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Received w/Ltr Dated 8-4-72

RECEIVED JUL 10 1972

50-346

DAVIS-BESSE

NUCLEAR POWER STATION

COST AND BENEFIT

ANALYSIS SUPPLEMENT

TO

ENVIRONMENTAL REPORT

THE TOLEDO EDISON COMPANY

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July 5, 1972

APPLICATION FOR LICENSES

FOR

DAVIS-BESSE NUCLEAR POWER STATION

ENVIRONMENTAL REPORT

Docket No. 50-346

Enclosed herewith, supplementing the above entitled report is the Cost and Benefit Analysis Supplement to the Environmental Report which is being submitted in accordance with the requirements of revised Appendix D to 10 CFR Part 50 and Directorate of Licensing letter of May 12, 1972.

THE TOLEDO EDISON COMPANY

By Glenn J. Sampson

Vice President, Power

Sworn to and subscribed before me, this 5th day of July, 1972.

Fred W. Germain

Notary Public

BENEFIT-COST DESCRIPTION OF ALTERNATIVE DESIGNS FOR THE DAVIS-BESSE NUCLEAR POWER STATION

by

THE TOLEDO EDISON COMPANY
THE CLEVELAND ELECTRIC ILLUMINATING COMPANY

and

BATTELLE
Columbus Laboratories

July, 1972

TABLE OF CONTENTS

INTRODUCTION

This report has been prepared in connection with the proceeding before the United States Atomic Energy Commission (AEC) regarding the construction of the Davis-Besse Nuclear Power Facility near Port Clinton, Ohio, by the Toledo Edison Company and the Cleveland Electric Illuminating Company (Applicants). In accordance with the AEC revised regulations (10CFR50, Appendix D) implementing the National Environmental Policy Act of 1969, the Applicants have submitted benefit-cost data in the Supplement to the Environmental Report for the Davis-Besse Nuclear Power Station. The present report supplies additional benefit-cost information for the project in a format which follows, insofar as feasible, the AEC "Guide for Submission of Information on Costs and Benefits of Environmentally Related Alternative Designs for Defined Classes of Completed and Partially Completed Nuclear Facilities", dated May, 1972.

The data and interpretation contained in this report is intended to provide information to the AEC for its development of a benefit-cost analysis which balances the environmental impact of the facility, and the alternatives for minimizing adverse environmental effects as well as the environmental, economic, technical, and other benefits of the facility.

BACKGROUND INFORMATION

Summary

The Toledo Edison Company and The Cleveland Electric Illuminating Company are members of the Central Area Power Coordination Group (CAPCO) which is a grouping of four electric utility companies in Ohio and Pennsylvania (plus a subsidiary of one). The purpose of this grouping together is to bring about economies in operation and reliability of power supplies in the areas served by these companies. As an initial step in plan and commitments agreed upon by the Group members in 1967, four jointly-owned electric generating units were to be installed, one on each of the four systems. The size and planned operation of all four units was based on the projected power requirements of the CAPCO Group members and the reserve capacity needed to assure reliability of service, based upon past experience and the best available information as to future requirements. Subsequent developments have shown that the output of each of these units is urgently needed by each scheduled operation date. Thus, the on-time operation of these units has and will continue to contribute to meeting the growing need for electric power of consumers in the areas served. The Davis-Besse Nuclear Power Station is the fourth unit to be installed and is jointly owned by Toledo Edison and the Cleveland Electric Illuminating Company, and it is being installed on the Toledo Edison system.

The early joint planning of the companies comprising CAPCO considered alternatives involving general location of units and type of fuel. These studies of alternatives resulted in the decision that the fourth CAPCO unit, which is the Davis-Besse Station, should be located in the eastern part of the Toledo Edison service area and should be a nuclear unit. These decisions were based on the following considerations:

1. Location

The approximate integrated center of load for the CAPCO Group is about 100 miles east, southeast of the integrated center of the Toledo Edison load which is downtown Toledo. Since this was to be a jointly-owned unit with Cleveland and a CAPCO pool unit, the eastern part of the Toledo Edison service area was the most suitable location considering transmission line lengths, transmission energy losses, and CAPCO Group system electrical reliability. The CAPCO service area is shown on Exhibit F.

2. Fuel

Fuel oil and natural gas were not considered to be practically available in this area as a fuel for a base-load generating unit and were not considered as alternatives. Coal and nuclear fuel were considered and all studies indicated that for a unit of this size in this area, nuclear fuel would provide the lowest cost energy. All developments in the industry since the time of this initial decision have confirmed this projection.

3. Other Considerations

Another factor in the decision to go nuclear was the environmental consideration since nuclear fueled generating units have a much lower adverse environmental impact than coal-fired units.

As a final consideration, the seven-year lead time between the formation of CAPCO and the planned in-service date permitted sufficient time for the necessary long-planning and licensing requirements associated with a nuclear facility.

With the above decisions for a nuclear unit in the eastern portion of Toledo Edison's service area being decided by CAPCO Group planning, the Applicants' detail planning resulted in the present location based upon the following major considerations:

1. Availability of Cooling Water

All major electrical generating stations, except hydro stations, utilize steam turbines which discharge large quanities of low temperature unrecoverable heat that must be dissipated to the environment. This heat is rejected from the generating unit cycle to condenser cooling water which is raised in temperature from 12°F to 28°F, dependent upon the particular design. Historically, for most thermal generating stations, this condenser cooling water has come from a river or lake and has been returned to the same body of water from which it was drawn without undue stress on the water environment in a properly designed arrangement.

The selection of a site suitable for the Davis-Besse Station was based on a requi.ement that a suitable source of water would be available to provide for a once-through condenser cooling system. This limited the choice of sites to the lower Maumee river or the shore area of Lake Erie.

2. Siting Criteria

The Commission's siting criteria ruled out selection of a site in or near the City of Toledo which further limited the selection of a suitable site to the area near the Lake Erie shoreline.

With these restrictions imposed by selection of certain alternatives, the entire area from Toledo to Port Clinton was surveyed for potential sites. This shoreline area contains extensive Federal wildlife refuge areas, State wildlife and recreational areas and other public property in addition to summer and year-round residential areas as shown on Exhibit G. Three potential locations were identified in this area as having the necessary requirements for a station site with a minimum of problems regarding land acquisition, relocation of residents, and non-interference with public lands. One of these areas was the present site, another the Erie Ordnance Depot which was being decommissioned and in the process of being acquired by the Community Improvement Corporation of Ottawa County, and the area including the Darby Marsh, a privately-owned waterfowl marsh.

The preferred location was the present site, however, investigation of ownership revealed that the U.S. Government had recently taken a purchase option on the major portion of this potential site area known as the Navarre Marsh.

Investigation of the Erie Industrial Park area showed that very little of the upland area was available and since restrictions on locating the station structures in marsh areas eliminated consideration of this portion of the Erie Industrial Park, further consideration of this area was abandoned.

The Darby Marsh was available for purchase and a purchase option was obtained for this 489-acre tract. A detailed study of the suitability of this site for a nuclear generating station was undertaken by the Applicants with the assistance of NUS Corporation. This study included two informal meetings with the Commission's Division of Reactor Licensing staff personnel. From this study, it was concluded that this site was suitable, but restrictions against location of the main structures in marsh areas would result in a smaller than desired exclusion distance without including State Highway Route 2 which runs adjacent to the area. The relative close proximity to Port Clinton was also considered to be undesirable.

The U.S. Bureau of Sports Fisheries & Wildlife was contacted concerning what possibilities might exist regarding use of the Navarre Marsh area as a plant site. This and later meetings resulted in the exchange agreement and location of the Davis-Besse Station at the existing site. The details of this exchange agreement are given in Section 3.1 of the Environmental Report Supplement. By these considerations of alternatives, there are now over 500 additional acres of prime marsh area under U.S. Government control as National Wildlife Refuge lands at no additional cost to the U.S. Government. In addition, dikes have been installed at the plant site, dike improvements have been made at both locations, and water level control pumps are being installed at the plant site marshes at no cost to the U.S. Government.

As outlined above, the originally proposed cooling water system plan for the Davis-Besse Station provided for use of the waters of Lake Erie with a once-through condenser system and direct open discharge to Lake Erie. Detailed studies during the early design stages resulted in the economic selection of 685,000 gpm condenser cooling water flow with a temperature rise of 18°F.

To obtain minimum thermal impact on the lake, the open lake discharge was designed so that this water would enter the lake through a restricted discharge where jet entrainment with the unrestricted lake water would result, under normal conditions, in an area of the lake having a 5°F or higher temperature above ambient of about 88 acres. To further reduce the thermal impact, this plan was subsequently revised to provide for dilution of the condenser cooling water to increase the discharge flow to 1,027,000 gpm to attain a 12°F rise above ambient which would reduce the area with 5°F or higher temperature above ambient to about 37 acres. Neither the original nor the revised arrangement would have produced significant changes to the ecology of the local lake area based on extensive studies that had been conducted prior to making these decisions. This is futher confirmed by the consideration of this once-through condenser cooling system alternative contained in this Cost and Benefit Analysis Report.

However, the Applicants decided in July of 1970 to provide for rejection of this unrecoverable heat to the environment through a closed cycle system utilizing a natural draft cooling tower to reject the heat in the condenser cooling water directly to the atmosphere.

The decision to use a closed cooling water system was based on a number of factors, including the following:

(i) numerous statements of representatives of the Federal Water Quality Administration and others connected with the Department of the Interior opposing large additions of heat to Lake Erie from power plants,

(ii) uncertainty as to water quality standards applicable to the area, resulting from contradictory statements on the subject by Federal and State authorities,

(iii) tentative approval of thermal discharge standards for the station by State authorities based on the use of an open cycle system, but conditioned on installation of cooling towers "as are necessary to meet the approved Water Quality Standards," which as indicated were uncertain,

(iv) the publicly expressed concern of conservation and other organizations as to the effect of an open cycle system on the ecology of Lake Erie,

(v) the overriding need of having the station in operation on schedule and thus avoiding the possibility of delays pending decisions as to applicable water quality standards, and

(vi) the avoidance of duplicate costs involved in one system being partially or wholly built and then required to be replaced by a different system.

The public interest involved in the last two factors was deemed so great that the more costly and less efficient system should be installed. Applicants, as public utilities, are duty bound to use their best efforts to supply the needs of their customers. Because of constantly increasing demands for power, it is very important that the unit be in operation without delay.

Additional capital cost of the station with the closed cycle cooling system was estimated to be about $9 million and the annual cost, giving effect to extra costs and reduced output, amounted to about $3 million more than that of the open type, once-through cooling system.

In regards to radioactive waste treatment systems, the design of the station from the earliest stages of design included systems that would limit the release of radioactivity to the environment to a level which is as low as practicable and which is a small fraction of the limits contained in 10 CFR Part 20. As a result, only minor modifications have been added and the radioactive waste treatment systems as now designed will limit releases of radioactivity to values that are within the limiting conditions of proposed Appendix I to 10 CFR Part 50. Consequently, no alternatives for radioactive waste treatment subsystems are considered in this Cost and Benefit Analysis Report.

The Davis-Besse site selection and acquisition, site arrangement, station design in regard to radiological considerations and water quality aspects, design of off-site facilities, and construction activities have all been undertaken with proper consideration of the environmental aspects of the overall project and with a proper consideration and balancing of all the factors involved.

Various aspects of many of these factors have changed in the course of project development. Some very major alternatives have been incorporated such as the closed cycle evaporative cooling tower system to provide for condenser cooling where a balancing of the need for timely completion of the project was weighed against environmental concerns with an open lake cooling system and questions relating to applicable water quality standards. The station design as now formulated and which is now in the advanced stages of detailed design and construction has a proper balance for all considerations of the environment, is one which does not have a significant adverse effect on the environment, and is one which provides benefits far beyond the slight environmental costs.

Analysis of Requirements for Additional Generating Capacity

1.0 Forecasts of Demand

The extreme length of time required to place a new generating unit into service from the time of commitment requires extensive long-range planning. To provide a coordinated and economical expansion program requires an even longer period of planning. All of this planning is based on projections of future demands for electricity from the consumer. The validity of these projections determines the electrical energy availability for the consumer and financial status of the electrical utility industry. Under-projecting results in generating capacity shortages for the consumer and over-projecting results in idle capacity with attendant added costs to the utility.

All of the capacity addition plans for the Permittees and CAPCO* are based on individual company projections of future demand with the composite CAPCO demands determined from these projections.

To illustrate these projections and their validity, Charts 1 and 2 have been prepared. Chart 1 shows the Toledo Edison ten-year peak demand planning projection prepared in 1960 for the period 1960 through 1970. The actual system peak demand for 1960 through 1971 to date is also shown for comparison. The current ten-year projection prepared in 1970 is also shown for the period 1971 through 1980 and which forms the Toledo Edison system component of the CAPCO total demand projection shown on Chart 2 for the period 1970 through 1980.

* Central Area Power Coordination Group

All of this illustrates the increasing consumer demand for electrical energy and the prudent and accurate forecasting of these needs on the part of Applicants and CAPCO to properly serve the consumers in their service area.

2.0 Elements of Demand and Consumption

The historical demand for electrical energy on the Applicants' systems and forecast future demands can be categorized into three major sectors of consumers; namely, industrial, commercial, and residential.

Charts 3, 4, and 5 have been prepared to show this division in consumer demand. Chart 3 shows the annual peak demand, actual 1963 through 1971, and projected 1971 through 1975. Chart 4 shows the same information based on summer peak which is dominant from 1967 througy 1975. Chart 5 is the consumer division of energy used in megawatt hours. Table A lists these sectors and percentages for the year 1971 peak demand to date and sales to date plus estimated sales for the remainder of the year.

Currently, the industrial sector of the service area accounts for the largest portion of the peak demand, being 511 MW or 48.5% in 1971. The industrial activity in Toledo Edison's service area and generally in any area of the country is a direct and immediate indicator of the prosperity of the area and the resulting general level of the standard of living. A growth in industrial demand results in the economic growth of the area.

The residential sector accounts for 230 MW or 21.8% of the 1971 peak demand and is very sensitive to changes in industrial activity. The commercial sector is responsive to the residential sector and its growth generally lags changes in the residential and industrial sectors. The commercial sector accounted for 240 MW or 22.8% of the peak demand in 1971.

TABLE A

	Demand		Consumption	
	MKW	% of Peak	MMKWH	% of Total
Industrial	511	48.5	2,943	52.4
Commercial	240	22.8	752	13.4
Residential	230	21.8	1,376	24.5
Other*	73	6.9	547	9.7
Total	1,054	100.0	5,618	100.0

*Street lighting, Public Authorities, and Municipal Systems.

Contrary to the impression many opponents to nuclear power have expressed, the residential sector accounts for a small portion of the total demand, being only 21.8% of the system peak on Toledo Edison's system in 1971.

Company studies have shown conclusively that the chief determinant of the level of usage of electrical energy in the household is household income. These studies have also shown that new dwelling units consume significantly more electric energy than the older existing dwelling units.

The annual population growth rate over the past decade in the Toledo Edison service area is about 0.9%, however, the growth in residential customer units during this period in the residential sector has been about 1.6%. This is considerably less than the 6.4% growth rate in usage of electrical energy. This means that the increasing consumer demand in the household usage of electrical energy is consistent with a rise in the standard of living in the household.

In Lucas County, the county containing over 73% of the Toledo Edison service area population, the Office of Economic Opportunity estimates that there are over 18,000 families (one in eight) with incomes below $3,000. "Survey of Buying Power," Sales Management estimates show that 25% of families in Lucas County have incomes of $5,000 or less per year with another 20% having incomes between $5,000 and $8,000.

Clearly, a large segment of the area population is not sharing in a high standard of living. A shift of this segment into a higher standard of living will mean an increased usage of electricity since an increased usage is directly coupled with the standard of living.

The only meaningful way such a shift can come about is through a higher income from employment which requires a rise in industrial and commercial activity, all of which requires an increase in the demand for and supply of electricity.

An inability on the part of the Applicants to provide this energy upon demand, either resulting from delays in installing new capacity or forced rationing, as some critics have called for, will result in a limitation on the general level of prosperity in the areas served and potentially a lowering of the standard of living of the consumer in the service area.

3.0 Demand-Capacity Situation, 1974-1975

The Davis-Besse Nuclear Power Station is being built as a jointly-owned facility, 52.5% of its output will be owned by The Toledo Edison Company and 47.5% will be owned by The Cleveland Electric Illuminating Company. Both companies are members of the Central Area Power Coordinating Group (CAPCO).

This Group is a generating and operating pool composed of the Applicants' Duquesne Light Company, and Ohio Edison Company. These four CAPCO companies supply electricity in the northern and central areas of Ohio and in the western part of Pennsylvania as shown on Exhibit F.

The Davis-Besse Unit will be the fourth generating unit to be installed by CAPCO and it will be the second nuclear unit (Beaver Valley Unit 1 will be the first). The Davis-Besse Unit will become a part of the CAPCO pool generating capacity and it is needed to provide generating capability to meet anticipated load demand with adequate reserve generation for this pool. During the initial period of its operation, Ohio Edison will be entitled to 280 MW of its output; Cleveland, 314 MW, and Toledo, 277 MW. Table I shows the December, 1974 and June, 1975 load-generation situation for CAPCO with and without Davis-Besse. The generating capacity figures shown in Table I include the output from Beaver Valley Unit 1 during both the December, 1974 and June, 1975 peak-load periods, and the June, 1975 figures include Mansfield Unit 1, scheduled for April, 1975. Prior to completion of Davis-Besse, Toledo is entitled to 175 MW from Beaver Valley Unit 1 and Cleveland, 10 MW.

Table II shows similar data for the Toledo Edison system and Table III shows data for the Cleveland Electric Illuminating system. The official CAPCO load and generation forecasts, dated March 18, 1970, were used in Tables I, II, and III. This forecast data takes into account the long-range coordinated maintenance requirements and the allocation of generating capability to each company to provide adequate capacity for load and reserve during these maintenance periods. Table I data showing December, 1974 and June 1975 which is the CAPCO 1975 peak-load month is summarized below:

Table B

	CAPCO % Reserve	
	December 1974	June 1975
Prior to Maintenance		
With Davis-Besse	21.9	17.6
Without Davis-Besse	14.0	10.1
With Maintenance		
With Davis-Besse	14.3	12.4
Without Davis-Besse	6.4	5.0

This clearly illustrates the need for Davis-Besse on the part of CAPCO and that without Davis-Besse, there would not be adequate reserve to provide reliable service to the consumers of the CAPCO companies. This is substantiated by the FPC comments (see Appendix A) which deems a 20% reserve margin before maintenance considerations as requisite to provide pool reliability.

Tables II and III, which are Applicants' components of Table I, show that the Applicants' systems would have inadequate reserves without Davis-Besse in December, 1974 and both are deficient in generating capability to meet load in June of 1975.

This clearly shows that without Davis-Besse, Applicants'will be deficient in generating capability and that CAPCO as a group will have a serious deficiency in reserves and that generating capability equal to Davis-Besse must be found from other sources.

In late May, 1972, the CAPCO Planning Committee determined that additional generating capacity would be needed during the summer of 1974, due to the scheduled delay in the commercial startup of the Beaver Valley No. 1 Unit to October, 1974. It was originally planned that purchase power would be used to replace this delayed capacity, but it has since been determined that purchase power would not be available. It was then tentatively decided to install about 500 MW of peaking units before the summer of 1974. These units have not been allocated between the CAPCO companies. If these units are installed, they will increase the summer 1975 reserves by about 4%.

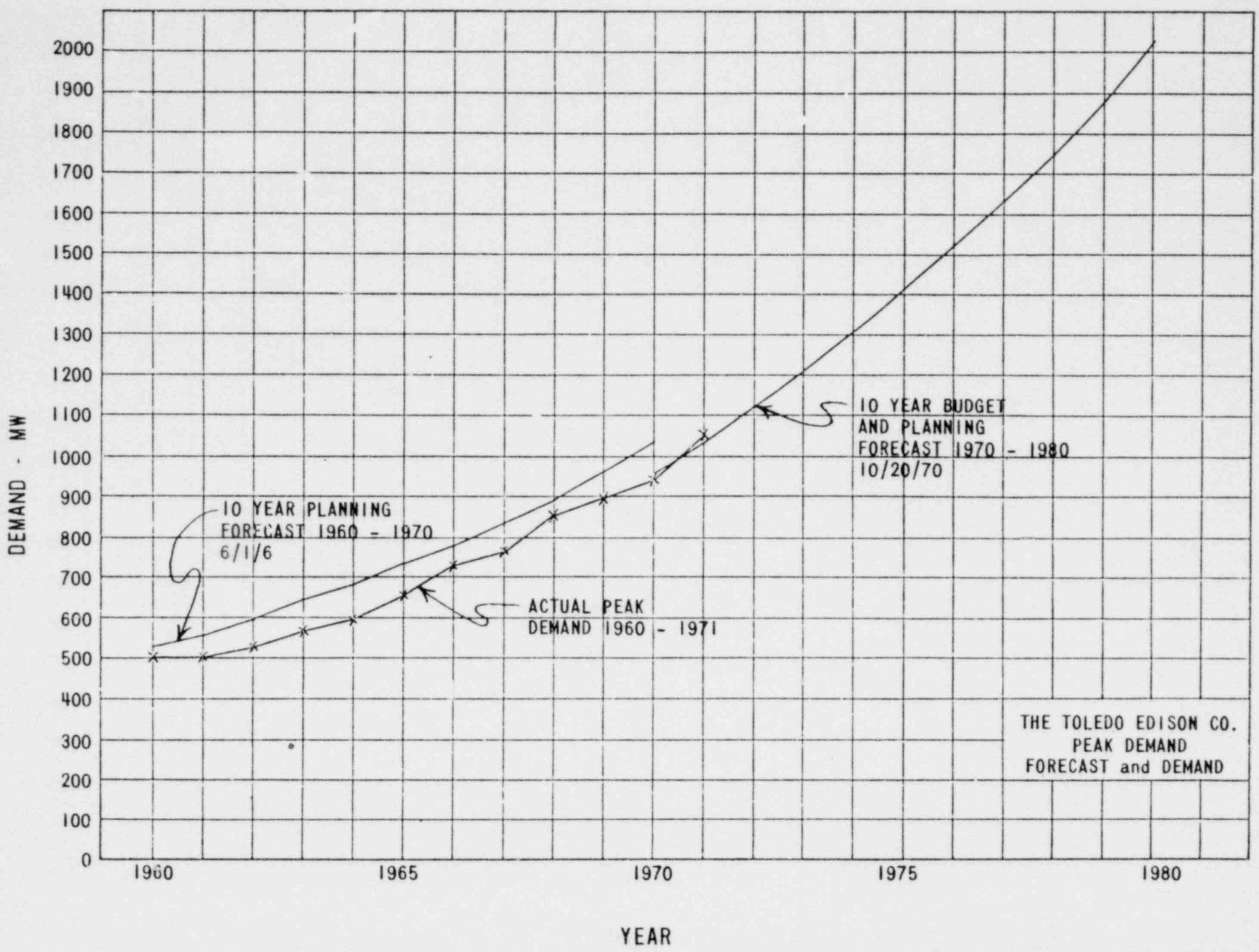

THE TOLEDO EDISON CO.
PEAK DEMAND
FORECAST and DEMAND
10 YEAR BUDGET
AND PLANNING
FORECAST 1970 - 1980
10/20/70
10 YEAR PLANNING
FORECAST 1960 - 1970
6/1/6
ACTUAL PEAK
DEMAND 1960 - 1971
DEMAND - MW
0
100
200
300
400
500
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
1700
1800
1900
2000
1960
1965
1970
1975
1980
YEAR

CHART NO. 1

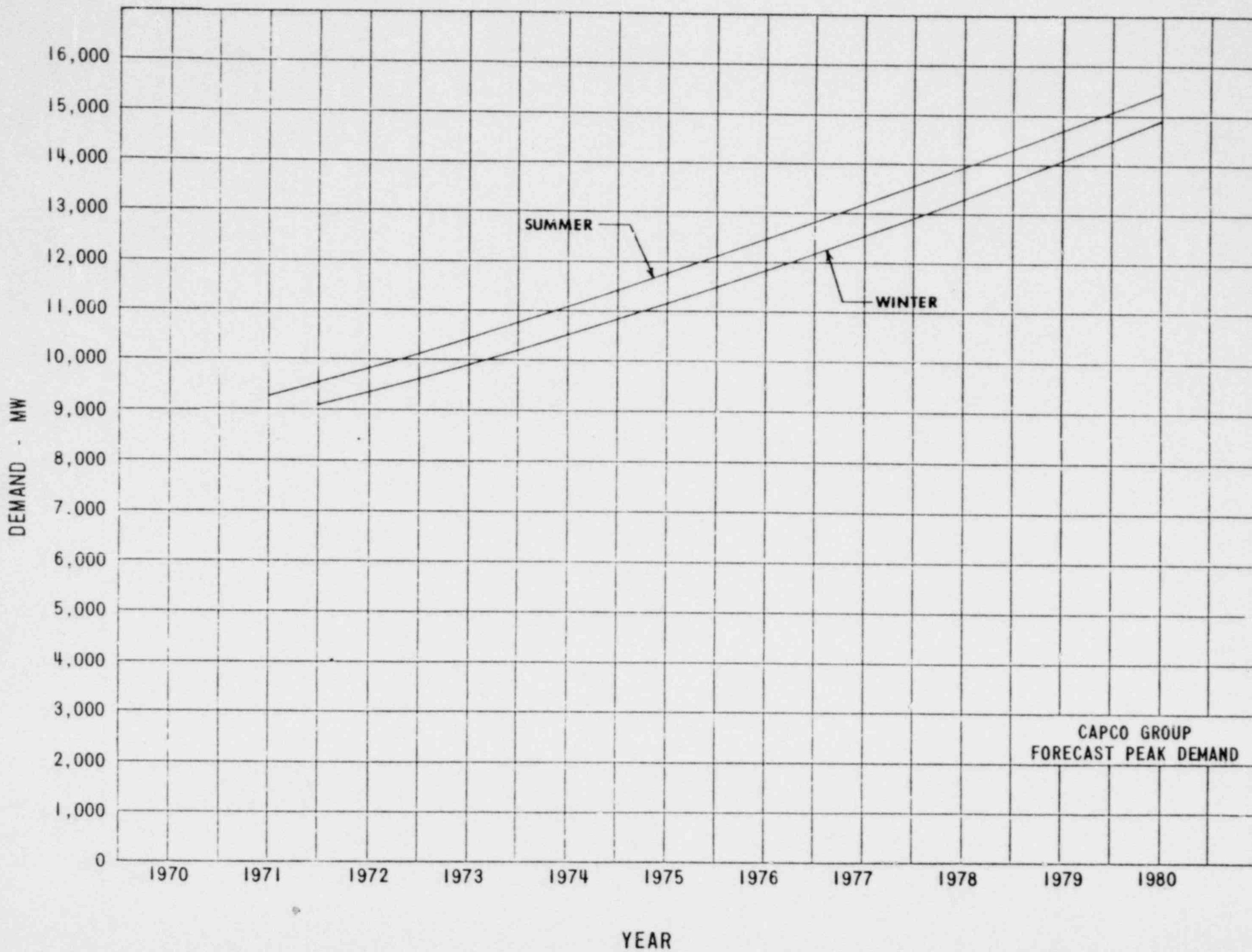

16,000
15,000
14,000
13,000
12,000
11,000
10,000
9,000
8,000
7.000
6,000
5,000
4,000
3,000
2,000
1,000
0
DEMAND - MW
SUMMER
WINTER
CAPCO GROUP
FORECAST PEAK DEMAND
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
YEAR

