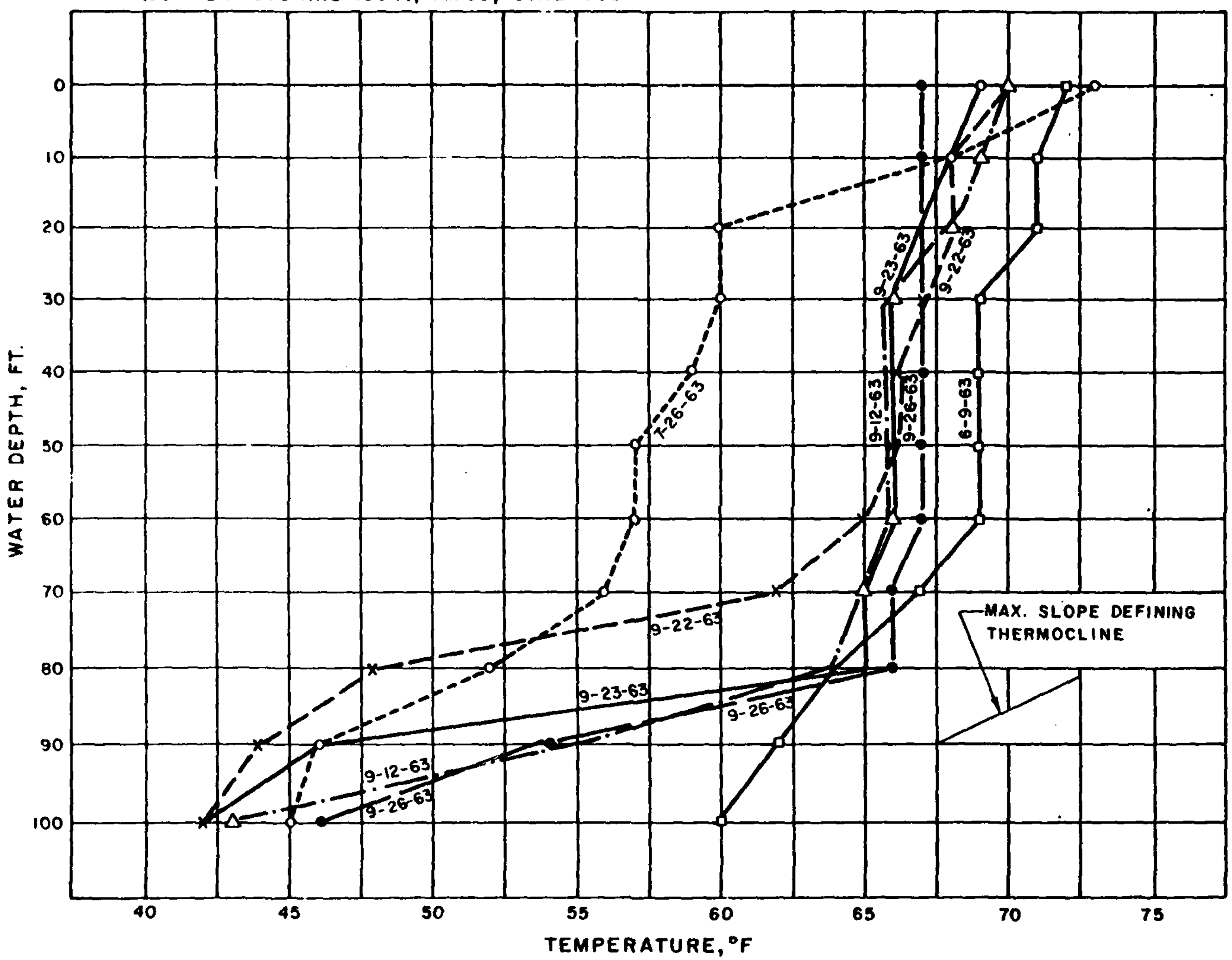


FIG. 8.2-3

TEMPERATURE VS. DEPTH PROFILES – 1963

NIAGARA MOHAWK POWER CORPORATION

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REF: STORR, J.F., "TEMPERATURE VARIATION WITH DEPTH AT NINE MILE POINT (SUMMER 1963 AND 1964)", NMPCO, JUNE 1968

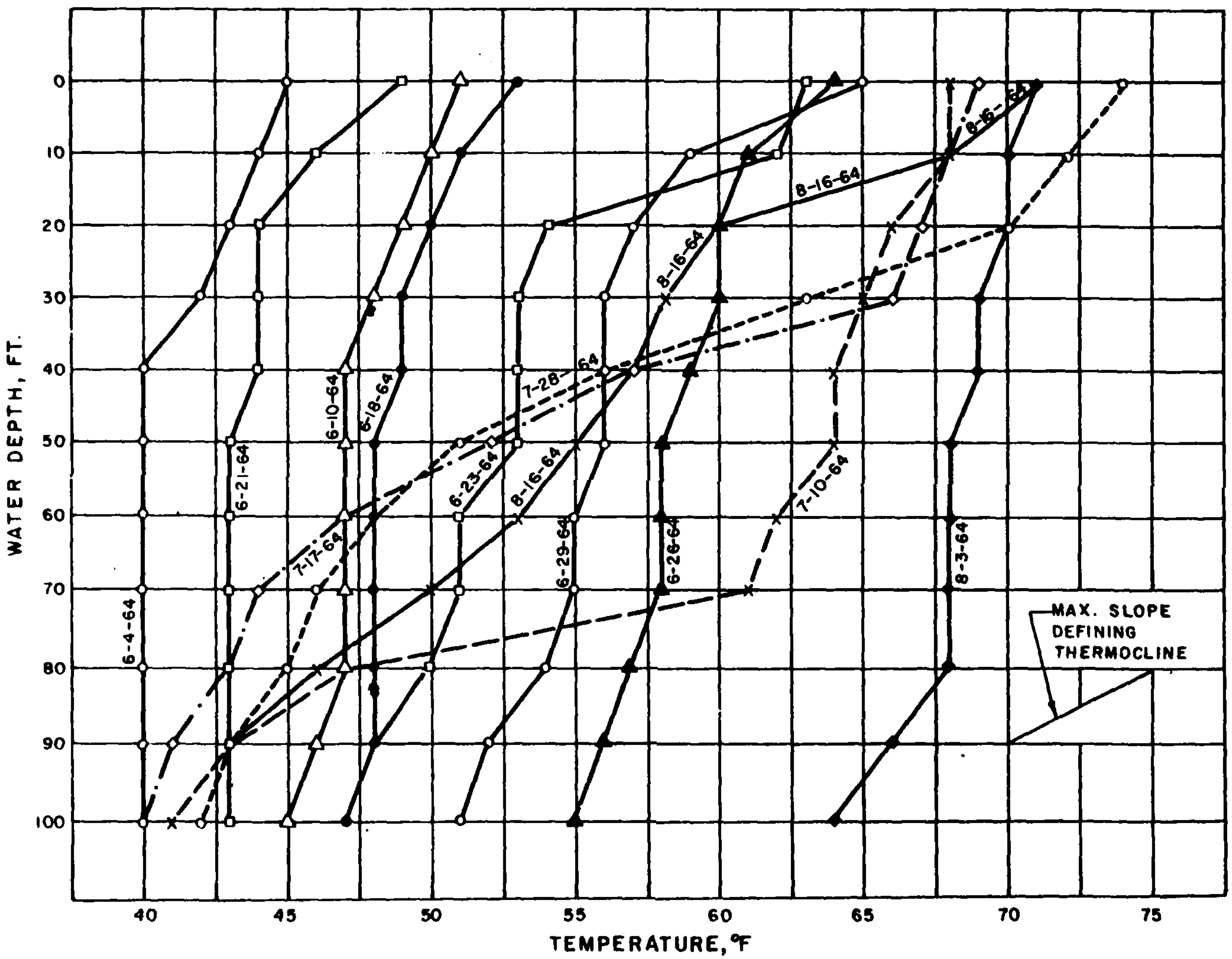

FIG. 8.2-4

TEMPERATURE VS. DEPTH PROFILES—1964

NIAGARA MOHAWK POWER CORPORATION

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thermoclines appear at depths ranging from about 71°F at the surface to about 62°F at the 100-ft depth, with no thermocline to be seen. However, in late August and throughout September, stratification is seen, with a thermocline in the 70- to 90-ft depth lasting for about two weeks.

In a report prepared by the International Lake Erie Water Pollution Board and the International Lake Ontario - St. Lawrence River Water Pollution Board (Ref. 3), a description of the thermocline in Lake Ontario is given. This report indicates that during the summer months the epilimnion is separated from the hypolimnion by a strong thermocline. It further indicates that the average depth to the thermocline in the southeastern portion of Lake Ontario (area of Lake Ontario near Oswego) is almost 30 meters or nearly 100 ft deep.

Taking all of the above data into consideration, it is concluded that no persistent thermocline is identifiable except in late summer, and then in water depths considerably greater than those in which it is proposed that intake and discharge structures for Oswego Unit 6 be installed.

Comment

EPA statement on page 2: "As to the effects of mechanical disturbance of the metalimnion, low dissolved oxygen and high nutrient concentrations are often found in the hypolimnion of stratified lakes. Localized mixing can introduce abnormally high nutrient levels to the area of the lake in which it occurs. For example, anaerobic hypolimnetic zones of lakes may contain high phosphate concentrations at the same time that epilimnetic phosphate has been depleted by the flora of the lake. Release of phosphate through breakdown of the metalimnion can be the causation of local algal blooms. This is of interest to the operation of Unit 6 in so much as the EIS states that phosphorus is the limiting nutrient for large populations of Cladophora in the area of the plant. Since Lake Ontario is basically an oligotrophic lake, these conditions may not exist below the metalimnion, but the possibility should be investigated. Combined discharges from Units 5 and 6 would intensify the problem as defined above."

Response

In regard to the statements concerning disturbances of the metalimnion and the possibility of increasing phosphate concentrations in the epilimnion by bringing phosphate up from the hypolimnion, the following statements should clarify the situation:

1. The location of both the Unit 5 and the proposed Unit 6 discharge structures are above the thermocline and, therefore, discharge entirely into the epilimnion.

2. Lake Ontario, as stated by the EPA, is an oligotrophic lake. The definition of an oligotrophic lake is "...water body poor in nutrient, characterized by low quantities of planktonic algae, high water transparency with high dissolved oxygen in upper layers, adequate dissolved oxygen in deep layers, low organic deposits..." As shown in Tables 2.9-2 and 2.9-3 of this report, the lake offshore of the Oswego Steam Station has a high dissolved oxygen content, generally near 100 percent of saturation, and has low, but similar, nitrogen and phosphorous concentrations from top to bottom as sampled in a 40-ft depth of water.

3. Page 3.1-10 of this report discusses Cladophora growth along the southeastern shore of Lake Ontario. It is stated that the phosphate concentration "appears" to be the limiting nutrient. Furthermore, little production of Cladophora occurs beyond the 12-ft depth, due to limitations on light penetration, and essentially no growth was found beyond the 15-ft depth. Since both the intake and discharge structures will be located well beyond the 15-ft depth, the potential for any detrimental effects on Cladophora growth are considered extremely unlikely.

In summation, the oligotrophic nature of the lake, and the location of the discharge (epilimnetic zone), combine to minimize any possible detrimental effects of the plant on attached flora or on natural algal dynamics in the lake.

Comment

EPA statement on page 2: "It should be noted that the temperature isotherm plot of Figure 3.1-3 shows the predicted 3°F isotherm to be fairly close to the limit allowed by New York State thermal regulations."

Response

The area enclosed by the 3°F isotherm of temperature rise as shown on Figure 3.1-3 in this report is 2.2 acres total for both Units 5 and 6. It should be noted that the total acreage within the 3°F isotherm for both units is only 34 percent of the allowable acreage for one unit.

The following information is offered by the Applicant to provide additional predictions of the thermal effects resulting from operation of six units at the Oswego site.

Lake Condition	Oswego River Discharge	Predicted Temperature Effects Surface Area Enclosed By Specific Isotherm (Acres) 3.0°F(1)	2.5°F	2.0°F
Still water (Run 1)	Low	1.2	4.7	15.1
Still water (Run 2)	Low	0.7	9.2	33
Still water	Mean	2.2	11	37
0.5 fps Drift (2) (Run 1)	Low	1.3	3.9	34
0.5 fps Drift (Run 2)	Low	1.7	9.9	37
0.5 fps Drift	Mean	4.8	19.4	62

(1) Surface areas for 3.0°F isotherm are the combined areas for both Unit 5 and Unit 6.

(2) Drift Current is from west to east at 0.5 fps.

The predictions presented in the above tabulation indicate compliance with New York State Thermal Criteria for extreme lake conditions and maximum operation of six units at the Oswego Steam Station. For less extreme conditions than those tested in the hydraulic model (e.g., lower ambient temperatures, lower plant loads, etc), it is expected that the temperature rises at the surface would be less than those listed in the previous table.

Comment

EPA statement on page 2: "A number of considerations leads us to some concern regarding impingement and entrainment losses."

Response

1. Entrainment - The EPA statement that there would be a difference between entrainment effects for Units 1-4 with a 12°F condenser rise and a 4-minute retention time in the discharge system and Unit 6 with a 32°F condenser rise and an 11-minute retention time is valid. However, the conclusion drawn by the EPA that a comparison of entrainment effects between Units 1-4 and Unit 6, "...is at best invalid," is not entirely correct. Entrainment mortality is generally attributed to either the absolute temperature or the temperature differential the organisms are subjected to as they pass through the circulating water system. The data obtained at Units 1-4 establish a lower limit on the mortality which could occur at Unit 6. If, eventually, it is determined

that the absolute temperature and not the temperature rise is the controlling factor, it is quite possible that, except for the summer months, the mortality incurred at Unit 6 would be very similar to that measured at Units 1-4.

In any case, the analyses presented on pages 3.1-8 and 3.1-9 of this report have considered the possiblity that the results at Units 1-4, i.e., 30 percent mortality, would not be representative of Unit 6. On page 3.1-8, Table 3.1-1, Column 1 presents the predicted percentage population reduction assuming 100 percent mortality. These numbers are reiterated below:

Assumed Model Boundaries	Reduction of Population (%) 100 Percent Mortality
Entire Lake	0.008
Ten Mile Inner Lake	0.014
One Mile Inner Lake	0.160

The values tabulated above indicate the upper limit of expected mortality for entrained organisms passing through the Unit 6 condenser.

Results of biological studies conducted by the Applicant have shown the area offshore of Oswego to be relatively sparse in benthic, planktonic and fish populations. It is likely, therefore, that even if 100 percent mortality were incurred due to passage through the Unit 6 condenser, the percent reduction in population would be less than that tabulated above.

Another factor reducing the percent of the population affected by Oswego Unit 6 is the fact that the intake structure is designed so that water will be withdrawn selectively from the middle and lower portion of the water column. The percent reduction in population assuming 100 percent mortality but selective withdrawal is presented below:

Assumed Model Boundaries	Reduction of Population (%) 100% Mortality - Selective Withdrawal
Entire Lake	0.002
Ten Mile Inner Lake	0.004
One Mile Inner Lake	0.048

If the values in the above tabulation are compared to values presented in Table 3.1-1, it is apparent that the effect of the selective withdrawal is to reduce the population reductions to what would be predicted for 30 percent mortality and no selective withdrawal.

In conclusion, the points raised by the EPA have been considered in the impact statement. The analysis presented in this report and extended in the discussion above indicates that even assuming 100 percent mortality for organisms entrained in the cooling water, the effects on the lake's population would be unmeasurable.

2. <u>Impingement</u> - Based on the data presented in the Draft statement, the analysis performed by the EPA is arithmetically correct. However, the use of a maximum hourly impingement rate to estimate daily values is unrepresentative of the actual daily values. Additional information from which more realistic impingement totals can be determined follows:

FISH IMPINGEMENT* STUDY

General

A fish impingement study is being conducted at the Oswego Steam Station existing intake structure with the following objectives:

1. To determine the number of fish entering the existing intake structure and retained on the traveling screens.

2. To identify diurnal and seasonal variations in the number of fish per day impinged.

3. To relate the information developed to an optimum design for the Unit 6 intake system and to assess the potential for fish impingement problems at the Unit 6 intake.

Data presented herein represent the study period beginning June 1, 1972 and ending January 4, 1973.

Procedure

Units 1 to 4 at the Oswego Steam Station have a total of eight circulating water pumps, with a combined capacity of approximately 340,000 gpm. The cooling water intake structure for the units is located in the lake, outside the harbor breakwater. It consists of a concrete ring on which rests a structural steel framework, topped by a wooden deck. A vertical 15-ft diameter shaft leads down to a horizontal tunnel of the same dimensions, which runs for about 700 ft to the onshore screenhouse. Here, the water passes through trash racks before flowing through four traveling screens, constructed of steel wire with 1/2 inch square mesh. The screens operate together on an automatically programmed cycle of 3-minutes backwashing every

*The term "impinged," as used here, describes the organisms which enter the cooling water system and are retained on the trash racks and traveling screens.

hour. Velocity of approach to the traveling screens at full flow is approximately 0.9 fps.

The traveling screens backwash water flows into a common trough running transversely across the screenhouse. The trough has a sectional cover of cast iron plates. A special backwash catch net with an aluminum frame which fits closely into the channel was constructed. When an impingement run was to be made, a convenient section of the cast iron cover was removed and the catch net slid into place. After the three minutes of backwashing ended, the net was hauled up and its contents examined.

On thirteen days between June 1, 1972 and January 4, 1973, the fish impinged on the traveling screens during a 1-hour period were collected from five to twenty-two times a day.

Results

The results of the fish impingement study conducted between June 1972 and January 1973 indicate definite diurnal and seasonal trends in the numbers and types of fish found on the traveling screens.

During the period June 1, 1972 through November 19, 1972 the alewife was the dominant species found at the screens, constituting more than 95 percent of the total fish found. Table 8.2-1 presents a summary of the species and numbers of each species found at the traveling screens during this period. The diurnal variation indicated a maximum number of fish entering the intake structure between 11 p.m. and 3 a.m., with the number rapidly dropping off on each side of the peak.

Table 8.2-1
Total Fish Impingement Catch
June 1 to Nov. 19, 1972

Species	Number	Percent of Total
Alewife	8156	95.73
Rainbow Smelt	122	1.43
Spottail Shiner	42	0.49
Gizzard Shad	86	1.01
Mottled Sculpin	30	0.35
Yellow Perch	24	0.28
Three-Spined Stickleback	18	0.21
Common Shiner	5	
Emerald Shiner	21	0.25
White Perch	6	
Smallmouth Bass	2	
Johnny Darter	1	
Sunfish	1	
Rock Bass	1	
Lamprey Eel	1	
Brown Bullhead	1	
Minnow	1	
White Bass	1	
Pumpkinseed	1	
	8520	99.75

Table 8.2-2 presents the maximum and average fish impingement rates for the period June 1 through November 19 including (1) all species found, (2) the alewife only, and (3) all other species except the alewife. As indicated in Table 8.2-2, excluding the alewife, the maximum of the maxima impingement rate of all other species is only 20 fish/hr. Including the alewife, the maximum impingement rate per hour ranges between 1 and 876.

During the period December 4, 1972 through January 4, 1973, a decrease in the numbers of fish impinged as well as a shift in the predominant species from alewife to rainbow smelt occurred. Table 8.2-3 presents the number of fish and species found at the screens during this period. As indicated in Table 8.2-3, the predominant species was rainbow smelt constituting about 53 percent of the total. Again the peak concentrations occurred between 11 p.m. and shortly after midnight. Table 8.2-4 presents the impingement rates during the December to January period. As shown in Table 8.2-4, the maximum impingement rates during this period dropped well below the maximum rates determined from the earlier sampling.

The monitoring program described herein extended over a 31-week period. It was found that the average alewife weight was approximately 0.75 oz. Based on the samples obtained during December and January, it appears that a value of about 0.40 oz for all the other species would be a reasonable and conservative estimate of the average weight.

Table 8.2-2
Fish Impingement Rates
June 1 to Nov. 19, 1972

Sampling Date	Alewife		Non-Alewife		All Species	
	Impingement Rate-Fish/hr.					
	Max.	Avg.	Max.	avg.	Max.	Avg.
6/1/72	238	149	16	9	254	158
6/20/72	871	458	5	3	876	461
7/13/72	131	59	4	2	135	61
7/27/72	22	14	5	2	27	16
8/23/72	1	0	0	0	1	0
9/7/72	2	0	1	0	3	0
9/22/72	37	11	7	3	44	14
10/13/72	31	18	16	11	47	29
11/7/72	5	1	3	2	8	3
11/19/72	4	1	20	6	20	7

Table 8.2-3
Total Fish Impingement Catch
December 4, 1972 to January 4, 1973

Species	Number	Percent of Total
Alewife	9	1.88
Rainbow Smelt	255	53.35
Spottail Shiner	1	
Gizzard Shad	12	2.51
Mottled Sculpin	12	2.51
Yellow Perch	75	15.69
Three-Spined Stickleback	1	
Common Shiner	0	
Emerald Shiner	100	20.92
White Perch	3	
Johnny Darter	0	
Sunfish	1	
Rock Bass	0	
Lamprey Eel	1	
Brown Bullhead	2	
Minnow	1	
Troutperch	2	
Goldfish	1	
Northern Pike	1	
Smallmouth Bass	1	
Longnose Dace	1	
	478	96.86

Table 8.2-4
Fish Impingement Rates
December 4, 1972 to January 5, 1973

	Impingement Rate-Fish/hr.					
			Non-Rainbow Smelt		All Species	
Sampling Date	Max.	Avg.	Max.	Avg.	Max.	Avg.
12/4/72	15	4	11	3	26	8
12/18/72	16	5	27	13	43	18
1/3/73	36	24	19	11	55	35

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Conclusions

1. Based on an analysis of the data obtained from the impingement study, average monthly impingement rates were estimated. Table 8.2-5 presents the average monthly impingement rate for the alewife, the rainbow smelt, all species excluding the alewife, and all species. It is apparent from Table 8.2-5 that the fish impingement rate after the month of June rapidly decreases. During June and July the alewife constitutes 99 and 96 percent, respectively, of the total fish impingement rate. However, this is the time of the year when dead alewives are washed ashore in large numbers. It is, therefore, concluded that the high impingement rate in June is directly related to the naturally occurring die-off of the alewives.

2. Utilizing average weights of 0.75 oz for the alewife and 0.40 oz for all other species, monthly estimates of the pounds of fish impinged at the Oswego station were determined. Table 8.2-6 presents the estimated monthly and annual poundage impinged at the screens.

To provide some perspective of what the values in Table 8.2-6 mean, the following comparisons are offered. The total landing of all fish from Lake Ontario during 1971 was 3,211,000 pounds (Ref. 4) with 305,600 pounds taken on the American side. These quantities do not include alewives which are considered to have no commercial or sport value. Therefore, the value of 1,669 pounds presented in Table 8.2-6 as an estimate of the total annual poundage of impinged fish, excluding the alewife, is only 0.05 percent of the total landings.