CHART NO. 2

CHART NO. 3

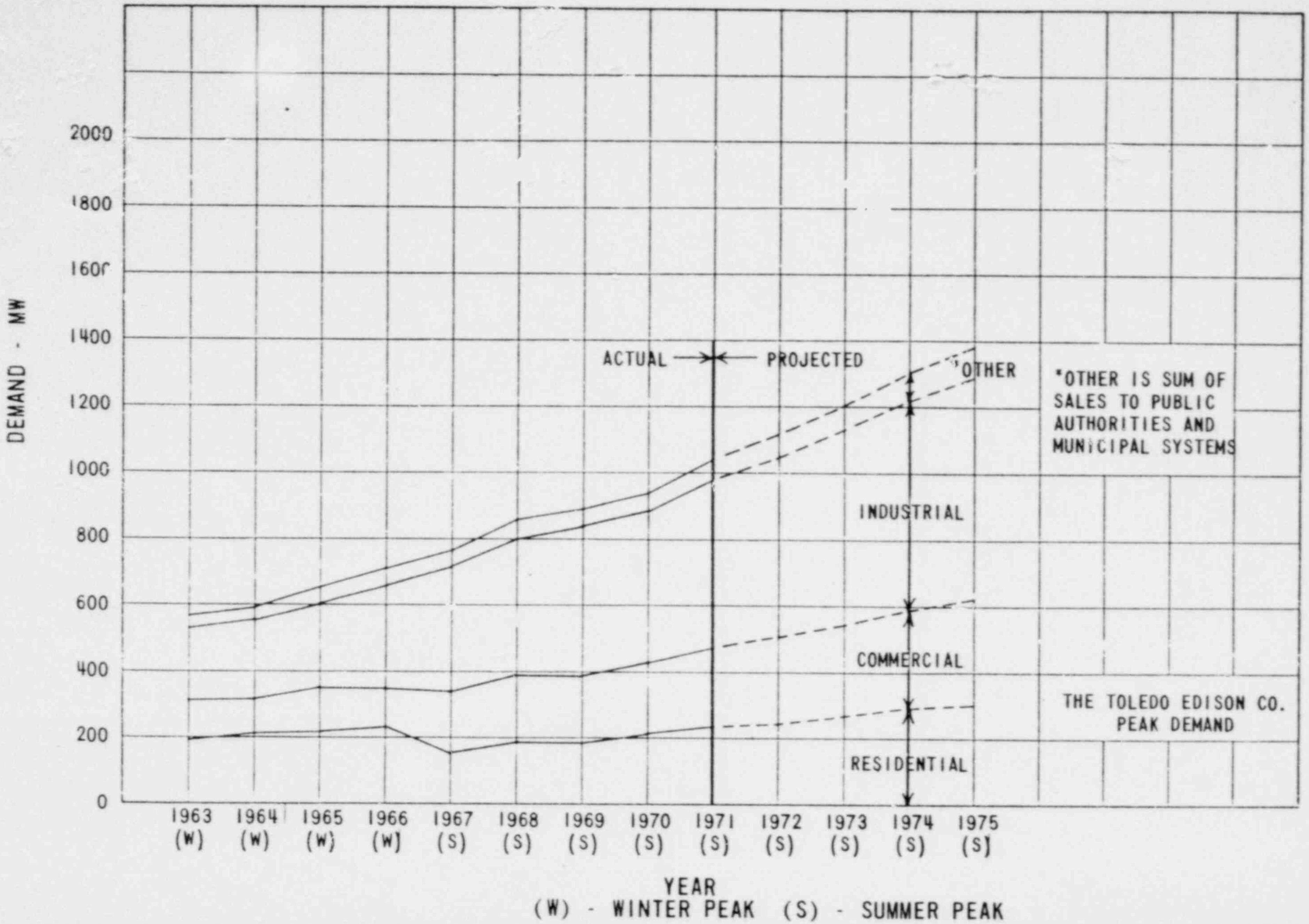
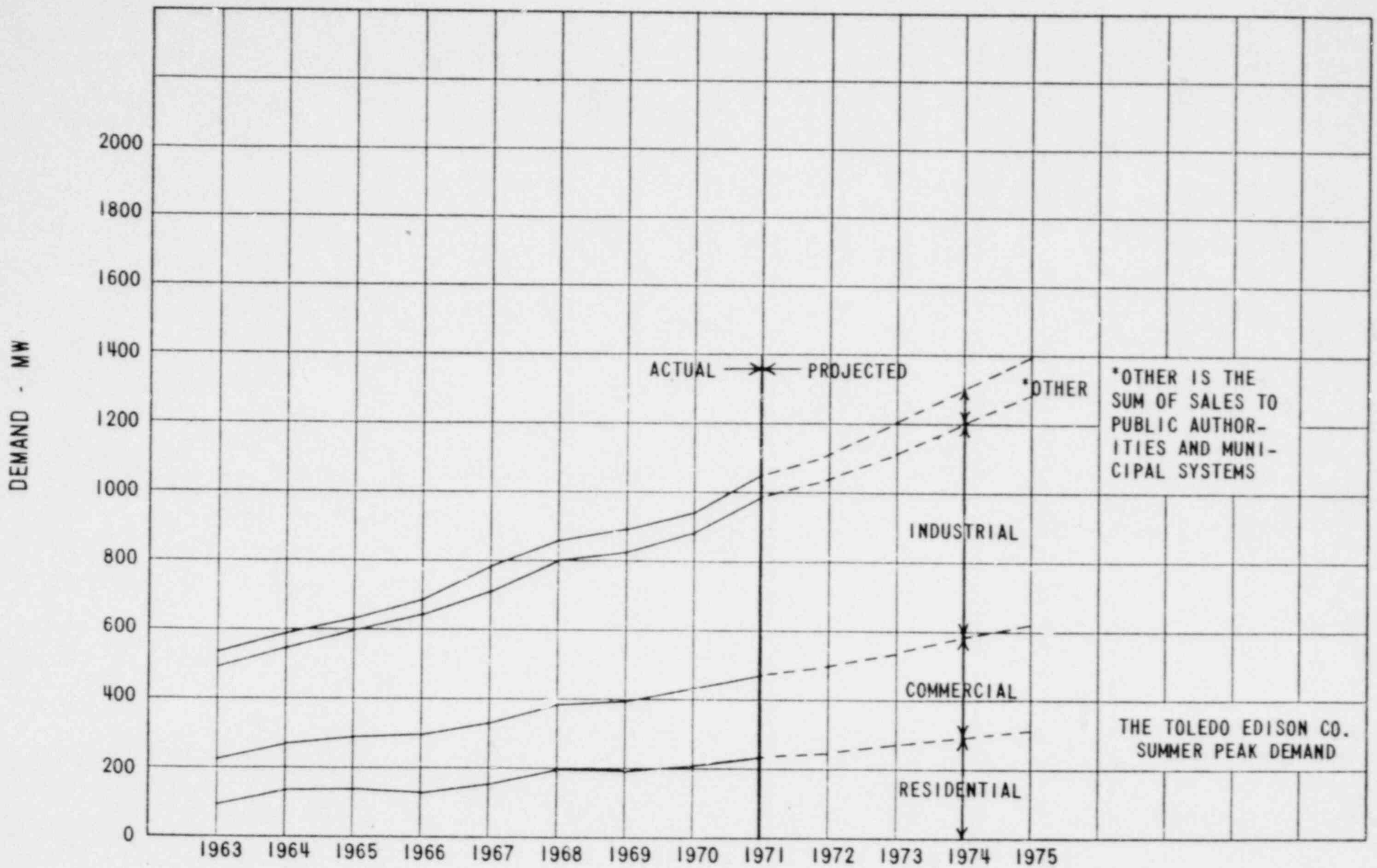

DEMAND - MW
0
200
400
600
800
1000
1200
1400
1600
1800
2000
ACTUAL
PROJECTED
*OTHER
*OTHER IS SUM OF SALES TO PUBLIC AUTHORITIES AND MUNICIPAL SYSTEMS
INDUSTRIAL
COMMERCIAL
RESIDENTIAL
THE TOLEDO EDISON CO.
PEAK DEMAND
1963 (W)
1964 (W)
1965 (W)
1966 (W)
1967 (S)
1968 (S)
1969 (S)
1970 (S)
1971 (S)
1972 (S)
1973 (S)
1974 (S)
1975 (S)
YEAR
(W) - WINTER PEAK (S) - SUMMER PEAK

CHART NO. 4



DEMAND - MW
0
200
400
600
800
1000
1200
1400
1600
1800
2000
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
ACTUAL
PROJECTED
*OTHER
*OTHER IS THE SUM OF SALES TO PUBLIC AUTHORITIES AND MUNICIPAL SYSTEMS
INDUSTRIAL
COMMERCIAL
RESIDENTIAL
THE TOLEDO EDISON CO.
SUMMER PEAK DEMAND

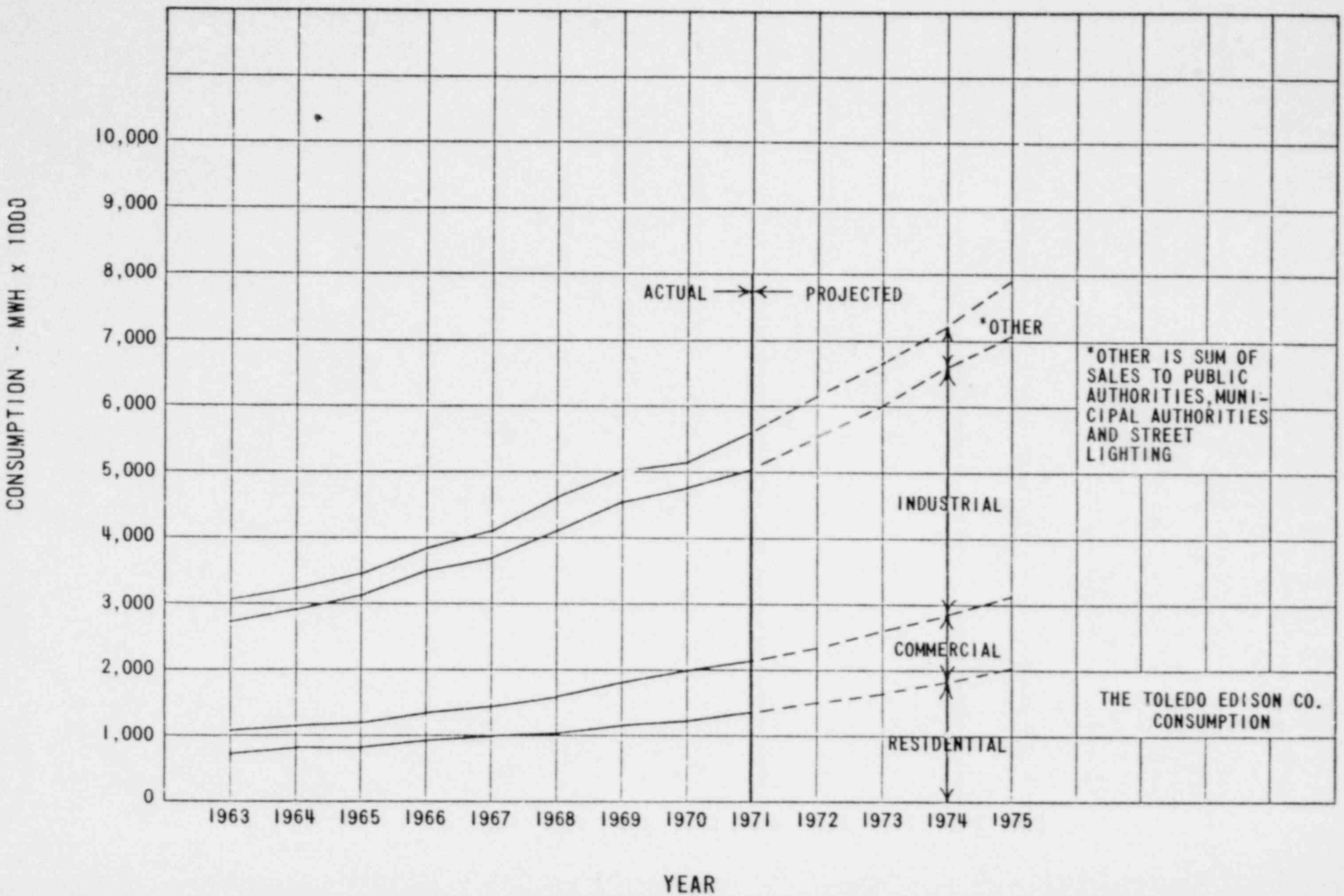

CONSUMPTION - MWH x 1000
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
YEAR
ACTUAL
PROJECTED
*OTHER
*OTHER IS SUM OF SALES TO PUBLIC AUTHORITIES, MUNICIPAL AUTHORITIES AND STREET LIGHTING
INDUSTRIAL
COMMERCIAL
RESIDENTIAL
THE TOLEDO EDISON CO.
CONSUMPTION

CHART NO. 5

TABLE I

CAPCO

PEAK LOAD WEEK

	December 1974		June 1975	
	With Davis-Besse	Without Davis-Besse	With Davis-Besse	Without Davis-Besse
Net Demonstrated Capability - MW	13,002	12,130	13,942	13,070
Net Concurrent System Capability - MW	12,850	11,978	13,572	12,700
Net Purchase from Other Systems - MW	536	536	261	261
Available Capability - MW	13,386	12,514	13,833	12,961
Scheduled Maintenance - MW	834	834	609	609
Available Capacity for Load - MW	12,552	11,680	13,224	12,352
Forecasted Peak Load Including Interruptable Loads - MW	10,980	10,980	11,767	11,767
Reserve Over Load				
With Scheduled Maintenance				
- MW	1,572	700	1,457	585
- %	14.3%	6.4%	12.4%	5.0%
With No Maintenance Provision				
- MW	2,406	1,534	2,066	1,154
- %	21.9%	14.0%	17.6%	10.1%

TABLE II

TOLEDO EDISON

PEAK LOAD WEEK CORRESPONDING TO CAPCO

	December 1974		June 1975	
	With Davis-Besse	Without Davis-Besse	With Davis-Besse	Without Davis-Besse
Net Demonstrated Capability - MW	1,523	1,065	1,523	1,065
Net Concurrent System Capability - MW	1,497	1,039	1,467	1,010
Net Purchase from Other Systems - MW				
AEP	100	100	100	100
CAPCO	44	219(1)	31	206(1)
OVEC	27	27	16	16
Michigan Pool	200	200	-	-
CAPCO (Delivery)	(290)	(110)(2)	-	-
Available Capability - MW	1,578	1,475	1,614	1,332
Scheduled Maintenance - MW	6	6	114	114
Available Capacity for Load - MW	1,572	1,469	1,500	1,218
Forecasted Peak Load - MW	1,292	1,292	1,389	1,389
Reserve Over Load				
With Scheduled Maintenance				
- MW	280	177	111	(171)
- %	21.7%	13.7%	8.0%	(12.3%)
With No Maintenance Provision				
- MW	286	183	225	(57)
- %	22.1%	14.2%	16.2%	(4.1%)

(1) Includes 175 MW from Beaver Valley which is TECo's Entitlement for Period until Davis-Besse is available. This would reduce Duquesne's Reserve Over Load by 7.7% in December 1974 and 7.3% in June 1975.

(2) Delivery of 180 MW of Toledo Edison's share of Davis-Besse output to Ohio Edison Company eliminated.

TABLE III

CLEVELAND ELECTRIC ILLUMINATING

PEAK LOAD WEEK CORRESPONDING TO CAPCO

	December 1974		June 1975	
	With Davis-Besse	Without Davis-Besse	With Davis-Besse	Without Davis-Besse
Net Demonstrated Capability - MW	4,146	3,732	4,203	3,789
Net Concurrent System Capability - MW	4,100	3,[illegible]6	4,118	3.704
Net Purchase from Other Systems - MW				
AEP	-	-	-	-
CAPCO	18	28(1)	-	10(1)
OVEC	-	-	-	-
Michigan Pool	-	-	-	-
CAPCO (Delivery)	(450)	(350)(2)	(41)	(41)
Available Capability - MW	3,668	3,364	4,077	3,673
Scheduled Maintenance - MW	46	46	124	124
Available Capacity for Load - MW	3,622	3,318	3,953	3,549
Forecasted Peak Load Including Interruptable Loads - MW	3,380	3,380	3,720	3,720
Reserve Over Load				
With Scheduled Maintenance				
- MW	242	(62)	233	(171)
- %	7.2%	(1.8%)	6.3%	(4.6%)
With No Maintenance Provision				
- MW	288	(16)	357	(47)
- %	8.5%	(0.5%)	9.6%	(1.3%)

(1) Includes 10 MW from Beaver Valley which is CEI's Entitlement for Period until Davis-Besse is available. This would reduce Duquesne's Reserve Over Load by 0.4%.

(2) Delivery of 100 MW of CEI's share of Davis-Besse output to Ohio Edison Company eliminated.

Site Description and Present Status of Construction

1.0 General Description of Site and Facilities

The plant site consists of 954 acres on the shore of Lake Erie in Carroll Township, Ottawa County, Ohio, with a lake frontage of 7,250 feet. It is about six miles northeast of Oak Harbor, six miles west of Port Clinton, and 21 miles east of Toledo.

The site includes 524 acres (532.9 deed acres) called the Navarre Tract which was acquired from the U. S. Bureau of Sport Fisheries and Wildlife pursuant to an exchange agreement wherein a well-developed marsh tract of 489 acres closer to Port Clinton held by the Permittees was exchanged for the Navarre Tract. This exchange agreement also provided for continued maintenance as a National Wildlife Refuge of the major part of the Navarre Tract so acquired. This exchange agreement also provided for addition to the Refuge area of marshlands acquired from others.

The station structures, except for the cooling tower, are located on a [illegible]-acre area which is approximately in the center of the site and about 3,000 feet from the shoreline. The location of these structures and other station facilities are shown on the site arrangement drawing included hereto as Exhibit A.

2.0 Particular Areas and Facilities

2.1 Marshlands

Pursuant to the exchange agreement with the U. S. Bureau of Sport Fisheries and Wildlife, 447 acres of the marshland acquired in the exchange have been leased to the Bureau to be used as a National Wildlife Refuge for a period of 50 years and 135 acres of prime marshland acquired from others will be so leased for a period of 25 years. Additionally, the Bureau will be given management of another 33 acres of marshland within the site. Thus, over 600 acres of prime marshland and wildlife habitat will be maintained in essentially the same condition as prior to acquisition. The various areas are shown on a drawing included hereto as Exhibit B.

The marsh areas will not be used in connection with the station except for the intake canal and intake and discharge pipes as described subsequently. The intake canal has been completely constructed. Neither the intake pipe nor the discharge pipe will be located in undisturbed marsh areas. Construction of the intake and discharge pipes will begin in the spring of 1973. Apart from the intake canal the only work in the marsh area was the construction, pursuant to the exchange agreement with the Bureau, of an earthen dike along the northern site property line in a marsh area which is north of the Navarre Tract. This dike separates the site from adjacent marsh areas and will permit water level control in this section of the site marsh area for better management as a wildfowl refuge area by the Bureau. This dike, which is not related to the Davis-Besse Station, was constructed in late summer of 1971 to avoid disturbance of nesting wildlife and was completed prior to the arrival of the major migratory flights to avoid disturbance of large gatherings of wildfowl in the fall of 1971. Activity in the marsh area during the second half of 1972 by Permittees will be some maintenance and repair of dikes in the area and the installation of water level control pumps, all in compliance with the exchange agreement. This work is not related to the construction or operation of the Davis-Besse Station. In advance of the final pump installations, the dikes were repaired in the spring of 1971 and temporary pumps were used to lower the marsh water level. This resulted in a decided improvement in the marsh vegetation in the summer of 1971.

2.2 Main Station Area

The main station area of about 56 acres is located almost entirely on the original upland portion of the site and has been graded up to a common elevation which ranges from 6 to 12 feet above the original grades. This graded area has installed within it, a storm drain system which collects all storm water and discharges it to a drainage ditch so that no storm run-off from the construction area enters the marsh. The ditch receiving the storm water drainage was formed when previous owners of the Navarre Tract dredged material to construct dikes along the property line and runs approximately 7,000 feet along the site boundary prior to entering the Toussaint River. The type of soils used for the grading, the manner in which it was placed, the storm drain system and the length of the on-site ditch assures that there is no possibility of any silt discharge to the river or lake from the construction area.

The fill material for grading of the station area has been taken from three other upland locations on the site. These three borrow pits total about 46 acres in surface area. Quarry operations and rock crushing have been completed in a portion of one borrow pit to provide a stockpile of granular backfill material for construction purposes. These areas are shown on Exhibits A and B. All exposed earth surfaces around these borrow pit areas and the cooling tower location drain into the borrow pits which prevents any silt or raw earth from being carried into the marsh areas or other waterways with storm water drainage.

The purpose of the quarry and rock crushing operation was to provide the granular backfill material placed in the excavated areas around the lower portions of the station structures. This crushed rock granular material was stockpiled adjacent to the quarry. Stockpiled material has largely been used. The small remaining portion of the stockpile will be placed by the end of 1972.

This quarry and the other borrow pit areas will fill with water upon completion of construction de-watering operations. The surrounding land areas will be landscaped which will result in attractive pond areas compatible with the wildlife refuge nature of the marsh.

The on-site quarry and crushing operations were located away from the marsh and have had no effect on the wildlife in these areas. This arrangement has also reduced considerably the truck delivery traffic to the plant site which would have placed a burden on the area roads and highways.

The site is underlain by glaciolocustrine and till deposits which overlie sedimentary bedrock. These soil deposits have a very low permeability and range in thickness from 15 to 20 feet. These geophysical features have produced an artesian groundwater condition in the upper layer of the bedrock which is generally independent of any surface water. Since the main station structures are founded on rock, and in the case of some structures they are 30 feet below the upper rock surface, the excavation required for these structures results in a water flow through the rock aquifer into the excavated area. This presently requires constant pumping from the excavated area to maintain a dry condition for construction. When all below-grade work in the excavated areas is complete, the pumping will be stopped and the rock aquifer will return to its normal level.

To prevent excessive water flow into the excavation and excessive lowering of the rock aquifer level off-site, the upper bedrock layer was grouted at the perimeter of the excavation area. This has limited the water flow to a small amount, but the zone of influence on the water table does extend off-site for a short distance, but has not in any manner affected the surface water conditions. This rock aquifer water is generally not suitable for human consumption or household use and the effect on local area wells has been minimal.

2.3 Main Station Structures

Construction work on the substructures of the station building began in September of 1970 upon receipt from the Commission of an exemption permitting certain below-grade work.

After receipt of the construction permit on March 24, 1971, slip forming of the shield building was commenced and reached full height of 220 feet above station grade on May 19, 1971. Erection of the steel containment vessel within the shield building commenced after the completion of the shield building and the complete bottom head and vertical sides are now in place. Erection of the hemispherical top will be completed within the confines of the shield building by the end of 1972.

The auxiliary building below grade is complete and certain areas above grade are now in place. The turbine-generator foundation is at full height, 39 feet above grade, and all base substructure work is complete in the turbine and office building area. Turbine building and office building structural steel was completed in June of 1972.

2.4 Cooling Tower

The cooling tower is located northwest of the main station area, as shown on Exhibit A. The tower will be natural draft with a hyperbolic reinforced concrete shell 493 feet high and 415 feet in diameter at the base. Circulation of water from the condenser through the tower will be at the rate of 480,000 gpm. The water will flow from the condenser to the tower through two underground pipes and will flow back to the pump house located at the turbine building through a single open channel. Blowdown from the cooling tower system will be discharged to the lake through pipes extending from the pump house to the discharge pipe referred to in subdivision 5 below.

Construction work commenced on the cooling tower in June of 1971 and construction of the basin slab at grade level, lintel support columns and lintel , to an elevation 40 feet above grade was completed by late fall of 1971. Construction of the shell above the lintel commenced in March of 1972 and will be complete by December of 1972.

Installation of the buried circulating water pipes from the condenser area to the cooling tower is complete.

2.5 Intake Canal, Intake and Discharge Pipes

Lake Erie water will be drawn into the station through submerged intake pipes extending about 3,000 feet into the lake in a northeasterly direction to a depth near the contour line 11 feet below mean low water datum level. The on-sote portion of the intake water system is a narrow intake canal occupying a 24-acre area in an isolated section of the large marsh and along the intake canal to the shoreline and continuing in an easterly direction into the lake for 1,300 feet.

The on-site intake canal was constructed in late 1970. In the spring of 1971, the canal banks and exposed earth were seeded to prevent erosion and to provide cover for wildlife.

A temporary 659-foot-long channel will be dredged beginning in August, 1972, from a deep water in the lake to the beach front at the open intake canal to permit barge delivery of the reactor vessel. This will involve about two acres of lake bed. The beach front will be temporarily opened for this delivery. Following delivery of the vessel which is scheduled in October, 1972, the channel area and the beach front will be restored to their original condition. The required permit from the Army Corps of Engineers pursuant to 33 U.S. Code 403 has been applied for.

2.6 Railroad Spur and Transmission Lines

Work has been completed on a railroad spur track from the Norfolk & Western Railroad main line to the station. This spur is approximately 7-1/2 miles in length and is contiguous to the main transmission corridor leaving the station site for two miles. It then continues contiguous with one of the main transmission line right-of-ways for the remainder of the distance.

This railroad location was chosen to coincide with the transmission routing to eliminate having an additional right-of-way route through the area even though a shorter route was available.

One of the three transmission lines leaving the station site will connect the Davis-Besse switchyard with that of the Bay Shore Station approximately 20 miles to the west of the Davis-Besse Station. A six-mile section of this line was completed in the summer of 1971 from a point about two miles from the station to provide a temporary connection with an existing 138 KV transmission line in order to supply temporary construction power for the Davis-Besse Construction. The continuation of this line to the Bay Shore Station follows an existing transmission line on cleared right-of-way. All towers for this portion have been errected and the conductors were installed in May of 1972.

The second transmission line extending westerly from the Davis-Besse Station to the Lemoyne Substation is now under construction. Tower bases have been installed on 7-1/2 miles of the 21-mile length of the line and 75% of the right-of-way has been cleared. Tower installation began in June, 1972. Off-site construction will not begin on the third transmission line extending easterly from the Davis-Besse switchyard to the Beaver Substation until early in 1973.

3.0 Investment in Station and Transmission Facilities

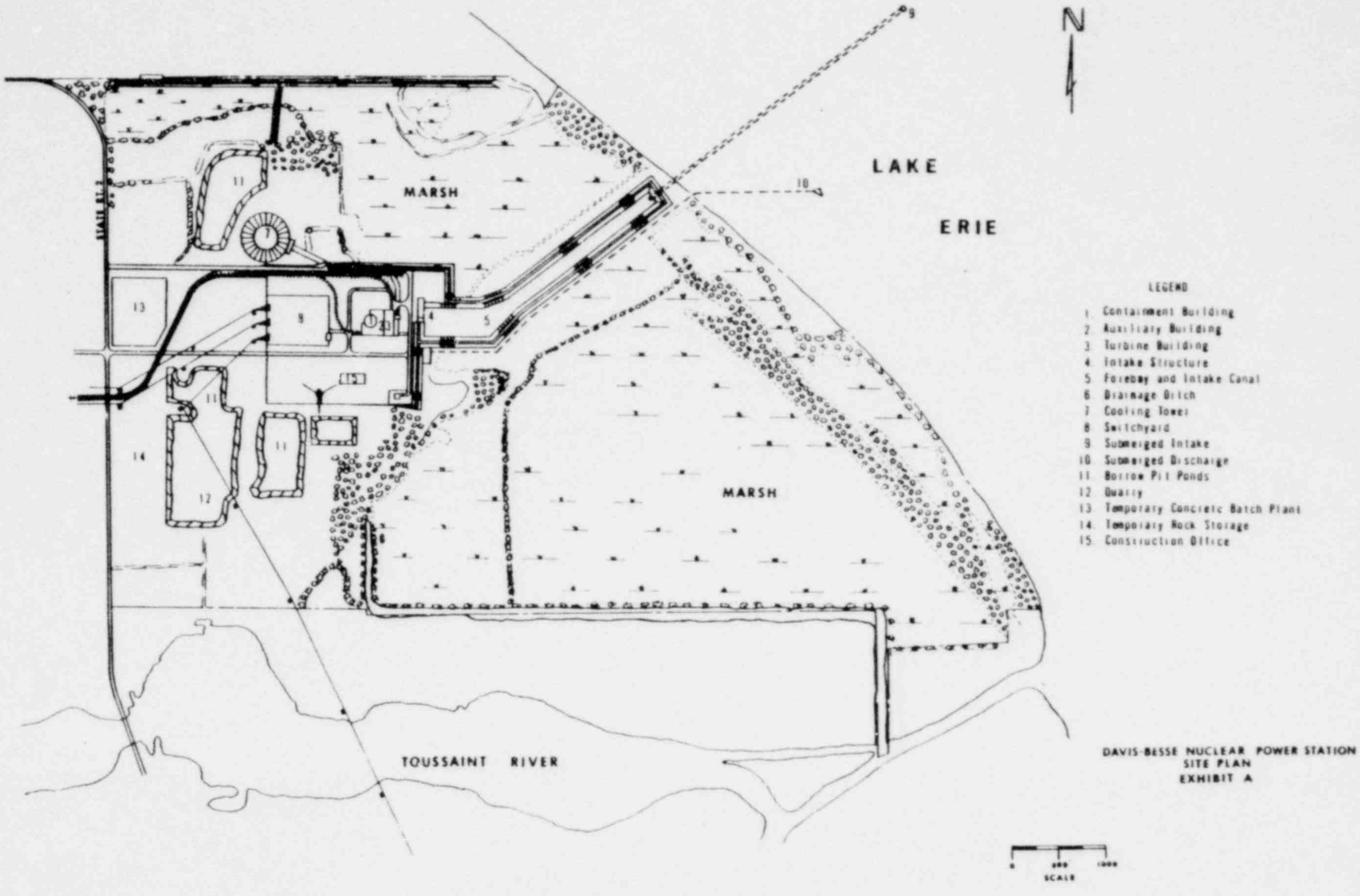
Construction of the Davis-Besse Station was 21% complete on May 31, 1972, and total investment in the station, switchyard and transmission facilities amounted to $97,249,000 as of this date.

Estimated investment for the remaining months of 1972 and annual investment to completion of this project are shown in the following tabulation.

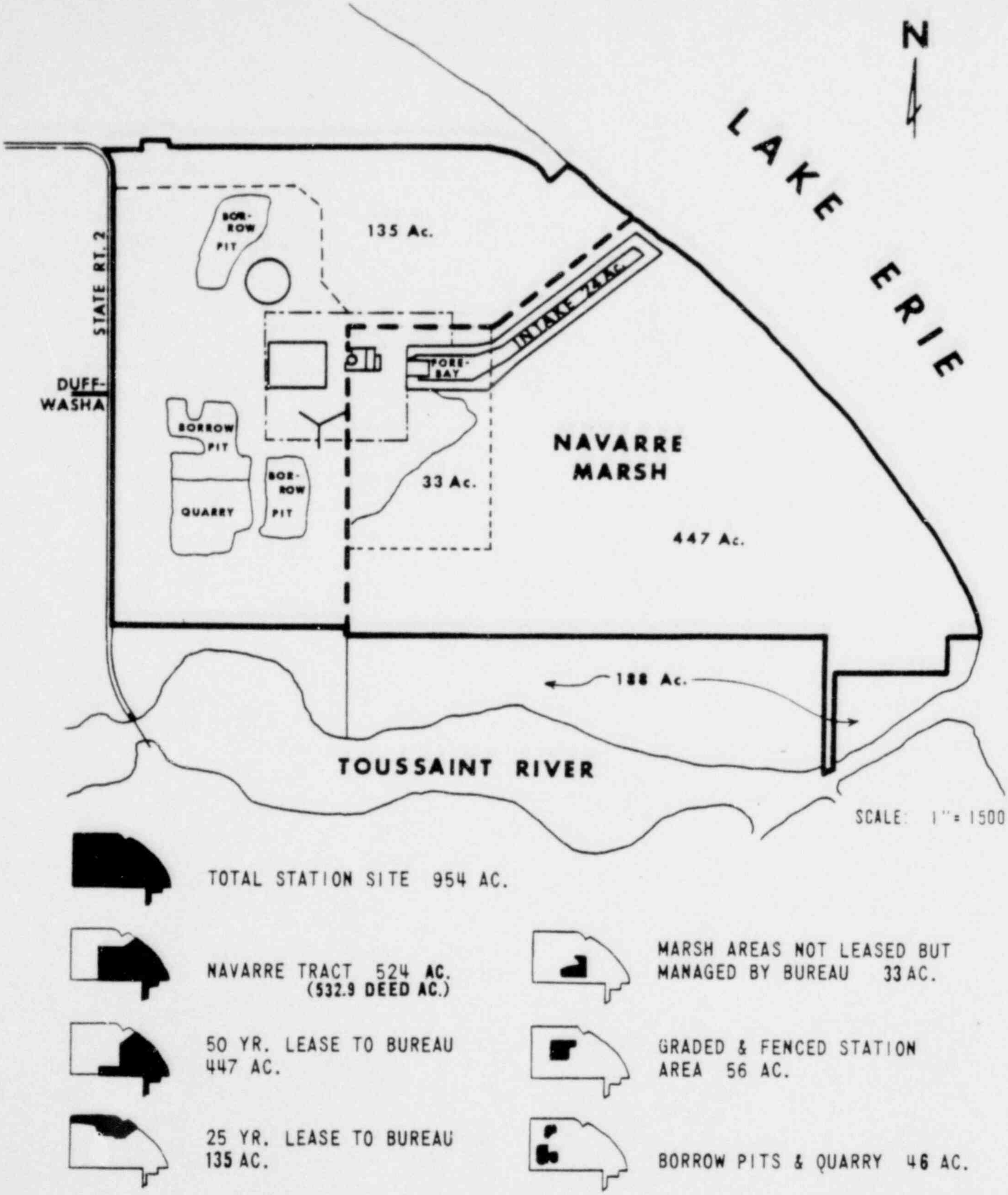
DAVIS-BESSE STATION INVESTMENT

Total Investment as of 5/31/72	$ 97,249,000
Additional 1972 - 5/31 to 12/31	51,894,000
Total as of 12/31/72	$149,143,000
Total 1973	115,983,000
Total 1974	50,584,000
Total 1975	5,299,000
Total Project Cost including Switchyard and Transmission	$321,009,000

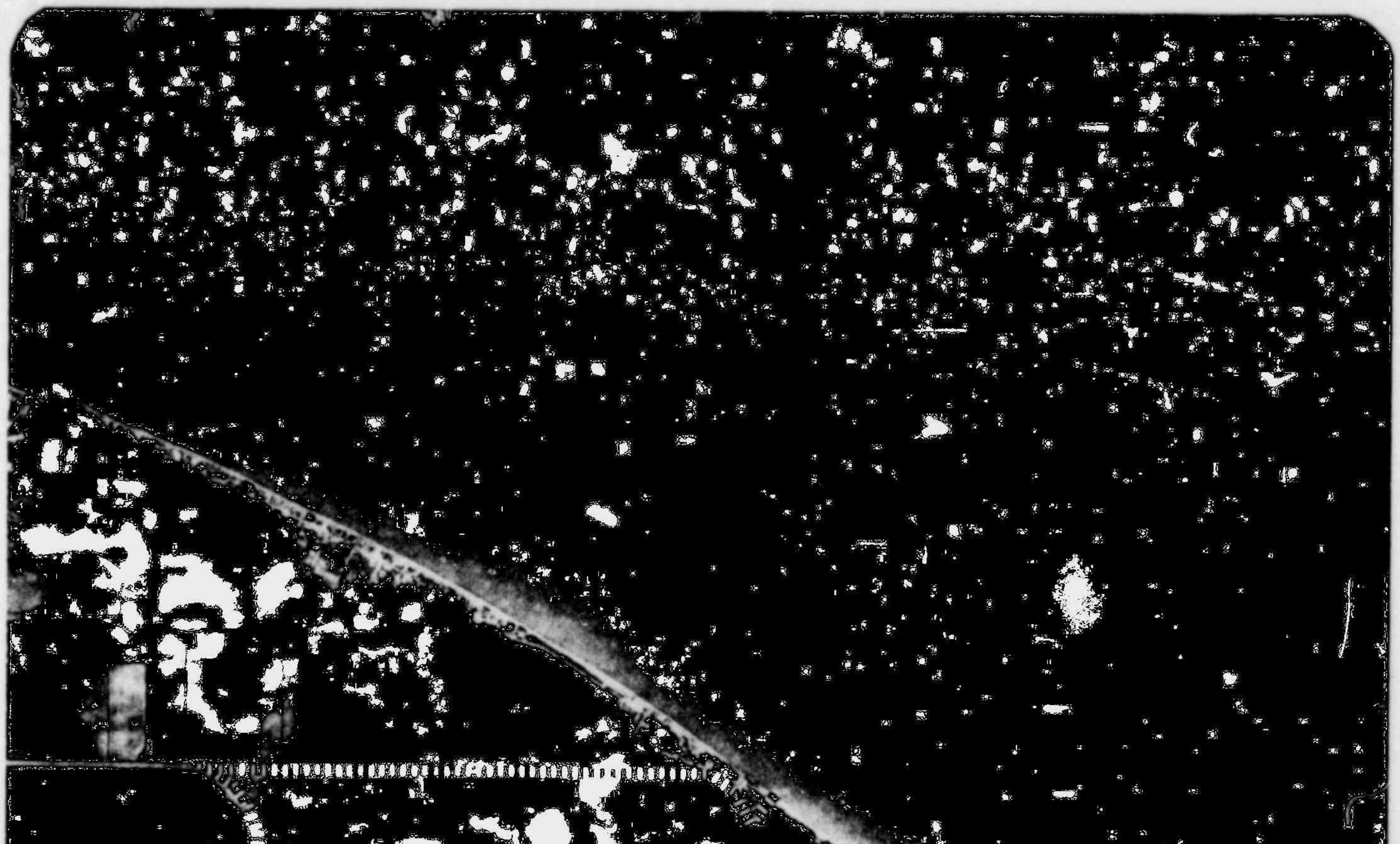
EXHIBITS A through G



DAVIS-BESSE NUCLEAR POWER STATION
SITE PLAN
EXHIBIT A

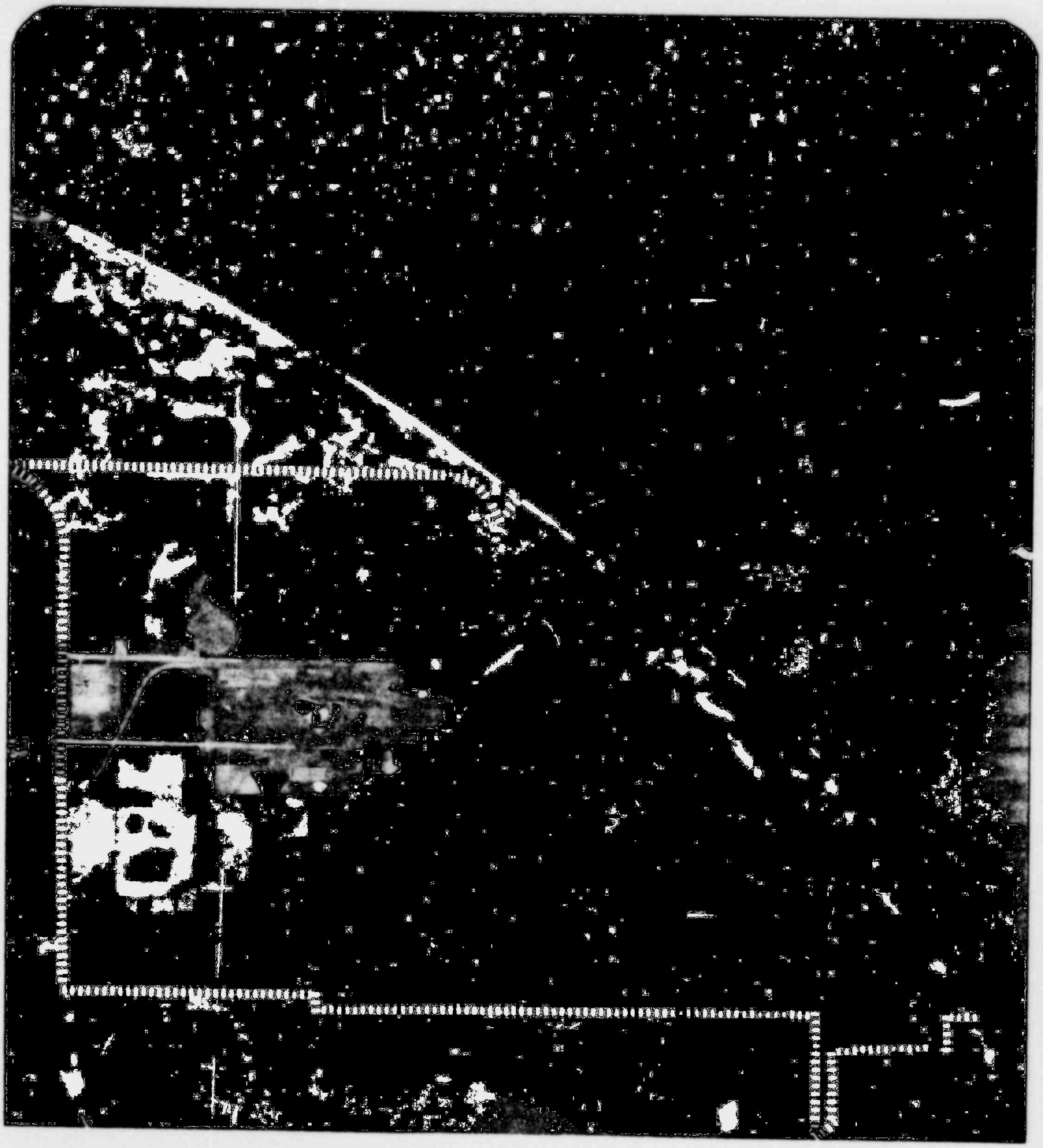


DAVIS-BESSE NUCLEAR POWER STATION
SITE AREAS
EXHIBIT B



IIIIII SITE BOUNDARY

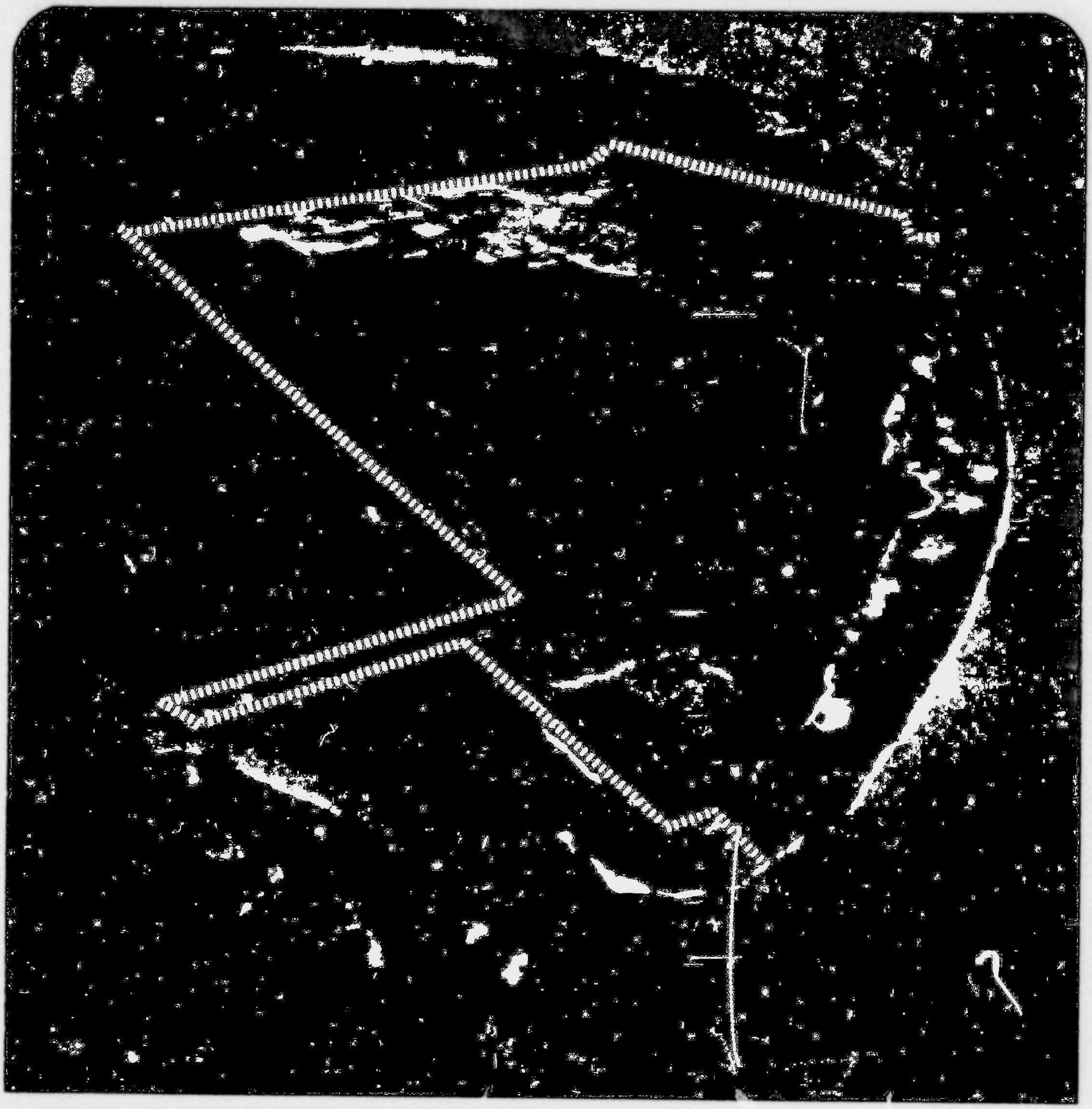
DAVIS-BESSE NUCLEAR POWER STATION
SITE PLAN
AERIAL PHOTOGRAPH
MAY 17, 1964
EXHIBIT C



▮▮▮▮▮▮ SITE BOUNDARY

POOR ORIGINAL

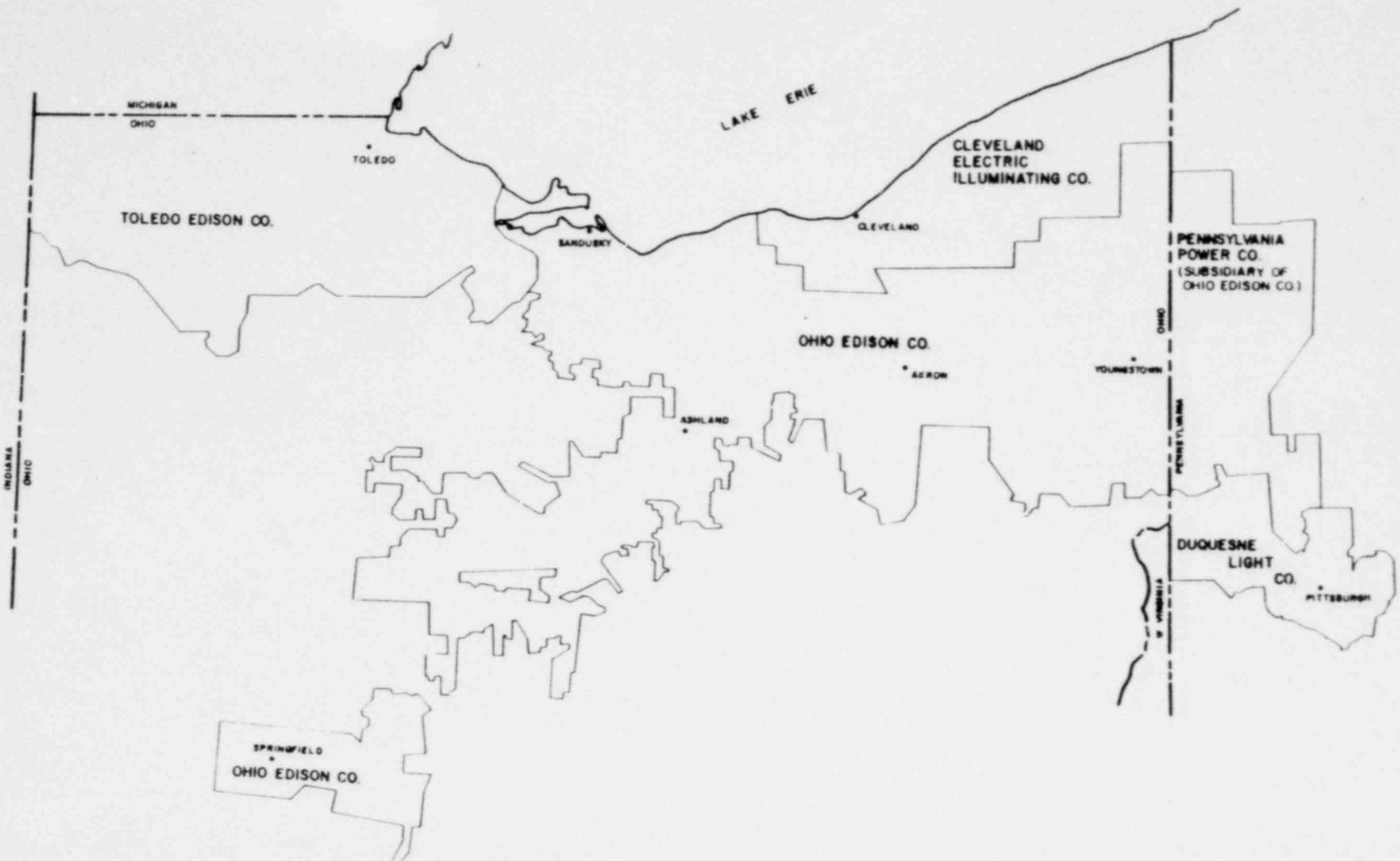
DAVIS-BESSE NUCLEAR POWER STATION
SITE PLAN
AERIAL PHOTOGRAPH
JULY 31, 1971
EXHIBIT D



▮▮▮▮▮▮ SITE BOUNDARY

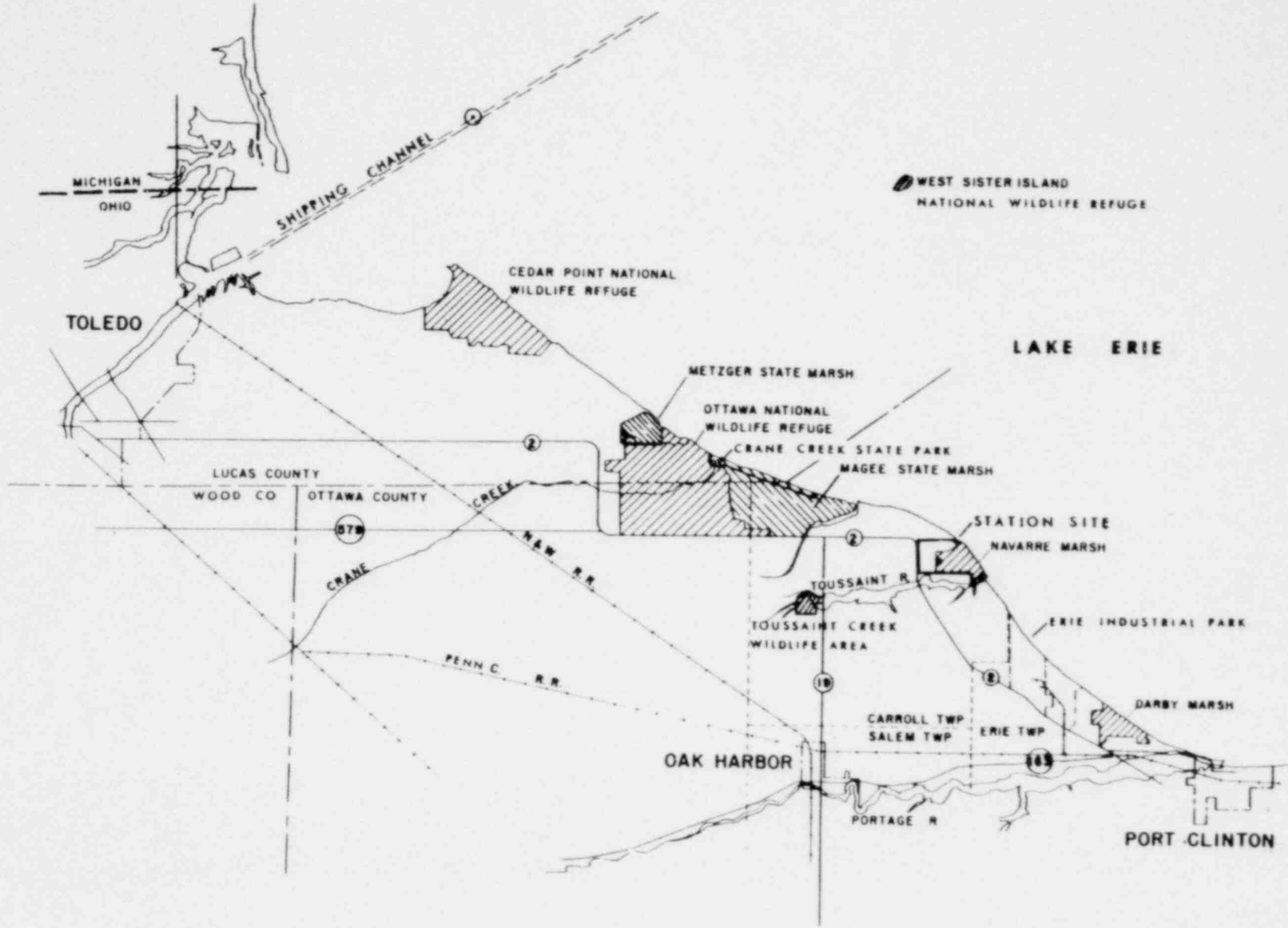
DAVIS-BESSE NUCLEAR POWER STATION

AERIAL PHOTOGRAPH
AUGUST 3, 1971
EXHIBIT E



AREA SERVED BY CAPCO

EXHIBIT F



DAVIS-BESSE NUCLEAR POWER STATION
SITE LOCATION PLAN
EXHIBIT G

BENEFITS FROM THE PROPOSED DAVIS-BESSE NUCLEAR POWER STATION

Direct Benefits

The primary benefit of the Davis-Besse Station will be the availability of 872 MW of reliable base-load electric generating capability to meet the consumer demand in Applicants' service area. This generating capability will also produce the least expensive generation that is available for new installation on Applicants' systems and will result in lowest cost to the consumer. Initial capacity of this station will be 872 MW and ultimately it will be increased to 906 MW corresponding to maximum nuclear steam supply system output.

Expected average annual generation is estimated to be 6,111,000,000 Kilowatt hours based on a capacity factor of 80% and the initial rated output of 872 MWC. The Davis-Besse station is jointly owned by the Cleveland Electric Illuminating Company and the Toledo Edison Company. The Cleveland Electric Illuminating Company, with 47.5% ownership of this unit, will receive 47.5% of the total generation, or 2,901,000,000 KWH per year average. The remaining 52.5%, or 3,210,000,000 KWH, will be the Toledo Edison Company's share of the generation.

Proportional Distribution of Electrical Energy by each company, and of the Total from the station in terms of percent is as follows:

Kilowatt Hours per year to	Total Generation	Toledo Edison	Cleveland Electric
Industrial	50.6	49.9	51.3
Commercial	18.9	15.2	23.1
Residential	24.6	25.6	23.4
Other	5.9	9.3	2.2
Total	100%	100%	100%

No steam from the Davis- Besse Station will be sold and there will be no other beneficial products.

Annual revenue totals and cents per KWH are given below for each of the owning companies and total energy generated:

	Total Generated	Toledo Edison	Cleveland Electric
Percent of Total	100%	52.5%	47.5%
Total KWH	6,111,000,000	3,210,000,000	2,901,000,000
Annual Revenue	108,321,000	57,789,000	50,532,000
Revenue per KWH	1.773¢	1.800¢	1.742¢

Annual revenue figures are based on 1975 revenue for each of the two companies.

Indirect Benefits

Indirect benefits that will be realized from the construction and operation of this station are as follows: Based on 1970 tax rates for the locality in which the Davis-Besse station is located, approximately $4,100,000 property tax will be paid by Applicants to the local government. Of this total, the Benton-Carroll-Salem School District will receive $3,450,000 while Carroll Township general fund will receive $287,000 and Ottawa County general fund, $385,000. The school district receives only $800,000 annually from local property tax at the present time.

The Applicants will also pay an annual excise tax of about $4,300,000 to the State of Ohio as a result of operation of the Davis-Besse plant. This is based on a tax rate of 4% of total revenue. In addition Federal income taxes will be paid at the rate of 52% of net income for the plant. The anticipated tax for 1975, the first year of operation, is estimated to be $9,200,000. Therefore, the total taxes paid to local, state, and federal governments from operation of the Davis-Besse plant is estimated at $17,600,000 per year.

Employment of construction labor during the construction period is adding materially to the economy of a large local area from which the constructionworkers are drawn. During the peak construction period the total labor force will be about 1200 and for short periods it may be as high as 1600. The average employment over the entire construction period will be 900. After completion of the station, it is expected that a total of 89 full-time employees will be used for its operation.

The preservation and improvement of all marsh areas on the site for wildlife and the addition to the National Wildlife Refuge System of over 500 acres of prime waterflow habitat represent other indirect benefits from the facility.

TABLE C

BENEFITS FROM THE PROPOSED FACILITY

Direct Benefits	Total	TECO	CEI
Expected Average Annual Generation in Kilowatt Hours x 1,000,000	6111	3210	2901
Capacity in Kilowatts x 1000	872	458	[illegible]4
Proportional Distribution of Electrical Energy-Expected Annual Delivery in Kilowatt Hours: x 1,000,000			
Industrial	3090	1602	1488
Commercial	1158	488	670
Residential	1500	822	678
Other	362	298	65
Expected Average Annual Btu (in millions) of Steam Sold from the Facility			
Expected Average Annual Delivery of Other Beneficial Products (appropriate physical units)	None		

Revenues from Delivered Benefits (Annual)	Total	TECO	CEI
Electrical Energy Generated . . . . Dollars x 1000	$108,321	$57,789	$50,532
Steam Sold	None		
Other Products	None		

Indirect Benefits (as appropriate)	
Taxes (Local, State, Federal)	$17,600,000
Research	None
Regional Product	None Claimed
Environmental Enhancement	
Recreation	None
Navigation	None
Air Quality:	
SO_2	Zero
NO_x	Zerc
Particulates	Zero
Others.	Zero
Employment (During Construction, 900 Ave., 1200 Peak) for Operation	89 Full time
Education	None
Others	Improved control of marsh water level and addition of 500 acres of prime waterfowl habitat.

EVALUATION OF PLANT DESIGNS

Alternatives

The May, 1972, AEC guidelines specify three major alternatives for which information is to be submitted: (a) Alternative A, Plant As Is, (b) Alternative B, Minimum Environmental Cost Design, and (c) Alternative C, Plant License Request Design. Tables are also supplied for cooling, radwaste, chemical, and other subalternatives.

Alternative A is the existing plant design for the Davis-Besse Station which includes the natural draft cooling tower operating closed-cycle with blowdown delivered to Lake Erie and diluted with lake water to limit the temperature of the discharge water to 20 F above ambient lake temperatures, the liquid and gaseous radioactive waste treatment systems, the chemical effluent systems, and the water intake system as described in the Environmental Report Supplement[1].

Alternative B consists of the existing facility design with the addition of supplementary cooling of the cooling tower blowdown and modified water intake system to minimize entrainment and impingement impacts to aquatic biota. Altogether seven cooling subalternatives, in addition to the present natural draft cooling tower design (A), were considered: (B) Once-through cooling using open intake and discharge canals across part of the marsh with tempering water flow to limit the temperature of the discharge to 12 F above lake temperature, (C) Mechanical draft cooling towers operating closed cycle with blowdown delivered to Lake Erie and diluted with lake waters to limit the temperature of the discharge to 20 F above ambient lake temperature, (C) spray canal with powered spray modules operating closed cycle with blowdown diluted

(20 F limit) and delivered to the lake, (E) Cooling lake operating closed cycle with blowdown diluted (20 F limit) and delivered to the lake, (F) The system as is with a small mechanical draft cooling tower to cool the natural draft tower blowdown before discharge to Lake Erie, (G) The plant as is with a small basin equipped with spray modules to cool the natural draft tower blowdown, and (H) The system as is with the borrow pits (ponds) used to cool the natural draft tower blowdown. In selecting the minimum overall impact design, once-through cooling was eliminated on the basis of its impact on the biota in the body of water and the marshlands and the natural draft cooling tower was considered superior to mechanical draft cooling towers, a spray canal, or a cooling lake on the basis of lower environmental impact from either noise generation, fog, ice and drift effects, or land needs. Finally the impact of the natural draft tower could be further minimized by cooling the blowdown under Subalternative G. This supplementary cooling design was selected on the basis of its low thermal discharge to Lake Erie, on its minimal noise, fog, or drift impact on the terrestrial environment, and on its lack of effect on migratory waterfowl. The presently designed radwaste treatment systems for the Davis-Besse plant are expected to meet the AEC's proposed Appendix I (dated 6/9/71) to 10CFR50. Therefore, no radwaste system sub-alternatives were considered. The present chemical effluent system discharges essentially only dissolved solids that occur naturally in the lake water at about twice the ambient concentration in relatively low volume. Therefore, no chemical effluent system subalternatives were considered. Two water intake system subalternatives besides the present design, which produces an intake velocity of 1.5 ft/sec, were considered; (1) a structure with vertical downflow slots (maximum intake velocity of 0.5 ft/sec) and (2) this same

structure in conjunction with an air screen system. The latter of these two designs was selected for minimal environmental impact on the basis of the air screen which should help divert aquatic species from the intake structure.

To summarize, the minimum environmental impact design consists of the natural draft cooling tower operating closed cycle with its blowdown cooled with a small spray basin before discharge, the existing radwaste and chemical effluent systems, and the vertical downflow water intake structure equipped with an air screen device.

Alternative C consists of the plant as is in all respects except for replacement of the present water intake system with the vertical downflow intake structure equipped with an air screen. This is a reasonable balance between the minimum environmental impact design and economic costs.