Considering the yellow perch and the white perch, which constitute better than 37 percent of the total U.S. landings (the white perch landing of 83,500 pounds was the largest landing of all the species fished in 1971 on the American side), the annual pounds impinged are estimated to be 0.05 percent and 0.016 percent, respectively, of the total U.S. poundage landed.

Based on the results of the analysis presented by the applicant, it is concluded that the value of 33,000 fish/day calculated by the EPA is an unrealistic number. Considering only those species commonly designated as having a commercial or sport value, the maximum average monthly value of 35 fish/hr would yield a total impingement catch for all six units at the Oswego Steam station of only 2,520 fish/day. Even if the maximum of the maxima hourly rates was used to estimate the total impingement per day for all six units, a value of 3,960 fish or about 12 percent of the value calculated by the EPA would be determined. The most realistic estimate of the daily number of fish impinged would probably correspond to the average rate determined from the study completed to date. Utilizing this value (5 fish/hr), a total of 360 fish/day would be estimated for the operation of all six units.

Table 8.2-5

Average Monthly Fish Impingement Rate - Fish/Hr.

Month	Alewife	Rainbow Smelt	All Species w/o Alewife	All Species
June	268	2	4	272
July	46	0.1	2	48
August	0.3	0	0	0.3
September	5	0.1	1	6
October	18	4	11	29
November	1	1	5	6
December	0.4	5	12.6	13
January	0.1	24	35	35
Average Values For Entire Study Period June-January	60	3	5	65

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Table 8.2-6

Estimates of Pounds of Fish Impinged On Oswego Unit 6 Screens Per Month

Month	Alewife	Rainbow Smelt	All Species w/o Alewife	All Species
June	9045	36	72	9117
July	1604	2	37	1641
August	10	0	0	10
September	169	2	20	189
October	628	74	205	833
November	34	18	90	124
December	14	93	234	248
January	3	446	651	654
February* (4 mo. thru period) May	8100	216	360	8460
Total Pounds Per year -	19,607	887	1,669	21,276

*Based on average impingement rates determined on study results June through January.

Since the Applicant has stated that the impingement study will be continued for a year, the data presented previously will be updated to reflect the additional study results as they are obtained. However, the initiation of the study in the late spring has ensured that the data presented in this report reflects the time of year when the fish population near the intake would be expected to be greatest.

Comment

EPA Statement on page 2: "None of the sites measured will meet this standard (45 dBA at night for property lines bordering on residential areas) and one site will exceed it by 13 dBA. Thus, it can be expected that further means of noise abatement may be needed for the plant."

Response

Unit 6 will be built with sound levels such that if any noise abatement is required at the property lines, this abatement can be accomplished by treatment of the present plant.

In other words, Unit 6 will be built with sound treatment such that it will not violate the proposed standards if they become regulations.

In regard to other construction noise, the Applicant will comply with any noise regulations that apply to this site.

References for EPA Responses

1. Quirk, Lawler and Matusky Engineers, "Effect of Circulating Water System on Lake Ontario Water Temperature and Aquatic Biology," for Niagara Mohawk Power Corporation, Oswego Steam Station Unit 6, November 1972.

2. Storr, J.F., "Temperature Variation with Depth at Nine Mile Point (Summer 1963 and 1964)." A Report submitted to Niagara Mohawk Power Corporation, June 1968.

3. International Lake Erie Water Pollution Board and the International Lake Ontario-St. Lawrence River Pollution Board, Volume 3, "Lake Ontario and the International Section of the St. Lawrence River, Report to the International Joint Commission on the Pollution of Lake Erie, Lake Ontario and the International Section of the St. Lawrence River," 1969.

4. Telephone conversation on February 8, 1973 with Mr. Robinson of the United States Department of Commerce, Statistics and Market News Division, National Marine Fisheries Service.

State of New York, Department of Environmental Conservation Albany, New York

Comment

We feel it is important to point out that the Corps apparently has not performed any independent analysis or interpretation of the data and information as submitted by the Applicant or their Consultants. This is particularly significant in the area of water quality and thermal and chemical effects. It is our interpretation of the National Environmental Policy Act of 1969 which mandates environmental statements, and subsequent Federal Court decisions, that the Federal agency, not the applicant or their consultants, shall prepare the environmental statement.

Response

Department of the Army Regulation No. 1105-2-507, 3 January 1972, par. 14e (3) requires in the instant case that we prepare the statement "utilizing the information obtained from the various agencies and the public in response to the original public notice, the information provided by the applicant and the public hearing, if one were held."

The basic data concerning water quality, thermal and chemical effects of the plant, submitted by Niagara Mohawk Power Corporation for its Unit 5, at Oswego, NY were reviewed by the Corps staff, by Dr. Robert A. Sweeney, Great Lakes Laboratory, State University of New York at Buffalo, and by Dr. Alfred Beeton, of the University of Wisconsin at Milwaukee. It is our impression that each of the two men is considered to be an outstanding limnologist. Additionally, the meteorological section, including the interaction of the thermal discharge being released into the lake off-shore, was reviewed by Dr. Ulrich Czapski, State University of New York at Albany. All of the professors mentioned were hired as consultants and paid for their comments and input to the statement.

The data submitted by the Corporation for Unit 6, about one year later, were reviewed again under contract by Dr. Robert A. Sweeney and Dr. Ronald Stewart, Atmospheric Science Research Center, State University of New York at Albany. However, at this time, we have on our staff an Environmental Engineer, PhD; a Plant Ecologist, PhD; a Marine Biologist, MS; and a Biologist, BS, among others.

The foregoing information was forwarded to the New York State Department of Environmental Conservation by letter, dated 20 February 1973. By reply, dated 3 April 1973, the Department of Environmental Conservation indicated satisfaction that we had made sufficient independent study of the data. A copy of the letter is in Section 8.4.

Comment

1. **Aquatic Ecology**

The discussion on aquatic ecology suffers from having the material broken down in sections which are not well interrelated. Since entrainment and impingement of aquatic life forms is currently the center of major attention, more information and data should be presented to back up the Applicant's claims. For example:

a. Fish eggs - while there have been indications that fish larvae were sampled and detected, reference to fish eggs, except in general terms, was not included. Many of the species taken in the area have attached eggs. It would be appropriate to indicate which species have attached eggs and which are free floating, thus giving the reviewer some indication of the potential magnitude of the problem.

Response

Of the total number of fish collected at both the control and plant site sampling locations (see Table 2.9-7), five species were found to constitute 85 percent of all fish caught. Tabulated below are the five dominant species and their respective percentages of the population.

Species	Percent of Total Fish Sampled (%)
Alewife	60
Spottail Shiner	14.7
White Perch	5.3
Smelt	2.3
Yellow Perch	2.7

In response to the New York State question concerning fish eggs, the following discussion describes the spawning habits and characteristics of the fish eggs of the five species tabulated above.

1. Alewife - The alewife generally spawns in shallow water often only a few inches deep, although sometimes in water as deep as 10 ft. Upon extrusion, the eggs are adhesive and generally adhere to stones or gravel. Recent studies have indicated that soon after extrusion they lose their adhesive property and become free floating.

2. Spottail Shiner - Spawning occurs in shallow water along shore usually with a clean sandy or gravel substrate. The eggs are non-adhesive and tend to scatter after spawning.

3. White Perch - Eggs can either be demersal or adhesive with spawning occurring in shallow areas.

4. Smelt - Spawning occurs in the shallow water along the shore of the lake. Smelt eggs sink to the bottom immediately after being released and attach themselves to the substrate by a short pedicel formed from the outer shell membrane.

5. Yellow Perch - Spawning occurs in shallow weedy areas. Eggs are deposited in a long ribbon configuration bound together by a jelly-like substance. The egg chain is adhesive and tends to attach to bottom flora.

The above information is offered to provide the reviewer with some indication of the types of fish eggs that could be found in the Oswego area. It should be noted that the biological studies performed by the Applicant have indicated that Lake Ontario in the Oswego area does not support a large permanent fish population. In addition, since the intake structure is located in a water depth greater than 20 ft and the fish spawn generally in a water depth of only a few feet, the potential for any detrimental effects on the fish population is minimal.

Comment

b. Fish larvae - the Applicant's contention that larvae are more abundant in surface waters than in bottom waters needs more substantiation. Since the plant will raise water temperatures 32 F and water will take 11 minutes to circulate through the facility, expectations for 100 percent mortality for all organisms is highly likely. Applicant's reference that fish larvae and zooplankton suffer less than total mortality based on studies at other generating facilities is unsound since most "other" facilities have more benign operating regimes. Therefore, the models alluded to on pages 3.1-8 to 3.1-10 should reflect this facility more closely.

Response

Larval studies were performed at the Oswego Steam Station during September and October 1972. The results of these studies are presented in Volume IV, Appendix D of a report submitted by the Applicant in November 1972 to the New York State Department of Environmental Conservation (Ref. 1)* in support of a permit application to discharge a heated effluent from the Oswego Steam Station Unit 6. This engineering and biological report was submitted to and is available in the Bureau of Industrial Wastes (Industrial Facilities Section of the NYSDEC). This report is also available from the Applicant. Tabulated below are the larval concentrations found in Lake Ontario at Oswego during the fall 1972 sampling.

Number of Larvae/1000 Cu. Ft at Oswego

Station		Daytime		Nighttime	
Depth Ft	Depth	Sept	Oct	Sept	Oct
10	Surf.	-	0.0	0.30	0.0
15	Surf.	4.41	-	0.63	-
20	Surf.	-	0.0	-	0.0528
30	Surf.	0.11	0.0	1.99	0.0
30	15 ft	0.0	0.0333	0.59	0.0993
40	Surf.	-	0.0	1.87	0.0
40	15 ft	-	-	0.35	-
40	20 ft	-	0.0	-	0.0
50	30 ft	-	0.0	-	0.0
60	Surf.	-	-	0.31	-

Note: A dash (-) denotes no tow made at the given location.

As indicated in the above tabulation, the larval concentration was greater in the surface water than at depth for the stations sampled. In any event the concentrations found at the lake in the vicinity of Oswego appears to be very small either at the surface or with depth.

The statement that there would be a difference between entrainment effects for Units 1-4 with 12 F condenser rise and a 4-minute retention time in the discharge system, and Unit 6 with a 32 F condenser rise and an 11-minute retention time is valid. Entrainment mortality is generally attributed to either the absolute temperature or the temperature differential the organisms are subjected to as they pass through the circulating water system. The data obtained at Units 1-4 establish a lower limit of the mortality which could occur at Unit 6. If, eventually, it is determined that the absolute temperature and not the temperature rise is the controlling factor, it is quite

*See references listed at the end of N.Y. Department of Environmental Conservation comments and responses possible that, except for summer months, the mortality incurred at Unit 6 would be very similar to that measured at Units 1-4.

In any case, the analyses presented on pages 3.1-8 and 3.1-9 of this report have considered the possibility that the results at Units 1-4, i.e., 30 percent mortality, would not be representative of Unit 6. On page 3.1-8, Table 3.1-1, Column 1 presents the predicted percentage population reduction assuming 100 percent mortality. These numbers are reiterated below:

Assumed Model Boundaries	Reduction of Population (%) 100 Percent Mortality
Entire Lake	0.008
Ten Mile Inner Lake	0.014
One Mile Inner Lake	0.160

The values tabulated above indicate the upper limit of expected mortality for entrained organisms passing through the Unit 6 condenser.

Results of biological studies conducted by the Applicant have shown the area offshore of Oswego to be relatively sparse in benthic, planktonic and fish populations. It is likely, therefore, that even if 100 percent mortality was incurred due to passage through the Unit 6 condenser, the percent reduction in lake population would be less than that tabulated above.

Another factor reducing the percent of the population affected by Oswego Unit 6 is the fact that the intake structure is designed so that water will be withdrawn selectively from the middle and lower portion of the water column. The percent reduction in population, assuming 100 percent mortality but selective withdrawal is presented below:

Assumed Model Boundaries	Reduction of Population (%) 100% Mortality - Selective Withdrawl
Entire Lake	0.002
Ten Mile Inner Lake	0.004
One Mile Inner Lake	0.048

If the values in the above tabulation are compared to values presented in Table 3.1-1, it is apparent that the effect of the selective withdrawal is to reduce the population reductions to what would be predicted for 30 percent mortality and no selective withdrawal.

In conclusion, the analysis presented in the Draft EIS and extended in the discussion above indicates that, even assuming 100 percent mortality for organisms entrained in the cooling water, the effects on the lake's population would be unmeasurable.

Comment

c. Fish entrainment - intake velocities will be less than one fps. While this works well with restricted intake designs it is felt that in offshore intakes as presently proposed greater intake velocities would result in low fish entrainment. Fish can detect horizontal velocities of very low levels. However, fish could not be expected to avoid these velocities unless they found them intolerable. One fps or less has not to our knowledge proved to be intolerable. Therefore, it is highly likely that all fish that are in the vicinity stand a good chance of entering the intake structure. Perhaps literature on similar structures operating at nuclear facilities on the West Coast should be examined.

Response

The comments offered by the State are correct in regard to the ability of fish to sense horizontal velocities and not being able to sense vertical velocities. In studies performed for the design of the California Edison Company's Huntington Beach Steam Station (Ref. 2) a series of model studies and prototype measurements at the El Segundo power plant were conducted. The results of these studies culminated in a design for the Huntington Beach Station which utilized a horizontal approach velocity of about 2 fps. However, it was the opinion of the engineers concerned with the project that the entrance velocity was not critical as long as it was greater than the velocity the fish normally experienced. They recommended a velocity range of 1 to 3 fps. Since the flow into the structure is radial, the velocity pull is variable and different fish will sense the velocity at different distances from the structure.

Velocities in Lake Ontario as recorded in the area near the Oswego site indicate that at the depth of the intake the current velocity could be expected to be equal to or less than 0.08 fps 50 percent of the time and that currents as great as 1 fps were not observed. Based on the actual lake currents, it is expected that a velocity of 1 fps would be greater than the normal velocity experienced by the fish and would serve its function as a warning to the fish. If, however, problems associated with fish entrainment should occur after Unit 6 is operational, a solution could be to block off a portion of the aperture, thereby increasing the horizontal velocity with no major effect on the design parameters of the plant.

It is therefore concluded that the intake structure proposed by the Applicant has been designed with intentions to minimize fish entrainment and should achieve its purpose. In the event a problem does develop, remedial actions could be instituted and the problem solved.

Comment

d. Other aquatic organisms - further sampling would be necessary in order to determine the composition and abundance of bacteria, phytoplankton, zooplankton, microflora and macroinvertebrates.

Response

The Applicant has submitted a comprehensive engineering and biological report to the New York State Department of Environmental Conservation in support of a thermal discharge permit application. This report, entitled "Effect of Circulating Water System on Lake Ontario Water Temperature and Aquatic Biology" (Ref. 1), contains the results of detailed biological studies conducted by the Applicant.

Generally, the results of the biological studies indicated a sparse planktonic population, a small benthic population beyond the 15-ft water depth, and, due to the low nutrient content of the lake, the microflora concentrations would be expected to be small.

For more details on the biology of the lake in the vicinity of Oswego, see Appendix D of the previously mentioned report (Ref. 1).

Comment

2. Terrestrial Ecology

The analysis presented on terrestrial ecology is somewhat nebulous due to the fact that the location of the generating facility is in an industrial area. The submission of species list is not adequate. The point of discussion should be the potential impacts of the generating facility on its environs.

Response

The terrestrial ecology as discussed in Section 2.7 is concerned with the environmental setting without the proposed action. The potential impact of the proposed facility on its environs is discussed in Sections 3.6 and 3.7.

Comment

3. Hydrology

With regard to hydrology, the discussion has inadequate data on ground or surface water quality based on sampling over a sufficient period of time. The report mentions that the water quality is "fairly uniform"; what is meant by this terminology?

Response

The water quality data presented in Tables 2.9-1 and 2.9-2 extend over a period of seven years from 1964 to 1970. Data presented in Table 2.9-3 were developed by the Applicant based on water quality sampling conducted April through August 1972. The Applicant has sampled and analyzed the water quality of the lake and the Oswego Harbor during 1970 and 1972. During 1970, samples were taken weekly over a 17-week period from July through November. In 1972, samples were collected monthly from April through November (excluding May and October). The results of all the water quality sampling are presented in the Applicant's report to the NYSDEC (Ref. 1).

The statement that the water quality is "fairly uniform with depth" appears on page 3.1-6 of this environmental statement and is referenced to the data collected at the surface and at the bottom in a water depth of 40 ft. As shown on Table 2.9-3, the ranges of values for fifteen water quality parameters listed are not significantly different between the surface and bottom in the 40-ft water depth.

Comment

A statement is made that critical thermal operating conditions may occur when all six units are operating at capacity and the lake is at a maximum ambient temperature, lake currents are at maximum or still water exists in the lake, and the Oswego River is either at a high or low flow. There is no basis or data given for these assumptions.

Response

To explain the basis for the statement in question, the parameters mentioned in the statement are discussed individually below:

1. Six units operating at maximum capacity - There can be no question that the maximum heat load discharged to the lake occurs when the units are operating at maximum capacity. At any capacity below maximum the Btu's discharged to the lake and the corresponding thermal effects would be reduced.

2. Maximum ambient temperature - It is generally accepted that at elevated temperatures fish experience stresses which can eventually result in mortality. The use of a maximum lake ambient temperature results in showing the plume behavior under the most biologically critical thermal regime. It is acknowledged that the discharge plume may disperse somewhat differently under different ambient conditions (due to different buoyant forces), however, the critical condition from a biological

standpoint is still the condition with maximum lake ambient. In addition, jet dilution would be minimum under maximum lake ambient conditions.

3. Lake conditions of maximum current and still water- Hydraulic model testing conducted by the Applicant (1), and other testing conducted at the Massachusetts Institute of Technology (Ref. 3) and the Alden Research Laboratories (Ref. 4) have shown that the dilution achieved by a multiport subaqueous diffuser is reduced as the drift current is increased. Based on this, the testing of a maximum lake current is felt to yield the critical temperature effects due to ambient lake conditions.

   Still water testing was performed to document the most severe condition for combined operation of all units at the site. By eliminating drift currents the heat discharged from all the units is not convected from the area by the drift current. Therefore, only dispersion and the circulation pattern developed by the discharges themselves transport the heat out of the area.

   By testing both extremes of potential lake currents, the Applicant has considered the most critical conditions.

4. Oswego River Discharge - The effect of the Oswego River is to supplement the transport of the discharge from Units 1-4 into Lake Ontario. By testing low Oswego River discharge, the Applicant has shown the effect of minimum initial dilution of Units 1-4 as well as a minimum discharge momentum out of the harbor. This results in the potential for the maximum expected interference between the Units 1-4 discharge and the discharge from Units 5 and 6. Mean Oswego River discharge was tested to indicate a more typical discharge from the harbor. The testing of Oswego River discharges in excess of 6100 cfs was not deemed necessary since the most severe results obtained at 6100 cfs were less than 40 percent of the allowable value. Based on 33 years of stream flow records, the Oswego River discharge is always less than the mean value of 6100 cfs during the months of June through November when the lake temperatures are highest (condition tested in the model).

In conclusion, the hydraulic model study conducted by the Applicant has sufficiently satisfied the testing of a combination of possible critical lake and plant operating conditions which would yield the most severe thermal effects.

Comment

The ability to meet the New York State Thermal Standards was given as the reason for selecting the once-through cooling process. However, in another section of the report it is stated that not all of the hydraulic model tests have been completed and that the most critical condition has not been tested. Again we find a deficiency in the amount of data which supports the conclusions.

Response

All testing, including the most critical conditions, was completed at the time the Applicant concluded that the New York State Thermal Criteria would be satisfied. A typographical error on page 3.1-6, paragraph 6 of the Draft Environmental Statement, which states, "The hydraulic model tests will be conducted..." led to the confusion. The statement on page 3.1-6 of this report now reads, "The hydraulic model tests were conducted..."

The area enclosed by the 3F isotherm of temperature rise as shown on Figure 3.1-3 in this report is 2.2 acres total for both Units 5 and 6. It should be noted that the total acreage within the 3F isotherm for both units is only 34 percent of the allowable acreage for one unit.

The following information is offered by the Applicant to provide additional predictions of the thermal effects resulting from operation of six units at the Oswego site.

Lake Condition	Oswego River Discharge	Predicted Temperature Effects Surface Area Enclosed By Specific Isotherm (Acres)		
		3.0 F[1]	2.5 F	2.0 F
Still water (Run 1)	Low	1.2	4.7	15.1
Still water (Run 2)	Low	0.[illegible]	9.2	33
Still water	Mean	2.2	11	37
0.5 fps Drift[2] (Run 1)	Low	1.3	3.9	34
0.5 fps Drift (Run 2)	Low	1.7	9.9	37
0.5 fps Drift	Mean	4.8	19.4	62

(1) Surface area for 3.0F isotherm are the combined areas for both Unit 5 and Unit 6.

(2) Drift Current is from west to each at 0.5 fps.

The predictions presented in the above tabulation indicate compliance with New York State Thermal Criteria for extreme lake conditions and maximum operation of six units at the Oswego Steam Station.

Comment

4. Air Quality and Meteorology

a. There is some indication that not all of the emission regulations will necessarily be met as stated on page 3.2-1.

Calculations of expected emissions compared with the amounts allowed by regulation are as follows:

	Units Nos. 1-5 Emissions (lb/hr)		Unit No. 6 Emissions (lb/hr)	
	Expected	Allowable	Expected	Allowable
Particulates	1,040	1,171	180	809
Sulfur dioxide	23,052	25,760	6,455	6,472
Nitrogen oxide	Not avail.	Not avail.	2,406	2,427

Units 1-5 will probably meet the emission regulations although there is not much room for increase of particulate emission.

Unit 6 is well within the particulate emission regulation but just about meets the regulation for SO2 and NOx. Any decrease in efficiency of the MgO system will probably result in exceeding the SO2 regulation. Although the NOx emission is marginal, the standard is very tight and difficult to achieve.

Response

Provided that the emission control systems operate within their guaranteed performance, and that the fuel sulfur content is as specified by law, all emission standards will be met. All plant emission control systems were designed with the maximum allowable emission set by emission standards. This is why expected emissions are very close to allowable emissions.

After the plant is operating, the additive rate of MgO will be optimized with some reduction of particulate emission. The SO2 emissions given in Table 3.2-3 considered that all the sulfur present in the fuel is emitted as SO2. Therefore, any sulfur that is removed by the MgO additive will reduce SO2 emissions.

After the plant is operating, an emission testing program will be conducted, as explained on page 3.9-2, to confirm that emissions are within the standards.

Comment

b. The ambient air quality data (page 2.10-1) should be considered in terms of its limitations.

The SO2 data is based on a very limited time period of study using instrumentation which is not generally approved because it is subject to significant interferences and generally renders higher values than are actually present.

The method of estimate of the annual average for SO2 should be described. It is expected that this estimate is quite tenuous.

Both the SO2 and particulate sampling data represent values including the contributions from Units 1-4 which may be assumed to have been operating during the sampling periods. Hence the data may represent a higher background reference level to which the theoretical values is added.

Response

The SO2 monitoring and Hi-Vol sampling data were considered in terms of their limitations; however, it was necessary to base background levels on this sparse information due to the absence of any other recorded ambient air quality data in the Oswego area. Because of the sampling techniques and the inclusion of ground level effects due to the emissions of Units 1-4 firing coal, the data did render high contaminant concentrations and are, therefore, consistent with the conservative approach maintained in this air quality study.

Niagara Mohawk, realizing the limitations of these data, is planning to install and maintain ambient air quality monitoring instrumentation in the vicinity of the plant. The information compiled from this monitoring system will provide a basis for more accurate estimation of ambient contaminant levels and serve to corroborate predicted ground level concentrations of sulfur dioxide, nitrogen oxides, and particulate matter.

Ambient sampling of sulfur dioxide was conducted by Niagara Mohawk in Oswego during one summer month in 1970, and during a six-week winter period in 1970-71. During the winter sampling period, December 17, 1972 through February 1, 1971, the sampling station was located at Oswego Naval Reserve Center, which is about 1/2 mile northeast of the power plant. Over 900 hourly observations of wind direction, wind speed, temperature, and SO2 concentrations were recorded.

The average of the SO2 concentrations measured during the six-week period was 0.039 ppm. The measured maximum 1-hr concentration was 0.12 ppm and the measured maximum 24-hr average concentration was 0.075 ppm. Both of these maximum values occurred when the wind was blowing from the south-southeast.

Ambient sampling was also conducted within the Oswego town limits during August, 1970. A sulfur dioxide sampler was located on the roof of the Niagara Mohawk commercial offices which are situated in the downtown section of the city, about 1 1/4 miles east-southeast from the power plant. The background concentration of SO2 during this period was estimated to be 0.01 ppm.

The estimated average background concentration within the City of Oswego was determined by assuming that 0.039 ppm SO2 levels occur for two winter months and that 0.01 ppm SO2 levels occur for three summer months. By taking the weighted average of these concentrations, the estimated average background level was then calculated to be 0.02 ppm.

Comment

c. The listing of "Estimated Concurrent Background" values in Table 3.2-1 is not consistent with sampling values appearing on page 2.10-1. That is, the maximum 24-hour SO2 sampling concentration is 0.075 ppm whereas the estimated background is 0.03 ppm. Also, the maximum 24-hour particulate concentrations are 97 and 142 ug/m³ while the estimated background figure is 70 ug/m³. What is the explanation for these differences and how was the estimated concurrent background determined?

Response

The background levels of sulfur dioxide and particulate matter shown in Table 3.2-1 represent both concentrations that occur concurrently with the predicted maximum ground level concentrations. The predicted maximum ground level contaminant concentrations due to the Oswego Steam Station would occur in the vicinity of the monitoring site only when the wind blew directly from the power plant to the monitor located at the Oswego Naval Reserve Center. The average hourly SO2 concentrations from each wind direction during the sampling period were calculated by summing the concentrations produced while the wind was from a specific direction and dividing by the total number of hours of sampling data. Using the results of this analysis, the background levels were assumed to be the maximum occurring during southwest winds, i.e., winds directly from the power plant toward the monitor. The maximum recorded SO2 concentrations representing background levels would then be 0.03 ppm for a 24-hr maximum and 0.12 ppm for 1-hr maximum.

Comment

d. In Table 3.2-3 the emission of particulates for Units 1-5 is listed as 1,040 lb/hr. Is it correct that only 75 percent of the potential particulate emission is removed?

Response

The particulate collectors for Units 1 through 4 are 15 percent efficient and the electrostatic precipitator for Unit 5 is 95 percent efficient. These combine to give 75 percent collection of the particulates produced in Units 1 through 5. The emissions are discharged through a single stack and the total emission from Units 1 through 5 is 0.042 lb/10⁶ Btu compared to the emission standard for particulate matter of 0.1 lb/10⁶ Btu.

Comment

e. In Section 3.2, the calculation of predicted ground level concentrations and comparison with the air quality standards neglects to consider two aspects:

(1) There is no evaluation of compliance with the 1-hr and 24-hr SO2 standards that must be met 99 percent of the time, i.e., 0.25 ppm and 0.10 ppm, respectively.

(2) There is no indication that 400-ft topographic elevations to the south of the plant were considered in estimating ground level concentrations.

Response

(1) Since our dispersion analysis showed no hourly value over 0.25 ppm and no 24-hr values over 0.1 ppm, this was not included in our report.

(2) Terrain features at an elevation of 150 ft above the stack base were considered and included in the Air Quality Report. They will also be incorporated in the final Environmental Report. All concentrations in this investigation were within the standards with a maximum possible concentration of 0.33 ppm occurring if the following conditions occur simultaneously: 1) northerly winds at 8 mph, 2) the plant operating at 30 percent load or less, and 3) unstable atmospheric conditions. It is considered unlikely that these variables will occur simultaneously.

Comment

f. In Table 3.2-1, two New York State annual average standards for SO2 are listed. As of this time, there is only one, .03 ppm. Also, in this table, the New York State maximum annual standard for particulates is listed as 45 ug/m³ corresponding to Level I. The City of Oswego is indicated to be Level III and the surrounding are Level II. The corresponding standards are 65 and 55 ug/m³, respectively.

Response

The second value for the annual average SO2 standard, i.e., 0.02 ppm, was outdated and in error and the report has been revised accordingly.

The standards listed in Table 3.2-1 were the maximum ambient air quality standards for New York State. Although the plant site and the City of Oswego are not in Level I, such a region exists within 2 1/2 miles of the plant. As the effects of the emissions of Oswego Steam Station were observed at this distance, standards for Level I were tabulated. In addition, the ground level contaminant concentrations were in compliance with Level I standards and would not, therefore, contravene those for Level II and Level III.

Comment

g. On page 3.2-8 it is indicated that the critical height of the inversion base for plume trapping is 450 meters. It is not clear how this height was determined. This height is dependent, according to Briggs, on buoyancy flux, the mean wind speed and an inversion parameter. It is essentially the assumptions on this inversion parameter that determines the height of the base of an elevated inversion at which plume penetration would occur. Exactly what assumptions were made in this determination? Also, the assumption of a 12 meters per second wind speed during the period of elevated inversion does not seem reasonable since a weak pressure gradient is generally associated with the subsidence inversion. What is the justification for the 12 mps (25 mph) speed?

Response

The 450-meter height used to represent the base height of the lowest evaluated inversion that could trap beneath it a significant portion of Oswego stack plumes was based on several considerations. First, analysis of the Buffalo, New York, sounding data showed that elevated inversions based between height of 400 to 500 meters occasionally occur. Second, atmospheric stability beneath one inversion based between 400 to 500 meters was classified as unstable. Third, the analysis showed that winds in the layer beneath elevated inversions at times have speeds averaging as high as 12 meters per second (mps). Although analytical information did not provide resolutions of wind speed by stability class and inversion base height, it was assumed a 12-mps speed occurred coincidently with an inversion based between 400 to 500 meters which had the unstable layer beneath it. This sequence of events was selected to provide a conservative or extreme estimate of resulting ground level SO_2 concentrations. In reality, speeds of 12 mps are more likely to be associated with neutral atmospheric conditions beneath an inversion layer. Resulting ground level concentrations of SO_2 in this case would be lower. Fourth, Briggs' (Ref. 5) plume rise formula (for neutral and unstable conditions) along with a physical stack height of 212 m provides an effective height (plume rise plus physical stack height) of about 450 meters for Oswego Units 1 through 6. Finally, it was assumed that the inversion based between 400 to 500 meters existed at 450 meters and that all plant effluent was trapped beneath it.

Comment

h. In Table 3.2-2, the contributions of Units 1-6 as a percentage of standards are presented. It is appropriate to present also the expected levels including background as a percentage of the standings.

Response

The contributions of Units 1 thorugh 6 were presented as percentage of the standards, as the ambient air quality data which served as the basis for background level estimates were inadequate. It is, therefore, not appropriate to consider contaminant levels of Units 1 through 6 along with background levels as a percentage of the standard, until reliable background data becomes available. Previous background levels monitored during 1970-71 included Units 1-4 burning coal and would not be representative for the Oswego area in the future. The new regulations require low sulfur fuels for industry and for utilities such as NMPC's Oswego Station. Because of these regulations all 6 Units at Oswego will burn oil with a lower sulfur and ash content than coal.

Comment

i. In Appendix A, reference is made to the use of five operating modes for the plant. Explicit specification of these operating modes should be presented.

Response

The five operating modes referred to in Appendix A are, in percent load:

	I Day 8am-4pm	II Day 4pm-12pm	III Day 12pm-8am	IV Weekend 8am-12pm	V Weekend 12pm-8am
Units 1-4	100	29	29	0	0
Unit 5	100	100	40	100	100
Unit 6	100	100	40	100	40

Comment

5. Wastes and Disposal

The report discusses the offsite landfill operation owned by Niagara Mohawk but does not offer a description of this offsite facility or the methods by which the waste and excavated material is transported to the landfill.

Response

The offsite disposal area is south of the City of Oswego. The area has been previously approved by the New York Department of Environmental Conservation in accordance with Permit No. 4-97-7-05 for disposal of dredged material from the west basin of the harbor. In addition, the Corps of Engineers has also approved of the area in its Permit 070-0X2-1-050016 for disposal of the dredged material. Wastes will be trucked from the site in enclosed trucks.

Comment

6. Fuel Storage

Are there any precautionary structures, such as dikes, for fuel spillage or leaks around fuel storage tanks? It is not discussed in any section of the report.

Response

All fuel storage tanks are diked. The four main fuel oil storage tanks are earthern diked to a height of 12 ft around the entire perimeter of the storage area and also bisecting the area. Day tanks are surrounded by appropriately sized steel dikes. Rainwater is contained within the dikes. Replaceable sand beds are located to absorb oil at areas where minor leaks could occur.

Comment

7. Land Use and Aesthetics

The statements regarding aesthetics and ambient land uses do not consider the impact on populated scenic or historic areas. It does not provide adequate data and descriptions on the design of the structure and layout of the site.

The illustration presented in the frontispiece is not satisfactory. This "birds eye" illustration depicts the least likely impact because it will never be seen from this position. The impact can be best assessed from a ground level perspective at which the facility can be viewed.

The description "landscaping and plants will be used to create a pleasing appearance" is not adequate to describe how buffer treatment of facilities, restoration of site excavation and shoreline treatment will be handled.

The report mentions "Oswego Market House,... and several other sites are being considered for designation" as historic sites; where are they and what will the impact be on these sites? Also the future land uses which will be affected adversely are not described in detail. What are these designated land uses and the adverse effects on them?

Response

The illustration was chosen to convey the best overall indication of the entire completed facility. Since the facility can be viewed from any point of the compass, many ground level perspectives would be required to convey the same information.

Of the 93 acres of land in the property, about 50 acres will be landscaped in some manner, with appropriate planting, graveled areas, scarps, and berms. The remaining acres are occupied by the plant, tank farm, parking areas, auxiliary structures, switchyard and transformer areas. Both deciduous and evergreen trees will be used to properly screen and outline the perimeter and interior spaces of the property. The major open areas will have grass and hardy vegetative cover while the lawns will be confined largely to the areas around the buildings.

The property will be cleared and appropriately graded for drainage and, when landscaped, will provide an attractive overall appearance.

The impact of Unit 6 on populated, scenic, and historic areas encompasses a number of aspects, i.e., the effects of air quality, odors, noise, aesthetics, and traffic. The air quality, odors, and noise effects of Unit 6 have been discussed extensively in other sections of the report and will be in compliance with all applicable environmental regulations and criteria. The addition of Unit 6 to the station is not expected to have any significant effects on the traffic patterns in Oswego. As for aesthetics, the station and its stacks will be visible from most populated, scenic, and historic areas in Oswego and its suburbs.

Oswego Market House is 1 mile east-southeast of the plant. The Market House was built in 1838 and was originally used as the town assembly hall with markets on the first floor. This three-story building is now used as a warehouse.

The statement "...several other sites are being considered for designation" refers to those sites as listed in the table on pages 2.4-1 and 2.4-2 of this report.

References for NYSDEC Responses

1. Quirk, Lawler & Matusky Engineers, "Effect of Circulating Water System on Lake Ontario Water Temperature and Aquatic Biology," for Niagara Mohawk Power Corporation, Oswego Steam Station Unit 6, November 1972.

2. Weight, R.H., "Ocean Cooling Water System for 800 Mw Power Station," Journal of the Power Division, Proceeding of the American Society of Civil Engineers, December 1958.

3. Harleman, D.R., Jirka, G., Stolzenbach, K.D., "A Study of Submerged Multi-Port Diffusers for Condenser Water Discharge with Application to the Shoreham Nuclear Power Station," Department of Civil Engineering, Massachusetts Institute of Technology, Report No. 139, July 1971.

4. Stone & Webster Engineering Corporation, "Engineering and Ecological Studies for Design of Intake and Discharge Structures for James A. FitzPatrick," A report submitted to the Power Authority of the State of New York, January 1970.

5. Briggs, G.A. "Plume Rise", U.S. Atomic Energy Commission, Division of Technical Information, 1969.

Federal Power Commission, Washington, D.C.

Comment

The staff of the Bureau of Power concludes that the electric power output represented by the Oswego Unit No. 6 is needed to implement the Applicant's and the New York Power Pool's generation expansion programs for meeting projected loads and to provide reserve margin capacity for the 1976-77 winter and 1977 summer peak periods.

Response

No response to this comment was deemed necessary.

United States Department of the Interior, Washington D.C.

Comment

History and Historical and Scenic Sites

This section contains a description of numerous historic properties within the affected area. However, it does not evaluate the effects of the proposal on the properties it describes.

Some confusion concerning the National Register of Historic Places is evidenced. The following is a list of National Register properties in Cayuga and Oswego Counties as of December 1972: Cayuga County-Flatiron Building (1-3 Genesee Street, Auburn); William H. Seward House National Historic Landmark (33 South Street, Auburn); Jethro Wood House National Historic Landmark (New York 34B, Poplar Ridge); Oswego County-Oswego City Library (120 East Second, Oswego); Fort Ontario (East Seventh, Oswego). This section should be corrected to reflect the above information. It should be noted that the Oswego City Library is neither a national historic site nor a national historic landmark.

Normally the Federal agency preparing an environmental statement should determine the existence of National Register properties by consulting the National Register of Historic Places and the State Liaison Officer for Historic Preservation, who will alert the agency to other properties he regards eligible for nomination to the National Register. In this case we have provided this listing of properties as part of our assistance to you in interpreting the terminology of the National Historic Preservation Program.

It should be noted that all properties listed in the National Register of Historic Places come under the purview of Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665). To assure compliance with Section 106 of that Act and with Executive Order 11593 of May 13, 1971, the statement should indicate that in accordance with the procedures of the Advisory Council on Historic Preservation (Federal Register, November 14, 1972) required steps have been taken to determine the effects of the action on National Register Properties and to seek the assistance of the Advisory Council and the State Liaison Officer in evaluating such effects and, if possible, mitigating or avoiding them. We believe that the statement should indicate that a positive determination was made of the existence of National Register properties and compliance with Section 106. It should show that the New York State Liaison Officer was consulted concerning the existence of cultural resources in the affected area.

We do not consider the declaration that "no known archeological excavations exist near Oswego" is adequate documentation of the presence or absence of archeological remains. Generally, we think that the presence or absence of archeological resources should be established as a result of direct professional examination and evaluation. An archeological survey of the site will probably be necessary to the preparation of an adequate environmental statement. The New York State Liaison Officer may be able to recommend sources of professional archeological advice and consultation.

As noted above, a discussion of the effects of the proposal on cultural resources is very important in the case of National Register properties. Any cultural resources, such as archeological remains, on the actual construction site will likely be irreversibly and irretrievably lost; however, professional assessment of any such resources may indicate that salvage before construction will be advisable. Effects upon other properties may be less obvious, for instance, possible structural damage from plant emissions. However, these impacts should be considered and mitigating measures discussed.

Response

As stated on page 2.4-1, only the historic sites and scenic attractions within ten miles of Oswego are discussed in this section. As of February 1973, only the Oswego City Library and Fort Ontario are listed as National Register properties. It is noted that the Oswego City Library is not a National Historic Landmark and the text of the Final Environmental Impact Statement has been corrected.

As discussed in this report, the Oswego Steam Station of the Niagara Mohawk Power Corporation (NMPC) occupies a site containing about 91 acres. The site now contains four fossil steam electric generating units with a fifth unit scheduled for commercial operation in October 1974. Unit 6 will be an extension to the existing station.

A Draft EIS was issued by the Corps of Engineers for Oswego Steam Station Unit 5 on October 8, 1971 and was reviewed by the National Park Service and the New York State Historic Trust. The Final EIS for Unit 5 with comments by these agencies was issued on December 27, 1971. The National Park Service reported that the construction and operation of Unit 5 would not directly affect any existing or proposed National Park Service areas. They also stated that the project would not impinge adversely on any Registered or National Historic Landmark. Similarly, the New York State Historic Trust reported that this addition to the Oswego Station would not directly damage any places of historic significance. Since Unit 6 will occupy the same site as Unit 5 and the entire 91-acre site was discussed in the EIS for Unit 5, the comments of the National Park Service and the New York State

Historic Trust for Oswego Unit 5 would be equally valid for Unit 6. Since the site already houses five steam electric generating units and no archaeological artifacts were uncovered during construction of the existing station, it is unlikely that the area to be affected by the construction of Unit 6 would contain significant archaeological remains.

Comment

Circulating Water

Since management techniques to improve important sport and commercial fisheries of Lake Ontario are being applied on a continuing basis and water quality conditions are also improving through pollution control efforts, it is logical to expect the fish production to increase. If this increase in production occurs, the likelihood of unacceptable damage to aquatic life stemming from impingement and entrapment at the intake screens will also increase. Therefore, we question the basis for the conclusion indicated on page 3.1-2 that, based on the impacts of existing intakes at this plant, the maximum approach velocity to the traveling screens of 0.97 fps for Unit 6 will be low enough to adequately protect the fish. Experience at other large plants have shown that generally aquatic life is adequately protected when the maximum approach velocity is less than about 0.5 fps.

We are pleased that the intake structure screenwell is designed to allow for the future installation of fish transfer devices if the need arises.

Significant fish mortality from rapid temperature changes, as a result of abrupt plant factor changes, could occur. We suggest that if possible the temperature change in the water in the discharge area should be limited to about 2°F per hour.

Response

Nine months of experience has now been obtained by the Applicant in monitoring the fish impingement rate at the traveling screens of the existing Units 1-4. These have a maximum approach velocity of 0.94 fps, i.e., very close to the design value of 0.97 fps for Unit 6.

Every indication is that fish over approximately 7 in. long and in good condition have no difficulty staying away from the traveling screens. In the daytime, when light penetrates into the screenwell, fish of this size and larger can be clearly seen swimming across the front of the screens.

The expansion of fishery resources currently underway in Lake Ontario pertains specifically to salmonids, which achieve the 7 in. size very early in their lives. They are cold water fish and tend to inhabit the deeper, colder waters of the lake. The likelihood of their coming into the shoreward waters is small. Should they approach the lake intake structure, they are unlikely to be swept in by 1.0 fps maximum approach velocity at the intake bar racks. Finally, if they should get into the screenwell, they will easily resist the flow into the screens.

If, then, large fish appear to be congregating in the intake screenwell, fish transfer devices can be installed.

With reference to rapid temperature changes due to abrupt changes in plant load, it should be borne in mind that the Unit 6 discharge is right alongside the Unit 5 discharge. An unscheduled shutdown is rather unlikely to affect both units at the same time.

The Applicant recognizes that rapid temperature changes may be harmful to fish and all practical means will be utilized to regulate the temperature changes in the discharge area.

Comment

Cooling Water Heat Dissipation

A discussion of the effects of the cooling water discharge begins on page 3.1-3. We think that the statement should indicate on a map and in the text the sources and magnitudes of heat discharged to the lake, the distribution of thermal plumes from other powerplants, and other industrial plants in the vicinity. A discussion of these cumulative impacts from other sources is needed to lend credibility to indications that no thermal problems will exist as the result of the construction and operation of the proposed plant.

The Applicant's model tests, which involve near-field plume models that are considered amenable to useful analysis, have apparently demonstrated the feasibility of keeping thermal discharges within the limitations of New York State's water quality standards. However, since the 32.4F cooling water temperature rise is rather high, we suggest that remedial measures, which will be taken if impacts are unacceptable, should be developed and presented in the final environmental statement.

Response

Table 8.2-7 lists all known significant heat inputs into Lake Ontario, projected to the year 1980. In addition, Figure 8.2-5 identifies their locations.