To facilitate the discussion of the Alternatives and Subalternatives a simple identification system has been used in this report. All subalternative systems are discussed under the Alternative B category since these results are used in the process of selecting the combination that defines that alternative. The identification system used is as follows:

Cooling System Subalternatives	Radwaste System Subalternatives	Chemical Effluent System Subalternatives	Intake System Subalternatives
A-Natural Draft Tower	A-Present Design	A-Present System	A-Present Structure
B-Once-Through			B-Vertical Downflow Structure
C-Mechanical Draft Towers			C-Vertical Downflow Structure with Air Screen
D-Spray Canal			
E-Cooling Lake			
F-As Is With Supplemental Mech. Draft Tower			
G-As Is With Supplemental Spray Basin			
H-As Is With Supplemental Borrow Pits (Ponds)			

To illustrate, a design identified as GAAC would refer to Cooling System Subalternative G (As Is With Supplemental Spray Basin); Radwaste System Subalternative A (Present Design); Chemical Effluent System Subalternative A (Present Design); and Intake System Subalternative C (Vertical Downflow Structure With Air Screen).

Generating Costs

The values obtained for Generating Cost-Present Worth (GC_p) and Generating Cost-Annualized (GC_a) were computed using the procedures outlined in the "Guide For Submission of Information on Costs and Benefits of Environmentally Related Alternative Designs for Classes of Completed and Partially Completed Nuclear Facilities", issued by the U. S. Atomic Energy Commission, Division of Radiological and Environmental Protection, May, 1972. The computed values are summarized in Table IV

Values used in the calculations for the various plant design alternatives are given in Table V. Cost figures are further broken down in Table B-1 in the Appendix B.

It should be noted that cooling subalternatives B, C, and D will cause a 12-month delay in plant operations, while subalternative E will result in an 18-month delay. These factors are considered in the calculations by using P_t as a replacement cost for the appropriate time period and setting O_t and F_t to zero for that same period. O_t and F_t are then set to their first year values, while P_t becomes zero. The discount factor is then computed in the normal manner with O_t and F_t changing as shown in Table V.

Not included in Table V are the figures for the loss or gain in generating capacity for the various subalternatives. These are as follows: Subalternative A-Base value, B-25,000 KW gain, C-4,400 KW loss, D-9,100 KW loss, E-same as base value, F-250KW loss, G-400 KW loss, and H-same as base value.

TABLE IV

VALUES OF GENERATING COST-PRESENT WORTH (GC_p) AND GENERATING COST ANNUALIZED (GC_a) FOR VARIOUS COOLING AND INTAKE SUBALTERNATIVES

Cooling Subalternative	GC_p \$ x 1000	GC_a \$ x 1000	Intake Subalternatives	GC_p \$ x 1000	GC_a \$ x 1000
A (Plant As Is)	457,394	45,511	AAAA (Plant As Is)	457,394	45,511
			AAAB (Plant As Is With Low Velocity Intake)[a]	457,574	45,529
			AAAC (Plant As Is With Air Screen)[b]	457,799	45,551
B (Once-Through)	519,396	51,680			
C (Mechanical Draft)	517,032	51,445			
D (Spray Mod)	516,664	51,408			
E (Large Pond)	549,765	54,702			
F (As Is With Mechanical Draft Supplementary Cooling)	458,353	45,606			
G (As Is With Spray Mod Supplementary Cooling)	458,447	45,615	GAAC (As is With Spray Mod Supplementary Cooling And Air Screens)[c]	458,852	45,656
H (As Is With Small Pond Supplementary Cooling)	458,176	45,589			

(a) Intake Subalternative B adds \$180,000 above base cost. Intake Subalternative C adds \$405,000 above base cost.

(b) Plant Operating License Request

(c) Plant With Minimal Environmental Impact

TABLE V

VALUES USED FOR COMPUTING GENERATING COSTS

ITEM	SYMBOL	UNITS	VALUES
Total Outlay Required to Bring Facility To Operation	C_I	\$ x 1000	A- 309,074 (base) [(a),(b)]; B- 319,930; C- 317,306; D- 316,709; E- 324,844; F- 309,826; G- 309,774; H- 309,704
Annual Operating Costs	O_t	\$ x 10^6	t = 1, 2.77 [(a),(c)]; t = 2 to 30, 2.52; B-\$20,000; C-\$50,000; D-\$75,000; E-\$60,000; F-\$20,000; G-\$30,000; H-\$10,000
Annual Fuel Cost of Plant	F_t	\$ x 10^6	t = 1, 14.6 [(a)]; t = 2, 11.8; t = 3, 11.2; t = 4, 11.0; t = 5, 11.0; t = 6, 11.15; t = 7 to 30, Add \$150,000 per year for escalation costs
Make Up Power Required in Year t	P_t	\$ x 1000	1,482 per month demand charge [(a)]; 4,400 per month energy charge; 5,882 per month total [(d)]
Discount Factor	ν		$\nu = (1 + i)^{-1}$ where i = 9.25% [(a)]; $\nu = 0.91533$
Generating Cost Present Worth	GC_p	\$	$GC_p = C_I + \sum_{t=1}^{30} \nu^t (O_t + F_t) + \sum_{t=1}^{30} P_t \nu^t$ Where values are as defined above (See Table IV for values for GC_p)
Generating Cost Annualized	GC_a	\$	$GC_a = GC_p \times \frac{i(1+i)^{30}}{(1+i)^{30} - 1} = GC_p\ (0.0995)$ See Table IV for values of GC_a.

(a) Values supplied by Toledo Edison

(b) Letters refer to cooling subalternatives, values include cost difference added to base

(c) Base costs--additional annual operating costs for various subalternatives must be added as shown.

(d) If delay occurs in plant operations (cooling subalternatives B,C,D,E), P_t is used as replacement costs and O_t is used for the first full year of operations.

Environmental Effects

1. NATURAL SURFACE WATER BODY: LAKE ERIE

1.1 Cooling Water Intake Structure

1.1.1 Fish

Alternative A. Plant As Is

Environmental Cost: 0.00053 percent of the fish in Lake Erie per yr.

Data for fish affected by the cooling water make up intake structure are very difficult to obtain. Some larger fish, predominantly the old or infirm, will be drawn into the intake crib and destroyed by the traveling screens. However, the greatest majority of the larger fish will be able to avoid the intake because of the low velocity (1.5 fps) of the water. To estimate conservatively how many fish will be lost due to condenser passage at the Davis-Besse Station, the following technique was used. First, it was assumed that about 1 percent of the larger fish (greater than 3/8-inch in diameter) in the cooling water flow were killed on the traveling screens. The makeup water flow (93.6 cfs) is 0.053 percent of the average lake flow (176,000 cfs). One percent of this 0.053 percent gives about 0.00053 percent of the larger fish in Lake Erie destroyed by the traveling screens.

Alternative B. Minimum Environmental Cost Design

Subalternatives CAAA, DAAA, EAAA, FAAA, GAAA, HAAA

Environmental Cost: 0.00053 percent of the fish in Lake Erie per year

The technique used in Alternative A was applied here, and the cost would be the same.

Subalternatives AAAB and AAAC

Environmental Cost: 0.00053 percent of the fish in Lake Erie per yr.

Fewer fish would be destroyed in these alternatives, because of the lower velocity of the intake structure (0.5 fps). The low velocity of this structure would allow essentially all larger fish to avoid the intake as well as many smaller ones. The air screen may discourage fish that are attracted by the intake structure but the degree cannot be quantified.

Subalternative BAAA (Once-Through Cooling)

Environmental Cost: 0.013 percent of fish

The greater volume of water required for once-through cooling increases the number of fish exposed to the intake structures. Assuming the velocity of water to remain 1.5 fps, 1.3 percent of the average water flow passes into the intake structure. Method used same as Alternative A.

Alternative C. Plant License Request Design

Subalternative C - Natural Draft Tower - Low Velocity Intake

Environmental Cost - 0.00053 percent of the fish in Lake Erie per year

Same as Alternative B.

1.2 Passage Through the Condenser and Retention in Closed-Cycle Cooling System

1.2.1 Primary Producers and Consumers

Alternative A. Plant As Is

Environmental Cost: 380 lb per year

The average phytoplankton density in Lake Erie at the Davis-Besse Station is approximately 10,000 individuals per ml. or 3.8×10^7 individuals per gallon. Assuming each phytoplankter weighs about 10^{-10} gm, the phytoplankton weigh 8.4×10^{-6} lb per gallon (3.8×10^7 cells/gal 10^{10} gm $\div$ 454) Calculations on individual blue-green algal cells resulted in an average cell weight of 10^{-11} gm. Because of colonial and larger unicellular organisms, the 10^{-10} gm used here is considered a conservative estimate. In a closed-cycle cooling system entrainment is assumed to produce 100 percent mortality in phytoplankton.* A maximum of 2.2×10^{10} gallons of makeup water are used by the station per year (42,000 gpm x 5.26×10^5 min/yr). This volume contains 1.85×10^5 lb of phytoplankton (2.2×10^{10} gal/yr x 8.4×10^{-6} lb/gal). Converting to pounds of fish (using a conversion factor of 1/1000)(2) gives 1.85×10^2 lb fish per year. Zooplankton densities vary about 5 fold during the year in the area of the Davis-Besse Station. To provide a conservative estimate of loss the average density for May (the month of highest concentrations) will be used. This is approximately 105.5 organisms per liter or 398.7 organisms per gallon. Zooplankton are considered to weight 10^{-5} gm per organism of dry weight for these calculations. Assuming that all zooplankton would be lost to entrainment effects of closed-cycle cooling, about 1.95×10^5 lb per year of zooplankton would be lost (398.7 cells/gal x 2.2×10^{10} gal/yr x 10^{-5} gm/cell $\div$ 454 gm/lb). In terms of pounds of fish, this would be 1.95×10^2 lb per year.

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* This is caused by the combined effects of mechanical, thermal, and chemical damage and the continuous recirculation of the water which occurs in closed cycle operation.

Thus, a total of 3.8×10^2 lb per year (converted to fish weight) would be affected.

Alternative B. Minimum Environmental Cost Design

Subalternative CAAA (Mech. Draft Towers),

DAAA (Spray Ponds), EAAA (Cooling Lake), FAAA (Nat. Draft w/ Mech. Draft Towers) GAAA (Nat. Draft Tower w/Spray Pond), HAAA (Nat. Draft Tower w/Pond)

Environmental Cost: 380 lb per year

Same as Alternative A.

Subalternative BAAA (Once-through Cooling)

Environmental Cost: 920 lb per year

Phytoplankton are sensitive to two aspects of condenser passage-temperature increase and biocide application. Temperatures above 97 F are harmful to phytoplankton(3). The harmful effects may include the killing of some of the less thermal tolerant individuals or reduction of photosynthesis, growth, and reproduction in the more thermal-resistant individuals. This temperature (97 F) is reached or exceeded in the condenser cooling water (ΔT = 18 F) when the lake temperature is 79 F or higher. Lake Erie water temperatures in the Toledo-Port Clinton Area would not be expected to exceed this temperature except on a few days in July or August. Maximum temperature of record is 82 F and average peak temperatures for June, July, and August are only 77 F. While some thermal effects would be expected during these extremely high periods the effects of biocide application is so predominant as to make the thermal effects insignificant.

While plans for the exact periods of chlorination have not been formalized for this subalternative, operating practice with

with other similar size nuclear power stations indicate 1-1/2 hours per day to be adequate for prevention of slime buildup. This figure will be used for calculation of entrainment effects. With respect to a 24-hour operating schedule, 1-1/2 hours of chlorination represents 6.2 percent of the time. During this period of each day all planktonic organisms would be killed during passage through the cooling system. About 5.4×10^{11} gallons of water would flow through the station a year under this cooling alternative (1.027×10^{6} gpm x 5.26×10^{5} min/yr). This volume contains 4.5×10^{6} lb of phytoplankton (5.4×10^{11} gal per yr x 8.4×10^{-6} lb per gal). Approximately 6.2 percent or 2.81×10^{6} lb of the phytoplankton passing through the condensers is damaged each year. Converting to pounds of fish (using a conversion factor of 1/1000) gives 281 lb fish per year.

Zooplankton are generally larger than phytoplankton and thus more susceptible to mechanical damage. Data from the Commonwealth Edison-Waukegan Station indicate that a maximum of 7.4 percent of zooplankton are destroyed by mechanical damage[(4)]. To be conservative this 7.4 percent added to the 6.2 percent killed as a result of chlorination result in a loss of 13.6 percent of the zooplankton passing through the condensers in once-through cooling. This means that 4.7×10^{6} lb per yr of zooplankton are destroyed by entrainment (5.40×10^{11} gal per yr x 8.78×10^{-6} lb per gal). Converted to fish weight, it represents 639 lb of fish.

Thus, a total of 920 lb per year (converted to fish weight) would be affected.

Alternative C. Plant License Request Design

Environmental Cost: 380 lb per yr

Same as Alternative A.

1.2.2 Fish

Alternative A. Plant As Is

Environmental Cost: 0.0000053 percent of fish in Lake Erie per year

The amount of eggs and fish larvae and fry (smaller than 3/8-inch diameter) destroyed by passage through the condenser was estimated. It is assumed that mortality is 100% with closed-cycle cooling. Since data on the absolute density of these life stages in Lake Erie are not known, the amount destroyed is expressed as a fraction of the total population in the pool. Assuming that the population in Lake Erie is in equilibrium and the sex ratio of fish is 1:1, each adult female must leave two offspring, one male and one female, to maintain that equilibrium. Female fish lay large numbers of eggs (less than 2,000 eggs for nest-building species to as many as a million eggs for indiscriminant spawners)[5]. If the average female fish in Lake Erie lays 20,000 eggs (a conservative estimate), two of those eggs or 0.01 percent must survive to adulthood. About 0.053 percent of the average lake flow is drawn for makeup water. If the eggs or juveniles are randomly distributed in the lake, about 0.0000053 percent of those eggs or juveniles which would survive to adulthood could be destroyed. In terms of the millions of eggs, larvae, and fry in Lake Erie, this essentially is a zero impact.

Alternative B. Minimum Impact Design

Subalternatives CAAA, DAAA, EAAA, FAAA, GAAA, HAAA

Environmental Cost: 0.0000053 percent

Using the same technique as Alternative A, the fraction of fish destroyed by condenser passage for these cooling subalternatives is about 0.0000053 percent.

Subalternative BAAA (Once-through Cooling)

Environmental Cost: 0.00013 percent of fish in Lake Erie per year

Conservatively assuming 100 percent mortality from entrainment in once-through cooling, about 1.3 percent of the average lake flow is drawn for cooling and dilution water.

Alternative C. Plant Operating License Request

Environmental Cost: 0.0000053 percent

Same as Alternative A

1.3 Discharge Area and Thermal Plume

1.3.1 Water Quality, Physical

Alternative A. Plant As Is

Environmental Cost: See Table 1.3-1 (Cooling Subalternative A)

The values used to assess this impact are tabulated in Table 1.3-1 along with values that are needed to estimate the impacts considered under Items 1.3.3 and 1.3.5.

Under this alternative, the only heat of any significance discharged into Lake Erie will be that contained in the cooling tower blowdown. Since the blowdown flow is relatively constant (average flow of 9,225 gpm with a range of 7,500 to 10,400 gpm), the amount of heat discharged is dependent on the temperature difference between the lake water and the cooling tower blowdown. The cooling tower blowdown which is taken from the cold water side of the system is entirely dependent on the wet bulb temperature of the air and so the amount of heat discharged to the lake from station operation is related to the difference between the atmospheric wet bulb temperature and lake temperature. The greater this temperature difference, the greater the amount of heat discharged. During certain short periods in early fall and winter, this temperature difference can be negative, which will result in lake heat being discharged to the atmosphere from the makeup-blowdown system. The maximum temperature difference between the lake and the discharge from the collecting basin will be limited to 20° by supplying ambient water, when necessary, from the intake canal directly to the collecting basin to dilute the tower blowdown and, thus, lower the temperature of the discharge. With this diluting water added to the blowdown, the discharge flow to Lake Erie can be as high as 13,800 gpm under normal conditions. This latter flow with the maximum

TABLE 1.3-1. HEAT DISCHARGED TO LAKE ERIE PLUS VOLUMES AND SURFACE AREAS WITHIN SELECTED ISOTHERMS OF TEMPERATURE RISE

Cooling Subalternative[a]		Heat Discharged 10^6 BTU/hr	Volume,[b] acre-ft			Surface Area,[b] acres		
			Within 5F	Within 3F	Within 2F	Within 5F	Within 3F	Within 2F
A	ND	138	0.22	0.91	2.25	0.11	0.34	0.70
B	OT	6210	174	1,602	16,493	37	340	1,750
C	MD	138	0.22	0.91	2.25	0.11	0.34	0.70
D	SP	138	0.22	0.91	2.25	0.11	0.34	0.70
E	CL	138	0.22	0.91	2.25	0.11	0.34	0.70
F	MDB	69	0.11	0.44	1.38	0.06	0.17	0.44
G	SBB	69	0.11	0.44	1.38	0.06	0.17	0.44
H	BPB	110	0.20	0.70	2.70	0.09	0.27	0.69

(a) ND = Natural Draft Tower with blowdown to Lake Erie and dilution to limit discharge temperature to 20°F above lake.
OT = Once-Through Cooling and tempering water flow to limit temperature of discharge to 12°F above lake.
MD = Mechanical Draft Tower with blowdown to Lake Erie and dulution for 20°F temperature limit.
SP = Spread Spray Pond with Powered Spray Modules, blowdown to Lake Erie and dilution for 20°F temperature limit.
CL = Cooling Lake (1360 acre) with blowdown to Lake Erie and dilution for 20°F temperature limit.
MDB = Natural Draft Tower with Mechanical Draft Tower to reduce temperature of blowdown. Dilution to 10°F limit.
BPB = Natural Draft Tower with Borrow Pits (Ponds) to reduce temperature of blowdown. Dilution to 16°F limit.
SBB = Natural Draft Tower with Small Spray Basin to reduce temperature of blowdown. Dilution to 10°F limit.

(b) Volumes and areas based on a flow of 13,800 gpm and a jet discharge velocity of approximately 4.6 fps for Subalternatives A, C, D, E, F, G, and H. Flow for Subalternative B - 1,027,000 gpm with a discharge velocity of 6.7 fps.

20° F rise will result in the maximum quantity of heat discharged to Lake Erie which will be 138×10^6 BTU/hour.

The slot-type discharge point at the terminus of the discharge pipe in the lake is designed to provide a relatively high velocity discharge to the effluent entering the lake and induce rapid jet entrainment mixing of the discharge with ambient lake water. The rate of mixing and resulting isotherms in the lake have been calculated by Dr. D. W. Pritchard[(6)]. Under the conditions of the maximum heat discharge of 138×10^6 BTU/hour, the resulting water volume and surface areas within differential temperature isotherms of 2°, 3°, and 5°F are given in Table 1.3-1.

The resulting area of the lake that will see temperatures of 2°F or higher than ambient lake temperatures resulting from this discharge is 0.70 acres for the maximum conditions of heat discharged. This area extends for 377 feet from the discharge orifice, which in contrast is 5,000 feet away from the mouth of the Toussaint River and 16,250 feet from Toussaint Reef, which is the closest offshore reef of a group of reefs which are of concern as fish spawning area, particularly pickerel. In contrast with the 0.70 acre size of the area having a 2°F or higher temperature, the 5°F or higher area envelops only 0.11 acres and extends only 152 feet from the discharge orifice. These relatively small areas are not expected to have adverse effects on Lake Erie.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: See Table 1.3-1 (Cooling Subalternative G)

Table 1.3-1 lists the estimated heat inputs, volumes and surface area for all the various subalternatives evaluated for Alternative B. The procedures employed were as described above for Alternative A and these were repeated for the various subalternatives: B--Once-through cooling; C--Mechanical Draft Towers; D-Spray Pond Cooling; E--Cooling Lake; F--Natural Draft Tower with Mechanical Draft Tower; G--Natural Draft Tower with Small Spray Basin); and H--Natural Draft Tower with Borrow Pits (ponds). The value chosen to represent the environmental cost for Alternative B, Minimum Environmental Cost Design, is that for Subalternative G. The quantity of heat to be introduced is negligible when compared to the heat being dissipated with Subalternative B. The volume and areas within the isotherms are all small for the closed-cycle subalternatives (A,C,D, and E). Additional cooling of the blowdown water results in further reduction of the water impact and is identical for Subalternatives F and G, but not so important for Subalternative H. The selection of the natural-draft tower with a small spray basin to reduce the temperature of blowdown to represent Alternative B is based on (1) less thermal impact than Subalternatives A, B, C, D, E, and H, (2) less potential for ground fog, icing, and salt deposit than Subalternatives C, D, E, and F, (3) less terrestrial and avian ecology impact than Subalternative E or H.

Alternative C. Plant License Request Design

Environmental Cost: See Table 1.3-1 (Cooling Subalternative)

The licensing is being requested for Alternative A, the plant as is, a natural-draft tower with blowdown to Lake Erie and dilution to limit discharge temperature to 20 F above the lake temperature. The environmental costs for this system are shown in Table 1.3-1 and are not significantly higher than the environmental cost for Alternative B, Minimum Environmental Cost Design.

1.3.2 Oxygen Availability

All Alternatives

Environmental Cost: 0 acre-ft

Dissolved oxygen in Lake Erie near the site averages 10 pp[(1)*]. Since the system water in all of the cooling alternatives is in intimate contact with air the outlet water will contain an oxygen content which is essentially at the saturation level corresponding to the cold water outlet temperature. The oxygen content for the highest outlet temperature during hot weather periods reaches a low of 7 ppm and is correspondingly higher during the colder months. Dissolved oxygen reaches 5 ppm in freshwater (100 percent saturation) at about 130°F. None of the alternatives will discharge water at this temperature.

* Average of samples from November, 1968, to October, 1970, taken 50 to 100 feet from shore.

1.3.3 Aquatic Biota

Alternative A. Plant As Is

Environmental Cost: 0.034 lb of commercial fish
0.007 lb of sport fish

While both planktonic organisms and fish may be subject to damage in the thermal plume, the harmful temperatures (usually >94 F) in the Davis-Besse Station plume influence such a small volume of water that no adverse effects are expected on the planktonic organisms.

Commercially important fish species in Lake Erie include walleye, white bass, yellow perch, sheepshead, carp, goldfish, channel catfish, and suckers. The total commercial catch for 1969 in Lake Erie was 59 million pounds. The western basin provided 75 percent of this catch. The 1970 sport fish catch for Lake Erie was 12.975 million pounds. Yellow perch comprised the great majority of the fish taken. Spawning areas for fish include several offshore reefs near the site. The Toussaint and Round Point Reefs are the closest, about 3 miles offshore.

The effects on the fish of the heated water discharge to Lake Erie by the natural draft alternative are small. The average maximum summer water temperature near Davis-Besse is about 77 F. The upper tolerance limit for yellow perch is about 84 F. Other fish species, such as carp and goldfish, can withstand substantially warmer temperatures. It is expected that the area of the plume between 94 and 97 F will be near 0 (maximum blowdown temperature will be 97 F) and the area of the 84 F isotherm will be extremely small (less than 0.11 acres). The discharge is about 1 mile from the Toussaint River and 3 miles from the closest reefs and should no interfere with these spawning areas.

Using figures from Table 1.3-1. in volumes (acre-feet) of the thermal plume at the 5 F isotherm, the weight of harvest fish is calculated by multiplying the lb per acre-ft of fish by the volume in acre-ft within the 5 F isotherm. These fish are considered to be potential environmental costs. Even though temperature preference and greater tolerance may tend to reduce these figures, the potential for cold shock damage (caused by sudden plant shutdown in winter months) could eliminate such reductions.

TABLE 1.3.3.-1 ANNUAL FISH CATCH AND DENSITIES FOR LAKE ERIE PLUS LBS AFFECTED BY 5 F ISOTHERM FROM DAVIS-BESSE STATION

Fish Catch	Annual Catch, lb	Lb/ Acre-ft	Lb w/in 5 F Isotherm
Commercial	59×10^6	0.159	0.034
Sport	12.975×10^6	0.035	0.007

Alternative B. Minimum Environmental Cost Design

Subalternatives, CAAA, (Mechanical Draft Tower), DAAA (Spray Pond), EAAA (Cooling Lake)

Environmental Cost: 0.034 lb of commercial fish
0.007 lb of sport fish

Same as Alternative A.

Subalternatives FAAA (Nat. & Mech. Draft Tower), GAAA (Nat. Draft Tower w/ Spray Basin)

Environmental Cost: 0.017 lb commercial fish
0.004 lb sport fish

Using acreage from Table 1.3-1, method of calculation follows Alternative A. This impact is considered to be insignificant or near zero.

Subalternative HAAA (Nat. Draft w/ Borrow Pits)

Environmental Cost: 0.0318 lb of commercial fish
0.007 lb of sport fish

Using acreage from Table 1.3-1, method of calculation follows Alternative A. This impact is considered insignificant or near zero.

Subalternative BAAA (Once-through Cooling)

Environmental Cost: 27.66 lb commercial fish
6.09 lb sport fish

Calculations follow Alternative A. Even these amounts represent minimal impact on the approximately 70 million pounds of catchable fish.

Alternative C. Plant License Request Design

Environmental Cost: 0.034 lb commercial fish
0.008 lb sport fish

Same as Alternative A. Intake structures do not affect heat discharge.

1.3.4 Wildlife

All Alternatives

Environmental Cost: 0 acres

The thermal plume, even with once-through cooling is not expected to impair any marsh land or water surface habitats in Lake Erie. The jet diffusers used in all alternatives will discharge the water at high velocities away from the shoreline at a distance far enough from shore that the shallow, slow-moving water habitats near the shores which are most likely to be used by wildlife will not be affected.

1.3.5 Fish, Migration

Alternative A. Plant As Is

Environmental Cost: 0 lb per yer.

The Davis-Besse Station is not expected to interfere with the migration of any fish populations. Walleye spwning grounds are within 3 miles of the station. However, no adverse interaction with the thermal or chemical discharge is expected to occur. The proximity of the Toussaint River is also considered but the very small thermal plumes from this Alternative should not affect whatever spawning activity may take place near the mouth of the river.

Alternative B. Minimum Environmental Cost Design

Subalternatives. CAAA, DAAA, EAAA, FAAA, GAAA, and HAAA

Environmental Cost: 0 lb per yr.

The discussion for Alternative A also applies to these subalternatives.

Subalternative BAAA. Once Through Cooling

Environmental Cost: Negligible lb per yr.

Calculations performed by Pritchard and reported in Appendix 14B of reference (1) indicates that under conditions of an on-shore current in Lake Erie the thermal plume from the discharge canal could be bent such that a "thermal barrier" of several degrees may develop across the mouth of the Toussaint River. Since this river is apparently used as spawning grounds by channel catfish, the potential exists for interference of spawning activity under the once-through cooling design. However, since such interference would require the simulatneous occurance of plant operation, proper on-shore current, and spawning season, it has been assigned a negligible cost.

Alternative C. Plant License Request Design

Environmental Cost: 0 lb per yr.

The discussion for Alternative A also applies to this Alternative.

1.4 Chemical Effluents

The chemical effluents which will be discharged from the Davis-Besse station are identified and the amounts to be released are described in the Supplement to the Environmental Report[1]. The State of Ohio has recently issued certification that there is reasonable assurance that water quality standards will be met.

1.4.1 Water Quality - Chemical

Alternative A. Plant As Is

Environmental Cost: 0 percent

All water discharges to Lake Erie occur from a collection basin where the various effluents mix and exert a mutual dilution effect. The major source of water inflow to this basin is the cooling tower blowdown. The main parameter to be concerned with in the blowdown flow is dissolved solids. The blowdown flow is based on a concentration factor of 2, thus this water contains the same dissolved solids as found in the lake water, but at twice the normal lake concentrations. The concentrations of dissolved solids near the intake is about 170 mg/liter, therefore, the blowdown water will contain about 340 mg/liter. Additions to this from the other plant processes will raise the concentration to about 359 mg/liter with a one-hour peak of 443 mg/liter. The neutral nature of the added salts and the rapid dilution that will occur in the discharge plume indicate that these levels of dissolved solids in the plant effluent are well within the Ohio standard for public water supplies (500 ppm) and will have negligible effect on lake water quality.

In addition, the only systems in the Davis-Besse plant which contain suspended solids are the backwash effluents from the filter clarifier unit and from the secondary system condensate polishing demineralizers. Since these effluents are directed to the settling basin with only the clear effluent being pumped to the station collecting basin for discharge to the lake, no suspended particulates should be released to Lake Erie.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: 0 percent

The discussion for Alternative A also applies here, since the minimum environmental cost design will use the same chemical systems.

Alternative C. Plant License Request Design

Environmental Cost: 0 percent

Same discussion applies as that in Alternative A.

1.4.2 Aquatic Biota

Alternative A. Plant As Is (AAAA)

Environmental Cost: 0 lbs/yr

The water discharged to Lake Erie from the natural-draft cooling tower contains about 2 times the lake water concentration of dissolved solids. Dilution of this volume, discharged at high veloci[illegible] in lake water will be rapid. The pH of the discharged water will be near neutral and the suspended solids will be less than that in the lake. No toxic substances will be released. The chlorine used in the various systems within the station should be less than 0.2 ppm in the discharge water.* Water discharged to the Toussaint River should be similar in quality to that of the river and lake. Thus, no change is expected in the biological communities of the river and lake due to chemical discharges from the power station.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: 0 lbs/yr

The discussion for Alternative A also applies here.

Alternative C. Plant License Request

Environmental Cost: 0 lb/yr

See Alternative A.

1.4.3 Wildlife

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Cost: 0 acres

The chemical discharges from the Davis-Besse Station are low and there will be no effect on the shallow-water habitats most commonly used by wildlife.

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* Effect of chlorination on aquatic organisms drawn into the plant from the lake are accounted for in Section 1.2.