As can be seen, the thermal discharges nearest to the Oswego Steam Station are Nine Mile Point Nuclear Power Station (also belonging to the Niagara Mohawk Power Corporation) eight miles to the east, and the proposed Sterling site of Rochester Gas & Electric, thirty miles west. It is highly unlikely that thermal

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Table 8.2-7

Thermal Inputs Into Lake Ontario - Year 1980

Plant	Capacity, MW	Discharge Flow, cfs	T Above Lake Ambient, F	Heat Rejection to Lake 10^9 Btu/hr
NMPC, Oswego Station Units 1-4, Fossil[1]	407	762	12.4	2.114
NMPC, Oswego Station Unit 5, Fossil[2]	890	635	28.6	4.090
NMPC, Oswego Station Unit 6, Fossil[3]	890	635	28.6	4.090
NMPC, Nine Mile Point Station Unit 1, Nuclear[1]	610	597	31.2	4.180
NMPC, Nine Mile Point Station Unit 2, Nuclear[2]	1100	1188	30.9	8.210
PASNY, J. A. FitzPatrick Station, Nuclear[2]	850	825	31.5	5.714
RG&E, Russell Station, Fossil[1]	282	239	19.6	1.051
RG&E, Ginna Station, Nuclear[1]	470	779	19.6	2.975
RG&E, Sterling Site, Nuclear[3]	1000	1040	30.0	7.000
NYSE&G, Somerset Site, Nuclear[3]	838	825	30.0	5.631
ASDA, Morrison Site, Nuclear[3]	1000	1040	30.0	7.000
Ontario Hydro, Richland L. Hearn Station, Fossil[1]	1200	1760	16.0	6.325
Ontario Hydro, Lakeview Station, Fossil[1]	2400	2810	17.0	10.727
Ontario Hydro, Pickering Station, Nuclear[1]	2160	3921	20.0	17.614
Ontario Hydro, Lennox Station, Fossil[3]	2000	2267	19.0	9.674
Sewage Plants, Oswego, N.Y.[1]				0.700*
Sewage Plant, Rochester, N.Y.[1]				0.500*
Sewage Plant, Somerset, N.Y.[1]				0.300*
Sewage Plant, Toronto, Ontario[1]				1.900*
Stelco, Hamilton, Ontario (Steel Co.)[1]				1.250*
Alcan Aluminum Corp, Oswego, N.Y.[1]				0.015
			TOTAL:	101.060
			or 2425 x 10^9 Btu/day	

*1980 Project
[1]indicates existing plant
[2]indicates plant under construction
[3]indicates proposed plant

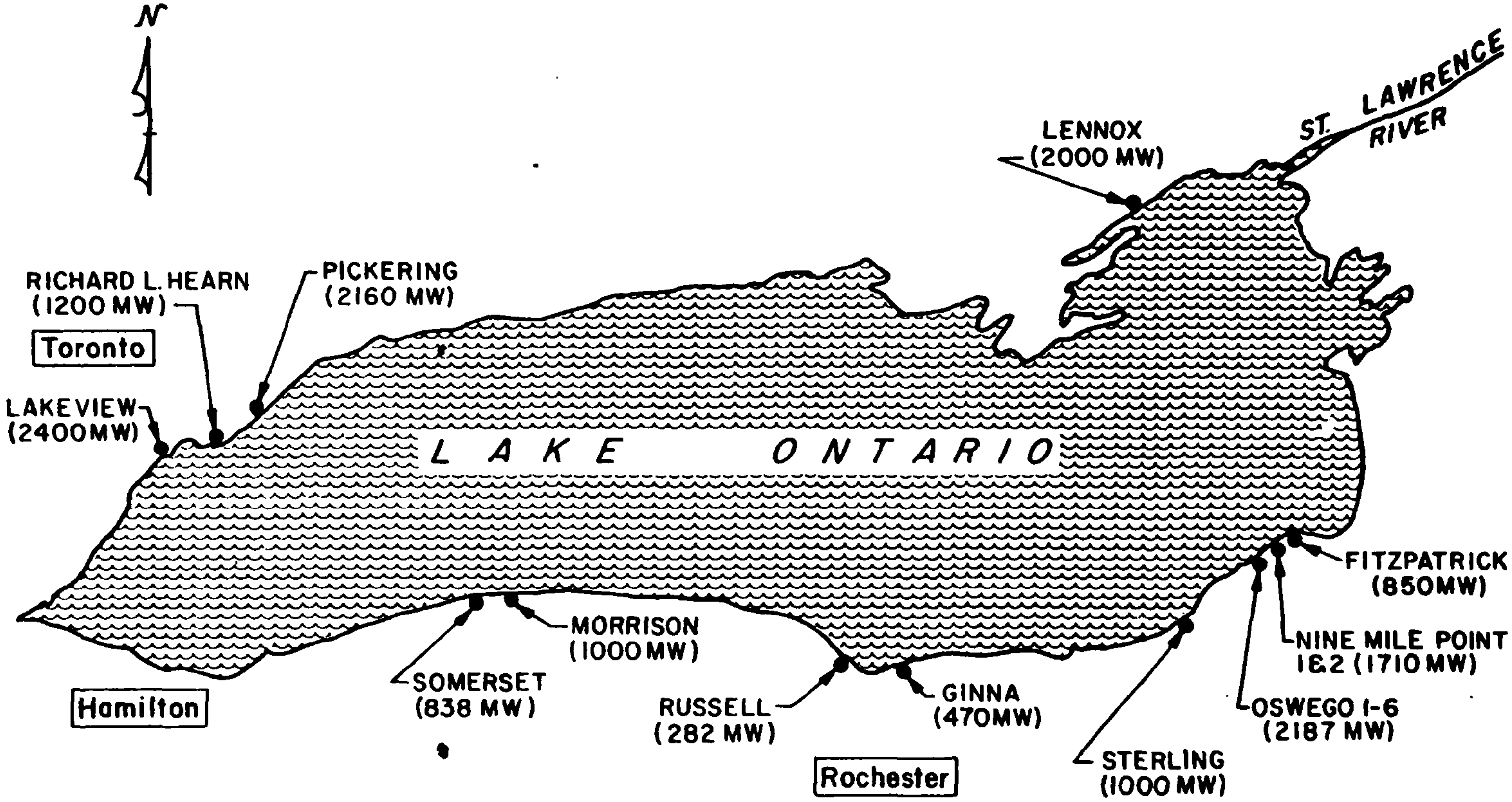

FIG. 8.2-5
LAKE ONTARIO POWER PLANTS
PROPOSED AND INSTALLED—1980
NIAGARA MOHAWK POWER CORPORATION

discharges from either of the two locations will be measured at Oswego.

The predicted annual average temperature rise in the waters of Lake Ontario as a result of the total heat loads discharged to the lake is 0.11°F for expected 1980 conditions.

Comment

Effects on Aquatic Biology

The results and quantitative analysis of the 1972 trawl and gill net survey mentioned on page 3.1-11 should be presented in the statement to more adequately support the conclusion that the proposed discharge will affect relatively small numbers of fish. A description of the methodology and results of the impingement studies conducted June through August 1972 should also be described on page 3.1-12. The maximum and minimum numbers of alewives captured per hour does not adequately indicate the expected impacts from entrainment.

Response

A description of the methodology and results of the impingement studies conducted from June through January 4, 1973, is presented in the responses to the questions raised by the Environmental Protection Agency.

Comment

Effects on Other Water Uses

It is stated on page 3.1-12 that cooling water intake and discharge for the proposed Unit 6 will have negligible effects on any other water user in the area. We suggest that this effect on recreational facilities, such as the municipal beach located adjacent to the project site, be quantified as to change in quality or use of recreation resources.

Response

As discussed in Section 3.1.2, the water quality offshore of the Oswego Station does not differ significantly between the surface and bottom as measured in 40 ft of water. Consequently, flow patterns induced by the circulating water system for Unit 6 will have little effect on the redistribution of nutrients in this area. In addition, the diffuser is located approximately 2350 ft offshore and is designed to achieve rapid dilution of the heated effluent and, therefore, little, if any, heat will reach the municipal beach. Furthermore, the intake and discharge structures are designed to conform to the U.S. Coast Guard's requirements. Therefore, the cooling water intake and discharge for the proposed Unit 6 will not affect the water quality or interfere with the recreational use of the municipal beach located adjacent to the project site, nor will they interfere with the movement of the pleasure craft in the area.

Comment

Atmospheric Discharges

It is suggested that Table 3.2-3 (page 3.2-5), which tabulates emissions for Units 1-6, include information used to obtain the values shown. Data such as sulfur content of oil, ash content of oil, and type of firing employed should be added as a footnote to the table. The basic background information is necessary for an adequate understanding of Table 3.2-2, page 3.2-4.

Response

The following data are supplied to answer the above question:

Units	Fuel Rate	Sulfur Content	Ash Content	Type of Firing
1-4	238,830 lb/hr	2.0 percent (1.1 lb/10^6 Btu)	0.09 percent	Front-wall burners with high-pressure mechanical atomizers
5	435,160 lb/hr	2.0 percent (1.1 lb/10^6 Btu)	0.09 percent	Front-wall burners with high-pressure mechanical atomizers
6	461,770 lb/hr	0.7 percent (0.4 lb/10^6 Btu)	0.09 percent	Front-wall burners with high-pressure mechanical atomizers

Comment

Solid Wastes

The draft environmental statement should describe the off-site landfill area and discuss in detail the environmental impact of disposing these various waste materials, particularly with respect to the topographic, geologic, and hydrologic setting of the fill area. References are made to solid waste disposal on pages 3.7-1, 1.3-4, and 1.3-7.

Response

The major materials to be disposed of in this area will consist of the following:

1. Common earth from excavation
2. Excavated rock
3. Excavations from previous coal and fly ash storage areas
4. Treated intermittent solid wastes from the liquid waste treatment system.

The disposal area is bounded on three sides by dikes constructed of glacial till which is essentially impervious. The dike has a maximum height of 40 ft with 1 1/2-1 side slopes and is 10 to 15 ft wide at the top. The relatively impervious nature of the glacial till will minimize any seepage.

The majority of the material disposed of is common earth and excavated rock which is inert. The relatively small quantities of previous coal, fly ash, and intermittent solid wastes will be contained in the above dike system. Therefore, the hydrological effects of this disposal area will be minimal.

The result of storing the above materials at the disposal site is expected to have a negligible effect on the topography and geology of the area.

Comment

Construction-Impact on Land

It is indicated on page 3.7-1 that public access to the existing breakwater will be blocked during construction. We suggest that this paragraph be expanded to describe the impact that this closing will have on public use; for example, will the closing action be a significant imposition, or are there other areas of access that can be utilized? If construction will close this area for several years, we suggest that temporary mitigation measures be considered to provide other access to the recreational facilities. Also, it may be in order to discuss the impact of the closing relative to other similar recreation areas in the vicinity, namely, Fairhaven Beach and Selkirk Shores (discussed on page 2.6-6).

Response

Land access to the breakwater is closed due to the construction of Unit 5 and will remain closed until 1976 when Unit 6 is completed. No statistics are available at the Regional Office of the NYSDEC on the use of the breakwater at Oswego by sport fisherman. On the condition that fisherman access will be restored following the completion of Unit 6 construction there has been no protest regarding the prohibition of access during the construction period.

Comment

Land Use Plan

We suggest that the applicant be encouraged to develop a land use plan for the site and associated transmission lines' right-of-way. This plan which should be developed in concert with various Federal, State, and local organizations should be mentioned in the final statement along with a schedule for its final completion. It should provide a system by which the maximum overall utilization of these areas occur to the general public within the limitations of adequate safety and sound operating procedures. Recreational and fish and wildlife resources would be a major part of such a plan.

Response

For security reasons, the general public will not have access to the plant site. Access will be provided along the plant boundaries to the existing breakwater to enable sport fishermen to utilize the breakwater. NMPC has a policy of multiple use of transmission lines rights-of-way by responsible organizations or agencies within the limitations of adequate safety and sound operating procedures. Information on these policies is available from the Applicant upon inquiry.

Comment

Monitoring Programs and Future Studies

We think that the procedures and results of the preoperational studies mentioned on page 3.9-1 should be presented in the statement in order that the scope of the work can be evaluated. In view of the success anticipated with the ongoing Coho Salmon introduction program, we think that the postoperational studies should be continued for as long as necessary to fully assess the impact of the plant on aquatic resources of Lake Ontario with special emphasis on the Coho Salmon fishery.

Response

As indicated in this report, the results of the first year of preoperational ecological investigations were reported upon and submitted to the NYSDEC (Ref. 1)*. A second year of

*See references listed at the end of U.S. Dept. of Interior comments and responses.

preoperational ecological investigations were ~~conducted by Quirk,~~ conducted by Quirk, Lawler & Matusky Engineers (QL&M) for the Applicant during 1972. A report was prepared by QL&M for Niagara Mohawk Power Corporation (Ref. 2) and submitted to the NYSDEC in support of an application for a permit to construct discharge facilities for Unit 6. These two reports detail the procedures and results of the two years of preoperational ecological studies conducted at the site to date.

<u>Response</u>

As indicated in this report, the results of the first year of preoperational ecological investigations were reported upon and submitted to the NYSDEC (Ref. 1). A second year of preoperational ecological investigations were conducted by Quirk, Lawler & Matusky Engineers (QL&M) for the Applicant during 1972. A report was prepared by QL&M for Niagara Mohawk Power Corporation (Ref. 2) and submitted to the NYSDEC in support of an application for a permit to construct discharge facilities for Unit 6. These two reports detail the procedures and results of the two years of preoperational ecological studies conducted at the site to date.

As stated in this report, the Applicant intends to conduct postoperational ecological investigations in order to evaluate the effects of plant operation on the aquatic environment. These investigations will include evaluations of the impact of the plant on the Coho Salmon fishery.

<u>Comment</u>

<u>Aquatic Biota</u>

The last sentence, third paragraph, page 4.0-1, does not have sufficient backup in the statement. Our comments on the section on the <u>Effects on Aquatic Biology</u> presented previously apply here also.

<u>Response</u>

See response to comment on <u>Effects on Aquatic Biology</u>.

<u>Comment</u>

<u>Alternative Means of Generation</u>

An expanded discussion of coal vs. oil is suggested. We think that the final statement should include a comparison of pollutant emissions for a coal-fired and an oil-fired unit. This comparison would add further support to the choice of an oil-fired unit since oil-fired units usually have less emissions than coal-fired units.

Three reasons are given on page 5.3-1 for choosing an oil-fired unit. We think that the important factor usually associated with the burning of oil instead of coal, that of reduced adverse environmental impacts, should also be included in this section.

It is mentioned that a nuclear unit could not be built at this location in accord with AEC siting criteria. The statement should indicate the particular AEC criteria which would be violated if a nuclear plant were constructed.

Response

The pollutant emission levels for a coal-fired unit would be greater than the proposed low sulfur oil-fired unit. The following standards of performance for fossil-fired steam generators compare the emissions for a coal-fired and an oil-fired boiler:

Emissions	Coal-Fired	Oil-Fired
Sulfur dioxide	1.2 lb/10^6 Btu	0.8 lb/10^6 Btu
Particulate	0.1 lb/10^6 Btu	0.1 lb/10^6 Btu
Oxides of nitrogen	0.7 lb/10^6 Btu	0.3 lb/10^6 Btu

The allowable emissions of SO2 and NOx are considerably greater for coal than for oil-fired boilers. As can be seen in the above table, for every 1,000,000 Btu of fuel consumed in the boiler, the coal-fired unit will emit almost twice as many pounds of these contaminants as compared to the oil-fired boiler.

A statment of the increased adverse environmental impact of coal firing has been added to the text of this report.

The text of this report now includes AEC siting criteria.

Comment

Irreversible and Irretrievable Commitments

This section should recongize that there will be an annual loss of fish and wildlife resources as a result of the construction and operation of this plant.

Response

There are no irreversible or irretrievable losses of fish or wildlife as a result of the plant. The construction and annual effects are discussed in Section 3 and 4.

<u>References for U.S. Department of the Interior Responses</u>

1. Quirk, Lawler & Matusky Engineers, "Effects of Circulating Water Systems on Lake Ontario and Oswego Harbor Water Temperature and Aquatic Biology," for Niagara Mohawk Power Corporation, Oswego Steam Station Unit 5, April 1971.

2. Quirk, Lawler & Matusky Engineers, "Effects of Circulating Water Systems on Lake Ontario Water Temperature and Aquatic Biogoly," for Niagara Mohawk Power Corporation, Oswego Steam Station Unit 6, November 1972.

8.3 UNRECONCILED CONFLICTS

There are no unreconciled comments.

8.4 CORRESPONDENCE

Copies of all correspondence received from the agencies listed in Section 8.2 regarding the Draft Environmental Statement are included in the following pages.

2083

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

700 East Water Street, Syracuse, New York 13210

January 17, 1973

Major Charles T. Myers, III
Acting District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Refer to: NCBPA

Dear Major Myers:

The draft summary Environmental Report for the Niagara Mohawk Power Corporation, Oswego Steam Station Unit 6, dated November 1972, submitted by you was reviewed by this office.

We submit the following comments:

1. Page 3 - 5th paragraph - second to last sentence

   'Residential uses are generally ..... in the outskirts." To this sentence you should add - "although a relatively large rural nonfarm population is characteristic of this county."

2. Page 4 - paragraphs 3 and 4

   a. It is not completely accurate to say agricultural activity has declined because of the poor soils -- actually, the soils of this area are fairly responsive to modern farming methods.

      The organic soils in this area are largely devoted to truck crops, producing good yields of onions and lettuce.

   b. Small commercial farms, apple orchards and pear orchards, dairy and truck farms still survive.

   c. This area is historically noted for the production of high quality strawberries.

   d. The abandoned field does support the plants listed. To this list, poison ivy and blackberries should be added.

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Filed by [illegible]

e. The dominant tree species should include sugar maple and red maple. Red oak is not as dominant as one would be led to believe by this write up.

3. Page 8 - Heading IV - 5th paragraph

   The beginning of the paragraph describes the land use near the the project area. This land use statement does not appear to be an adverse effect. It would be more appropriate to place it under Heading II, page 2, which describes the area of the project.

4. As the land to be used has already been designated for industrial use, we see no incompatibility with other land uses.

5. It would be appropriate to include a statement in this report that during construction activities, measures to control erosion and sedimentation will be taken. These could include prompt vegetation of denuded areas and proper salvage, storage and re-use of topsoil.

We appreciate the opportunity to review and comment on this proposed project.

Sincerely yours,

A. C. Addison

A. C. Addison
State Conservationist

2085

DEPARTMENT OF TR. SPORTATION
FEDERAL AVIATION ADMINISTRATION

EASTERN REGION
FEDERAL BUILDING
JOHN F. KENNEDY INTERNATIONAL AIRPORT
JAMAICA, NEW YORK 11430

17 January 1973

Mr. Robert L. Moore
Colonel, Corps of Engineers
District Engineer
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Moore:

In reply to your letter of 14 December 1972, NCBED-ER, concerning the Draft Environmental Impact Statement - Oswego Steam Generating Station, Unit 6, Oswego Harbor, New York, we have reviewed the statement.

Apart from Page 8.0-3, and the statement that, we have been or will be contacted at the planning, construction and operation of Unit 6 with respect to aids to navigation - acknowledgement of stack height, marking and lighting, we find that the Station has no impact on present or planned airports.

Sincerely,

WALTER D. KIES
Chief, Planning Staff

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2086

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION II

26 FEDERAL PLAZA

NEW YORK, NEW YORK 10007

FEB 2 1973

Class. ER-2

Colonel Robert L. Moore
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Moore:

This office has reviewed the draft environmental impact statement for Niagara Mohawk Power Corporation's Oswego Steam Station - Unit 6. We offer the following comments on the project as described therein.

The cooling water intake structure for the facility is to be located 1200 feet offshore in a water depth of 22 feet. The intake velocity through the structure will be 1 fps. The water being conveyed flows through a concrete lined rock tunnel into a combination pumphouse and screenwell structure. A fish refuge area will be provided in the forebay from which fish will be removed to the lake. It is hoped that the fish refuge serves its intended purpose and is assiduously attended to by the applicant.

The possibility exists for thermocline disruption by the heated discharge. Quoting New York State criteria for thermal discharges,

> "In lakes subject to stratification, the thermal discharges shall be confined to the epilimnetic area."

The following points might be made with regards to this:

a. The jet nozzles of the discharge on Unit #6 will be located at a depth of 32 feet. The intake structure will be located at 22 feet (maximum). Temperature depth studies in the lake have shown a thermocline after a period of calm days at the 7-9 foot depth. Wind induced mixing lowers the thermocline to 40 feet. Therefore, it should be noted that the discharge of Unit #6 will be operating beneath the epilimnion for some time during the summer months in violation of New York State thermal criteria.

b. As to the effects of mechanical disturbance of the metalimnion, low dissolved oxygen and high nutrient concentrations are often found in the hypolimnion of stratified lakes. Localized mixing can introduce abnormally high nutrient levels to the area of the lake in which it occurs. For example, anaerobic hypolimnetic zones of lakes may contain high phosphate concentrations at the same time that epilimnetic phosphate has been depleted by the flora of the lake. Release of phosphate through breakdown of the metalimnion can be the causation of local algal blooms. This is of interest to the operation of Unit #6 in so much as the EIS states that phosphorus is the limiting nutrient for large populations of Cladophora in the area of the plant. Since Lake Ontario is basically an oligotrophic lake, these conditions may not exist below the metalimnion, but the possibility should be investigated. Combined discharges from Units 5 and 6 would intensify the problem as defined above.

It is stated in the EIS that, according to model studies, operation of Unit 6 will not cause a contravention of New York State criteria for thermal discharge. These prohibit a temperature rise of more than 3°F outside a radius of 300 feet from the point of discharge. It should be noted that the temperature isotherm plot of Figure 3.1-3 shows the predicted 3°F isotherm to be fairly close to the limit allowed by New York thermal regulations.

A number of considerations leads us to some concern regarding impingement and entrainment losses. The evaluation of possible entrainment effects at Unit 6 is based on work at Units 1 - 4. Since the temperature differential across Units 1 - 4 is 12°F and the temperature differential across #6 is 32°F, any comparisons of entrainment effects is at best invalid. These studies done on Units 1 - 4 show a 30% mortality among larval fish entrained in the cooling system. It is probable that mortality will be much higher at Unit 6 with a temperature differential 20° higher. With regard to impingement, it is repeatedly stated that effects will not be significant. As many as 457 alewives per hour, however, have been captured on the screens of Units 1 - 4 during the month of June. It should be noted that Units 5 and 6 will <u>each</u> draw about as much water as 1 - 4 combined. This being so, we can calculate that about <u>33,000</u> alewives per day will be killed by combined operations at Units 1 - 6. This would constitute a major daily fish kill. Data on other species collected in the area and a reanalysis of impingement and entrainment problems should be included in the final EIS.

The sound pressure levels at the property line, indicated in Figure 3.3-1, are acceptable in the daytime hours (7:00 am - 11:00 pm) and will comply with daytime standards proposed by the New York State

Department of Environmental Conservation. Proposed daytime standards are 65 dBA for industrial property lines bordering on commercial or residential land uses. However, at night the proposed standard for property lines bordering on residential areas is 45 dBA. None of the sites measured will meet this standard and one site will exceed it by 13 dBA. Thus, it can be expected that further means of noise abatement may be needed for the plant when the proposed regulations go into effect.

No consideration was given in the EIS to construction noise. We recommend that the contract for construction of the unit comply with the noise criteria for construction similar to those promulgated by the Federal General Services Administration.

Efforts to minimize the impact of the operation of this plant on air quality are noteworthy. The unit will be built to conform with the federal New Stationary Source Performance Standards and as such will burn low sulfur oil, have particulate control equipment, and is designed to produce low concentrations of NOx. A fuel switching system for use during emergency episodes will be incorporated into the design of the plant in addition to the four day supply of very clean fuel (.1% distillate oil).

Thank you for the opportunity to review this impact statement. We would appreciate receiving a copy of the final statement for review when it is available.

Sincerely yours,

Paul H. Arbesman

Paul H. Arbesman
Chief
Environmental Impact
Statement Branch

42.7.1. All supplies and equipment on project site shall be stored in such a manner as to preclude mechanical and climatic damage. Site shall be maintained in a neat and orderly manner as to further minimize hazards to personnel, supplies, and equipment.

42.7.2 Contractor shall be responsible for maintaining the temporary structures and construction enclosure (fence) in good repair and visually pleasant. He shall further provide adequate security to prevent the presence of unauthorized persons on the site, and to keep gates secured when not in actual use to insure the integrity of the acoustic barrier as well as for property security.

42.8 Noise Control.

42.8.1 Equipment to be employed on this site shall not produce a noise level exceeding the following limits in Db(A) at a distance of 50 feet from the equipment under test.

Equipment	Effective Dates July 1, 1972	 January 1, 1975
Earthmoving		
front loader	79	75
backhoes	85	75
dozers	80	75
tractors	80	75
scrapers	88	80
graders	85	75
truck	91	75
paver	89	80
Materials Handling		
concrete mixer	85	75
concrete pump	82	75
crane	83	75
derrick	88	75
Stationary		
pumps	76	75
generators	78	75
compressors	81	75
Impact		
pile drivers	101	95
jack hammers	88	75
rock drills	98	80
pneumatic tools	86	80
Other		
saws	78	75
vibrator	76	75

42.8.2 The Contractor shall comply with all applicable state and local laws, ordinances, and regulations relative to noise control.

42.8.3 Stationary equipment may be provided with acoustic enclosures to provide the required sound attenuation subject to continued maintenance of such enclosures to assure that maximum sound levels specified are not exceeded.

42.8.4 Where field sound measurements reveal sound levels exceeding those listed above, Contractor shall cease operating such equipment and repair or replace it with equipment complying with these sound levels.

2091

STATE OF NEW YORK
DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
ALBANY

RONALD W. PEDERSEN
FIRST DEPUTY COMMISSIONER

February 7, 1973

Dear Major Meyers:

The State of New York has completed its review of the "Draft Environmental Statement for Intake and Discharge Facilities - Oswego Steam Station Unit No. 6 - Niagara Mohawk Power Corporation" prepared by the Buffalo District of the Corps of Engineers.

In preparing the attached comments, we have taken into consideration the views of all appropriate State agencies. Many of these comments are quite detailed and directed to very specific points in the draft environmental statement with the intent of clarifying and improving the Corps' final environmental statement.

We feel it is important to point out that the Corps apparently has not performed any independent analysis or interpretation of the data and information as submitted by the Applicant or their Consultants. This is particularly significant in the area of water quality and thermal and chemical effects. It is our interpretation of the National Environmental Policy Act of 1969 which mandates environmental statements, and subsequent Federal Court decisions, that the Federal agency, not the applicant or their consultants, shall prepare the environmental statement.

We request that you give our comments the utmost consideration. Thank you for giving us the opportunity to review this document.

Sincerely,

Charles T. Meyers, III
Major, Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

New York State

COMMENTS

on the

"Draft Environmental Statement -

Oswego Steam Station - Unit No. 6 -

Niagara Mohawk Power Corporation"

prepared by

U.S. Army Engineer District, Buffalo, N.Y.

20 November 1972

1. Aquatic Ecology

The discussion on aquatic ecology suffers from having the material broken down into sections which are not well interrelated. Since entrainment and impingement of aquatic life forms is currently the center of major attention, more information and data should be presented to back up the applicant's claims. For example:

a. Fish eggs - while there have been indications that fish larvae were sampled and detected, reference to fish eggs, except in general terms, was not included. Many of the species taken in the area have attached eggs. It would be appropriate to indicate which species have attached eggs and which are free floating, thus giving the reviewer some indication of the potential magnitude of the problem.

b. Fish larvae - the applicant's contention that larvae are more abundant in surface waters than in bottom waters needs more substantiation. Since the plant will raise water temperatures 32°F. and water will take 11 minutes to circulate through the facility, expectations for 100 percent mortality

b. (continued)

for all organisms is highly likely. Applicant's reference that fish larvae and zooplankton suffer less than total mortality based on studies at other generating facilities is unsound since most "other" facilities have more benign operating regimes. Therefore, the models alluded to on pages 3.1-8 to 3.1-10 should reflect this facility more closely.

c. Fish entrainment - intake velocities will be less than one fps. While this works well with restricted intake designs it is felt that in offshore intakes as presently proposed greater intake velocities would result in low fish entrainment. Fish can detect horizontal velocities of very low levels. However, fish could not be expected to avoid these velocities unless they found them intolerable. One fps or less has not to our knowledge proved to be intolerable. Therefore, it is highly likely that all fish that are in the vicinity stand a good chance of entering the intake structure. Perhaps literature on similar structures operating at nuclear facilities on the west coast should be examined.

d. Other aquatic organisms - further sampling would be necessary in order to determine the composition and abundance of bacteria, phytoplankton, zooplankton, macroflora and macroinvertebrates.

2. Terrestrial Ecology

The analysis presented on terrestrial ecology is somewhat nebulous due to the fact that the location of the generating facility is in an industrial area. The submission of species list is not adequate. The point of discussion should be the potential impacts of the generating facility on its environs.

3. Hydrology

With regard to hydrology, the discussion has inadequate data on ground or surface water quality based on sampling over a sufficient period of time. The report mentions that the water quality is "fairly uniform"; what is meant by this terminology? A statement is made that critical thermal operating conditions may occur when: all six units are operating at capacity and the lake is at a maximum ambient temperature, lake currents are at maximum or still water exists in the lake, and the Oswego River is either at a high or low flow. There is no basis or data given for these assumptions.

The ability to meet the New York State Thermal Standards was given as the reason for selecting the once-through cooling process. However, in another section of the report it is stated that not all of the hydraulic model tests have been completed and that the most critical condition has not yet been tested. Again we find a deficiency in the amount of data which supports the conclusions.

4. Air Quality and Meteorology

a. There is some indication that not all of the emission regulations will necessarily be met as stated on page 3.2-1.

Calculations of expected emissions compared with the amounts allowed by regulation are as follows.

	Units # 1-5 Emissions (lbs/hr)		Unit #6 Emissions (lbs/hr)	
	Expected	Allowable	Expected	Allowable
Particulates	1,040	1,171	180	809
Sulfur dioxide	23,052	25,760	6,455	6,472
Nitrogen oxide	Not avail.	Not avail.	2,406	2,427

2095

a. (continued)

Units #1-5 will probably meet the emission regulations although there is not much room for increase of particulate emission.

Unit #6 is well within the particulate emission regulation but just about meets the regulation for SO_2 and NO_x. Any decrease in efficiency of the MgO system will probably result in exceeding the SO_2 regulation. Although the NO_x emission is marginal, the standard is very tight and difficult to achieve.

b. The ambient air quality data (page 2.10-1) should be considered in terms of its limitations.

The SO_2 data is based on a very limited time period of study using instrumentation which is not generally approved because it is subject to significant interferences and generally renders higher values than are actually present.

The method of estimate of the annual average for SO_2 should be described. It is expected that this estimate is quite tenuous.

Both the SO_2 and particulate sampling data represent values including the contributions from Units 1-4 which may be assumed to have been operating during the sampling periods. Hence the data may represent a higher background reference level to which the theoretical value is added.

c. The listing of "Estimated Concurrent Background" values in Table 3.2-1 is not consistent with sampling values appearing on page 2.10-1. That is, the maximum 24-hour SO_2 sampling concentration is .075 ppm whereas the estimated background is .03 ppm. Also, the maximum 24-hour particulate concentrations are 97 and 142 ug/m^3 while the estimated background figure is 70 ug/m^3. What is the explanation for these differences and how was the

c. (continued)

estimated concurrent background determined?

d. In Table 3.2-3 the emission of particulates for Units 1-5 is listed as 1,040 lbs/hr. Is it correct that only 75% of the potential particulate emission is removed?

e. In Section 3.2, the calculation of predicted ground level concentrations and comparison with the air quality standards neglects to consider two aspects:

(1) There is no evaluation of compliance with the one hour and 24-hour SO_2 standards that must be met 99% of the time, i.e., 0.25 ppm and 0.10 ppm, respectively.

(2) There is no indication that 400 ft. topographic elevations to the south of the plant were considered in estimating ground level concentrations.

f. In Table 3.2-1, two New York State annual average standards for SO_2 are listed. As of this time, there is only one, .03 ppm. Also, in this table, the New York State maximum annual standard for particulates is listed as 45 ug/m^3 corresponding to Level I. The City of Oswego is indicated to be Level III and the surrounding are Level II. The corresponding standards are 65 and 55 ug/m^3, respectively.

g. On page 3.2-8 it is indicated that the critical height of the inversion base for plume trapping is 450 meters. It is not clear how this height was determined. This height is dependent, according to Briggs, on buoyancy flux, the mean wind speed and an inversion parameter. It is essentially the assumptions on this inversion parameter that determines the height of the base of an elevated inversion at which plume penetration would occur. Exactly

g. (continued)

what assumptions were made in this determination? Also, the assumption of a 12 meters per second wind speed during the period of elevated inversion does not seem reasonable since a weak pressure gradient is generally associated with the subsidence inversion. What is the justification for the 12 mps (25 mph) speed?

g. In Table 3.2-2, the contributions of Units 1-6 as a percentage of standards are presented. It is appropriate to present also the expected levels including background as a percentage of the standards.

i. In Appendix A, reference is made to the use of five operating modes for the plant. Explicit specification of these operating modes should be presented.

5. Wastes and Disposal

The report discusses the offsite land fill operation owned by Niagara Mohawk but does not offer a description of this offsite facility or the methods by which the waste and excavated material is transported to the land fill.

6. Fuel Storage

Are there any precautionary structures, such as dikes, for fuel spillage or leaks around fuel storage tanks? It is not discussed in any section of the report.

7. Land Use and Aesthetics

The statements regarding aesthetics and ambient land uses do not consider the impact on populated, scenic or historic areas. It does not provide adequate data and descriptions on the design of the structure and layout of the site.

7. (continued)

The illustration presented in the frontispiece is not satisfactory. This "birds eye" illustration depicts the least likely impact because it will never be seen from this position. The impact can be best assessed from a ground level perspective at which the facility can be viewed.

The description "landscaping and plants will be used to create a pleasing appearance" is not adequate to describe how buffer treatment of facilities, restoration of site excavation, and shoreline treatment will be handled.

The report mentions "Oswego Market House, . . . and several other sites are being considered for designation" as historic sites; where are they and what will the impact be on these sites? Also the future land uses which will be affected adversely are not described in detail. What are these designated land uses and the adverse effects on them?

2099

State of New York
Department of
Environmental Conservation
Albany

Ronald W. Pedersen
First Deputy Commissioner

April 3, 1973

Dear Colonel Moore:

This is in reply to your letter of February 20, 1973, regarding the State's comments on the Draft Environmental Statement for Intake and Discharge Facilities - Oswego Steam Station Unit No. 6 - Niagara Mohawk Power Corporation.

The information contained in your letter has adequately satisfied us that the Corps had performed an independent analysis of the data and information as submitted by the applicant.

Thank you for your reply.

Sincerely,

Robert L. Moore
Colonel, Corps of Engineers
District Engineer, Buffalo District
1776 Niagara Street
Buffalo, New York 14207

2100

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

IN REPLY REFER TO:

FEB 2(1973

Colonel Robert L. Moore
District Engineer
Buffalo District, Corps of Engineers
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Moore:

This is in response to your letter of December 14, 1972, requesting comments on the Corps of Engineers Draft Environmental Statement related to the proposed permit to allow construction of intake and discharge facilities by the Niagara Mohawk Power Corporation for the Oswego Steam Generating Station Unit No. 6.

Pursuant to the National Environmental Policy Act of 1969, and the April 23, 1971, Guidelines of the Council on Environmental Quality, these comments review the need for the facilities as concerns the adequacy and reliability of the affected bulk power systems and matters related thereto.

In preparing these comments, the Federal Power Commission's Bureau of Power staff has considered the Corps of Engineers' Draft Environmental Statement; related reports made in response to the Commission's Statement of Policy on Reliability and Adequacy of Electric Service (Order 383-2); and the FPC staff's analysis of these documents together with related information from other FPC reports. The staff of the Bureau of Power bases its evaluation of the need for a specific bulk power facility upon long term considerations as well as the load-supply situation for the peak load period immediately following the availability of the facility.

Need for the Facility

The Niagara Mohawk Power Corporation's Oswego Unit No. 6 is an 816-megawatt oil-fired steam electric generating unit. The Oswego Steam Station now contains four fossil fueled steam electric generating units with Unit No. 5 presently under construction and scheduled for commercial operation in October 1974.

Oswego Unit No. 6 is presently scheduled for commercial operation in November 1976. It is expected to be available in time to assist in meeting the 1976-1977 winter peak load.

The current generation expansion program of the Niagara Mohawk Power Corporation is tabulated below:

GENERATION EXPANSION PROGRAM
NIAGARA MOHAWK POWER CORPORATION

Estimated Commercial In-Service Date	Station	Type 1/	Capability
May 1973	Roseton No. 1	F	240 2/
September 1973 3/	Roseton No. 2	F	240 2/
October 1974	Oswego No. 5	F	816
November 1976	Oswego No. 6	F	816
July 1978	Nine Mile Pt. No. 2	N	1100

1/ Type : F - Fossil
N - Nuclear

2/ Niagara Mohawk Power Corporation's share of jointly owned unit. The other owners are Central Hudson Gas and Electric Corporation and Consolidated Edison of New York, Inc.

3/ Due to boiler damage sustained during test on December 8, 1972, this unit delayed from May 1973 to September 1973.

The Niagara Mohawk Power Corporation, the Power Authority of the State of New York, and six other investor-owned utilities 4/ operating in New York State comprise the New York Power Pool. All of New York's

4/ Central Hudson Gas and Electric Corporation
Consolidated Edison Co. of New York, Inc.
Long Island Lighting Company
New York State Electric and Gas Corporation
Orange and Rockland Utilities, Inc.,
Rochester Gas and Electric Corporation.
* Jamestown Municipal Electric System
* Long Sault, Inc.
* Village of Freeport.

* New York State Companies that are not members of the New York Power Pool but report their load and capability as part of the New York State Interconnected Systems.

major systems are interconnected and are operated as one coordinated power system on instructions from the New York Power Pool. The Pool was established for the purpose of coordinating the operation and planning of power facilities throughout the State. A Power Pool control center near Albany coordinates the hour-to-hour operations of all available generation to meet the entire state's demand reliably and economically. Power Pool standard operating procedures and New York Public Service Commission orders require that all areas of the State assist any area where there is a power shortage. Thus, the Oswego Unit No. 6 must be considered in relation to the supply and demand in the New York Power Pool as well as in relation to the specific demand of the Niagara Mohawk Power Corporation system.

The Pool has and will continue to take advantage of the diversity that exists between the upstate New York winter peaks and downstate New York summer peaks. The New York Power Pool is a summer peaking system and the winter peaks are expected to be lower than the immediately preceding summer peaks. However, due to generating units being taken out of service for scheduled maintenance in the winter, the winter peak period is considered almost as critical as the summer peak period.

The current construction program of large generating units for the New York Power Pool for completion during the years 1972 through 1977 is tabulated below:

Col. Robert L. Moor..

GENERATION EXPANSION PROGRAM-NEW YORK POWER POOL

Estimated Commercial In-Service Date	Station	Type	Capability
June 1972 1/	Glenwood Gas Turbines	GT	105
July 1972 1/	Northport No. 3	F	386
May 1972 1/	Narrows No. 1	GT	174
June 1972 1/	Narrows No. 2	GT	174
October 1972 1/	Bowline Point No. 1	F	600
February 1973	Blenheim-Gilboa No. 1	PS	250
March 1973	Blenheim-Gilboa No. 2	PS	250
April 1973	Blenheim-Gilboa No. 3	PS	250
May 1973	Blenheim-Gilboa No. 4	PS	250
May 1973	Roseton No. 1	F	600
September 1973	Indian Point No. 2	N	873
September 1973	Roseton No. 2	F	600
October 1973	James A. FitzPatrick	N	821
May 1974	Glenwood Gas Turbine	GT	265
June 1974	Bowline Point No. 2	F	600
October 1974	Oswego No. 5	F	816
December 1974	Astoria No. 6	F	800
October 1975	Indian Point No. 3	N	1069
February 1976	2/	GT	700
February 1976	Homer City No. 3	F	325 3/
May 1976	Northport No. 4	F	387
May 1976	2/	GT	265
November 1976	Oswego No. 6	F	816
May 1977	Shoreham No. 1	N	849
May 1977	2/	2/	300

1/ In-Service

2/ Undetermined

3/ New York Power Pool share of jointly-owned unit.. The other owner is Pennsylvania Electric Company.

The following tabulation shows the electric system loads to be served by the Applicant and the New York Power Pool, and the relationship of the electrical output of the Oswego No. 6 Unit to the available reserve capacities on the winter-peaking Applicant's and summer-peaking New York Power Pool's systems at the time of the 1976-1977 winter and 1977 summer peak load period. This is the anticipated initial service period of the unit, but the life of the unit is expected to be some 30 years or more, and it is expected to constitute a significant part of the Applicant's total generating capacity throughout that period. Therefore, the unit will be depended upon to supply power to meet future demands over a period of many years beyond the initial service needs discussed in this report.

FORECAST 1976-77 WINTER PEAK LOAD - SUPPLY SITUATION

	Niagara Mohawk Power Corporation	New York State Interconnected System
Conditions with Oswego Unit No. 6 (816 Megawatts)		
Net Dependable Capacity - Megawatts	6,149	33,130
Net Peak Load - Megawatts	4,005 1/	23,462 2/
Reserve Margin - Megawatts	2,144	9,668
Reserve Margin - Percent of Peak Load	53.5	41.2
Conditions without Oswego Unit No. 6		
Net Dependable Capacity - Megawatts	5,333	32,314
Net Peak Load - Megawatts	4,005 1/	23,462 2/
Reserve Margin - Megawatts	1,328	8,852
Reserve Margin - Percent of Peak Load	33.2	37.7

1/ Reduced by 2,100 megawatts net firm purchases.

2/ Includes 72 megawatts net firm sales.

FORECAST 1977 SUMMER PEAK LOAD - SUPPLY SITUATION

	New York State Interconnected System
Conditions with Oswego Unit No. 6 (816 Megawatts)	
Net Dependable Capacity - Megawatts	33,142
Net Peak Load - Megawatts	25,800 1/
Reserve Margin - Megawatts	7,342
Reserve Margin - Percent of Peak Load	28.5
Conditions without Oswego Unit No. 6	
Net Dependable Capacity - Megawatts	32,326
Net Peak Load - Megawatts	25,800 1/
Reserve Margin - Megawatts	6,526
Reserve Margin - Percent of Peak Load	25.3

1/ Reduced by 480 megawatts net firm purchases.

The availability of Oswego Unit No. 6 for winter 1976-77 would provide the Applicant with an expected system reserve margin of 2,144 megawatts or 53.5 percent of peak load. Any delay which results in the unavailability of Oswego Unit No. 6 for the 1976-77 winter peak period would reduce reserves to 1,328 megawatts or 33.2 percent of peak load.

To meet the reliability objectives of the Pool, the Applicant states capacity in excess of 18 percent of peak load is desired. To meet the projected 1976-77 winter peak load and maintain the desired reserve margin, the Applicant must have in excess of 4,726 megawatts of generating capacity. Without taking into consideration the expected loss of capacity due to scheduled maintenance and forced outages, the Applicant states, system reserves will be reduced by a minimum of 663 megawatts due to day-to-day short-term unavailability of generating capacity. The resulting 4,670 megawatts of capacity projected for winter 1976-77 without Oswego Unit No. 6 is 56 megawatts less than the forecasted peak load plus the desired reserve margin.

Without the addition of Oswego Unit No. 6 for the winter 1977-78, the Applicant's system projects a reserve of 917 megawatts, or about 14.4 percent of peak load. The Applicant's only other scheduled future base-load generating unit is the Nine Mile Point Nuclear Unit No. 2 scheduled for commercial operation in July 1978.

With the availability of Oswego Unit No. 6 for the winter 1976-77 and summer 1977, the New York Power Pool has an expected system reserve margin of 9,668 megawatts or 41.2 percent of peak load and 7,342 megawatts or 28.5 percent of peak load, respectively. Without the unit, system reserves would be reduced to 8,852 megawatts or 37.7 percent of peak load and 6,526 megawatts or 25.3 percent of peak load, respectively.

The reserve margins indicated in the foregoing tabulations and text are gross in that they include all of the capacity available not only for meeting expected loads but that which may be out of service due to scheduled maintenance or forced outages and any that might be needed to meet unforeseen demands due to errors in load forecasting and exceptional weather.

Reports prepared by the New York State Public Service Commission show that from August 1972 through January 1973 the generating capacity actually available for the entire state has fluctuated between 71.5 percent and 86.8 percent of the total installed capacity. "Capacity Available" is the net after installed capacity has been adjusted for purchases, sales, deratings, forced outages and capacity out for maintenance. There is little reason to believe that this range will improve substantially.

The New York Power Pool uses a minimum reserve margin criterion based on coincident statewide loads not exceeding available generation more frequently than one day in ten years. Although the pool has attempted to achieve that degree of reliability, inability to meet in-service schedules, unexpected large equipment outage rates, forced unit capacity deratings and some earlier underestimation of load growth have resulted in performance well below this criterion the past few years.

The Consolidated Edison Company of New York has experienced a concentration of the contributing factors to unreliable bulk power supply. Indian Point Unit No. 3 has recently been delayed another 12 months and is not now expected for commercial operation until October 1975. No new baseload capacity has been added to the system since 1969, while load has continued to grow. Some 1,900 megawatts of gas-turbine peaking capacity has been added; however, extended operation of such units has resulted in extensive maintenance problems and reduced availability of the gas-turbine capacity. On the Consolidated Edison Company's system, thirty-six base-load generating units totaling 2,104 megawatts or approximately 25 percent of base-load capacity, are over thirty years old. Continued dependence on over-aged generating equipment can only lead to increased maintenance, forced outages and deratings resulting in decreased system reliability.

In 1970 the New York Power Pool experienced 17 days when voltage had to be reduced in New York State so that load would not exceed the available generating capacity. Despite such voltage reduction there was one day upon which 135 megawatts of residential and commercial load and 25 megawatts of industrial load had to be disconnected. In the summer of 1971, despite favorable weather without prolonged hot spells and appeals to the public to conserve electricity, there were twenty days when voltage had to be reduced.

The adequacy and reliability of the New York Power Pool in meeting future loads is dependent upon the timely operation of all the units scheduled in its current construction program. Current information indicates that delays are being experienced in bringing most large new generating units into commercial operation and this trend may continue for some time in the future.

In view of the above history and the possible construction and licensing delays, as well as the brief time for maturation of these units between their scheduled commercial service dates and the winter peak of 1976-77 and summer peak of 1977, the New York Power Pool resources appear none too large.

The Pennsylvania-New Jersey-Maryland Interconnection (PJM) and the New England Power Pool (NEPOOL) are experiencing capacity shortages similar to those of New York Power Pool and any mutual capacity support is not great. The Ontario Hydro and Hydro Quebec power systems do have some spare capacity for sale during the summer months as their loads are predominantly winter-peaking. However, transmission capability both within the New York Power Pool and in the interconnections from New York to Ontario is already heavily loaded. New York, Ontario and Quebec power systems are presently investigating major transmission reinforcements for mutual support in the late 1970's and early 1980's.

Transmission Facilities

The Niagara Mohawk Power Corporation presently plans for service in October 1974 three additional transmission lines emanating from the Oswego Generating Station. The three lines are: a 345-kilovolt single-circuit line approximately 82 miles long to the existing Edic Substation, of which approximately 70 miles will be designed and constructed for future operation at 765 kilovolts; a 345-kilovolt single-circuit line approximately 22 miles long to the cross state 345 kilovolt lines at the new Syracuse substation; and a 345-kilovolt line approximately 12 miles long to the new Volney Substation. A fourth 345-kilovolt line approximately 12 miles long between the Lafayette and Dewitt substations will complete a 345-kilovolt loop around the Syracuse area.

The Applicant does not report any additional transmission lines associated solely with the scheduled commercial operation of Oswego Unit No. 6 for November 1976.

Alternates to the Proposed Facilities

The Applicant, in determining the need for additional generation to meet its projected demands, considered a number of alternatives including location, type (baseload and peaking), fuel (nuclear, coal, oil or gas), purchases of power, environmental effects and economics. The final decision rested between constructing a baseload nuclear-fueled plant and a baseload fossil-fired plant.