1.4.4 People

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Cost: 0 days, 0 acres

The slight increase in dissolved solids content of Lake Erie water due to the Davis-Besse station should be insignificant at locations where the water is withdrawn for either industrial or potable uses. (The nearest location is the Camp Perry water Intake, 2.8 miles to the southeast of the station discharge.) The water at these points is also expected to be unchanged or improved by plant operations with respect to bacteria count, odor, dissolved oxygen level, pH, and other chemical constituents. Discharges will be within the Ohio Water Quality criteria for public water and, thus, little or no effects on recreational uses should be expected from liquid-chemical effluents from the Davis-Besse station.

1.5 Radionuclides Discharged to Water Body

1.5.1 Aquatic Organisms

Alternative A. Plant As Is

Environmental Cost: 1.6×10^{-4} rad/year to benthos in bottom sediment and 2.4×10^{-4} rad/year to fish

The dose to benthos resulting from accumulation of radionuclides on the lake bottom near the point of discharge of liquid effluent from the plant is selected as the means of estimating radiological impact to this class of biota. The estimated dose to benthic organisms residing in the top one inch of lake sediment from one year of plant operation is 1.6×10^{-4} rad/year. In making this estimate it was assumed that the long-lived radionuclides (Co-60, Sr-90, Cs-134, and Cs-137) anticipated in the liquid effluent (Tables 4-3 and 4-5 of reference 1) were uniformly and completely deposited in the bottom sediment over an area of one-square kilometer.

The radiological impact cost of this alternative based on the dose to fish in Lake Erie is 2.4×10^{-4} rad/year. This dose is estimated assuming that (1) the fish reside only in the vicinity of the effluent mixing zone, (2) the average mixing in this zone reduces lake concentrations of the radionuclides to 1/10 of the annual average concentrations in the discharge water, (3) the weight of the fish is 1 kg, and (4) that most of the fission and corrosion product radionuclides are concentrated in the fish(7). Most of the total dose to fish is due to tritium discharge (2.1×10^{-4} rad/year). The tritium dose estimate is based on an actual annual average concentration in the plant discharge of 1.1×10^{-5} μCi/ml. The dose contribution from fission and corrosion product activities is 2.5×10^{-5} rad/yr and is based on actual annual average concentrations in the plant discharge of all nuclides listed in Tables 4-3 and 4-5 of reference (1).

Alternative B. Minimum Environmental Cost Design

Environmental Cost: same as Alternative A

The minimum environmental cost design utilizes the same radwaste systems as the plant as is. Therefore, the cost of this alternative will be the same as Alternative A, i.e., 1.6×10^{-4} rad/year to benthos in bottom sediment and 2.4×10^{-4} rad/year to local fish.

Alternative C. Plant License Request Design

Environmental Cost: same as Alternative A

The plant license request design will utilize the same radwaste systems as the plant as is. Therefore, the cost of this alternative will be the same as Alternative A, i.e., 1.6×10^{-4} rad/year to benthos in bottom sediment and 2.4×10^{-4} rad/year to local fish.

1.5.2 People - External

Alternative A. Plant As Is

Environmental Cost:

Individual External Radiaton Dose Rem/year/person	
Swimming	Boating, Skiing, or Fishing
4.1×10^{-12}	1.5×10^{-11}

Population External Radiation Dose Man-rem/year
All Activities Combined
2.2×10^{-6}

Estimated 1975 Population = 113,300

The individual radiation dose estimate for swimming is based on (1) the combined concentrations of radionuclides given in Tables 4-3 and 4-5 of reference (1) corrected to true annual values, (2) a lake dilution factor of 4 x 10^{-4} (8) which applies to points 6 miles either upshore or downshore from the plant (nearest swimming locations according to the PSAR, Chapter 2), (3) 100 hours per year of in-water activity for the average swimmer, and (4) an average effective energy of 0.7 Mev/dis for whole body exposure for the group of radionuclides.

The individual radiation dose estimate for above-water activities is based on the same approach except: (1) a lake dilution factor of 1.2 x 10^{-3} (8) was used which applies to points 2.5 miles on either side of the plant, (2) 250 hours per year for use rate was used, and (3) a geometry factor of 1/2 was applied.

The population dose estimate for all activities is based on the assumption that all persons within 20 miles of the plant (or the equivalent) will receive the above annual doses. Using population data given in the PSAR the projected 1975 population figure is 113,300. This leads to a combined population exposure for recreational activities of 2.2 x 10^{-6} man-rem/year.

<u>Alternative B. Minimum Environmental Cost Design</u>

Environmental Cost: same as Alternative A

The minimum environmental cost design will use the same radwaste systems as the plant as is. Therefore, the cost of this alternative to people through radiation exposure during recreational use of Lake Erie will be the same as Alternative A or 2.2 x 10^{-6} man-rem/year.

Alternative C. Plant License Request Design

Environmental Cost: same as Alternative A

The plant license request design will utilize the same radwaste systems as the plant as is. Therefore, the cost of this alternative to people through radiation exposure during recreational use of Lake Erie will be the same as Alternative A or 2.2×10^{-6} man-rem/year.

1.5.3 People - Ingestion

Alternative A. Plant As Is

Environmental Cost:

	Drinking Lake Erie Water			
	Whole Body	GI	Bone	Thyroid[a]
Individual Dose, rem/yr	2.1×10^{-6}[b]	3.9×10^{-11}	2.1×10^{-9}	6.7×10^{-8}
Population Dose, man-rem/yr	0.14[c]	-	-	-
Population (1975 estimate)	611,100	-	-	-

(a) Child.
(b) Camp Perry Potable Water Supply.
(c) Toledo and Oregon Potable Water Supply.

	Eating Fish From Lake Erie			
	Whole Body	GI	Bone	Thyroid[a]
Individual Dose, rem/yr	3.3×10^{-8}	1.5×10^{-10}	2.7×10^{-9}	1.8×10^{-9}
Population Dose, man-rem/yr	0.0034	-	-	-
Population (1975 estimate)	104,000	-	-	-

(a) Child.
(b) Based on population supplied by 2.5 million pound annual catch at individual consumption rate of 24 lb/yr.

The individual radiation doses from drinking Lake Erie water are based on (1) total consumption of drinking water from the lake at a rate of 2.2 liters per day, (2) water taken from the Camp Perry Potable Water Intake which is located 2.8 miles to the east-southeast (lake dilution factor of 1.16×10^{-3})[8], (3) the radionuclide discharge concentrations given in Tables 4-3 and 4-5 of reference (1) adjusted to actual annual averages and, (4) a tritium annual discharge of 350 Ci. The individual organ doses are computed on the basis of 10CFR20 MPC values and maximum permissible organ doses for nonoccupational exposure. The population dose is based on estimated radionuclide concentrations at the location of the Toledo and Oregon Potable Water Intake (lake dilution factor of 1.2×10^{-4})[8] and a population served by this supply as defined in Appendix 7B of reference (1). Under the above series of assumptions the maximum expected individual dose will occur from drinking Camp Perry water but the maximum population dose will occur from consumption of Toledo-Oregon water.

The radiation dose estimates for eating fish from Lake Erie are based on the conservative assumptions that (1) the fish reside permanently in the area of the Camp Perry Water Intake, (2) the radionuclide concentrations in the water are the same as those used for calculating doses from drinking water, (3) the average person consumes 30 grams of fish daily and, (4) radionuclides are selectively concentrated by the fish[7]. The organ doses are also computed on the basis of 10CFR20 MPC values and maximum permissible organ doses for nonoccupational exposure. In estimating the population dose, the combined fish landings at Port Clinton and Toledo for 1970 (2.5 million pounds) were used as given in Chapter 3 of reference (1). It was assumed that all the fish contained radionuclide concentrations characteristics of the Camp Perry location. The population consuming the fish was computed by dividing the annual catch by the assumed consumption rate of 24 lb/yr (30 g/day).

The radiological impact cost transferred to the Cost Description Forms are for whole body exposure from drinking water since this exposure pathway gives the highest dose estimate.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: same as Alternative A

The minimum environmental cost design will use the same radwaste systems as the plant as is. Therefore, the cost of this alternative will be the same to people through the ingestion pathway as Alternative A.

Alternative C. Plant License Request Design

Environmental Cost: same as Alternative A

The plant license request design will use the same radwaste systems as the plant as is. Therefore, the cost of this alternative will be the same to people through the ingestion pathway as Alternative A.

1.6 Consumptive Use

1.6.1 People

Alternative A. Plant As Is

Environmental Cost: 4.85×10^9 gal/year

The evaporative loss from the cooling towers can vary between 7500 and 10,400 gpm with an average loss of 9225 gpm[1]. The source of this water is Lake Erie and since the lake is used for drinking water supplies, the plant consumption represents a loss of 4.85×10^9 gal/year. However, the loss is only about 0.01 percent of the average water flow through the lake which is about 79 million gpm.

Alternative B. Minimum Environmental Cost Design

Subalternative BAAA (Once-Through Cooling)

Environmental Cost: Negligible gal/year

There is essentially no loss of water from consumptive use when the lake water is used for once-through cooling.

Subalternatives CAAA (Mechanical-Draft Towers), DAAA (Spread Spray Pond), and EAAA (Cooling Lake)

Environmental Cost: 4.85×10^9 gal/year

These alternative cooling designs have the same evaporative loss as the plant as is design. Therefore, the impact values are the same.

Subalternatives FAAA (Mechanical-Draft Tower to Cool Blowdown) and GAAA (Small Spray Basin to Cool Blowdown)

Environmental Cost: 4.91×10^9 gal/year

The evaporation loss for these designs is the combined loss from the natural-draft cooling tower (9225 gpm) and the loss from the supplementary system that is used to cool the blowdown. In each case this loss is 138 gpm (corresponding to a cooling rate of 69×10^6 Btu/hr as indicated in Table 1.3-1), making a total consumptive use of 9363 gpm or 4.91×10^9 gal/year.

Subalternative HAAA (Borrow Pits to Cool Blowdown)

Environmental Cost: 4.88×10^9 gal/year

The evaporative loss for this design is the combination of the loss from the natural-draft tower (9225 gpm) and the loss from the water surface in the borrow pit (5 6 gpm) which corresponds to a cooling rate of 28×10^6 Btu/hr as indicated in Table 1.3-1. The total is 9281 gpm or 4.88×10^9 gal/year.

Alternative C. Plant License Request Design

Environmental Cost: 4.85×10^9 gal/year

The environmental effect is the same as for Alternative A.

1.6.2 Property

All Alternatives

The environmental costs and the documentation for loss of potential irrigation water are identical with those for drinking water losses given in Section 1.6.1.

1.7 Other Impacts

No other impacts have been identified.

1.8 Combined or Interactive Effects

There is double counting of the consumptive uses of water, 1.6.1 and 1.6.2.

2. GROUNDWATER

2.1 Raising/Lowering of Groundwater Levels

2.1.1 People

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Cost: 0 gal/year

The primary source of potable water in the area around the Davis-Besse site is Lake Erie. Most other drinking water is trucked into the area because deep well water is usually too hard and sulfurous for drinking and cooking. All water used by the plant will be taken from Lake Erie. Since no groundwater use or releases of water to ground from plant operations will occur, no noticeable change in groundwater level will be observed.

2.1.2 Plants

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Cost: 0 acres

Vegetation remaining in the immediate site area is associated with the marsh and is characteristically shallow-rooted. Any deep-rooted vegetation would not be able to penetrate the shallow bedrock to the depth of the aquifer. Vegetation tapping the groundwater supply is already quite limited at the plant site, and since the plant will not affect groundwater levels, no vegetation will be affected either.

2.2 Chemical Contamination of Groundwater

2.2.1 People

2.2.2 Plants

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Cost: 0 gal/year, 0 acres

Groundwater of the Davis-Besse station site is located at the surface of the bedrock. An artesian effect is characteristic in this area. When the groundcover overlying the bedrock is penetrated, water is expelled from the groundwater aquifer. Contamination by an inward flow of a substance is highly unlikely.

The soil on and near the site is reported to be nearly impermeable, so even accidental spills of chemicals would not be expected to penetrate the soils. Therefore, chemical contamination of groundwater in the area is not expected.

2.3 Radionuclide Contamination of Groundwater

2.3.1 People

All Alternatives

Environmental Cost: 0 rem/yr; 0 man-rem/yr

No discharge of radioactivity from the Davis-Besse plant to the groundwater in the area is expected. The soil on and near the site is quite impermeable[(1)] so any airborne radionuclides that might deposit on the ground should not reach the groundwater. Therefore, no radiation exposure to people is expected due to consumption of groundwater in the area.

2.3.2 Plants and Animals

All Alternatives

Environmental Cost: 0 rad/yr

No discharge of radioactivity from the Davis-Besse plant to the groundwater in the area is expected. The soil on and near the site is quite impermeable[(1)] so any airborne radionuclides that might deposit on the ground should not reach the groundwater. Therefore, no radiological impact on plants or animals that may utilize groundwater will occur.

2.4 Other Impacts on Groundwater

No other impacts on groundwater have been identified.

3. AIR

3.1 Fogging and Icing

3.1.1 Ground Transportation

Alternative A. Plant As Is (Cooling Subalternative A)

Environmental Cost: 1.75 hours/year of increase during hazard per year

A comprehensive study of the environmental effects of a natural draft cooling tower was done by the NUS Corporation for Toledo Edison[9]. This study analyzed a representative five-year period of meteorological data from the Toledo Express Airport to determine those conditions related to the natural occurrence of fog. The use of Toledo Airport data was necessary since the recording of occurrence of fog conditions was a part of the data required to be analyzed and data from no closer point was available. The analysis of the Toledo data formed the basis for evaluating the potential of producing or intensifying local fog conditions. A comparison of the Toledo data with on-site meteorological data collected over a two-year period showed that the Toledo data is quite representative of climatic conditions at the Davis-Besse site.

The results of the NUS study indicate that the maximum increase in the occurrence of fog in the absence of downwash conditions would be 3.5 hours per year at 24.8 miles from the tower. It should be noted that the increase in fog is calculated for the centerline of the plume and treated as if representative of an entire 22.5° sector. This is quite conservative at large distances since at 25 miles an arc span of 10 miles for a 22.5° sector would occur and probabilities of increased fog conditions would be less when averaged over the entire area. The increased occurrence of fog conditions does not represent discrete cases of fog, but rather represents the possibility of fog occurring earlier and lasting longer than normal. Since the figure of 3.5 hours annual increase in the occurrence of fog conditions is based on the summation of the individual sector contributions at 24.8 miles, and the Davis-Besse site is located on the lake front, only a contribution from 180° can be considered as contributing to increased driving hazard by fog and ice and represents an environmental cost of 1.75 hours per year. During the year there are an average of 831 hours of fog occurring naturally. An annual increase of 1.75 hours represents only a 0.21 percent increase which is not a significant change and, therefore, should not be a major environmental problem. The predicted increases in induced fog under icing conditions (temperatures less than 32°F) were computed to be a maximum of one minute for any 22.5° sector. This represents a negligible environmental effect.

The occurrence of downwash conditions under which the cooling tower effluent is caught in the turbulent wake of the tower structure and brought down to the surface was not considered to be a frequent effect and the persistence of these conditions would not be great for any direction due to expected gustiness and variability of the wind. The probability of downwash conditions were calculated to occur as often as 12.8 percent of the time during the entire year (about 1121 hours per year) and 0.79 percent of the winter season (about 17 hours). The winter downwash could result in icing on surfaces off-site at a rate of 0.03 - 0.07 inches of ice per hour. However, these calculations are considered to be extremely conservative upper limits since downwash occurrences have not been verified in actual cooling tower operations in the United States.

<u>Alternative B. Minimum Environmental Cost Design</u> (Cooling Subalternative G)

<u>Environmental Cost</u>: 1.75 hours of increased driving hazard per year

This alternative represents the same conditions as described above for Alternative A with the exception that a spray basin will be used to reduce the temperature of the natural draft tower blowdown with dilution to a 10°F limit over the ambient lake temperature. Since use of the spray basin discharges only very little additional water to the atmosphere the environmental cost will be essentially identical to that given under Alternative A (Plant As Is). The surface area of the spray basin (about one acre) would be too small to cause any significant fog except in the immediate vicinity.

Once-through cooling (Subalternative B) does not use a cooling tower so no water will be discharged to the air. Also, the surface area of the lake occupied by the thermal plume would be too small to cause any significant radiation fog. Therefore, there will be no significant fogging or icing from the once-through cooling subalternatives.

The cooling subalternatives using mechanical draft towers (Subalternatives C and F) can be expected to produce moderate fogging and icing conditions within 1-2 miles of the site and would be detrimental to traffic on State Route 2. Very heavy local fogging and icing conditions could result from the Spray Canal Subalternative (Subalternative D) with extremely adverse effects on State Route 2 traffic, although these conditions would be confined within the site area. Heavy local fogging would be expected from the 1360-acre cooling lake. Subalternative (Subalternative E) with the heat load at 1-1/2 acres per megawatt. Some local fogging may also occur from the Borrow Pit ponds (Subalternative H).

<u>Alternative C. Plant License Request Design</u>

<u>Environmental Cost</u>: 1.75 hours of increased driving hazard per year

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A.

3.1.2 <u>Air Transportation</u>

<u>Alternative A. Plant As Is</u> (Cooling Subalternative A)

Environmental Cost: Airport closed less than 1 hour per year

The closest commercial airport is Toledo Airport, 38 miles west of the site, and the nearest airport with a paved runway is located 13 miles to the east-southeast at Port Clinton (Chap. 2, PSAR). The analysis of fog discussed in Section 3.1.1 indicated that a maximum of 3.5 hours of fog per year would occur at 24.8 miles from the tower (based on a summation of all sectors). The predicted increase in occurrence of fog for a 22.5° sector (based on the average of all directions) would be 2.2×10^{-1} hours per year which is not considered significant. The Toledo Express Airport is located too far away to be affected.

Alternative B. Minimum Environmental Cost Design (Cooling Subalternative G)

Environmental Cost: Airport closed less than 1 hour per year

This alternative represents the same conditions as described above for Alternative A with the exception that a spray basin will be used to reduce a 10 F limit over the ambient lake temperature. Since use of the spray basin will discharge very little additional water to the atmosphere, the environmental cost will be nearly identical to that given under Alternative A (Plant As Is). The surface area of the basin and the few sprays[(6)] would be too small to cause any significant radiation fog except in the immediate vicinity. A similar environmental cost would be expected for Subalternatives F and H.

The nearest airport is too far from the site to be affected by the other Subalternatives.

It should be noted that the maximum frequency of fog occurs at the plume elevation which is in excess of 100 feet for mechanical-draft towers and in excess of 1000 feet for natural-draft towers. The frequency of fog at the plume elevation could approach several hundred hours per year, but it is doubtful whether this would cause the airport to close.

Alternative C. Plant License Request Design

Environmental Cost: Airport closed less than 1 hour per year

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A.

3.1.3 Water Transportation

Alternative A. Plant As Is (Cooling Subalternative A)

Environmental Cost: Ships reduce speed 1.75 hours per year

Using the information discussed in Section 3.1.1 the expected maximum annual increase in fog over a 180° sector (lake portion) amounts to 1.75 hours per year. This increase is not considered significant.

Alternative B. Minimum Environmental Cost Design (Cooling Subalternative G)

Environmental Cost: Ships reduce speed 1.75 hours per year

This alternative represents the same conditions as described above for Alternative A with the exception that a spray basin will be used to reduce the temperature of the natural draft tower blowdown with dilution to a 10°F limit over the ambient lake temperature. Since the use of the spray basin will discharge very iltter additional water to the atmosphere, the environmental cost will be identical to that given under Alternative A (Plant As Is). The surface area of the basin and the few sprays (6) would be too small to cause any significant radiation fog except in the immediate vicinity.

Once-through cooling (Subalternative B) does not use a cooling tower so no water will be discharged to the air. Also, the surface area of the lake occupied by the thermal plume would not be large enough to cause any significant radiation fog. Therefore, there will be no significant effect on shipping from these subalternatives.

The cooling subalternatives using mechanical draft towers (Subalternatives C and F can be expected to produce moderate fogging within 1-2 miles of the site and would affect boats along the lake shoreline. Very heavy local fogging could result from the Spray Pond Subalternative (Subalternative D) and could affect boats within a few hundred yards from the site. Heavy local fogging would be expected from the 1360 acre cooling lake subalternative (Subalternative E) with the heat load at 1-1/2 acres per megawatt, but this should not affect water transportation. The Borrow Pit subalternative (Subalternative H) showed exhibit similar behavior but on a much smaller scale.

Alternative C. Plant License Request Design

Environmental Cost: Ships reduce speed 1.75 hours per year

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A.

3.1.4 Plants

Alternative A. Plant As Is (Cooling Subalternative A)

Environmental Cost: 0 acres

For the natural-draft cooling alternative without downwash, the maximum ground level fog in the 180° land portion surrounding the tower would be approximately 1.75 hours per year occurring about 24.8 miles from the site. (See Section 3.1.1). Increase in ground level atmospheric moisture content short of fog formation would be expected more frequently. Such moisture increases are not expected to have any direct adverse effects on the plants in the region and the increases in soil moisture which might be caused by the tower may actually be beneficial to vegetation during the growing season.

Under conditions of downwash using a conservative prediction technique (See Section 3.1.1), ground fog was calculated to occur about 12.8 percent of the year (1121 hr.). Icing would occur under these conditions about 17 hours per year. The increases in soil moisture caused under downwash conditions may be beneficial to the vegetation. The icing may damage some vegetation, especially trees and shrubs. However, much of the land around the site is farmed and extensive woodlands are not found there. Consequently, the damage to plants from ground level fogging and icing is estimated to be insignificant.

Alternative B. Minimum Environmental Cost Design (Cooling Subalternative G)

Environmental Cost: 0 acres

This alternative represents the same conditions as described above for Alternative A with the exception that a spray basin will be used to reduce the temperature of the natural-draft tower blowdown with dilution to a 10°F limit over the ambient lake temperature. Since use of the spray basin will discharge little additional water to the atmosphere the environmental cost will be identical to that given under Alternative A (Plant As Is). The surface area of the spray basin would be too small to cause any significant radiation fog except in the immediate vicinity.

Once-through cooling (Subalternative B) does not use a cooling tower so no water will be discharged to the air. There will be no significant fogging or icing from the once-through or cooling lake subalternatives and, therefore, no damage to plants in the vicinity.

The cooling subalternatives using mechanical draft towers (subalternatives C and F) can be expected to produce moderate fogging and icing conditions within 1-2 miles of the site and could produce some plant damage (due to icing conditions) within this area. Very heavy local fogging and icing conditions could result from the Spray Pond Subalternative (Subalternative D) and extensive plant damage within the site area could be expected. Heavy local fogging would be expected from the 1360 acre cooling lake Subalternative (Subalternative E) with the heat load at 1-1/2 acres per megawatt. Local fogging would also be expected from the 1360 acre cooling lake Subalternative E) with the heat load at 1-1/2 acres per megawatt. Local fogging would also be expected from the borrow pit design (Subalternative H).

<u>Alternative C. Plant License Request Design</u>

<u>Environmental Cost</u>: 0 acres

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A.

3.2 Chemical Discharge to Ambient Air

The only emissions of chemicals to the air from the Davis-Besse Station will originate from the auxiliary boiler used for space heating (up to 1300 hours per year) and the emergency diesel generators (both of which are tested for 1 hour per month). The fuel burned in both the boiler and generators is No. 2 fuel oil with a sulfur content of 0.3% by weight.

3.2.1 Air Quality, Chemical

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Costs:

Emissions (% of Standard)		Emissions (Lb/Yr)
Boiler Particulates	41	13841
Boiler SO_2	23	39309
Boiler NO_x	145	73819
Deisel SO_2	25	421

Tables 3.2.1-1 and 3.2.1-2 present the emission calculations for both the auxiliary boiler and the emergency diesel generators. Environmental costs are presented only for those cases for which there is an applicable emission standard.

The auxiliary boiler is well below emission standards in all instances except NO_x emissions. A boiler of this size is almost always a horizontally fired unit and these units inherently emit a high amount of NO_x. It must be remembered, however, that the calculations presented are based on 100% loading of the boiler and that this boiler is only scheduled for a maximum 60% loading. If the 60% loading were taken into account, the boiler would probably meet the NO_x emission standard. Only one emission standard is applicable to the diesel generators and that standard (SO_2) is met easily by these units.

TABLE 3.2.1-1 AUXILIARY BOILER

Fuel - #2 Oil

Heat Content - 141,800 BTU/gal

Sulfur Content - .3%

Operating Hours - 1300 hrs/yr

Amt. - 6,736,000 lb/yr or 222,740 gal/yr

Heat Input - 130 x 10^6 BTU/hr

Pollutant	Emission Factor (lb/10^3 gal)	Emissions lb/hr	Emissions lb/yr	Std. (lb/hr)	% of Std.
Particulate	15	10.7	13841	26 (Ohio)	41
SO_2	142 x 5*	30.2	39309	130 (Ohio)	23
HC	3	2.2	2768	N.A.**	N.A.
CO	.2	.14	18.5	N.A.	N.A.
NO_x	80	56.8	73819	39(Fed.)	145

* S = Sulfur Content of Fuel (%)

**N.A. = No Applicable Standard

TABLE 3.2.1-2 EMERGENCY GENERATORS (2)

Fuel - # 2 Oil

Amt. - 35088 lb/yr or 4807 gal/yr each

Heat Content - 141,800 BTU/gal

Sulfur Content - .3%

Operating Hours - 12 hr/yr

Heat Input - 68 x 10^6 BTU/hr

Pollutant	Emission Factor (lb/BHP/hr)	Emissions lb/hr	Emissions lb/hr	Std. (lb/hr)	% of Std.
SO_2	N.A.	16.8	211	68 (Ohio)	25
NO_x	.0242	82.3	1029	N.A.*	N.A.
HC	.00028	.97	12	N.A.	N.A.
CO	.0085	28.9	361	N.A.	N.A.

* N.A. = No Applicable Standard

Taking all emissions presented in Tables 3.2.1-1 and 3.2.1-2 into consideration, it can still safely be assumed that the Davis-Besse Station chemical discharges to the atmosphere will not result in any significant degradation of the atmosphere around the site.

3.2.2 Air Quality, Odor

Alternative A. Plant As Is
Alternative B. Minimum Environmental Cost Design
Alternative C. Plant License Request

Environmental Cost: None

Although a few chemicals of an organic nature (e.g., cleaning solvents, floor wax, paint) are anticipated for use in the plant, the amounts will be so small and their concentrations in the atmosphere and discharge waters will be so low that no perceptible odors will be experienced at off-site locations.

3.3 Radionuclides Discharged to Ambient Air

3.3.1 People - External

Alternative A. Plant As Is

Environmental Cost:

Location or Condition	Individual Whole Body[(a)] Exposure, Rem/year/person
Site Boundary (730 meters from the plant)	2.0×10^{-5}
Average per capita dose within 50-mile radius of plant	4.9×10^{-8}

Cumulative Population within 50 miles of plant	Population Whole Body[(a)] Dose, Man-rem/year
2.67×10^{6} (1980 estimate)	0.131

(a) Reference (1), Table 7-1.

The radiation doses were estimated from gaseous radioactive waste discharge data given in Section 4.4.2 of reference (1) which are based on 60-day holdup of waste gases, a 150-day release period per year, annual average X/Q data as given in reference (8) , and 0.1 percent defective fuel in the reactor core. The exact calculational procedure is given in Appendix 7A of reference (1).

The cumulative population dose is the product of the radiation dose and the 1980 projected population in the various annuli around the plant out to a 50-mile radius. The average per capita dose for this region was obtained by dividing the man-rem values by the population figure.

The maximum radiological impact costs are 2.0×10^{-5} rem/year for an individual who resides at the site boundary for a whole year, and 0.131 man-rem/year for the population within 50 miles of the plant. Based on the national average an individual at the site boundary would receive 0.125 rem/year[10] from natural background radiation and the cumulative population exposure from natural background over the 50-mile region would be 333,000 man-rem/year. Thus, expected doses due to Davis-Besse operations would be a maximum of 0.016 percent of natural background for any individual, and 0.000039 percent of natural background for the population within 50 miles.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: same as Alternative A

This alternative uses the same radwaste systems as for the plant as is. Therefore, the radiological impact will be identical to that of Alternative A.

Alternative C. Plant License Request Design

Environmental Cost: same as Alternative A

This alternative uses the same radwaste systems as for the plant as is. Therefore, the radiological impact will be identical to that for Alternative A.

3.3.2 People - Ingestion

Alternative A. Plant As Is

Environmental Cost:

	Thyroid Doses	
	Adult	Child
Individual Exposure[(a)] rem/year/person	5.2×10^{-7}	5.2×10^{-6}
Population Exposure man-rem/year	1.2×10^{-4}	1.2×10^{-3}
Population (estimate)	1330	1330

(a) Reference (1), Table 7-1.

The gaseous radioactive discharges will contain iodine radionuclides as described in reference (1). Iodine represents the most significant ingestion hazard among the radionuclides in the gaseous discharge because iodine is concentrated in the pasture-cow-milk-man food chain. Therefore, human consumption of milk is used to assess the maximum ingestion hazard dose that could occur.

The individual thyroid dose value for a child given above was taken from Table 7-1 of reference (1) and assumes the cow that produces the milk grazes at the plant site boundary. The value is based on an equivalent I-131 release rate of 8.8×10^{-6} μCi/sec and a site boundary X/Q value of 5×10^{-7} sec/m^3. The adult thyroid dose is obtained on the basis that the adult thyroid is 10 times the weight of a child's thyroid.

The population exposures are based on the known distribution of dairy cows within 5 miles of the plant site as given in Chapter 2 of the PSAR and on X/Q data as a function of distance as given in Appendix 7A of reference (1). It is also assumed that the daily production of each cow (about 20 liters) supplies the needs of 20 people and these people are equally divided between adults and children. Due to the low expected exposures per individual and the limited dairy industry in the vicinity of the site the population exposure estimates are quite low.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: same as Alternative A

This alternative uses the same radwaste systems as for the plant as is. Therefore, the radiological impact due to ingestion of released gaseous activity will be identical to that of Alternative A.

Alternative C. Plant License Request Design

Environmental Cost: same as Alternative A

This alternative uses the same radwaste systems as for the plant as is. Therefore, the radiological impact will be identical to that of Alternative A.

3.3.3 Plants and Animals

Alternative A. Plant As Is

Environmental Cost: cow thyroid dose of 8×10^{-5} rad/year

The radiation exposure to the thyroid of a cow is selected in assessing the maximum radiological impact cost to terrestrial plants and animals because (1) the noble gas radionuclides are not concentrated by biota, (2) iodine isotopes (particularly I-131) are the only other radionuclides which are discharged in significant quantities to the atmosphere, and (3) the accumulation factor for iodine in the thyroid of a grazing cow combines an appreciable forage area (50 mi^2/day) with an organ specificity (0.3).

The deposition of I-131 on the pasture was calculated from (1) the anticipated site boundary concentration given in Table 4-8 of reference (1) corrected to true annual average release conditions, (2) a deposition velocity of 1 cm/sec, (3) a retention of 25 percent on grass, (4) an effective half-life of I-131 on grass of 5 days, (5) the assumption that the cow grazes on pasture one-half of the year, (6) on effective half-life of 7.6 days for I-131 in the thyroid and, (7) a mass of 30 grams for the thyroid of a cow.

Alternative B. Minimum Environmental Cost Design

Environmental Cost: same as Alternative A

This alternative uses the same radwaste systems as for the plant as is. Therefore, the radiological impact cost to plants and animals will be identical to that for Alternative A.

Alternative C. Plant License Request Design

Environmental Cost: same as Alternative A

This alternative uses the same radwaste systems as for the plant as is. Therefore, the radiological impact cost to plants and animals will be identical to that for Alternative A.

3.4 Other Impacts on Air

3.4.1 Migratory Birds

Alternative A. Plant As Is

Environmental Cost: Minor

It is expected that birds will be able to avoid or successfully fly through the updrafts, localized fog, and visible plume caused by the natural draft tower. Collisions with the tower may cause some problem, especially with migratory waterfowl descending to or ascending from the marshlands near the site. Collisions are mostly likely at night or during times of heavy natural fog. The tower should not cause significant amounts of low-level fog. However, the noise of the falling water within the tower may provide an audible landmark for birds when visibility is reduced. Larger numbers of resident birds are not expected to be destroyed by collision with the tower. During the migratory seasons (spring and fall) when large numbers of waterfowl use the air space around the Davis-Besse site, the numbers killed may increase, but this is not expected to significantly reduce the migratory waterfowl population. High intensity white lights can interfere with the nighttime navigation of resident and migratory birds. The high intensity strobe lights used atop the natural-draft tower at Davis-Besse will be turned off at night and should not cause significant interference with birds.

Alternative B. Minimum Environmental Cost Design

Subalternatives CAAA(Mech. Draft Tower),
FAAA (Nat. Draft Tower w/Mech. Draft Tower),
GAAA (Nat. Draft Tower w/ Spray Basin), HAAA
(Nat. Draft Tower w/Borrow Pits

Environmental Cost: Minor

Because of the presence of cooling towers in these subalternatives the impacts would be similar to Alternative A.

Subalternatives BAAA (Once-Through Cooling), DAAA (Spray Canal), EAAA (Cooling Lake)

Environmental Cost: 0

These subalternatives do not have a cooling tower associated with them. A lessening of those potential impacts considered in Alternative A should result. Only those birds that would strike the reactor containment vessel or supportive facilities should be affected.

Alternative C. Plant License Request Design

Environmental Cost: Minor

Since this alternative design includes a cooling tower, the environmental impacts would follow Alternative A.

4. LAND

4.1 Pre-emption of Land

4.1.1 Land, Amount

Alternative A. Plant As Is

Environmental Cost: 0 acres

No additional land is required for this alternative.

Alternative B. Minimum Environmental Cost Design

Subalternative EAAA (Cooling Lake)

Environmental Cost: 1360 acres

Substantial additional acreage, most of which is currently being farmed, would be required for this alternative.

All Other Subalternatives

Environmental Cost: 0 acres

No additional land would need to be acquired for any of the other cooling or intake subalternatives.

Alternative C. Plant License Request Design

Environmental Cost: 0 acres

No additional land acquisition is needed for this alternative.

4.2.1 People (Amenities)

All Alternatives

Environmental Cost: Zero

No residents, schools, or hospital beds within the area will experience noise higher than present levels. Nuclear power plants are relatively quiet facilities when operated with once-through cooling (Alternative Cooling System B). Although pumps and turbines may produce high noise levels, these machines are enclosed in buildings and the noise levels outside the buildings are low.

Estimates were made of the noise levels which are expected from the natural-draft tower (Alternative Cooling System A) and these estimates indicate noise levels of 50 dB(A) or higher will be confined to a distance of 700 feet from the tower. Noise levels from mechanical-draft towers (Alternative Cooling System C) are expected to be higher and noise levels of 50 dB(A) or higher may extend to distances of 1300 feet from the towers. The use of a mechanical-draft tower for cooling the blowdown from the natural-draft tower (Alternative Cooling System F) should produce significantly lower noise levels than the large mechanical draft towers (Alternative Cooling System C). No increase in ambient noise levels is expected from Alternative Cooling Systems D (Spray Canal), E (Cooling Lake), G (Natural-Draft Tower with Spray Basin to Reduce the Temperature of the Blowdown), and H (Natural-Draft Tower with Borrow Pits to Reduce Temperature of the Blowdown).

Since the area within 1300 feet of the tower is entirely within the site boundary, this environmental cost is zero for all the alternatives.

4.2.2 People (aesthetics)

Aesthetic values pertain to the quality or condition of the environment as perceived by individuals in society. They include the presence or absence of color, odor, taste, smell in air and water, the existence of aquatic and land fauna and flora, and the composition effect of combining man-made objects with the natural environment. Individuals vary in their responses to these external stimuli in the environment. Thus, it is difficult to quantify and to reach complete agreement concerning changes in aesthetics resulting from man's activity. However, by systematically analyzing the changes in these external stimuli, it is possible to compare alternative developments.

Alternative A. Plant As Is

Environmental Cost: Major

The proposed design[1] for the reactor, turbine, and auxiliary buildings is simple, functional, and has varied roof lines. These structures are expected to be compatible with the surrounding environment in all things, except their height. However, this desruption of the existing landscape is minor in nature. The switching yard detracts from the natural landscape but the impact should be reduced by landscaping along highway State Route 2. Each of the three routes[1] proposed for transmission lines are selected to minimize the impact on the environment. The lattice towers between 135 and 145 feet tall used to carry the transmission lines will have some adverse effect on the aesthetic setting of the area. The railroad spur line, located along the right-of-way of the Lenoyne transmission route, will reduce the aesthetic impact. Finally the site will be landscaped to blend as much as possible with the natural marsh lands.

The natural draft cooling tower of about 490 feet has a pleasing and interesting design, but its massiveness completely dominates the surrounding flat landscape. The presence of the tower will change the aesthetic setting for residences at Sand Beach, Long Beach, and the Toussaint River; the recreation areas near the site; and the boating on Lake Erie near the site. Thus, the overall aesthetic impact of the present design is considered major in nature.

Alternative B. Minimum Environmental Cost Design

Subalternative BAAA (Once-Through Cooling)

Environmental Cost: Minor

The significant aesthetic impact for this alternative cooling design is caused by the transmission lines.

Subalternative CAAA (Mechanical Draft Towers)

Environmental Cost: Moderate

Other than specific aesthetic impacts from the mechanical draft towers, the aesthetic impacts are similar to the present design. The mechanical draft towers are low in profile and would not compete with other structures at the site from a height standpoint but their length (probably several hundred feet) would tend to dominate the site. It is also expected that the vapor from the towers would be visible in the communities of Sand Beach, Long Beach, and at the Toussaint River. These factors in combination with noise considerations indicates the aesthetic impact would be moderate in nature.

Subalternatives DAAA (Spray Canal) and EAAA (Cooling Lake)

Environmental Cost: Minor

The spray canal and the cooling lake would be compatible with the surrounding landscape of lakes, marshes, and rivers. The only aesthetic effects would be the heights of the buildings and the transmission lines. Therefore, the aesthetic impact would be minor.

Subalternatives FAAA (Mechanical Draft Tower to Cool Blowdown), GAAA (Spray Basin to Cool Blowdown) and HAAA (Borrow Pits to Cool Blowdown

Environmental Cost: Major

These alternatives include small systems to cool the blowdown from the natural draft cooling tower. The dominance of the large tower would cause the aesthetic impact to be essentially the same as for the plant as is.

4.2.3 Wildlife

Alternative A. Plant As Is

Environmental Cost: 24 acres

While the Davis-Besse Station site is not located on prime wildlife habitat it is essentially surrounded by it. Of the 125 acres directly affected by the site 24 acres of marsh land are required for construction of the intake canal. Since the habitat is being used extensively by waterfowl the canal will not be lost to them, only the food production of that area will be lost. The acreage will be lost to other non-aquatic marsh inhabitants, however. The remaining 828 acres of the site will remain essentially unchanged and either leased or managed by the U. S. Bureau of Sport Fisheries and Wildlife as a wildlife refuge for migratory waterfowl. Also, approximately 15 acres in the southern portion of the western half of the site will remain under cultivation. Twenty-five percent of this crop will not be harvested, and will be used to provide field forage for waterfowl. Actual improvements have been made during the construction period in the marshes along the southern property boundary. This coupled with the added water area provided by the new ponds (filled borrow pits) on-site should serve to lessen or balance the impact of the intake canal.

Alternative B. Minimum Environmental Cost Design

Subalternative CAAA, DAAA, EAAA, FAAA, GAAA, HAAA

Environmental Cost: 24 acres

Same as Alternative A.

Note on Subalternative HAAC: Should waterfowl be attracted to winter over in the warm borrow pit ponds, it would be necessary to feed them supplementally to insure an adequate food supply. It is not possible to predict the numbers of birds that will be attracted to stay in the area, if any.

Subalternative BAAA (Once-through Cooling)

Environmental Cost: >24 acres

Implementation of this alternative would require the construction of a canal across the 447-acre marsh in the southeastern part of the site. Extensive measures to protect the water regime within this area would be nessary. While some land would be lost, the increase in water area would not necessarily be detrimental to the wildlife of this habitat.

Alternative C. Plant License Request Design

Environmental Cost: 24 acres

Same as Alternative A. Intake structures do not effect any change.

4.2.4 Land, Flood Control

All Alternatives

Environmental Cost: None

The station and the various subalternatives have no implications regarding flood control.

4.3 Salts Discharged from Cooling Towers

4.3.1 People

Alternative A. Plant As Is (Cooling Subalternative A)

Environmental Cost: 3.7×10^{-4} lb per sq ft per yr

This alternative uses a natural draft cooling tower with blowdown to Lake Erie and dilution to limit temperature of discharge to 20 F above lake. The design flow of this system is 480,000 gpm and the drift is a negligible amount, being an expected 0.01% of design flow or 48 gpm. A concentration factor of 2 was chosen for this system with a resulting concentration of dissolved solids approximately twice that of the makeup water from the lake. Based upon lake water containing 225 ppm dissolved solids (high estimate), the dissolved solids content in the tower water would be approximately 478 ppm. (maximum). Even assuming a uniform salt distribution over a 10-sq mi area (highly conservative for natural draft towers) the salt deposited would amount to 3.7×10^{-4} lb per sq ft per yr. Since this area receives an average of 30.5 inches of rain per yr the salt concentration if all taken by by the rain would be approximately 2 ppm and no threat to the groundwater can be identified. These estimates are conservative since they assume a uniform 360 distribution of the salt around the plant site. Actually, since the plant is located on the shore of Lake Erie and the wind direction blows onto the lake for a majority of the time, most of the salt will be deposited in the lake and not contribute to the environmental cost.

Alternative B. Minimum Environmental Cost Design (Cooling Subalternative G)

Environmental Cost: 8.5×10^{-4} lb per sq ft per yr

This alternative is the same as Alternative A with the addition of a spray basin to reduce the blowdown temperature. There is very little additional drift to the atmosphere using this alternative, and extra salt deposition would be confined to the immediate vicinity of the spray basin. Actually the additional amount would be approximately 4.8×10^{-4} pounds per sq ft per yr within 750 feet of the spray ponds (based on a flow of 9200 gpm, a drift rate of 0.004% (Ceramic Cooling Tower Corp.) and the assumption that all the salt will be deposited within a circle with a 750-foot radius).

The other considered cooling alternatives, except Subalternative B (Once-Through Cooling), E (Cooling Lake) and H (Borrow Pits for cooling blowdown) will discharge some salts to the air. The salt concentration in the drift water is expected to be a maximum of 478 ppm. This salt concentration is not much greater than that in the lake (about 225 ppm) and is not expected to cause any serious salt buildup near or on the site. The worst salt buildup will be expected from the spray pond (Subalternative D) and experience with similar systems has shown that the maximum salt deposit will be within 750 feet. Within this area the salt buildup could be as high as 0.06 lb per sq ft per yr.

For Subalternative C (Mechanical Draft Towers), assuming all the salt is deposited within one mile of the site (conservative estimate), the design flow is 480,000 gpm, the drift will be about 0.008% (Ecodyne Corp.), and the salt deposited would amount to 9×10^{-4} lb per sq ft per yr.

For Subalternative F, the salt deposition will be essentially the same as for Subalternative A plus a small additional amount of salt deposited from the mechanical draft cooling of the blowdown water. This additional amount would be approximately 1.7×10^{-5} lb per sq ft per yr within one mile of the site (based on a flow of 9200 gpm, a drift rate of 0.008% and the assumption that all the salt will be deposited within a circle with a one-mile radius).

amount would be approximately 1.7×10^{-5} lb per sq ft per yr within one mile of the site (based on a flow of 9200 gpm, a drift rate of 0.008% and the assumption that all the salt will be deposited within a circle with a one-mile radius).

For Subalternative H, the salt deposition will be the same as for Subalternative A since the use of borrow pits (ponds) to reduce the temperature of the blowdown water will not introduce any drift into the air.

Since there are no wells used for drinking water near the plant site, the possibility of groundwater contamination is slight.

Alternative C. Plant License Request Design

Environmental Cost: 3.7×10^{-4} lb per sq ft per yr.

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A.

4.3.2 Plants and Animals

Alternative A. Plant As Is (Cooling Subalternative A)

Environmental Cost: 0 acres

The entrainment of salt in drift losses occurring from this subalternative and subsequently available for deposition on the surrounding landscape has been considered in the discussion given for Alternative A in Section 4.3.1. Based upon this discussion, no significant salt deposition detrimental to plant or animal life would be expected.

Alternative B. Minimum Environmental Cost Design (Cooling Subalternative G)

Environmental Cost: 0 acres

Based on the discussion in Section 4.3.1, no significant salt deposition would be expected for any of the subalternatives with the possible exception of the spray canal subalternative (Subalternative D). For this subalternative, extensive plant damage can be expected within 750 feet of the spray ponds.

Alternative C. Plant License Request Design

Environmental Cost: 0 acres

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A. No significant salt deposition detrimental to plant or animal life would be expected.

4.3.3 Property Resources

Alternative A. Plant As Is (Cooling Subalternative A)

Environmental Cost: 0 dollars per yr

Based on the discussion in Section 4.3.1, no significant salt buildup would be expected using this subalternative. Consequently, there will be no environmental costs to property resources associated with this alternative.

Alternative B. Minimum Environmental Cost Design (Cooling Subalternative G)

Environmental Cost: 0 dollars per year

Based on the discussion in Section 4.3.1, no significant salt spray would impinge upon local community property and consequently, there will be no environmental costs to property resources associated with this alternative. Any structures located within 750 feet of the spray canal subalternative (Subalternative D) can expect some damage due to salt buildup.

Alternative C. Plant License Request Design

Environmental Cost 0 dollars per year

Since this Alternative is identical to Alternative A, it will have the same environmental cost as described under Alternative A. No environmental costs to property resources are expected with this alternative.

4.4 Other Land Impacts

No other land impacts have been identified.

4.5 Combined or Interactive Effects

None.

The Alternative of Abandonment

1.0 Economic Cost

The economic cost of abandonment consists of two components: (1) the unrecoverable costs of abandoning the station, and (2) the additional generating and storage costs.

1.1 Unrecoverable Investment Cost

The unrecoverable cost of abandonment of the Davis-Besse project at the end of the NEPA review period assumes this date is December 31, 1972, with suspension of construction also taking place on this date. The total actual investment in the Davis-Besse Station as of May 31, 1972, amounted to $97,249,000. The estimated investment for the remaining seven months of 1972 amounts to $33,778,000. In addition, the Applicants have firm contract commitments for the nuclear ste . system, nuclear fuel, turbine-generator, and other equipment, together with field construction contracts. The economic cost of abandonment of the Davis-Besse project would necessarily include large cancellation costs associated with the procurement of this equipment and commitments to the construction contractors. The cost of cancelling the field construction contracts alone, assuming abandonment of the project at the conclusion of the NEPA Review Period amounts to an estimated $11,805,000.

Investment cost for major equipment items scheduled for delivery after December 31, 1972, amount to an additional $32,409,000.

The unrecoverable cost of abandoning the Davis-Besse Station on December 31, 1972, is summarized in Table VI.

TABLE VI. Unrecoverable Cost of Abandoning the Davis-Besse Station on December 31, 1972

Station	Investment
Total Investment to 5/31/72	$ 97,249,000
Investment from 6/1/72-12/31/72	33,778,000
Other Expenses	
Equipment Payments	12,963,000
Interest During Construction	5,153,000
Equipment Delivered After 12/31/72	32,409,000
Construction Contractors Cancellation	11,805,000
Total Investment to 12/31/72	$193,357,000
Less Salvageable Material	75,146,000
Total Abandonment Cost (12/31/72)	$118,211,000

1.2 Additional Generating and Storage Cost

To minimize the cost of abandonment, if such action would be required, the salvageable equipment would be stored and later installed at another site. With the extensive regulatory reviews required for this type of facility, the lengthy engineering period required and the long construction period, the earliest date that a unit would be in operation using this salvaged equipment would be July, 1980.

Further, if the Davis-Besse project were to be abandoned, there would nevertheless remain a need to provide the equivalent generating capacity on the same time schedule.

The only feasible way to provide the replacement generating capacity on a timely basis would involve the installation of gas turbine units. This alternative adds considerably to the cost of generation for the period of December, 1974 to 1980.

On the assumption that the major equipment components of the Davis-Besse Project, including the reactor vessel, steam generators, other major steam supply system components, and turbine-generator could be used at a new location, they would have to be prepared for storage and stored for a period of approximately six years.

The total cost of this salvageable equipment is estimated at $75,146,000. Interest on this investment would accrue over this six-year period, but no added cost to the replacement unit utilizing this equipment would be considered since the interest charges would approximately equal the estimated escalation costs of comparable equipment which would otherwise be purchased.

Total cost of abandonment of the project at the end of the NEPA Review Period on December 31, 1972, is summarized in Table VII below.

TABLE VII. Total Abandonment Cost for the Davis-Besse Station

Item	Cost (Present Worth, January, 1975)
Unrecoverable Costs of $118,211,000	$141,092,000
Added Costs of Generation with Gas Turbine Installation to Replace Davis-Besse Capacity for Period December 1974 to 1990	30,900,000
Fixed Charges (1980-1990) on Storage Costs	24,597,000
Total Abandonment Cost	$196,589,000

2.0 Environmenta. Costs

Environmental costs that will be incurred at the Davis-Besse Station site as a result of completed construction activities by December 31, 1972, (the assumed abandonment date) result from: (1) site preparation activities, (2) the station intake canal and forebay, (3) the major plant buildings, (4) the natural draft cooling tower, (5) the transmission lines, and (6) the temporary barge channel.

2.1 Site Preparation Activities

When acquired, the site contained eight residences. These residences have been either moved, demolished, or abandoned. Of the original 230 acres of farmland on the site, 150 acres have been removed from this category. The main station area of about 56 acres has been graded up to a common elevation ranging from 6 to 12 feet above the original grade. The fill material for the grading was taken from three borrow pits (about 46 acres in surface area) at other upland locations on the site. Quarry operations were conducted in a portion of one borrow pit to provide granular backfill material for excavated areas around the lower portions of the station structures. By the assumed abandonment date this work will be completed and the borrow pits will have filled with groundwater and surface runoff water to form small ponds. However, landscaping of the area would not be scheduled before the abandonment date.

2.2 Station Intake Canal and Forebay

The on-site portion of the intake water system is a narrow intake canal and wider forebay at the plant which occupies a 24-acre area in an isolated section of the large marsh. This structure is complete and presently terminates at the shoreline of Lake Erie. Thus, 24 acres of wildlife habitat have been lost but this represents a small fraction of the total unaffected marshland area at the site (about 615 acres).

2.3 Major Plant Buildings

Construction work on the substructures of the station building began in 1970. The shield building reached full height of 220 feet above station grade in May, 1971. Erection of the steel containment vessel within the shield building will be completed by the abandonment date. The auxiliary building below grade is complete, the turbine-generator foundation is at full height and all base substructure work is complete in the turbine and office building area. Turbine building and office building external structures will be completed by the abandonment date. Abandonment would leave these foundation and building shell structures unused and not maintained. Subsequent deterioration would lead to an undesirable visual impact.

2.4 The Cooling Tower

The natural-draft cooling tower is located northwest of the main station area. The hyperbolic reinforced concrete shell, 493 feet high and 415 feet in diameter at the base, is presently being constructed and completion is scheduled for December, 1972. Therefore, at the assumed abandonment date this large structure will exist to exert its effect on the aesthetic appearance of the area and on birds that may use the marshlands.

2.5 The Transmission Lines

One of the three transmission lines leaving the station site will connect to the Bay Shore Station approximately 20 miles to the west. All towers for this line have been erected. The second transmission line extends westerly from the Davis-Besse Station to the Lemoyne Substation. This line will be about 75% installed by the end of December, 1972. Off-site construction on the third transmission line extending easterly to the Beaver Substation is not scheduled to begin until early in 1973. Therefore, only the first two transmission lines and right-of-way represents committed environmental cost at the assumed time of abandonment.

2.6 Temporary Barge Channel

A temporary 650-foot-long channel will be dredged beginning in August, 1972 from deep water in the lake to the beach front at the intake canal to permit barge delivery of the reactor vessel. This will involve about two acres of lake bed. The beach front will be temporarily opened for this delivery. Following delivery of the vessel, which is scheduled in October, 1972, the channel area and the beach front will be restored to their original contour. The only committed environmental cost this activity represents is the disruption to bottom organisms in the dredged area and the time it will take for the ecosystem to recover from the temporary stress.

TABULATION OF ENVIRONMENTAL AND GENERATING COSTS FOR ALTERNATIVES

ALTERNATIVE PLANT DESIGN SUMMARY			A Plant As Is (Base Design)	B Plant With Minimal Environmental Impact	C Plant Operating License Request	D
IDENTIFICATION OF SUBSYSTEMS						
Alternative Cooling Systems (I)			A	G	A	
Alternative Rad Waste System (II)			A	A	A	
Alternative Chemical Effluent Systems (III)			A	A	A	
Alternative Intake System (specify) (IV)			A	C	C	
GENERATING COST — Present Worth (Million Dollars)			457.4	458.9	457.6	
GENERATING COST — Annualized (Million Dollars)			45.5	45.7	45.6	
LOST CAPACITY (MWe)			Base	400	0	
INCREMENTAL ENVIRONMENTAL EFFECTS		UNITS				
Primary Impact						
Natural Surface Water Body						
1.1 Cooling Water Intake Structure	1.1.1 Fish	% Fish / Year	5.3×10^{-4}	$<5.3\times10^{-4}$	$<5.3\times10^{-4}$	
1.2 Passage Through the Condenser and Retention in Closed-Cycle Cooling Systems	1.2.1 Primary Producers & Consumers	lb/yr	380	Same	Same	
	1.2.2 Fish	% Fish / Year	5.3×10^{-6}	Same	Same	
1.3 Discharge Area and Thermal Plume	1.3.1 Water Quality, Physical	Acres Ac-ft	0.70 2.25	0.44 1.38	0.70 2.25	
	1.3.2 Oxygen Availa-	Acres	0	Same	Same	

		UNITS	A	B	C	D
	1.3.3 Aquatic Biota	lb/yr	.034	.017	.034	
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres	0	Same	Same	
	1.3.5 Fish, Migration	lb/yr	0	Same	Same	
1.4 Chemical Effluents	1.4.1 Water Quality, Chemical	Ac-ft/day %	0 0	Same Same	Same Same	
	1.4.2 Aquatic Biota	lb/yr	0	Same	Same	
	1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres	0	Same	Same	
	1.4.4 People	Days Acres	0 0	Same Same	Same Same	
1.5 Radionuclides Discharged to Water Body	1.5.1 Aquatic Organisms	Rem/yr	2.4×10^{-4}	Same	Same	
	1.5.2 People, External	Rem/yr Man-rem/yr	1.5×10^{-11} 2.2×10^{-6}	Same Same	Same Same	
	1.5.3 People, Ingestion	Rem/yr Man-rem/yr	2.1×10^{-6} 0.14	Same Same	Same Same	
1.6 Consumptive Use (evaporative losses)	1.6.1 People	Gal/yr	4.85×10^{9}	4.91×10^{9}	4.85×10^{9}	
	1.6.2 Property	Gal/yr	4.85×10^{9}	4.91×10^{9}	4.85×10^{9}	
1.7 Other Impacts	None					
1.8 Combined or Interactive Effects	None					

		UNITS	A	B	C	D
2. Groundwater						
2.1 Raising/Lowering of Groundwater Levels	2.1.1 People	Gal/yr	0	Same	Same	
	2.1.2 Plants	Acres	0	Same	Same	
2.2 Chemical Contamination of Groundwater	2.2.1 People	Gal/yr	0	Same	Same	
	2.2.2 Plants	Acres	0	Same	Same	
2.3 Radionuclide Contamination of Groundwater	2.3.1 People	Rem/yr Man-rem/yr	0	Same	Same	
	2.3.2 Plants and Animals	Rem/yr	0	Same	Same	
2.4 Other Impacts on Groundwater	None					
3. Air						
3.1 Fogging & Icing (caused by evaporation and drift)	3.1.1 Ground Transportation	Hrs/yr	1.75	Same	Same	
	3.1.2 Air Transportation	Hrs/yr	< 1	Same	Same	
	3.1.3 Water Transportation	Hrs/yr	1.75	Same	Same	
	3.1.4 Plants	Acres	0	Same	Same	
3.2 Chemical Discharge to Ambient Air	3.2.1 Air Quality, Chemical	% lb/yr	145 (NO_x) 73819 (NO_x)	Same Same	Same Same	
	3.2.2 Air Quality, Odor	--	None	Same	Same	
3.3 Radionuclides Discharged to Ambient	3.3.1 People, External	Rem/yr Man-rem/yr	2×10^{-5} 0.131	Same Same	Same Same	

		UNITS	A	B	C	D
3.3 Radionuclides Discharged to Ambient Air (cont'd.)	3.3.2 People, Ingestion	Rem/yr Man-rem/yr	5.2×10^{-6} 1.2×10^{-3}	Same Same	Same Same	
	3.3.3 Plants and Animals	Rem/yr	8×10^{-5}	Same	Same	
3.4 Other Impacts on Air	3.4.1 Migratory Birds	--	Minor	Same	Same	
4. Land						
4.1 Pre-emption of Land	4.1.1 Land, Amount	Acres	0	Same	Same	
4.2 Plant Construction and Operation	4.2.1 People (amenities)	#	0	Same	Same	
	4.2.2 People (aesthetics)	--	Major	Same	Same	
	4.2.3 Wildlife	Acres	24	Same	Same	
	4.2.4 Land, Flood Control	--	None	Same	Same	
4.3 Salts Discharged from Cooling Towers	4.3.1 People	lb/ft^2 per yr	3.7×10^{-4}	8.5×10^{-4}	3.7×10^{-4}	
	4.3.2 Plants and Animals	Acres	0	Same	Same	
	4.3.3 Property Resources	$/yr	0	Same	Same	
4.4 Other Land Impacts	None					
4.5 Combined or Interactive Effects	None					

			A	B	C	D	E	F	G	H
ALTERNATIVE COOLING SYSTEMS			ND	OT	MD	SC	CL	MDB	FBB	BPB
INCREMENTAL GENERATING COST	Present Worth (Million Dollars)		Base	62.00	59.64	59.27	92.37	.96	1.05	.78
	Annualized (Million Dollars)		Base	6.17	5.93	5.90	9.19	0.10	0.10	0.08
LOST CAPACITY (KWe)			Base	(25,000)	4400	9100	0	250	400	0
INCREMENTAL ENVIRONMENTAL EFFECTS		UNITS								
Primary Impact	Population or Resource Affected									
Natural Surface Water Body										
1.1 Cooling Water Intake Structure	1.1.1 Fish	% Fish / Year	$5.3x10^{-4}$	$1.3x10^{-2}$	$5.3x10^{-4}$	$5.3x10^{-4}$	$5.3x10^{-4}$	$5.3x10^{-4}$	$5.3x10^{-4}$	$5.3x10^{-4}$
1.2 Passage Through the Condenser and Retention in Closed-Cycle Cooling Systems	1.2.1 Primary Producers & Consumers	lb/yr	380	920	380	380	380	380	380	380
	1.2.2 Fish	% Fish / Year	$5.3x10^{-6}$	$1.3x10^{-4}$	$5.3x10^{-6}$	$5.3x10^{-6}$	$5.3x10^{-6}$	$5.3x10^{-6}$	$5.3x10^{-6}$	$5.3x10^{-6}$
1.3 Discharge Area and Thermal Plume	1.3.1 Water Quality, Physical	Acres Ac-ft	0.70 2.25	1750 16493	0.70 2.25	0.70 2.25	0.70 2.25	0.44 1.38	0.44 1.38	0.69 2.20
	1.3.2 Oxygen Availability	Acres	0	0	0	0	0	0	0	0

		UNITS	A	B	C	D	E	F	G	H
	1.3.3 Aquatic Biota	lb/yr	.034	27.7	.034	.034	.034	.017	.017	.032
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres	0	0	0	0	0	0	0	0
	1.3.5 Fish, Migration	lb/yr	0	negligible	0	0	0	0	0	0
1.4 Chemical Effluents	1.4.1 Water Quality, Chemical	Ac-ft / day / %	N.A.							
	1.4.2 Aquatic Biota	lb/yr	N.A.							
	1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres	N.A.							
	1.4.4 People	Days Acres	N.A.							
1.5 Radionuclides Discharged to Water Body	1.5.1 Aquatic Organisms	Rem/yr	N.A.							
	1.5.2 People, External	Rem/yr Man-rem/yr	N.A.							
	1.5.3 People, Ingestion	Rem/yr Man-rem/yr	N.A.							
1.6 Consumptive Use (evaporative losses)	1.6.1 People	Gal/yr	4.85×10^9	negligible	4.85×10^9	4.85×10^9	4.85×10^9	4.91×10^9	4.91×10^9	4.88×10^9
	1.6.2 Property	Gal/yr	4.85×10^9	negligible	4.85×10^9	4.85×10^9	4.85×10^9	4.91×10^9	4.91×10^9	4.88×10^9
1.7 Other Impacts	None									
1.8 Combined or Interactive Effects	None									

		UNITS	A	B	C	D	E	F	G	H
2. Groundwater										
2.1 Raising/Lowering of Groundwater Levels	2.1.1 People	Gal/yr	0	0	0	0	0	0	0	0
	2.1.2 Plants	Acres	0	0	0	0	0	0	0	0
2.2 Chemical Contamination of Groundwater	2.2.1 People	Gal/yr	N.A.							
	2.2.2 Plants	Acres	N.A.							
2.3 Radionuclide Contamination of Groundwater	2.3.1 People	Rem/yr Man-rem/yr	N.A.							
	2.3.2 Plants and Animals	Rem/yr	N.A.							
2.4 Other Impacts on Groundwater										
3. Air										
3.1 Fogging & Icing (caused by evaporation and drift)	3.1.1 Ground Transportation	Hrs/yr	1.75	0	Moderate	Heavy	Heavy	Moderate	1.75	Minor
	3.1.2 Air Transportation	Hrs/yr	<1	0	0	0	0	< 1	< 1	< 1
	3.1.3 Water Transportation	Hrs/yr	1.75	0	Moderate	Heavy	Heavy	Moderate	1.75	Minor
	3.1.4 Plants	Acres	0	0	Moderate	Heavy	Heavy	Moderate	0	0
3.2 Chemical Discharge to Ambient Air	3.2.1 Air Quality, Chemical	% lb/yr	N.A.							
	3.2.2 Air Quality, Odor	--	N.A.							
3.3 Radionuclides Discharged to Ambient	3.3.1 People, External	Rem/yr Man-rem/yr	N.A.							