A number of factors influenced the final selection of the Oswego Steam Station Site. The most important were the time which could be saved by locating the unit on an existing site, and the joint use or sharing of existing facilities rather than constructing new ones. The Applicant states that a nuclear unit could not be sited at the location in accordance with Atomic Energy Commission siting criteria. Because of the unavailability of natural gas and low-priced coal, a baseload oil-fired generating unit was selected.

Conclusions

The staff of the Bureau of Power concludes that the electric power output represented by the Oswego Unit No. 6 is needed to implement the Applicant's and the New York Power Pool's generation expansion programs for meeting projected loads and to provide reserve margin capacity for the 1976-77 winter and 1977 summer peak periods.

Very truly yours,

T. A. Phillips
Chief, Bureau of Power

2109

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER-72/1451

MAR 5 1973

Dear Colonel Moore:

This is in further response to your letter of December 12, 1972, requesting our comments on the draft environmental statement for Oswego Steam Station, Unit 6, Oswego County, New York.

Our comments are presented according to the format of the statement or according to specific subjects.

<u>History and Historical and Scenic Sites</u>

This section contains a description of numerous historic properties within the affected area. However, it does not evaluate the effects of the proposal on the properties it describes.

Some confusion concerning the National Register of Historic Places is evidenced. The following is a list of National Register properties in Cayuga and Oswego Counties as of December 1972: Cayuga County-Flatiron Building (1-3 Genessee Street, Auburn); William H. Seward House National Historic Landmark (33 South Street, Auburn); Jethro Wood House National Historic Landmark (New York 34B, Poplar Ridge); Oswego County-Oswego City Library (120 East Second, Oswego); Fort Ontario (East Seventh, Oswego). This section should be corrected to reflect the above information. It should be noted that the Oswego City Library is neither a national historic site nor a national historic landmark.

Normally the Federal agency preparing an environmental statement should determine the existence of National Register properties by consulting the National Register of Historic Places and the State Liaison Officer for Historic Preservation, who will alert the agency to other properties he regards eligible for nomination to the National Register. In this case we have provided this listing of properties as part of our assistance to you in interpreting the terminology of the National Historic Preservation Program.

Incl.

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It should be noted that all properties listed in the National Register of Historic Places come under the purview of Section 106 of the National Historic Preservation Act of 1966 (P.L. 89-665). To assure compliance with Section 106 of that Act and with Executive Order 11593 of May 13, 1971, the statement should indicate that in accordance with the procedures of the Advisory Council on Historic Preservation (Federal Register, November 14, 1972) required steps have been taken to determine the effects of the action on National Register properties and to seek the assistance of the Advisory Council and the State Liaison Officer in evaluating such effects and, if possible, mitigating or avoiding them. We believe that the statement should indicate that a positive determination was made of the existence of National Register properties and compliance with Section 106. It should show that the New York State Liaison Officer was consulted concerning the existence of cultural resources in the affected area.

We do not consider the declaration that "no known archeological excavations exist near Oswego" is adequate documentation of the presence or absence of archeological remains. Generally, we think that the presence or absence of archeological resources should be established as a result of direct-professional examination and evaluation. An archeological survey of the site will probably be necessary to the preparation of an adequate environmental statement. The New York State Liaison Officer may be able to recommend sources of professional archeological advice and consultation.

As noted above, a discussion of the effects of the proposal on cultural resources is very important in the case of National Register properties. Any cultural resources, such as archeological remains, on the actual construction site will likely be irreversibly and irretrievably lost; however, professional assessment of any such resources may indicate that salvage before construction will be advisable. Effects upon other properties may be less obvious, for instance, possible structural damage from plant emissions. However, these impacts should be considered and mitigating measures discussed.

2/11

Circulating Water

Since management techniques to improve important sport and commercial fisheries of Lake Ontario are being applied on a continuing basis and water quality conditions are also improving through pollution control efforts, it is logical to expect the fish production to increase. If this increase in production occurs, the likelihood of unacceptable damage to aquatic life stemming from impingement and entrapment at the intake screens will also increase. Therefore, we question the basis for the conclusion indicated on page 3.1-2 that based on the impacts of existing intakes at this plant the maximum approach velocity to the traveling screens of 0.97fps for unit 6 will be low enough to adequately protect the fish. Experience at other large plants have shown that generally aquatic life is adequately protected when the maximum approach velocity is less than about 0.5fps.

We are pleased that the intake structure screenwell is designed to allow for the future installation of fish transfer devices if the need arises.

Significant fish mortality from rapid temperature changes, as a result of abrupt plant factor changes, could occur. We suggest that if possible the temperature change in the water in the discharge area should be limited to about 2°F per hour.

Cooling Water Heat Dissipation

A discussion of the effects of the cooling water discharge begins on page 3.1-3. We think that the statement should indicate on a map and in the text the sources and magnitudes of heat discharged to the lake, the distribution of thermal plumes from other powerplants, and other industrial plants in the vicinity. A discussion of these cumulative impacts from other sources is needed to lend credibility to indications that no thermal problems will exist as the result of the construction and operation of the proposed plant.

The applicant's model tests, which involve near-field plume models that are considered amenable to useful analysis, have apparently demonstrated the feasibility of keeping thermal discharges within the limitations of New York State's water quality standards. However, since the 32.4°F cooling water temperature rise is rather high, we suggest that remedial measures, which will be taken if impacts are unacceptable, should be developed and presented in the final environmental statement.

Effects On Aquatic Biology

The results and quantitative analysis of the 1972 trawl and gill net survey mentioned on page 3.1-11 should be presented in the statement to more adequately support the conclusion that the proposed discharge will affect relatively small numbers of fish. A description of the methodology and results of the impingement studies conducted June through August 1972 should also be described on page 3.1-12. The maximum and minimum numbers of alewives captured per hour does not adequately indicate the expected impacts from entrainment.

Effects on Other Water Uses

It is stated on page 3.1-12 that cooling water intake and discharge for the proposed unit 6 will have negligible effects on any other water user in the area. We suggest that this effect on recreational facilities, such as the municipal beach located adjacent to the project site, be quantified as to change in quality or use of recreation resources.

Atmospheric Discharges

It is suggested that Table 3.2-3 (page 3.2-5), which tabulates emissions for units 1-6, include information used to obtain the values shown. Data such as sulfur content of oil, ash content of oil, and type of firing employed should be added as a footnote to the table. The basic background information is necessary for an adequate understanding of Table 3.2-2, page 3.2-4.

Solid Wastes

The draft environmental statement should describe the off-site landfill area and discuss in detail the environmental impact of disposing these various waste materials, particularly with respect to the topographic, geologic, and hydrologic setting of the fill area. References are made to solid waste disposal on pages 3.7-1, 1.3-4, and 1.3-7.

Construction-Impact on Land

It is indicated on page 3.7-1 that public access to the existing breakwater will be blocked during construction. We suggest that this paragraph be expanded to describe the impact that this closing will have on public use. For example, will the closing action be a significant imposition or are there other areas of access that can be utilized? If construction will close this area for several years, we suggest that temporary mitigation measures be considered to provide other access to the recreation facilities. Also, it may be in order to discuss the impact of the closing relative to other similar recreation areas in the vicinity, namely, Fair Haven Beach and Selkirk Shores (discussed on page 2.6-6).

Land Use Plan

We suggest that the applicant be encouraged to develop a land use plan for the site and associated transmission lines' rights-of-way. This plan which should be developed in concert with various Federal, State, and local organizations should be mentioned in the final statement along with a schedule for its final completion. It should provide a system by which the maximum overall utilization of these areas occur to the general public within the limitations of adequate safety and sound operating procedures. Recreational and fish and wildlife resources would be a major part of such a plan.

Monitoring Programs and Future Studies

We think that the procedures and results of the preoperational studies mentioned on page 3.9-1 should be presented in the statement in order that the scope of the work can be evaluated. In view of the success anticipated with the ongoing coho salmon introduction program, we think that the postoperational studies should be continued for as long as necessary to fully assess the impact of the plant on aquatic resources of Lake Ontario with special emphasis on the coho salmon fishery.

Aquatic Biota

The last sentence, third paragraph, page 4.0-1, does not have sufficient backup in the statement. Our comments on the section on the Effects on Aquatic Biology presented previously apply here also.

Alternative Means of Generation

An expanded discussion of coal vs. oil is suggested. We think that the final statement should include a comparison of pollutant emissions for a coal-fired and an oil-fired unit. This comparison would add further support to the choice of an oil-fired unit since oil-fired units usually have less emissions than coal-fired units.

Three reasons are given on page 5.3-1 for choosing an oil-fired unit. We think that the important factor usually associated with the burning of oil instead of coal, that of reduced adverse environmental impacts, should also be included in this section.

It is mentioned that a nuclear unit could not be built at this location in accord with AEC siting criteria. The statement should indicate the particular AEC criteria which would be violated if a nuclear plant were constructed.

Irreversible and Irretrievable Commitments

This section should recognize that there will be an annual loss of fish and wildlife resources as a result of the construction and operation of this plant.

We hope these comments will be helpful to you in the preparation of the final environmental statement.

Sincerely yours,

Deputy Assistant Secretary of the Interior

Colonel Robert L. Moore
District Engineer
Corps of Engineers
Department of the Army
1776 Niagara Street
Buffalo, New York 14207

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SECTION 9

REFERENCES

Reference Number	Description
1.	Effect of Circulating Water Systems on Lake Ontario and Oswego Harbor Water Temperature and Aquatic Biology, Quirk, Lawler & Matusky Engineers - April 1971
2	Great Lake Pilot, 1971
3	The Surface Tides of Lake Ontario, R.E. Simpson and D.V. Anderson, Res. Rept. No. 76, Ontario Dept. Lands & Forests, Ontario, Canada, 1967
4	Limnology, Nine Mile Point Lake Ontario, Dr. John F. Storr, Appendix Preliminary Safety Analysis Report Nine Mile Point Nuclear Station, Niagara Mohawk Power Corp., Syracuse, New York, 1964
5	The Surface Currents of the Great Lakes, M.W. Harrington, Bulletin, U.S. Weather Bureau, Washington D.C., 1895
6	Water Resources Data for N.Y., Part I: Surface Water Records, U.S. Department of the Interior 1970
7	Tornado Occurrences in the U.S., L.V. Wolford, U.S. Govt. Printing Office, 1960
8	Advance Report Population Count (V.1), Bureau of the Census, U.S. Dept. of Commerce, 1971
9	Demographic Projections for New York State Counties., Office of Planning Coordination. New York State, August 1972
10	U.S. Census of Population, Dept. of Commerce, and New York State Department of Conservation Division of Water Resources
11	Oswego, N.Y. Master Plan, Zoning Ordinance, Subdivision Regulations, Brown and Blauvelt, July 1958

12 1967 Census of Business , U.S. Dept. of Commerce, Bureau of the Census

13 Oswego, N.Y., Greater Oswego Chamber of Commerce, Inc.

Land Use and Transportation Plan - Policies for Action, Cayuga County Planning Board, May 1970

15 Oswego County Comprehensive Sewerage Study O'Brien and Gere, Consulting Engineers, November 1969

16 Onondaga County Comprehensive Public Water Supply Study, O'Brien and Gere Consulting Engineers CPWS-21, 1968

17 Oswego County Water Supply Study, Barton, Brown, Clyde and Loguidice, CPWS-23, 1967

18 Oswego River Drainage Basin Survey Series Report No. 3, New York State Department of Health, August 1955

19 A Review of Great Lakes Benthos Research, E.B. Henson, 1960

20 A Survey of California Coastal Plants, R.W. Zeller and R.L. Rulifson, Federal Water Pollution Control Administration Northwest Regional Office, Portland, Oregon, 1970

21 Thermal Effects and Other Considerations at Steam Electric Plants, J.R. Adams, Res. Rept. No. 69 34.4-68, Pacific Gas & Electric Co., Department of Engineering Research, 1968

22 Oswego Steam Station Hydraulic Model Study of Thermal Discharge, Quirk, Lawler & Matusky Engineers and Acres American Incorporated, April 1971

23 Literature Review on Effects of Passage Through Power Plants (Entrainment) and Thermal Discharge on Water Quality, Bacteria, and Macro-Invertebrates, G.L. Lauer, New York University Medical Center, February 1971

24 *Biological Aspects of Thermal Pollution, I: Entrainment & Discharge Canal Effects,* Charles C. Coutant, CRC Critical Reviews in Environmental Control, November 1970

25 *Handbook of Freshwater Fishery Biology,* K.D. Carlander, Wm. C. Brown Pub. Co., 1950

26 Letter from Charles M. Salter (Bolt, Beranek, and Newman Inc.) to Allen Goldman (Stone & Webster Engineering Corporation), Dated September 2, 1970

27 Letter from John R. Shadley (Bolt, Beranek, and Newman Inc.,) to Allen Goldman (Stone & Webster Engineering Corporation), Dated September 28, 1970

28 *Effect of Circulating Water Systems on Lake Ontario and Oswego Harbor Temperature and Aquatic Biology*, Quirk, Lawler and Matusky Engineers, Report prepared for Niagara Mohawk Power Corporation, April 1971.

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APPENDIX A

MATHEMATICAL AND TECHNICAL APPROACH TO DIFFUSION ANALYSIS OF AIR CONTAMINANTS

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APPENDIX A

MATHEMATICAL AND TECHNICAL APPROACH TO DIFFUSION ANALYSIS OF AIR CONTAMINANTS

A.1 INTRODUCTION

The dispersion of contaminants as they travel from a source to a receptor is a direct function of meteorological phenomena. As the scale of turbulence, wind speed, ambient temperature, and wind direction change, the ground level concentrations also change. Ambient temperature and wind speed influence the rise of the flue gases, and wind speed and turbulent characteristics of the winds affect the dilution of contaminants as they leave the source. Since these atmospheric parameters may change on an hourly basis, a thorough evaluation of the effects of a large source should include these variations.

Stone & Webster dispersion model uses actual weather data recorded near the site in determining the effect of a power station on ambient air quality. For each hour of weather data, the rise of the flue gas is calculated using the recorded temperature and wind speed. The plume rise establishes the effective height of release of the contaminants. Then the recorded wind speed and atmospheric turbulence conditions are used to calculate the concentrations that would be experienced at 24 distances from the source in the direction of the wind.

Since the hours are sequential, the determination of maximum 1 hr, 3 hr and 24 hr averages, as well as the annual averages, is possible at each of the distances along each of the 16 major wind lines. In addition, since each hour of weather data is categorized according to time and date, the station operating load may be varied for day, night, and weekend operation for a total of 5 different operating conditions. Any change in the plant operating conditions will affect ambient air quality by varying contaminant emission rate. Therefore, it is essential that variations in operating conditions be included in the analysis.

A.2 DIFFUSION EQUATION

The diffusion equation used in Stone & Webster's mathematical dispersion model uses statistical properties to describe the gas concentrations as the plume travels from the source. Based on the assumption that the plume has a Gaussian distribution in both the horizontal and vertical dimensions, the concentration formula is as follows:

$$X = \frac{Q}{\pi \bar{u} \sigma_y \sigma_z} \cdot \exp - \frac{H^2}{2\sigma_z^2} \cdot \exp - \frac{Y^2}{2\sigma_y^2}$$

where:

X is the concentration at ground level, assuming total reflection of the plume takes place at the earth's surface

Q is the source strength (emission rate, in gm/sec)

u is the mean wind speed affecting the plume, in meters/sec

H is the effective height of emission (stack height plus plume rise), in meters

Y is the crosswind distance from the plume centerline in meters

σ_z and σ_y are the standard deviations of plume concentration distribution in the vertical and horizontal directions, respectively, and are functions of downwind distance from the source in meters.

A.3 METEOROLOGY AND DISPERSION

The values of both σ_y and σ_z of the dispersion equation depend on the turbulent structure of the atmosphere. Measures of horizontal and vertical moticns of the air made by a bivane may be used to directly estimate σ_y and σ_z. If wind fluctuation measurements are not available, values for σ_y and σ_z may be estimated from predetermined curves which relate plume speed to downwind distances. These curves are given in D.B. Turner's "Workbook of Atmospheric Dispersion Estimates" (Ref. A-6). Each of these curves is related to a weather stability class which was defined by Pasquill (Ref. A-2) on the basis of insolation, cloud cover and wind speed measured at ten meters. The atmospheric conditions which define stability classes are listed in Table A-1.

Table A-1

Weather Stability Categories

Surface Wind Speed		Insolation			Night	
M Per Sec	Mph	Strong	Moderate	Slight	>4/8 Low Cloud	<3/8 Cloud
<2	<4.5	A	A	B	-	-
2-3	4.5 - 6.7	A-B	B	C	E	F
3-5	6.7 - 11.2	B	B-C	C	D	E
5-6	11.2 - 13.4	C	C-D	D	D	D
>6	>13.4	C	D	D	D	D

Strong insolation corresponds to a solar altitude (angle of the sun above the horizon) greater than 60 degrees with clear skies; it may occur on a sunny midday in midsummer. Slight insolation corresponds to a solar altitude of from 15 to 35 degrees with clear skies; it may occur on a sunny midday in midwinter. However, cloudiness will generally decrease insolation and should be considered along with solar altitude in determining insolation. Insolation that would be strong with clear skies might become moderate with broken middle clouds and slight with broken low clouds. Night refers to the period from 1 hour before sunset to 1 hour after sunrise. The neutral Category D should be assumed for overcast conditions during day or night.

A.4 PLUME RISE

The rise of the plume gases has a significant effect in allowing greater dispersion of contaminants before they reach the ground. Many procedures have been developed for use in estimating the rise of gas plumes. Some are entirely empirical in development while others are based on theoretical analyses with subsequent modifications resulting from experimental information. Over the past 15 years, the improved capability for estimating plume rise has brought about a more accurate and confident assessment of diffusion problems.

In 1963 the Tennessee Valley Authority, under the sponsorship of the Public Health Service, initiated a plume rise study at six of its electric generating stations (Ref. A-3). The plants studied varied in size from 173 to 704 MW and were studied under a variety of operating and meteorological conditions. The observed plume rises were later correlated with the plume rises predicted by several commonly used plume rise equations. The optimized Csanady and CONCAWE equations were adjusted to correlate best with the observed values of plume rise. The optimized CONCAWE equation which yielded the best fit to the TVA data represented a modified version of an equation developed from several hundred plume observations in western Europe. The CONCAWE equation is, however, independent of atmospheric stability and downwind distance. The optimized concawe capo equation used by the Stone & Webster mathematical model is presented below:

$$\Delta h = 0.414 \frac{Q_h^{0.444}}{u^{0.694}}$$

where:

h is the plume rise in meters

Q heat emission from the stack in cal/sec

u is the mean horizontal wind speed in m/sec

A.5 DOWNWASH

When stack gas exit velocity is lower than the wind speed, whether due to low load or high winds, a condition of stack-tip downwash may occur. In such a case, stack gases do not rise and plume rise equations are inapplicable. Instead, the plume extends horizontally from the stack top or flows partially down the sides of the stack. Once the stack exit velocity is less than 1.5 times the wind speed (Ref. A-4), the probability of stack tip downwash occurrence is high. This mathematical model incorporates this number as the point beyond which plume rise in set equal to zero.

A.6 MULTIPLE STACK PLUMES

Strom (Ref. A-5) states that when two or more stacks are closely grouped, they have mutual influences and their plumes tend to merge into one. Limits on this effect are given in a paper by Bosanquet, et al (Ref. A-6) where it is stated that plumes from multiple stacks will rise higher than a plume from only one of them, but not as high as a plume from one stack replacing all of them. As more data of the type obtained by Gartrell et al (Ref. A-7) at TVA become available, the analysis of multiple-stack effects will be improved.

Hawkins and Nonhebel (Ref. A-8) concluded that when the distance between the stacks is less than about three times their height, the concentration due to all the stacks together is the sum of the concentrations due to each individual stack. They also concluded that maximum concentration is not reduced by discharging the flue gas from a power station through several stacks, even if they are set as far apart as practicable. In addition, a single large stack will have a greater effective height than two or more smaller stacks carrying the same quantity of gas. Hence, a large stack will produce a smaller maximum ground level concentration. This conclusion, i.e., that one large stack is better than several smaller stacks, is strengthened as the temperature and quantity of the flue gas increase, because stack height becomes a smaller fraction of the effective height of emission. Recent English field studies agreeing with this concept have led to the construction of multiflue tall stacks.

At a 1965 symposium on air pollution problems, Gartrell (Ref. A-11) discussed TVA's extensive monitoring experience with single and multiple stacks. Utilizing results of recently completed full-scale dispersion studies (Ref. A-9) and plume rise studies in progress, a multiple stack correction factor of 0.9 was used in the expanded Oswego Steam Station dispersion analysis.

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A - 1 D. B. Turner, "Workbook of Atmospheric Dispersion Estimates," U. S. Department of HEW, PHS. No. 999-AP-26, 1969

A - 2 F. Pasquill, Atmospheric Diffusion, D. Van Nostrand Company, Ltd., 1962

A - 3 TVA Publication, "Full Scale Study of Plume Rise at Large Electric Generating Stations," 1968

A - 4 R. H. Sherlock and E. A. Stalker, "Study of Flow Phenomena in the Wake of Smoke Stacks," Michigan University, Engineering Research Bulletin No. 29, 1941

A - 5 G. H. Strom, "Atmospheric Dispersion of Stack Effluents," Air Pollution, Vol. 1, ed. A. C. Stern, Academic Press, 1962

A - 6 C. H. Bosanquet, W. F. Carey, and E. M. Halton, Procedures of the Institute of Mechanical Engineers, 162, 366, 1950

A - 7 F. E. Gartrell, F. W. Thomas, and S. B. Carpenter, Journal of the Air Pollution Association, 11, 60, 1961

A - 8 J. E. Hawkins and G. Nonhebel, "Chimneys and Dispersal of Smoke," Journal of the Institute of Fuel, 28:530-545, November 1955

A - 9 "Full-Scale Study of Dispersion of Stack Gases, A Summary Report," 1964. A joint report by TVA and the Public Health Service to be published by the Public Health Service

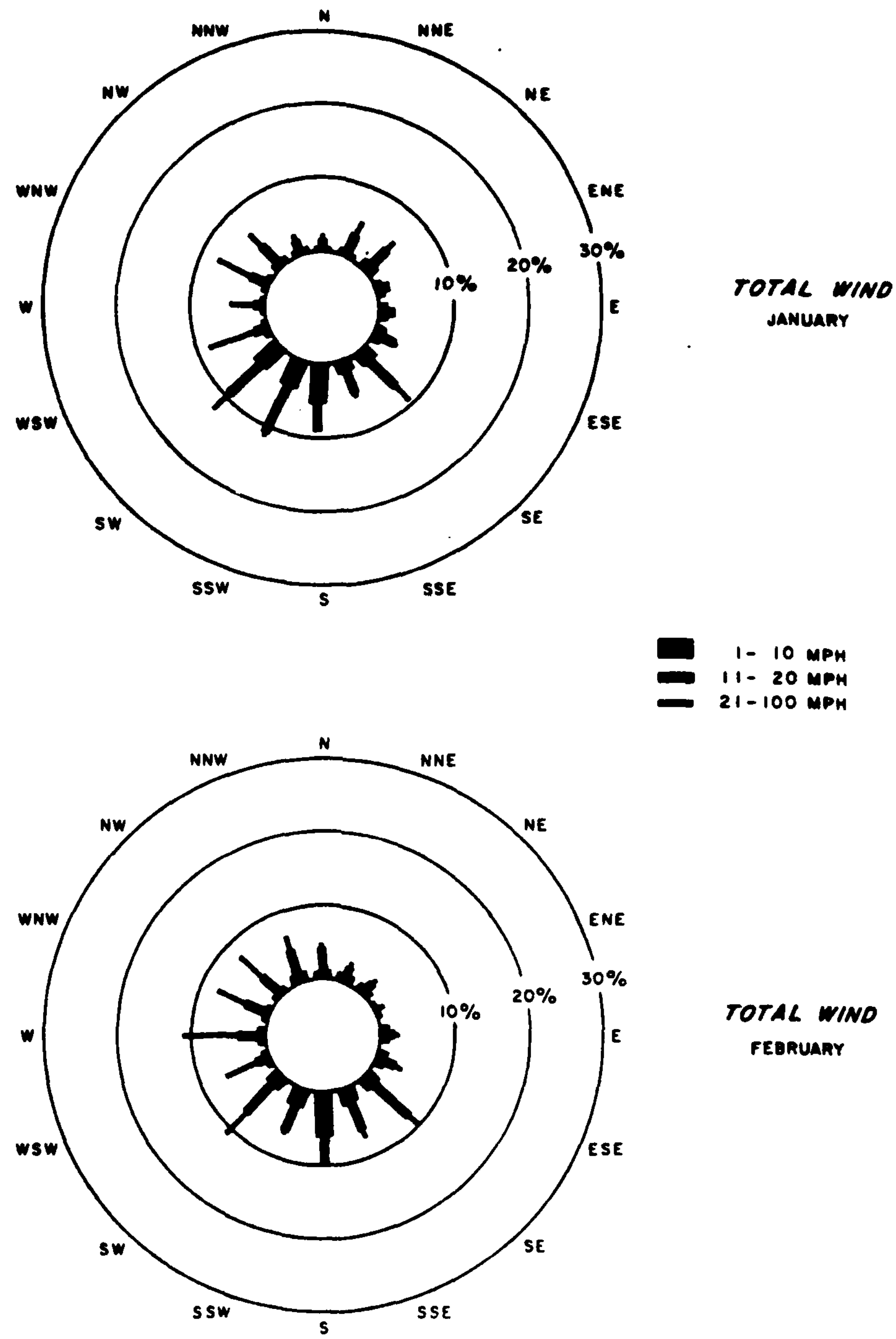
A - 10 G. A. Briggs, "Plume Rise," U. S. Atomic Energy Commision, Division of Technical Information, 1969

A - 11 F. E. Gartrell, "Monitoring of Sulfur Dioxide in the Vicinity of Coal Fired Plants - TVA Experience," Proceedings of the American Power Conference, 1965, Vol. XXVI, 1965

APPENDIX B

METEOROLOGICAL DATA SUMMARIES
NINE MILE POINT TOWER

AVERAGE WIND ROSES (Figures B-1 through B-6)
AVERAGE DIURNAL LAPSE RATES (Figures B-7 through B-12)



NOTE:
NINE MILE POINT WEATHER DATA

FIG. B-1
AVERAGE WIND ROSES
JANUARY & FEBRUARY 1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

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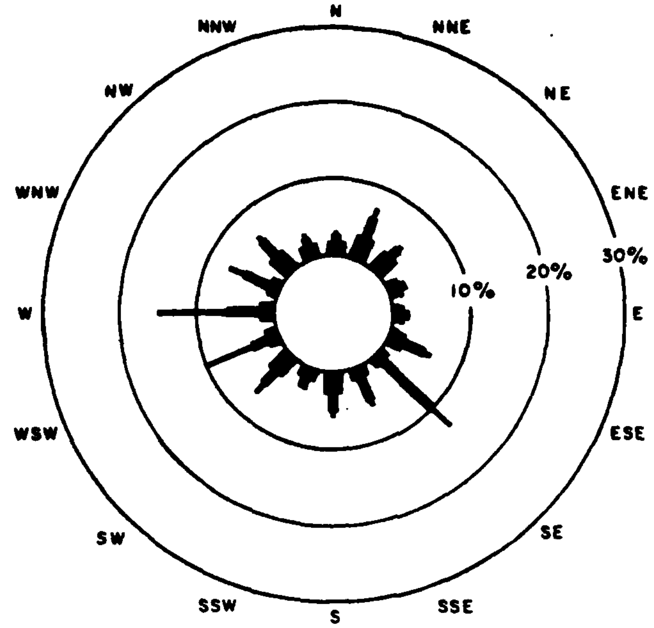
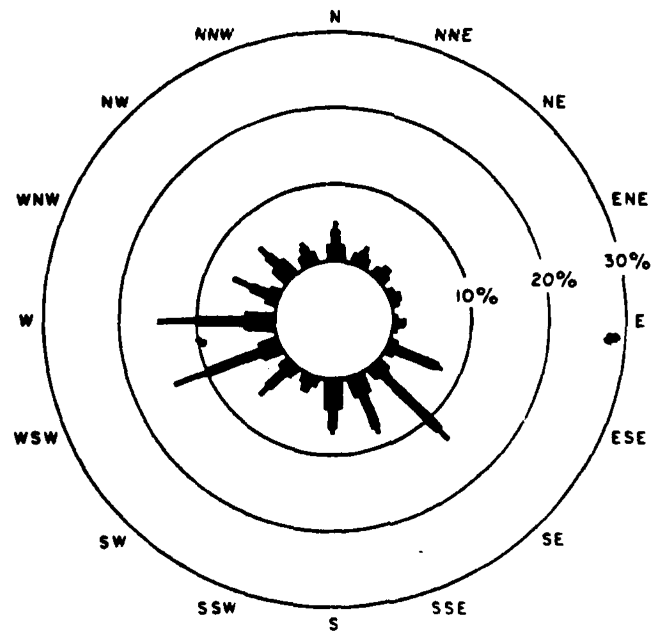


TOTAL WIND
MARCH

1- 10 MPH
11- 20 MPH
21-100 MPH



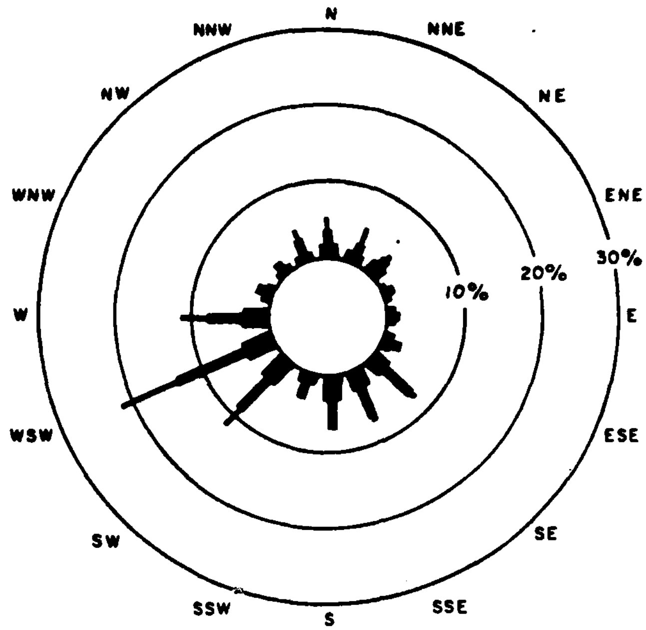
TOTAL WIND
APRIL

FIG B-2

AVERAGE WIND ROSES
MARCH & APRIL 1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

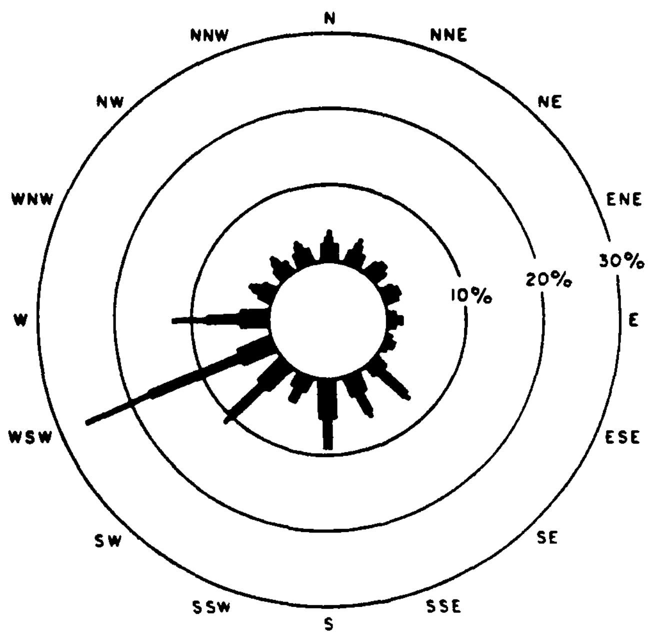
NOTE:
NINE MILE POINT WEATHER DATA

2127



TOTAL WIND
MAY

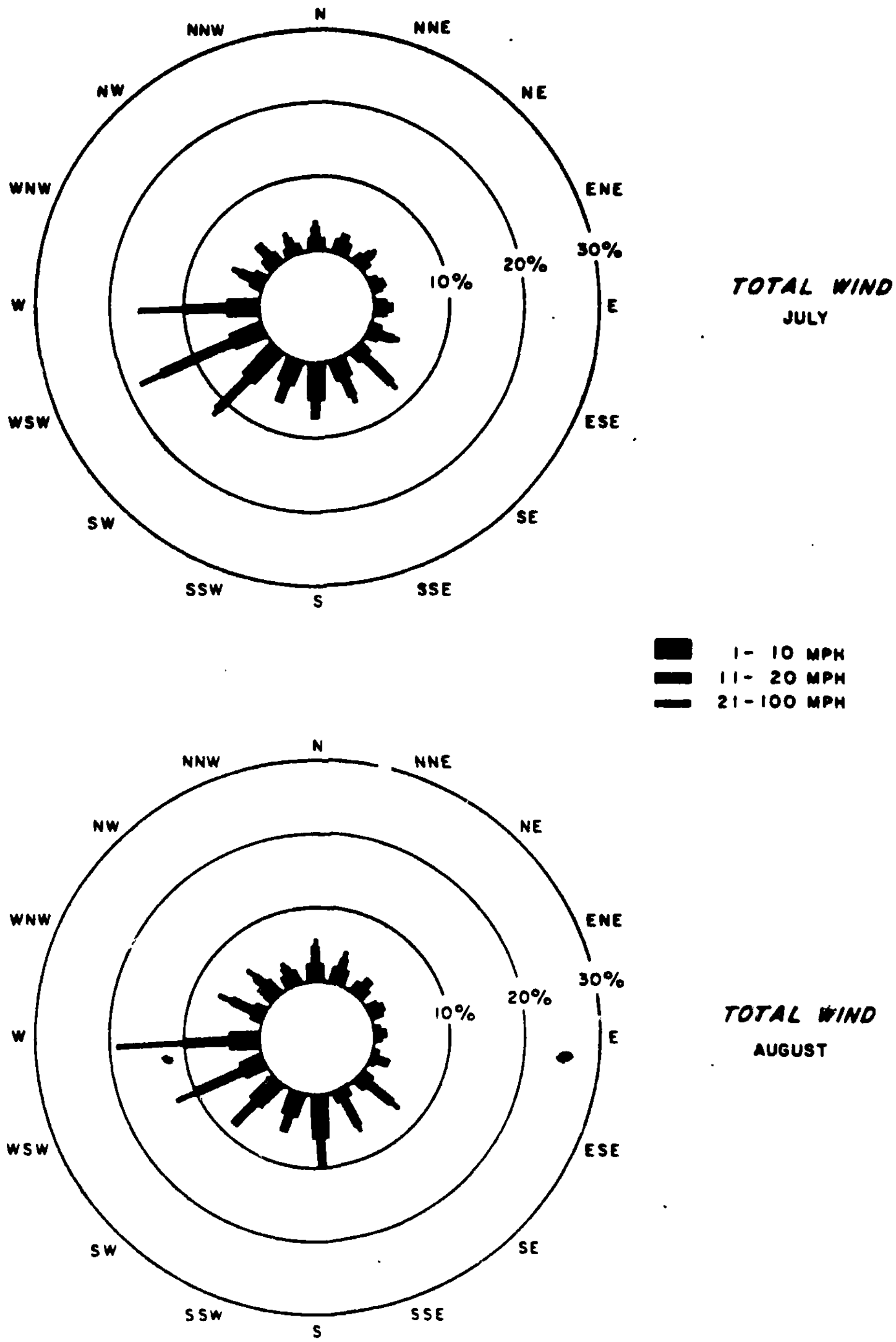
1- 10 MPH
11- 20 MPH
21-100 MPH



TOTAL WIND
JUNE

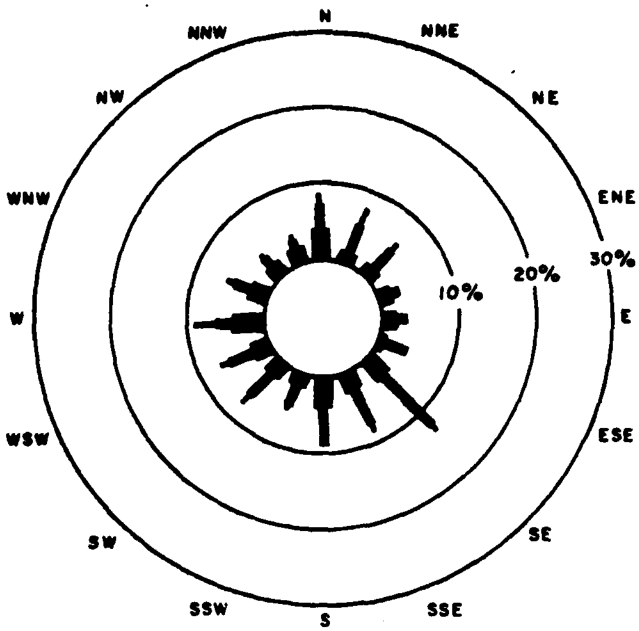
NOTE:
NINE MILE POINT WEATHER DATA

FIG. B-3
AVERAGE WIND ROSES
MAY & JUNE 1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



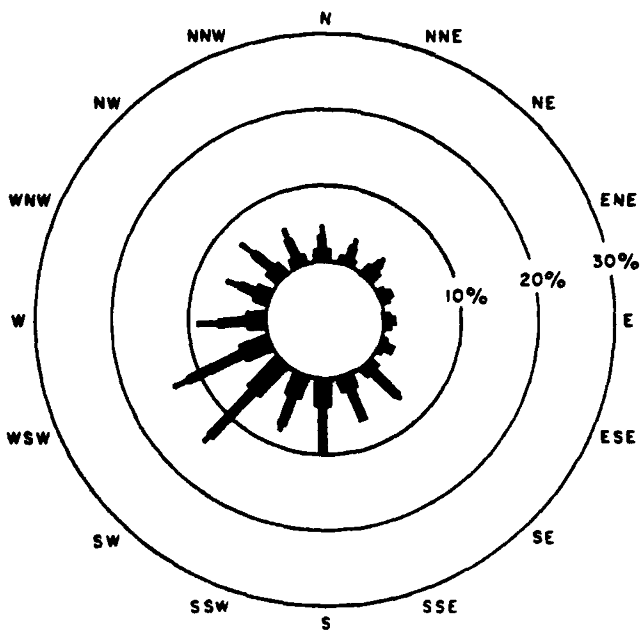
NOTE:
NINE MILE POINT WEATHER DATA

FIG. B-4
AVERAGE WIND ROSES
JULY & AUGUST 1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



TOTAL WIND
SEPTEMBER

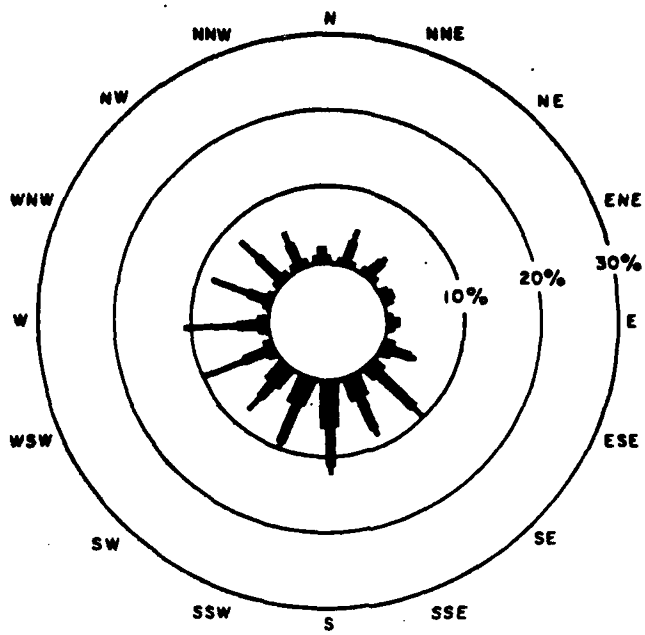
■ 1- 10 MPH
■ 11- 20 MPH
■ 21-100 MPH



TOTAL WIND
OCTOBER

NOTE:
NINE MILE POINT WEATHER DATA

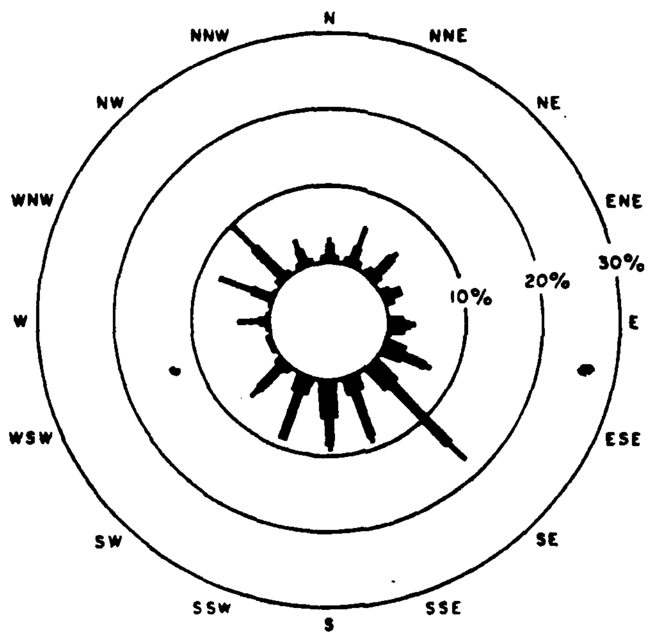
FIG. B-5
AVERAGE WIND ROSES
SEPTEMBER & OCTOBER 1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



TOTAL WIND

NOVEMBER

1- 10 MPH
11- 20 MPH
21-100 MPH



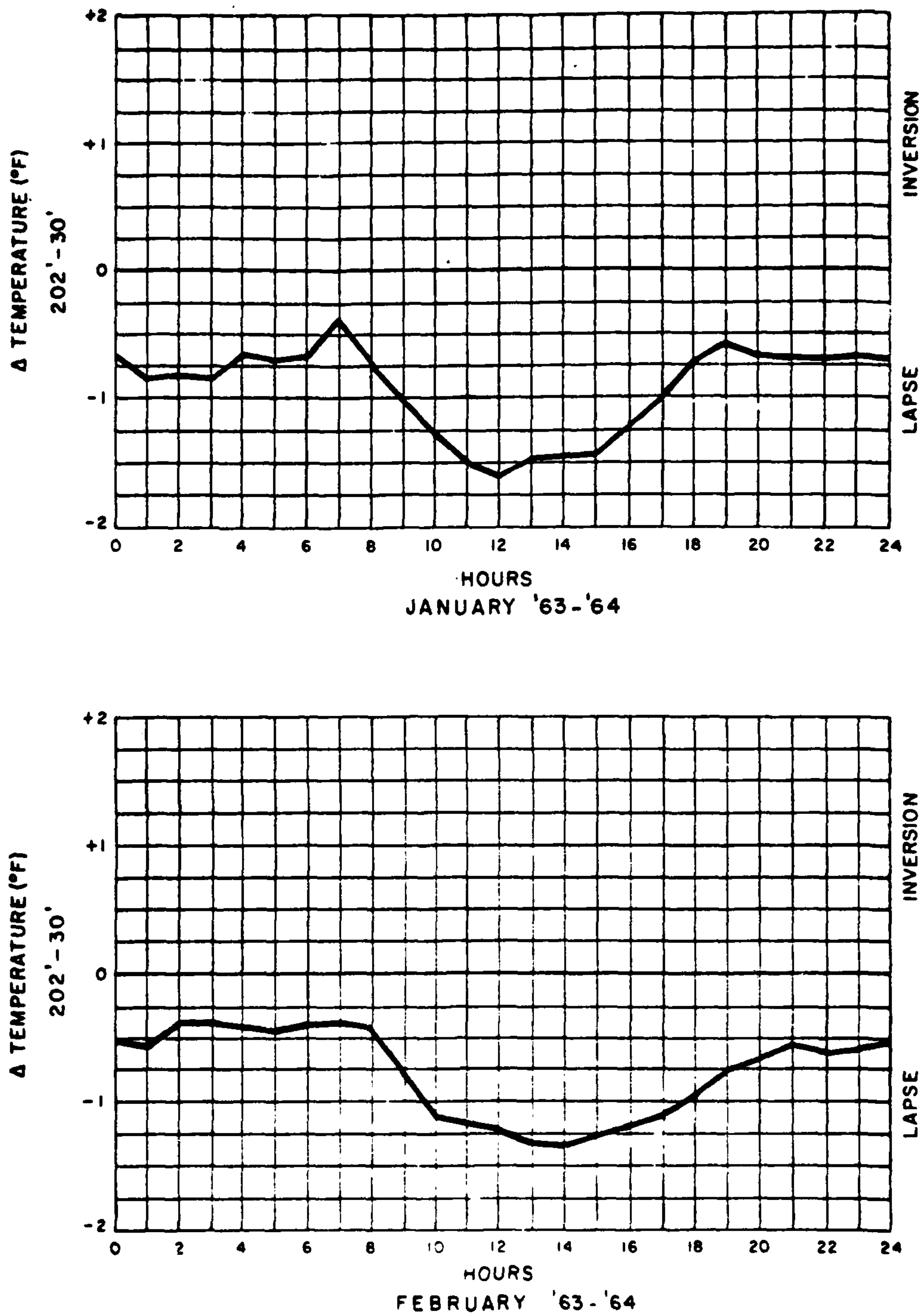
TOTAL WIND

DECEMBER

NOTE:
NINE MILE POINT WEATHER DATA

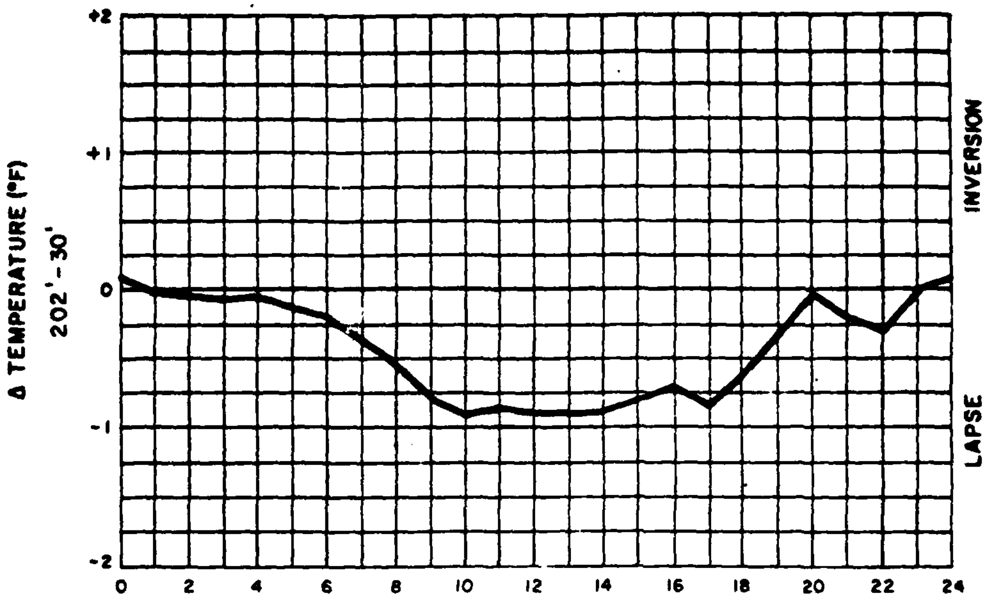
FIG. B-6

AVERAGE WIND ROSES
NOVEMBER & DECEMBER 1963-1964
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