		UNITS	A	B	C	D	E	F	G	[illegible]
3.3 Radionuclides Discharged to Ambient Air (cont'd.)	3.3.2 People, Ingestion	Rem/yr Man-rem/yr	N.A.							
	3.3.3 Plants and Animals	Rem/yr	N.A.							
3.4 Other Impacts on Air	3.4.1 Migratory Birds	--	Minor	0	Minor	0	0	Minor	Minor	Minor
4. Land										
4.1 Pre-emption of Land	4.1.1 Land, Amount	Acres	0	0	0	0	1360	0	0	0
4.2 Plant Construction and Operation	4.2.1 People (amenities)	¢	0	0	0	0	0	0	0	0
	4.2.2 People (aesthetics)	--	Major	Minor	Moderate	Minor	Minor	Major	Major	Major
	4.2.3 Wildlife	Acres	24	>24	24	24	24	24	24	24
	4.2.4 Land, Flood Control	--	0	0	0	0	0	0	0	0
4.3 Salts Discharged from Cooling Towers	4.3.1 People	lb/ft^2 per yr	3.7×10^{-4}	0	9×10^{-4}	0.06	0	3.9×10^{-4}	8.5×10^{-4}	3.7×10^{-4}
	4.3.2 Plants and Animals	Acres	0	0	0	40	0	0	0	0
	4.3.3 Property Resources	$/yr	0	0	0	Slight	0	0	0	0
4.4 Other Land Impacts	None									
4.5 Combined or Interactive Effects	None									

ALTERNATIVE RADWASTE SYSTEMS

			A	B	C	D
ALTERNATIVE RADWASTE SYSTEMS			Present Design			
ENCREMENTAL GENERATING COST	Present Worth		Base			
	Annualized		Base			
LOST CAPACITY (KWe)			Base			
INCREMENTAL ENVIRONMENTAL EFFECTS		UNITS				
Primary Impact	Population or Resource Affected					
Natural Surface Water Body						
1.1 Cooling Water Intake Structure	1.1.1 Fish	% Fish / Year				
1.2 Passage Through the Condenser and Retention in Closed-Cycle Cooling Systems	1.2.1 Primary Producers & Consumers	lb/yr				
	1.2.2 Fish	% Fish / Year				
1.3 Discharge Area and Thermal Plume	1.3.1 Water Quality, Physical	Acres Ac-ft				
	1.3.2 Oxygen Availability	Acres				

		UNITS	A	B	C	D
	1.3.3 Aquatic Biota	lb/yr				
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres				
	1.3.5 Fish, Migration	lb/yr				
1.4 Chemical Effluents	1.4.1 Water Quality, Chemical	Ac-ft/day %				
	1.4.2 Aquatic Biota	lb/yr				
	1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres				
	1.4.4 People	Days Acres				
1.5 Radionuclides Discharged to Water Body	1.5.1 Aquatic Organisms	Rem/yr	2.4×10^{-4}			
	1.5.2 People, External	Rem/yr Man-rem/yr	2.1×10^{-6} 0.14			
	1.5.3 People, Ingestion	Rem/yr Man-rem/yr	1.5×10^{-11} 2.2×10^{-6}			
1.6 Consumptive Use (evaporative losses)	1.6.1 People	Gal/yr				
	1.6.2 Property	Gal/yr				
1.7 Other Impacts	None					
1.8 Combined or Interactive Effects	None					

		UNITS	A	B	C	D
2. Groundwater						
2.1 Raising/Lowering of Groundwater Levels	2.1.1 People	Gal/yr				
	2.1.2 Plants	Acres				
2.2 Chemical Contamination of Groundwater	2.2.1 People	Gal/yr				
	2.2.2 Plants	Acres				
2.3 Radionuclide Contamination of Groundwater	2.3.1 People	Rem/yr Man-rem/yr	0			
	2.3.2 Plants and Animals		0			
2.4 Other Impacts on Groundwater						
3. Air						
3.1 Fogging & Icing (caused by evaporation and drift)	3.1.1 Ground Transportation	Hrs/yr				
	3.1.2 Air Transportation	Hrs/yr				
	3.1.3 Water Transportation	Hrs/yr				
	3.1.4 Plants	Acres				
3.2 Chemical Discharge to Ambient Air	3.2.1 Air Quality, Chemical	% lb/yr				
	3.2.2 Air Quality, Odor	--				
3.3 Radionuclides Discharged to Ambient	3.3.1 People, External	Rem/yr Man-rem/yr	2×10^{-5} 0.131			

		UNITS	A	B	C	D
3.3 Radionuclides Discharged to Ambient Air (cont'd.)	3.3.2 People, Ingestion	Rem/yr Man-rem/yr	$5.2x10^{-6}$ $1.2x10^{-3}$			
	3.3.3 Plants and Animals	Rem/yr	$8x10^{-5}$			
3.4 Other Impacts on Air	3.4.1 Migratory Birds	--				
4. Land						
4.1 Pre-emption of Land	4.1.1 Land, Amount	Acres				
4.2 Plant Construction and Operation	4.2.1 People (amenities)	#				
	4.2.2 People (aesthetics)	--				
	4.2.3 Wildlife	Acres				
	4.2.4 Land, Flood Control	--				
4.3 Salts Discharged from Cooling Towers	4.3.1 People	lb/ft^2 per yr				
	4.3.2 Plants and Animals	Acres				
	4.3.3 Property Resources	$/yr				
4.4 Other Land Impacts	None					
4.5 Combined or Interactive Effects	None					

ALTERNATIVE CHEMICAL EFFLUENT SYSTEMS			A	B	C	D
			Present System			
ENCREMENTAL GENERATING COST	Present Worth		Base			
	Annualized		Base			
LOST CAPACITY (KWe)			Base			
INCREMENTAL ENVIRONMENTAL EFFECTS		UNITS				
Primary Impact Natural Surface Water Body	Population or Resource Affected					
1.1 Cooling Water Intake Structure	1.1.1 Fish	% Fish / Year				
1.2 Passage Through the Condenser and Retention in Closed-Cycle Cooling Systems	1.2.1 Primary Producers & Consumers	lb/yr				
	1.2.2 Fish	% Fish / Year				
1.3 Discharge Area and Thermal Plume	1.3.1 Water Quality, Physical	Acres Ac-ft				
	1.3.2 Oxygen Availability	Acres				

		UNITS	A	B	C	D
	1.3.3 Aquatic Biota	lb/yr				
	1.3.4 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres				
	1.3.5 Fish, Migration	lb/yr				
1.4 Chemical Effluents	1.4.1 Water Quality, Chemical	Ac-ft/day %	0 0			
	1.4.2 Aquatic Biota	lb/yr	0			
	1.4.3 Wildlife (including birds, aquatic and amphibious mammals, and reptiles)	Acres	0			
	1.4.4 People	Days Acres	0 0			
1.5 Radionuclides Discharged to Water Body	1.5.1* Aquatic Organisms	Rem/yr				
	1.5.2 People, External	Rem/yr Man-rem/yr				
	..5.3 People, Ingestion	Rem/yr Man-rem/yr				
1.6 Consumptive Use (evaporative losses)	1.6.1 People	Gal/yr				
	1.6.2 Property	Gal/yr				
1.7 Other Impacts	None					
1.8 Combined or Interactive Effects	None					

		UNITS	A	B	C	D
2. Groundwater						
2.1 Raising/Lowering of Groundwater Levels	2.1.1 People	Gal/yr				
	2.1.2 Plants	Acres				
2.2 Chemical Contamination of Groundwater	2.2.1 People	Gal/yr	0			
	2.2.2 Plants	Acres	0			
2.3 Radionuclide Contamination of Groundwater	2.3.1 People	Rem/yr Man-rem/yr				
	2.3.2 Plants and Animals					
2.4 Other Impacts on Groundwater						
3. Air						
3.1 Fogging & Icing (caused by evaporation and drift)	3.1.1 Ground Transportation	Hrs/yr				
	3.1.2 Air Transportation	Hrs/yr				
	3.1.3 Water Transportation	Hrs/yr				
	3.1.4 Plants	Acres				
3.2 Chemical Discharge to Ambient Air	3.2.1 Air Quality, Chemical	% lb/yr	145 (NO_x) 73819 (NO_x)			
	3.2.2 Air Quality, Odor	--	None			
3.3 Radionuclides Discharged to Ambient	3.3.1 People, External	Rem/yr Man-rem/yr				

ALTERNATIVE INTAKE SYSTEMS			A	B	C	D
			Present System 1.5 fps	Vertical Intake 0.5 fps	Vertical Intake & Screen	
ENCREMENTAL GENERATING COST	Present Worth (Million Dollars)		Base	0.20	0.41	
	Annualized (Million Dollars)		Base	0.02	0.04	
LOST CAPACITY (KWe)			Base	0	0	
INCREMENTAL ENVIRONMENTAL EFFECTS		UNITS				
Primary Impact Natural Surface Water Body	Population or Resource Affected					
1.1 Cooling Water Intake Structure	1.1.1 Fish	% Fish / Year	$5.3x10^{-4}$	$<5.3x10^{-4}$	$<5.3x10^{-4}$	
1.2 Passage Through the Condenser and Retention in Closed-Cycle Cooling Systems	1.2.1 Primary Producers & Consumers	lb/yr				
	1.2.2 Fish	% Fish / Year				
1.3 Discharge Area and Thermal Plume	1.3.1 Water Quality, Physical	Acres Ac-ft				
	1.3.2 Oxygen Availability	Acres				

REFERENCES

(1) "Davis-Besse Nuclear Power Station Supplement to Environmental Report", Volumes 1 and 2, The Toledo Edison Company, 1971.

(2) Odum, E. P., Fundamentals of Ecology, 3rd Ed., W. B. Saunders Co., Philadelphia, 1972.

(3) Final Report to Commonwealth Edison Company, "Environmental Impact Report: Supplemental Information to the Quad-Cities Environmental Report", from Battelle-Columbus, filed with the U.S. AEC, November 1, 1971.

(4) Verbal communication with Commonwealth Edison Company.

(5) Carlander, K. D., Handbook of Freshwater Fishery Biology, 3rd ed., Vol. 1, Iowa State University Press, Ames, Iowa (1969), p. 18.

(6) Pritchard, D. W., "The Thermal Plume in Lake Erie Caused by the Discharge of Heated Effluent From the Davis-Besse Nuclear Power Plant", Appendix 4B of Reference (1)

(7) Chapman, W. H., Fisher, H. L., and Pratt, M. W., "Concentration Factors of Chemical Elements in Edible Aquatic Organisms", UCRL-50564 (1968).

(8) Parsont, M. A., and Goldman, M. I., "Effects of Estimated Radioactive Effluents From The Davis-Besse Nuclear Power Station for the Toledo Edison Company", NUS-729, Nov., 1970, Figures A-1, A-2, and B-2.

(9) "Evaluation of Environmental Effects of a Natural Draft Cooling Tower at The Davis-Besse Nuclear Power Station". By NUS Corporation, July, 1971, Appendix 7F of Reference (1).

(10) "Basic Radiation Protection Criteria", National Council on Radiation Protection and Measurements, NCRP Report No. 39, Jan. 15, 1971, p. 12.

APPENDIX A

FEDERAL POWER COMMISSION

COMMENTS RELATIVE TO THE

ENVIRONMENT STATEMENT ON

THE DAVIS-BESSE NUCLEAR

POWER STATION

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON, D.C. 20545

Docket No. 50-346

NOV 5 1970

APPENDIX A

The Toledo Edison Company
ATTN: Mr. Glenn J. Sampson
Vice President, Power
420 Madison Avenue
Toledo, Ohio 43601

Gentlemen:

This supplements my recent letters to you transmitting comments furnished by various Federal agencies on your environmental report for the Davis-Besse Nuclear Power Station.

A copy of the comments submitted by the Federal Power Commission is enclosed for your information.

Sincerely yours,

for Peter A. Morris, Director
Division of Reactor Licensing

Enclosure:
FPC ltr dtd 11/3/70
w/comments

cc w/enclosure:
Leslie Henry, Esquire
Fuller, Seney, Henry & Hodge

Donald H. Hauser, Esquire
The Cleveland Electric Illuminating Co.

George F. Trowbridge, Esquire
Shaw, Pittman, Potts, Trowbridge & Madden

FEDERAL POWER COMMISSION
WASHINGTON, D.C. 20426

NOV 3 1970

Mr. Harold L. Price
Director of Regulation
U. S. Atomic Energy Commission
Washington, D. C. 20545

Dear Mr. Price:

This is in reply to your letter of August 18, 1970, requesting comments of the Federal Power Commission on the environmental impact of the Davis-Besse nuclear power plant.

Although the Federal Power Commission does not generally have licensing jurisdiction over thermal power plants constructed by electric utilities, the Commission does have a real and continuing interest in the timely construction of generating and transmission facilities to meet growing electric loads and the impact of the facilities upon the environment in matters relating to air pollution, water quality, and other factors.

Our comments on pertinent factors related to the proposed environmental statement on the Davis-Besse nuclear power plant are enclosed.

Sincerely,

John N. Nassikas
Chairman

Enclosure
Comments on the AEC
Environmental Statement

3540

Federal Power Commission
Comments Relative to the Environment Statement
on the Davis-Besse Nuclear Power Station
to be Jointly Owned by the Toledo Edison
Company and the Cleveland Electric
Illuminating Company

General

The comments herewith are directed: to the relationship of the electrical capacity of this unit to the prospective power supply and demand situation of the system and region involved; to the fuel supply situation related to the type of plant and its environmental effects; and to comment on alternative means of meeting the power supply need for which this unit is proposed. It is understood that other agencies will review and comment upon those aspects of the project which involve its effects on air and water quality and other environmental factors.

The Need for Power

The Davis-Besse nuclear power station is being planned as a jointly owned facility 52.5 percent of whose output will be owned by the Toledo Edison Company and 47.5 percent by the Cleveland Electric Illuminating Company. Both companies are members of the Central Area Power Coordinating Group (CAPCO). This group is an operating pool composed of the applicants, Duquesne Light Company and the Ohio Edison Company, and is one of 11 operating pools which are participating in the East Central Area Reliability Coordination Agreement (ECAR). The 26 companies of ECAR operate utility systems whose combined service areas cover 192,000 square miles and extend from the southern border of Kentucky to the Northern Peninsula of Michigan and from western Maryland to the eastern border of Illinois.

In order to judge the need for the Davis-Besse nuclear station, it is necessary to examine the load-supply situation as it is expected to exist during the summer of 1975, which will be the first critical peaking period following the scheduled in-service date of the station, which is December 1974.

The following table summarizes the anticipated summer-1975 load-supply situations of the systems of each of the applicants, the immediate operating pool of which the applicants are members, and the regional consortium of systems which the applicants are committed to support:

	Toledo Edison Company	Cleveland Electric Illuminating Company	CAPCO	ECAR
Dependable Capacity, MW				
With Davis-Besse	1,492	4,049	13,640	77,573
Without Davis-Besse	1,034	3,635	12,769	76,701
Peak Load, MW, Summer 1975	1,449	3,502	11,502	62,347
Reserve Margin, MW				
With Davis-Besse	0	547	2,139	15,226
Without Davis-Besse	0	133	1,267	14,354
Reserve Margin, Percent				
With Davis-Besse	0	15.6	18.6	24.4
Without Davis-Besse	0	3.8	11.0	23.0

In evaluating the reserve margin situation on the systems of the Toledo Edison Company and the Cleveland Electric Illuminating Company, it should be noted that these systems are members of the CAPCO operating pool and that their operations and energy requirements are to be coordinated under the pool agreement. Normally each member of an operating pool is responsible for a proportional share of the pool's total reserve requirement. When the dependable capacity of any pool member is insufficient to meet its share of this requirement, the situation is corrected by the purchase of firm capacity from other systems. Thus, the unsatisfactory reserve margins shown in the table for both the Toledo Edison Company and the Cleveland Electric Illuminating Company have economic but no reliability significance for the systems involved during the summer of 1975.

The Davis-Besse nuclear power station is being planned as a facility whose output will contribute to the general resources of the operating pool. It is significant, therefore, that during the summer peaking season of 1975 the reserve margin of CAPCO, excluding the capacity of the Davis-Besse station is expected to be 1,267 megawatts or only 11 percent of an anticipated pool peak load of 11,502 megawatts. If it is assumed that the in-service date of the plant is met, the reserve margin of the pool will increase to 2,139 megawatts, which is equal to 18.6 percent of the anticipated peak load.

In general, we feel that for an operating pool of the size of CAPCO the reserve margin should be about 20 percent. There is no question, therefore, that on the basis of anticipated pool requirements, the capacity of the Davis-Besse nuclear power station will be needed by the summer of 1975.

As a matter of interest, we have included data pertaining to the anticipated summer-1975 load-supply situation of ECAR. The margins, with and without the Davis-Besse plant, are expected to be at an acceptable level, but this level is not regarded as sufficiently high to obviate the need of the proposed plant. Several considerations support this judgment. The most important of these is the operating philosophy, widely accepted in the utility industry, which holds that primary responsibility for serving electric loads belongs to the utility or operating pool in whose service area the loads occur. The primary function of regional interties, internal and external, according to that philosophy is assigned to the accommodation of imbalances between supply and loads, which are an unavoidable characteristic of utility system operations.

Furthermore, the reserve margin determination for ECAR as shown in the table obscures the location of these reserves with respect to the service areas of CAPCO. While this reserve margin may appear to be satisfactory on an area-wide basis and while the ECAR area is served by a highly advanced network of transmission lines, there remains a serious question whether enough of this reserve capacity could be made available in the CAPCO service area on a firm and continuing basis to warrant a delay in the construction of the Davis-Besse nuclear power station. Two other factors mitigate against such a delay. These are the current trends to construction of larger and larger units in the interest of economies of scale and the poor record of availability of such units during the first few years of initial operation. Under these circumstances, we feel it would be imprudent for the managements of the Toledo Edison Company and the Clevelands Electric Illuminating Company to rely on distant and widely scattered generating capacity, even if these were available to them, to supply the critical power needs of their service areas during the summer of 1975.

The Fuels Situation

The ECAR service area is deficient in both oil and natural gas but is abundantly endowed with bituminous coal resources. Practically all the electric power generated in the ECAR area is coal based. Most of the major plants are capable of burning some oil, but in recent years, oil has not been able to compete economically with the area's most available fuel.

The supply and demand of power generation fuels were greatly affected by the need to meet more restrictive air quality standards through use of fuels of lower sulfur content. In Cleveland, Ohio, as of October 15, 1969, the sulfur content of fuels burned in new plants was limited to one percent for coal and two percent for oil. On December 31, 1971, fuels burned in existing plants will be restricted to 2.0 percent for both coal and oil. In Toledo, Ohio, a sulfur limitation will become effective on January 1, 1971. This will restrict the sulfur content of coal burned to an average of 2.7 percent in any one month, and a firm 1.0 percent for oil, with the one exception that oil produced and consumed on the premises can have a sulfur content as high as 1.5 percent.

Throughout the entire ECAR service area, even where local public concern has not yet been translated into effective restrictive regulation on sulfur content of utility fuels, Federal legislation such as the Air Quality Act of 1967 and the National Environmental Policy Act of 1969, has set the stage for possible future restrictions. Since the service life of a major electric generation station is in the range of 30 to 35 years, these prospective changes in future fuel use of of a proposed station must be factored in at the planning stage as one of the critical design criteria.

In addition to the environmental complications, the ECAR companies are being seriously affected by the immediate situation which is developing in the utility coal markets. This situation appears to result from increasing exports of coal to Japan, a shortage of railroad coal cars, recent strict mine safety legislation, and a general reluctance on the part of the coal industry to invest in new mines prior to long-term committment of the output to specific customers. These factors are not only affecting the short term supply of coal but also appear to contribute to upward longer term pressures on the price of coal at the mine, thus affecting the competitive position of these fuels in favor of nuclear generation.

To meet existing and future sulfur oxides regulations, the Cleveland Electric Illuminating Company on May 13, 1970, submitted a request to the Oil Import Appeal Board for a permit to import one million barrels of low-sulfur residual fuel oil during the period April 1, 1971 to March 31, 1972 and 2.5 million barrels annually thereafter. Action on the request is still pending.

The prospect for substituting natural gas for nuclear power generation is not encouraging. Of the one billion Mcf of natural gas used annually in the State of Ohio, less than 18 million Mcf in 1969 was used for the generation of electric power by electric utilities presumably because of the high cost relative to other utility fuels. If a natural gas-fired plant were to be proposed in lieu of the Davis-Besse nuclear plant an additional annual supply of 65 million Mcf of natural gas would have to be assured. While the State of Ohio is a natural gas producing state and while natural gas is extensively used in Ohio for residential, commercial and industrial purposes, the bulk of the natural gas consumed depends on long distance pipelines extending to gas fields principally in Texas and Louisiana. These pipelines do not presently have the capacity to bring in the additional 65 million Mcf annually which would be required by a natural gas-fired substitute for the proposed nuclear plant. In most parts of the State of Ohio, no new natural gas consuming equipment equivalent to 30 megawatts or larger can be attached to existing gas lines.

According to the Toledo Edison Company, a series of economic studies has shown that the cost of power and energy from a plant of the size of the Davis-Besse nuclear plant and at its proposed site, favor the use of nuclear fuels. The present and future trends in the utility fuels market and public pressure for air quality improvement make it unlikely that a fossil-fuel plant as a substitute for the proposed nuclear plant could be justified by the applicants or found acceptable by local jurisdictions responsible for air quality.

Power Imports

The 1975 summer reserve margin situation as it is expected to develop in the various operating pools which surround the ECAR service area in a counter-clockwise direction are shown in the following table:

	Reserve Margin during Summer, 1975	
	Megawatts	Percent
New England	5,525	35.2
New York Pool	8,096	34.2
Mid-Atlantic Area Group	10,108	25.9
Virginia-Carolina Group	5,624	20.2
Tennessee Valley Authority	5,079	24.2
Illinois-Missouri Pool	1,799	16.7
Commonwealth Edison Company	1,853	12.7
Wisconsin-Upper Michigan Systems	1,261	20.4

These estimates were reported to the Federal Power Commission on September 1, 1970, by the Northeast Power Coordinating Council, the Mid-Atlantic Area Coordination Group, the Southeastern Electric Reliability Council and the Mid-America Interpool Network Organization in accordance with FPC Order No. 383-2 which calls for annual reporting of detailed system planning information for a period extending 10 years into the future.

During the summer peaking season of 1975, the reserve margin of the New England's systems and that of the New York Pool are expected to be substantially higher than the roughly 20 percent reserve which the Federal Power Commission normally considers as satisfactory. These reserves, however, are far too distant from the CAPCO service area to offer a sound alternative for any electric generating capacity, fossil or nuclear, sited within the service area of CAPCO. The reasons discussed in the section for the need for power which argue against the reliance of CAPCO's systems on the reserves of ECAR's systems, speak out even more cogently against any consideration of firm power imports from outside the ECAR service area.

While the Federal Power Commission is in favor of interconnections and the coordination of systems in adjacent regions as a sound practice in gaining the advantages of economies of scale and providing the inter-system means for emergency support, it does not overlook the penalty in terms of reliability of supply which is imposed on utility operations when sites of generation are selected at long distances from major service areas. In general, the Commission feels that the CAPCO's systems stand to gain an important advantage by planning the Davis-Besse nuclear power plant within the pool's service area rather than seeking to rely either on ECAR resources or those beyond.

Hydro Power Alternative

A hydroelectric installation as a substitute for the Davis-Besse nuclear power station does not appear to be feasible because of the lack of sites within economic transmission distance of the CAPCO service area which have a hydroelectric capacity potential comparable to the capacity of the proposed plant. Some pumped storage hydroelectric sites are available, but a pumped storage installation is useful only for peaking capacity. Pumped storage plants cannot serve as substitutes for base-load plants. The Davis-Besse nuclear plant is intended to serve a base-load function.

APPENDIX B

DESCRIPTION OF ALTERNATIVE DESIGNS

BASE ALTERNATIVE A - PRESENT DESIGN

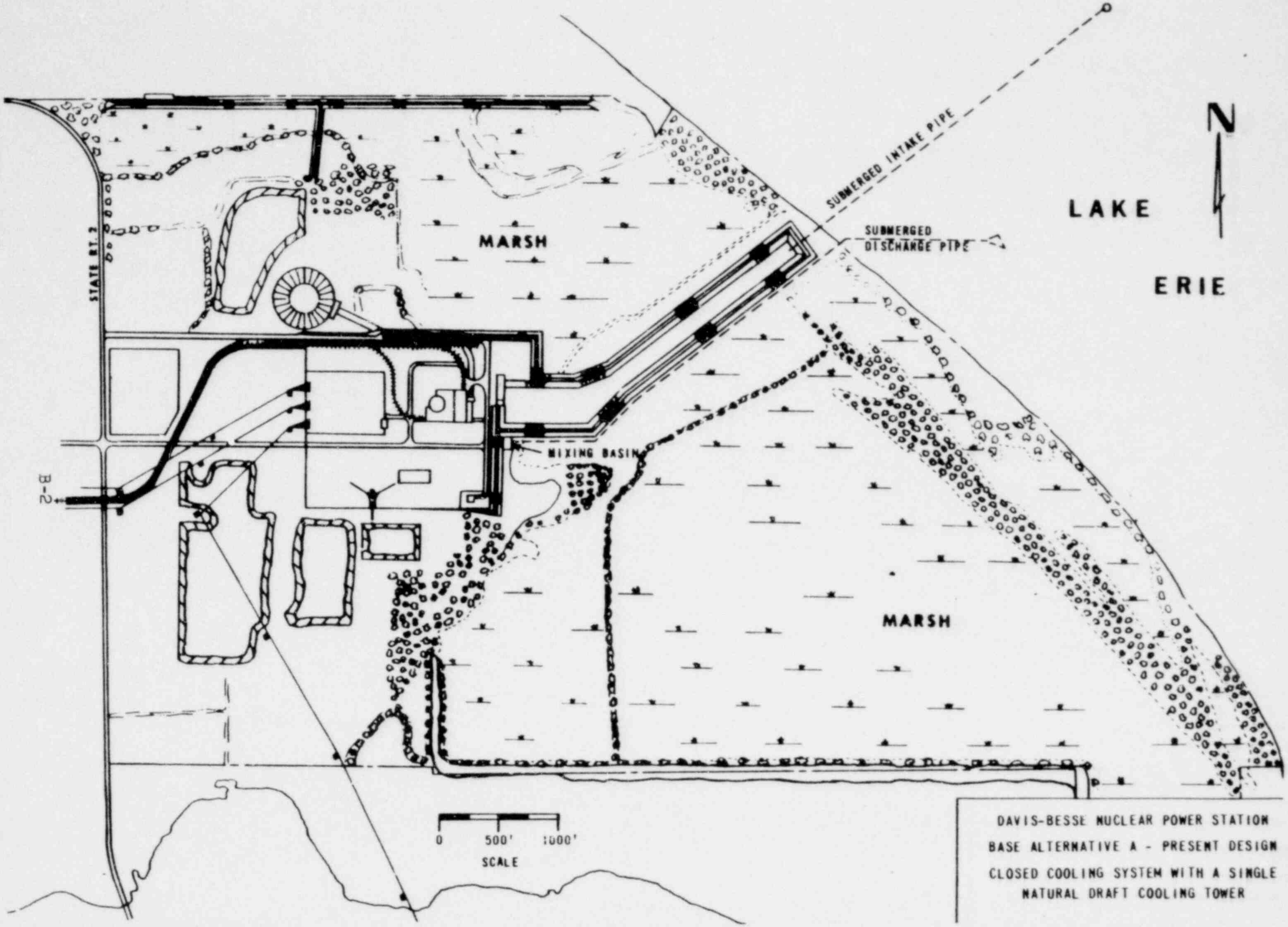
Closed Cooling System with a Single Natural Draft Cooling Tower

Alternative A is the condenser cooling water system as it is presently designed. It is a closed system with one Counter Flow Natural Draft Cooling Tower. Water flow through the cooling tower is 480,000 GPM and the cooling range of the tower is 26°F corresponding to 26°F temperature rise across the main turbine condenser.