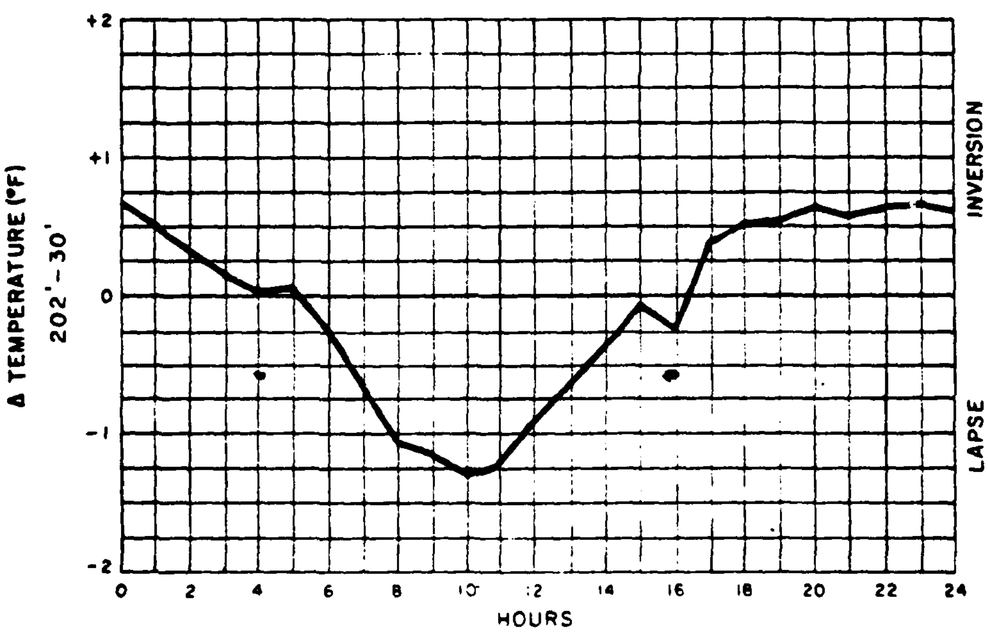


NOTE:
NINE MILE POINT WEATHER DATA

FIG. B-7
AVERAGE DIURNAL LAPSE RATES
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



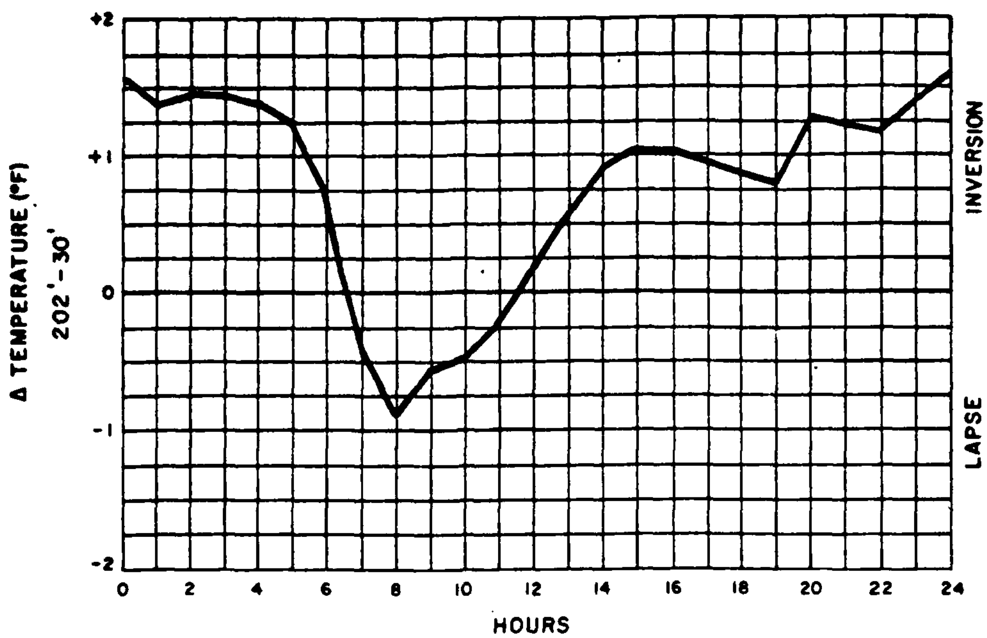
MARCH '63-'64



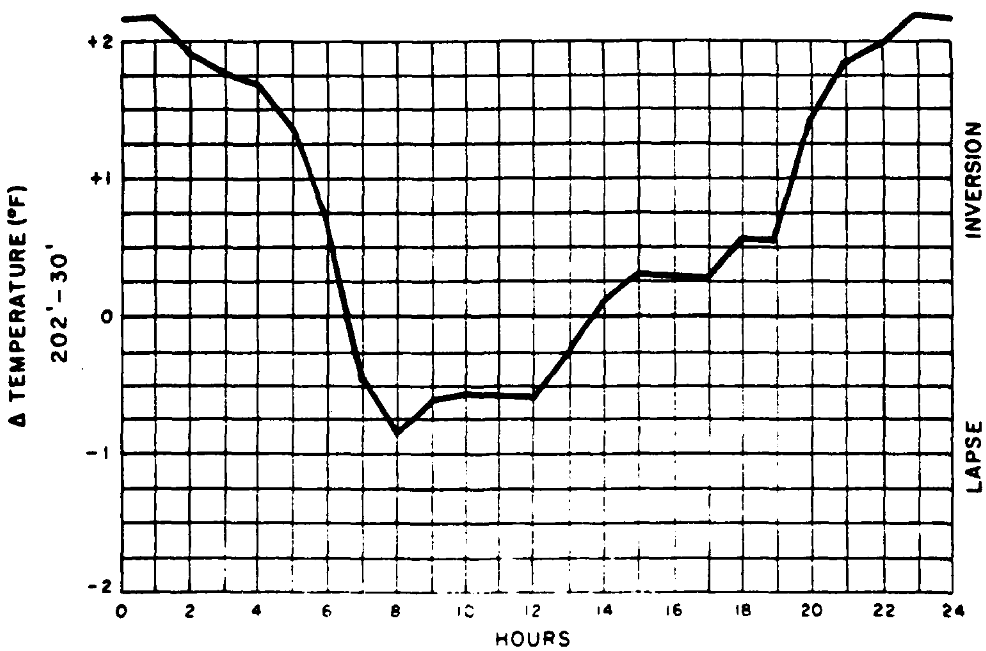
APRIL '63-'64

NOTE
NINE MILE POINT WEATHER DATA

FIG. B-8
AVERAGE DIURNAL LAPSE RATES
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



MAY '63-'64



JUNE '63-'64

NOTE

NINE MILE POINT WEATHER DATA

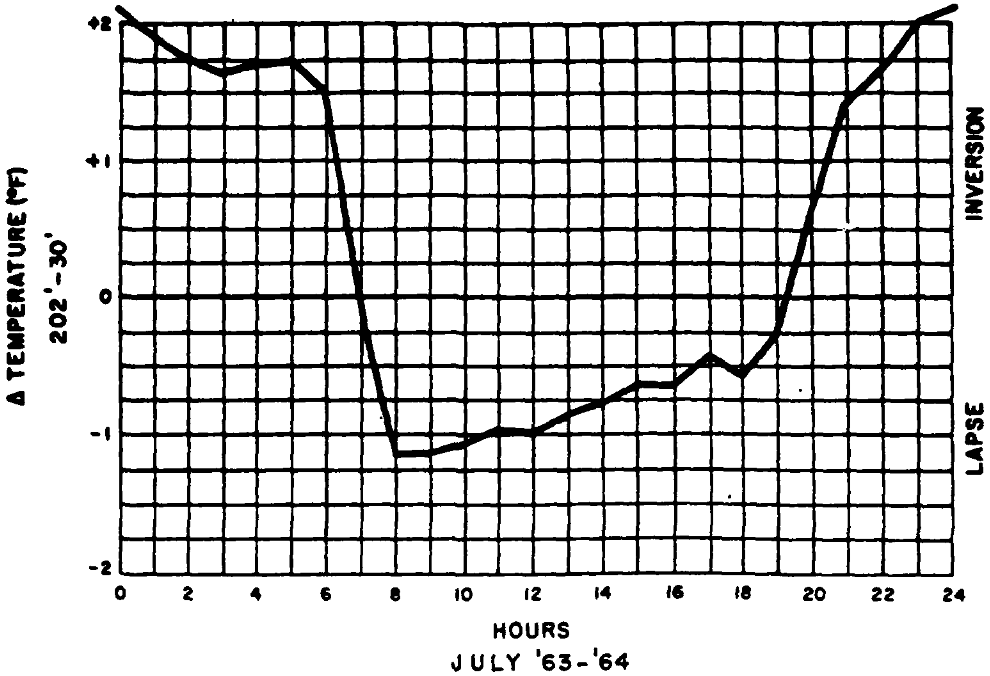
FIG. B-9

AVERAGE DIURNAL LAPSE RATES

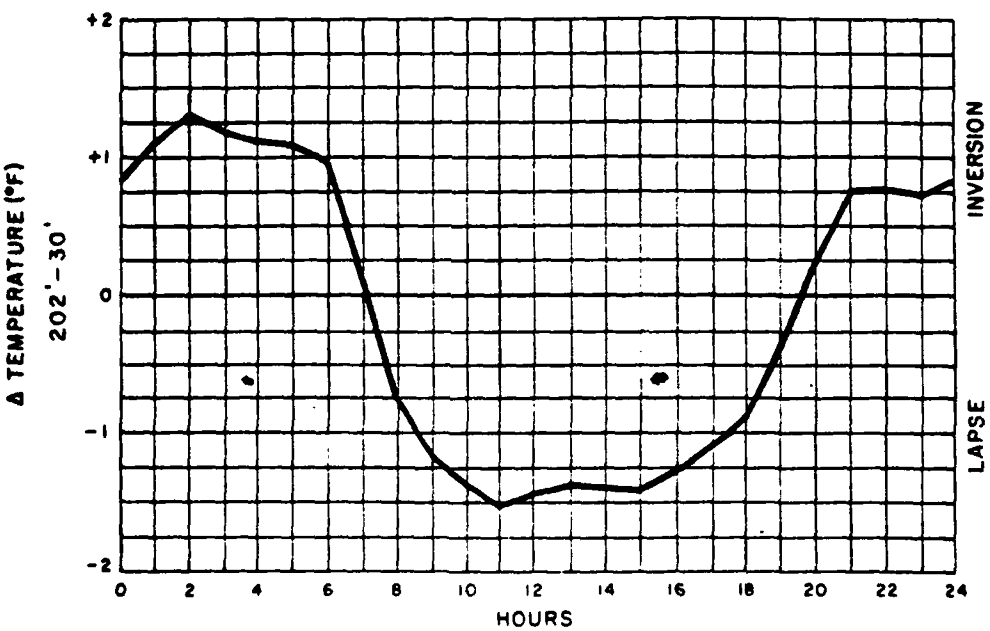
OSWEGO STEAM STATION

NIAGARA MOHAWK POWER CORPORATION

2134



JULY '63-'64



AUGUST '63-'64

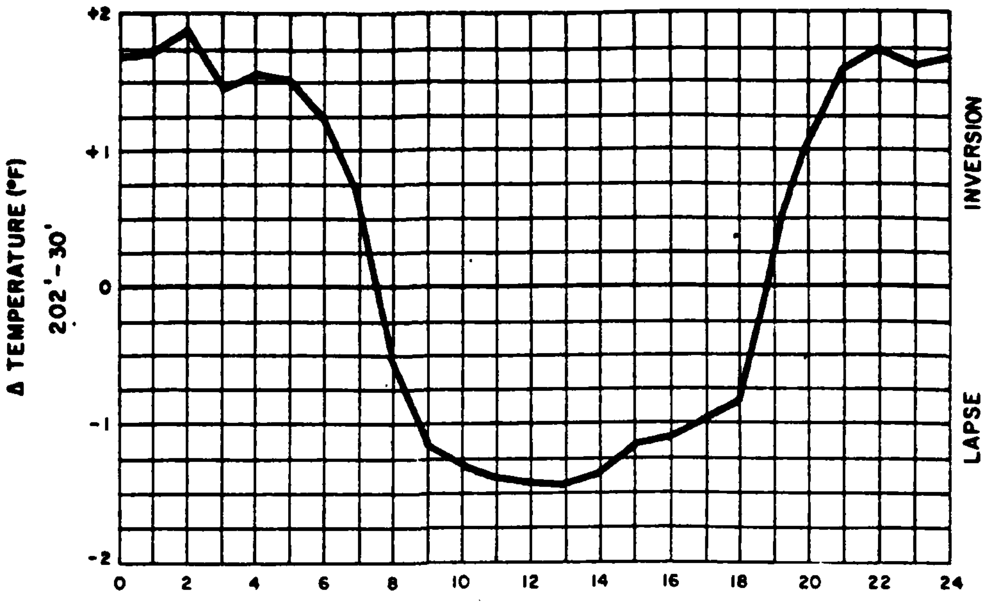
NOTE:
NINE MILE POINT WEATHER DATA

FIG. B-10

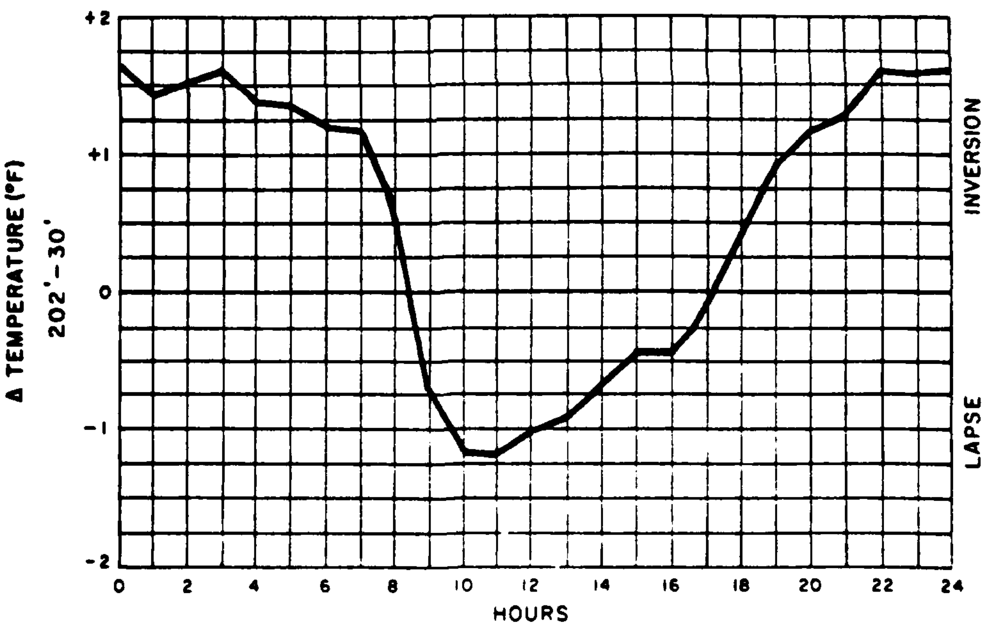
AVERAGE DIURNAL LAPSE RATES

OSWEGO STEAM STATION

NIAGARA MOHAWK POWER CORPORATION



SEPTEMBER '63 - '64

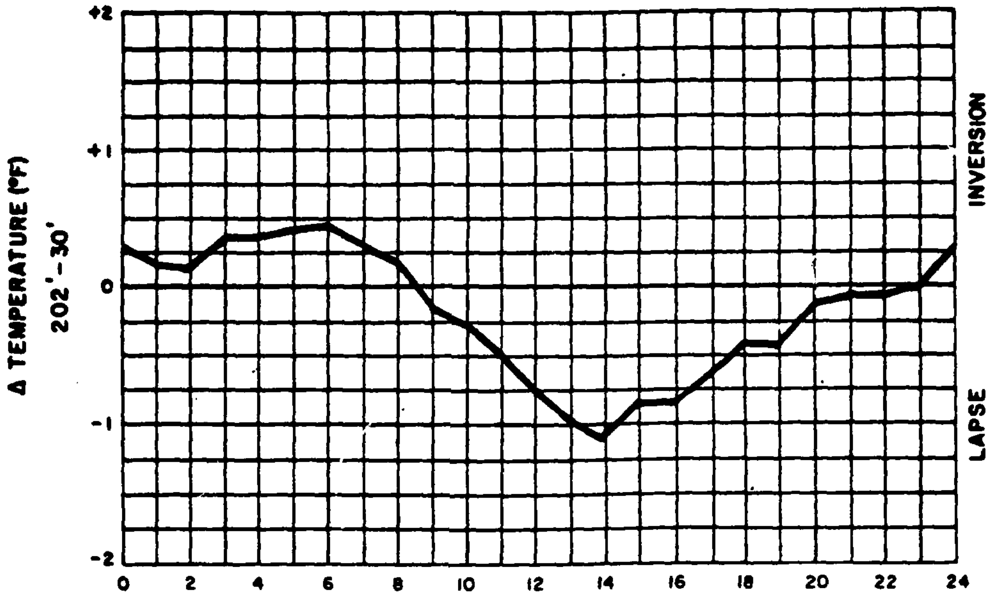


OCTOBER '63-'64

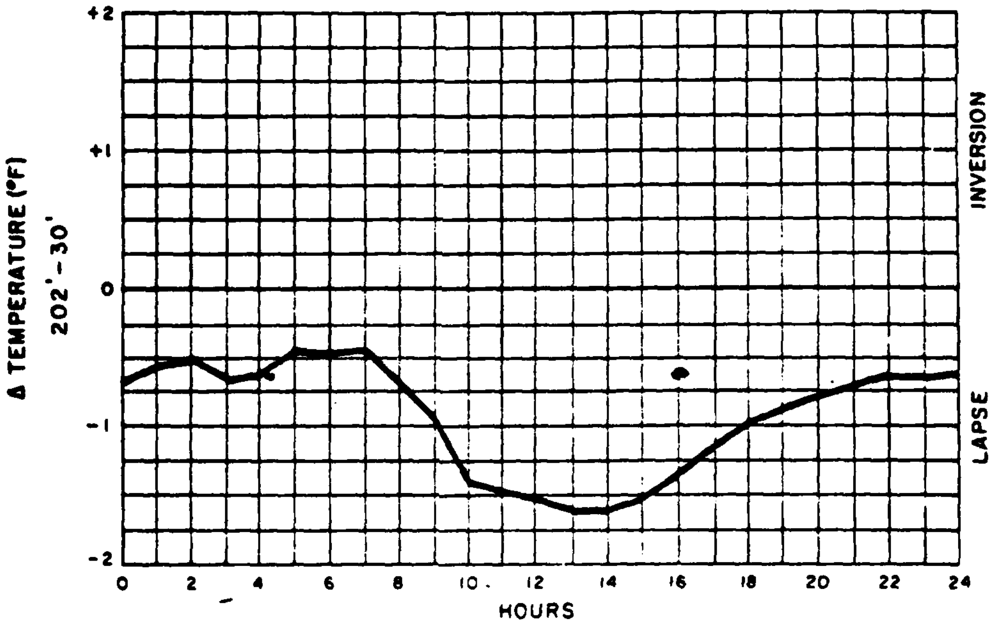
NOTE·
NINE MILE POINT WEATHER DATA

FIG. B-11

AVERAGE DIURNAL LAPSE RATES
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION



NOVEMBER '63-'64



DECEMBER '62-'63

December data based on '62 plus '63 data

('64 data unavailable because of instrument malfunction)

NOTE:
NINE MILE POINT WEATHER DATA

FIG. B-12

AVERAGE DIURNAL LAPSE RATES
OSWEGO STEAM STATION
NIAGARA MOHAWK POWER CORPORATION

APPENDIX C

PERMITS

The following is a list of permits applied for and their status:

City of Oswego:

Building Permit No. 733 issued 5-18-72.

State of New York

A. New York State Department of Environmental Conservation

1. Thermal Discharge Permit: filed 6-20-72
2. Waste Treatment Facility Permit: pending
3. Certificate of Reasonable Assurance that Water Quality will not be impaired: filed 6-20-72
4. Stack Discharge Permit: filed 6-20-72
5. Stream Disturbance Permit: filed 2-16-72

B. New York State Public Service Commission

1. Certificate of Environmental Compatibility and Public Need (transmission lines): filed 4-10-72

C. New York State Department of Transportation

1. Highway Crossing Permits pending

Federal:

A. U. S. Army Corps of Engineers

1. Rivers and Harbors Act of 1899 application for Section 10: submitted 7-27-72

B. U. S. Environmental Protection Agency

1. Amendments to Federal Water Quality Act of 1972, permit: filed 7-25-72

2139

$10,000

CITY OF OSWEGO, N. Y.

Building Permit #753

(Zoning) — (Construction)

May 18, 1972

This certifies that permission is granted to Niagara Mohawk Power Corp.

to construct, ~~enlarge, alter or repair~~ a Unit #6 building located on lot No. ——————,

Block No. ——————, ~~House No.~~ Oswego Steam Station Street, in accordance with the plans and specifications and lot diagram accompanying the application of this permit.

Width —————— Depth —————— Height ——————

Number of stories as shown on plans by Stone & Webster

Proposed use Electric Power Generating Station

Estimated cost $ 130,000,000.00

This permit is subject to all existing city ordinances and rules and expires by limitation if no work is commenced within one year from date.

This permit is voidable unless compensation is furnished before construction is started and it is subject to the rules and regulations of the State Labor Commission.

A. A. Lentz

City Engineer

Per ——————