The water intake for make-up to the cooling water system consists of an open canal over the land portion and the lake portion will be a submerged pipe. The pipe will extend out into the lake for a distance about 3,000 feet from the shoreline to a water depth of 11 feet.

Cooling Tower blowdown flow will be piped to a mixing basin where it will combine with other mixed effluents. The mixing basin will be elevated so that the combined effluent from the basin will flow by gravity through a submerged discharge pipe that will follow the intake canal to the shoreline where it will turn eastward and extend for a distance of approximately 1300 feet to a water depth of about 6 feet.

The maximum quantity of heat added to Lake Erie with this alternative is 138×10^6 BTU/Hr.



DAVIS-BESSE NUCLEAR POWER STATION

BASE ALTERNATIVE A - PRESENT DESIGN

CLOSED COOLING SYSTEM WITH A SINGLE NATURAL DRAFT COOLING TOWER

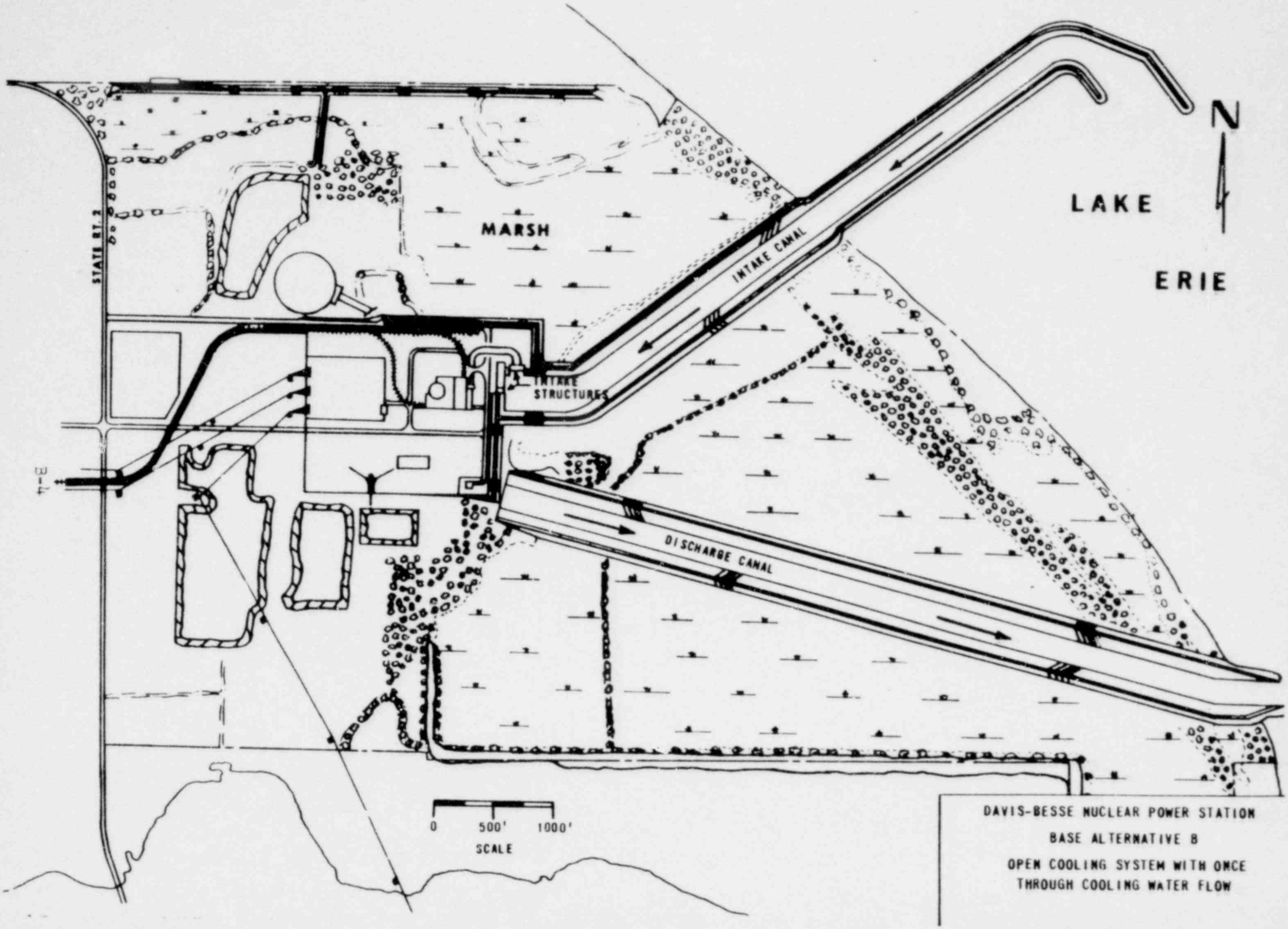
BASE ALTERNATIVE B

Open Cooling System with Once-Through Cooling Water Flow

This cooling water system alternative consists of two open canals approximately 200 feet wide through which the entire condenser cooling water system flow is conveyed from the lake to the condenser and returned to the lake.

Cooling water flow rate is normally greater and the temperature rise across the condenser is normally lower for this type system than is the case with the closed type system.

The flow and temperature rise conditions originally selected for the Davis-Besse Station, using the open system, were 685,000 gpm and $18^{\circ}F$. The total heat added to Lake Erie would amount to 6×10^{9} BTU/Hr. in this case.


N
LAKE
ERIE
MARSH
INTAKE CANAL
INTAKE STRUCTURES
DISCHARGE CANAL
STATE RT. 2
0
500'
1000'
SCALE
DAVIS-BESSE NUCLEAR POWER STATION
BASE ALTERNATIVE 8
OPEN COOLING SYSTEM WITH ONCE
THROUGH COOLING WATER FLOW

BASE ALTERNATIVE C

Closed Cooling System with a 32 - Cell Mechanical Draft Cooling Tower.

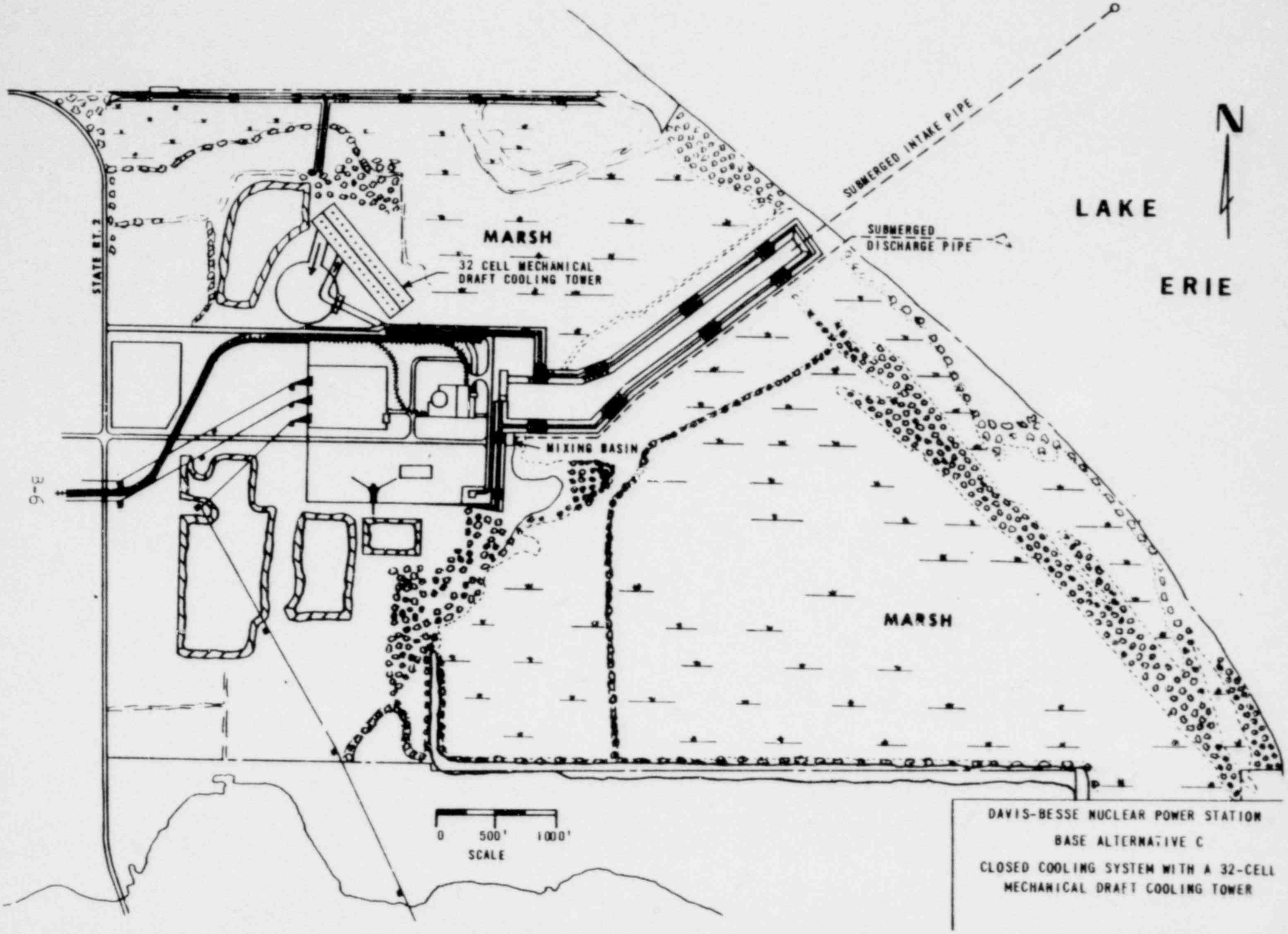
This Alternative is a closed system similar to the present design described in Base Alternative A except that a mechanical draft cooling tower has been substituted in place of the Natural Draft Tower.

The natural draft cooling tower would be dismantled down to the basin and supply piping as it now exists would be extended through elbow connections to the mechanical draft tower in the vicinity of the present natural draft tower. The collecting tower basin under the mechanical draft tower would be connected by an open canal to the remaining basin of the natural draft tower.

The tower foundation and basin under the mechanical draft tower would be elevated so that the cooling water would flow by gravity through the open canal to the circulating water pumps.

The mechanical draft tower consists of 32 cells arranged in two rows of 16 with each cell containing a 28 foot diameter induced draft fan.

The tower dimensions are 1050 feet long and 250 feet wide. Fan horsepower is 5520 H.P.


LAKE
ERIE
N
SUBMERGED INTAKE PIPE
SUBMERGED DISCHARGE PIPE
MARSH
32 CELL MECHANICAL DRAFT COOLING TOWER
MIXING BASIN
MARSH
STATE RT. 2
0 500' 1000'
SCALE
DAVIS-BESSE NUCLEAR POWER STATION
BASE ALTERNATIVE C
CLOSED COOLING SYSTEM WITH A 32-CELL MECHANICAL DRAFT COOLING TOWER

BASE ALTERNATIVE D

Closed Cooling System With 152 Spray Modules In Open Cooling Water Canal

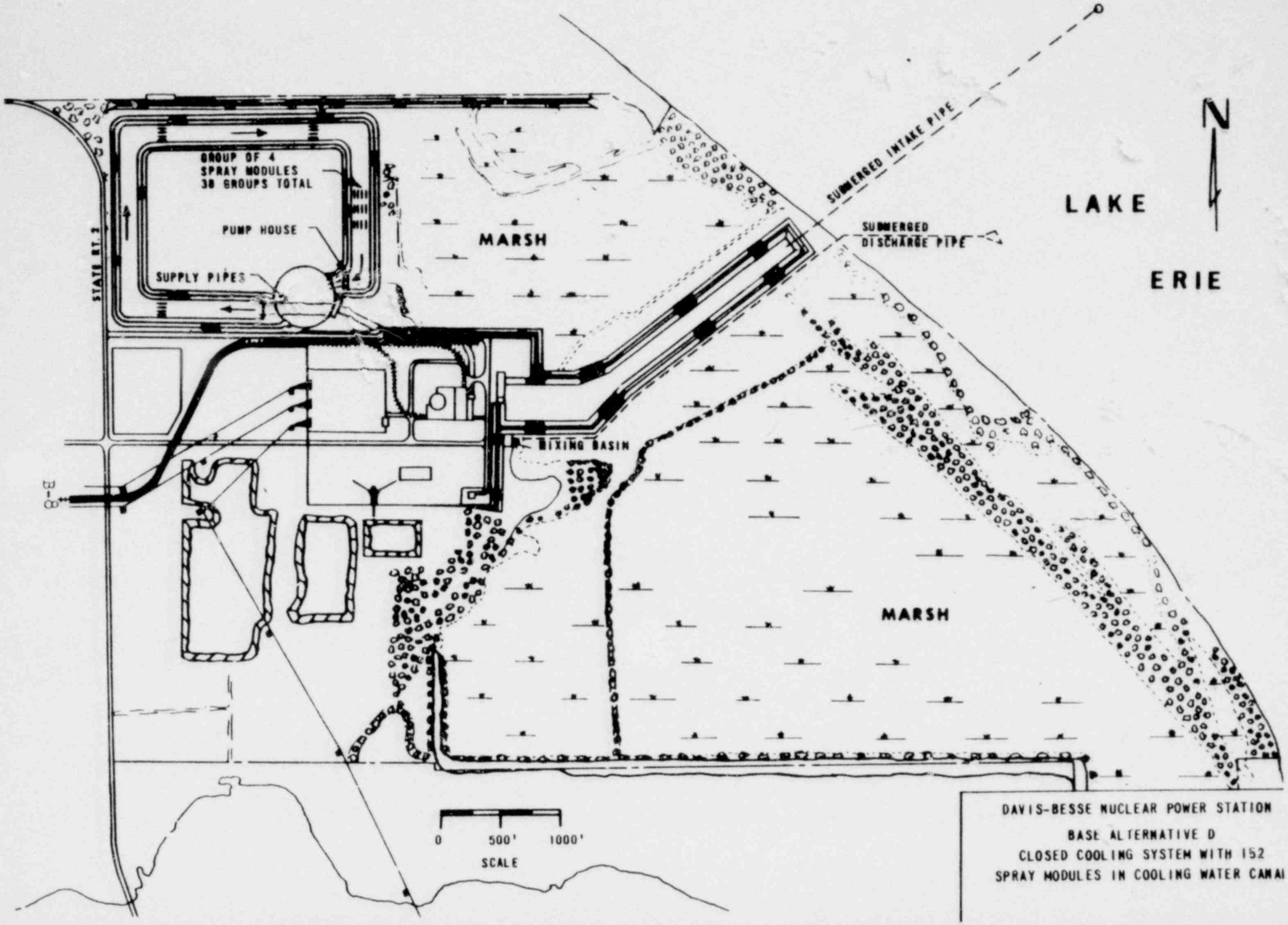
This alternative is a closed system similar to the Alternatives A & C except that the natural draft cooling tower has been dismantled down to the basin and a closed ended canal approximately 200 feet wide and 6,100 feet long has been substituted in its place.

To remove the heat by evaporative cooling, 152 powered spray modules would be installed in the open canal in 38 groups of four across the width of the canal. Each of the 152 modules would spray 10,000 gpm giving a total pumping rate of 1,520,000 gpm amounting to 215% recirculation of the total 480,000 gpm cooling water flow.

The existing cooling tower basin, after the natural draft cooling tower is removed, would be used as a collecting point for the cooled water return flow to the existing circulating water pumps. The elevation of this basin is relatively high and the elevation of the loop cooling water canal is, of necessity, low in elevation.

For this reason, low head pumps must be installed to raise the return water high enough to fill the tower basin. The existing pipes would be extended to supply the warmed water to this loop system.

Pump horsepower required for the spray modules in this alternative is 11,400.



DAVIS-BESSE NUCLEAR POWER STATION

BASE ALTERNATIVE D

CLOSED COOLING SYSTEM WITH 152

SPRAY MODULES IN COOLING WATER CANAL

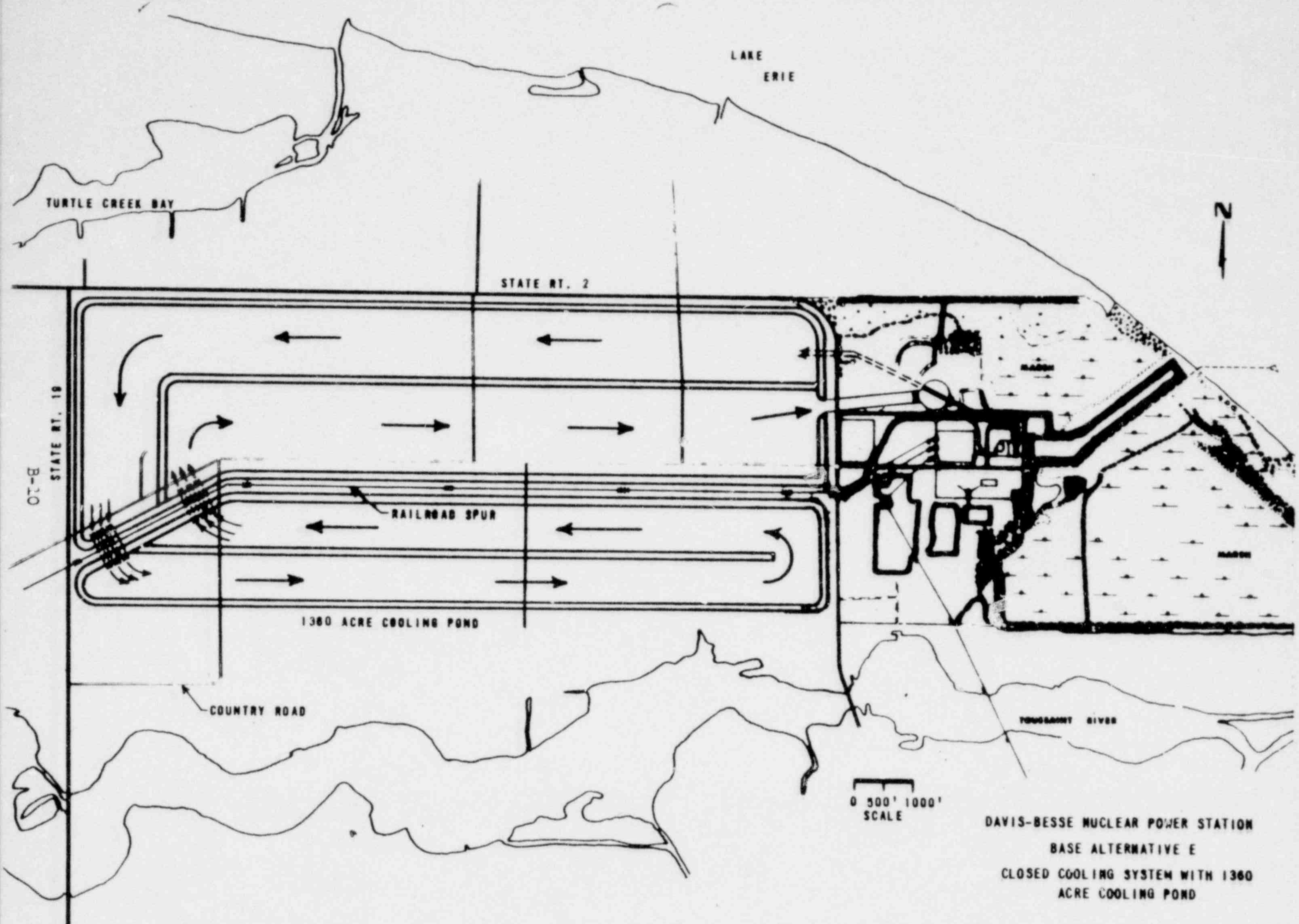
BASE ALTERNATIVE E

Closed Cooling System With 1,360-Acre Cooling Pond

This system is a closed system sized and arranged to cool all of the condenser cooling water by evaporation without any high-pressure sprays or draft-inducing equipment.

Acreage required for this type of cooling amounts to 1.5 acres per megawatt giving a total of 1,360 acres.

The dimensions of this pond, or cooling lake, are 13,000 feet long by 5,300 feet wide. Elevation of the existing cooling tower basin and the elevation of water in the cooling pond are such that low head pumps must be provided to raise the water from pond level up to cooling tower basin level. The cost of land alone for this alternative is nearly $7,000,000.



DAVIS-BESSE NUCLEAR POWER STATION

BASE ALTERNATIVE E

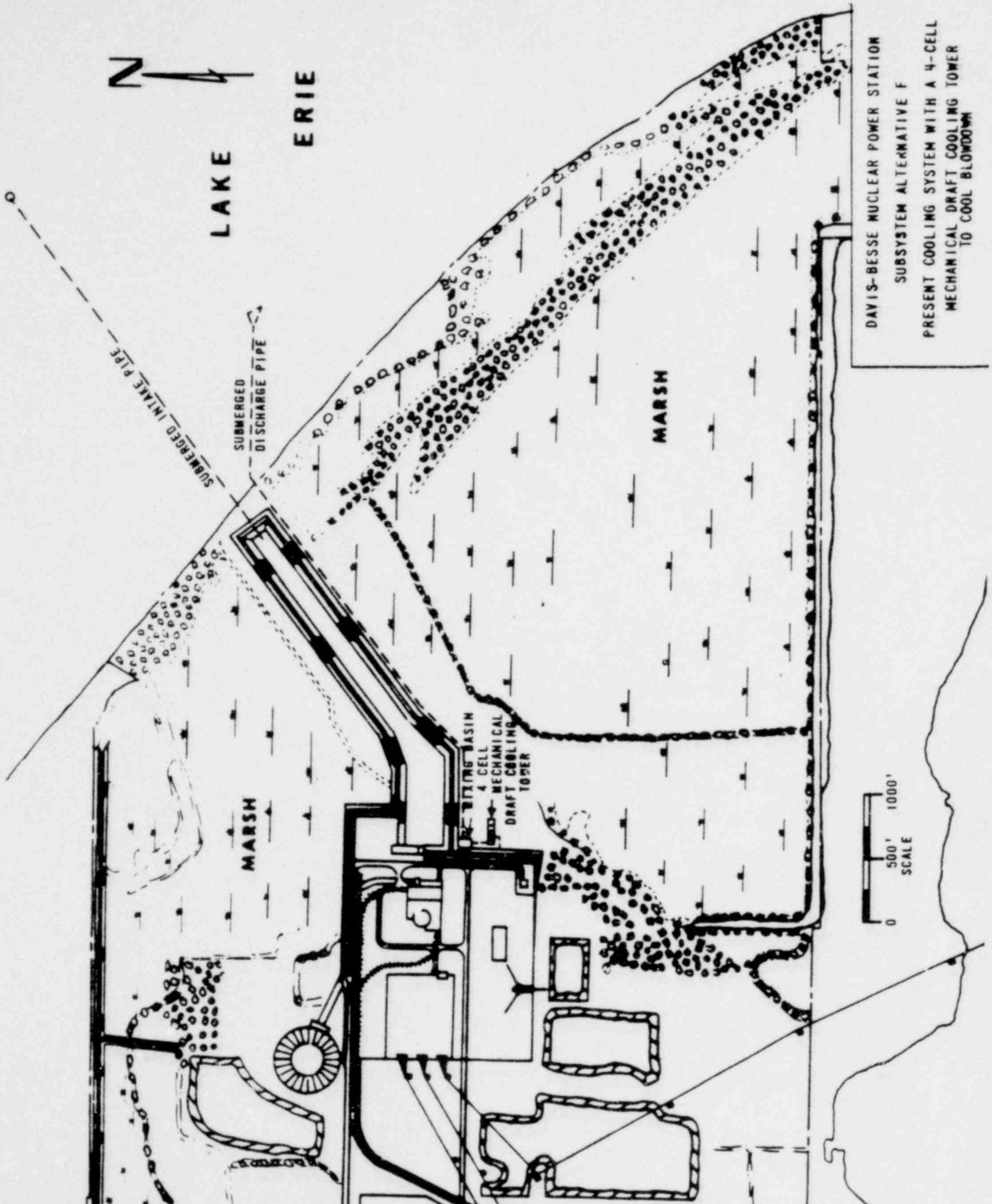
CLOSED COOLING SYSTEM WITH 1360 ACRE COOLING POND

SUBSYSTEM ALTERNATIVE F

Present Cooling System With A 4-Cell Mechanical Draft Cooling Tower To Cool Blowdown

This subsystem utilizes the present system with one natural draft cooling tower, and a supplemental mechanical draft cooling tower added to the blowdown system from the main cooling tower. With the present design, diluted water flow to Lake Erie will be a maximum of 20°F above Lake Erie temperature when discharged. With the installation of this cooling tower on the blowdown, the maximum temperature could be reduced to 10°F above the lake temperature.

This cooling tower would consist of 4 cells, each with an 18-foot diameter fan. Overall dimensions would be 50 feet by approximately 250 feet. The foundation of this tower would be elevated so that water from the cooling tower basin would flow to the mixing basin by gravity and additional pumps would not be required.


DAVIS-BESSE NUCLEAR POWER STATION
SUBSYSTEM ALTERNATIVE F
PRESENT COOLING SYSTEM WITH A 4-CELL MECHANICAL DRAFT COOLING TOWER TO COOL BLOWDOWN
N
LAKE ERIE
SUBMERGED INTAKE PIPE
SUBMERGED DISCHARGE PIPE
MARSH
MARSH
MIXING BASIN
4 CELL MECHANICAL DRAFT COOLING TOWER
0 500' 1000'
SCALE

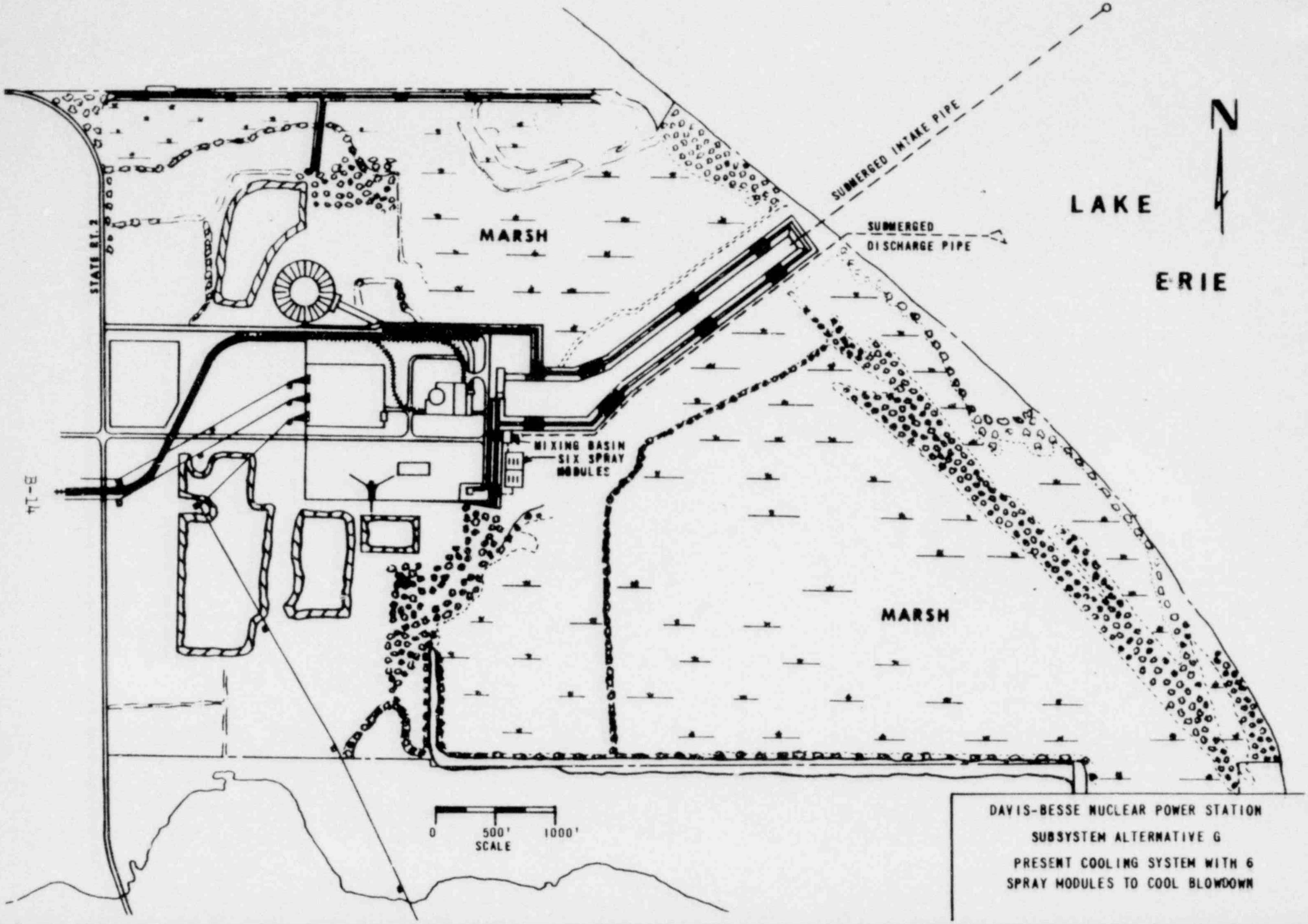
SUBSYSTEM ALTERNATIVE G

Present Cooling System With 6 Spray Modules to Cool Blowdown

This alternative is similar to Alternative F except that a small elevated pond is constructed and 6 spray modules are installed to cool tower blowdown.

No additional pumps would be required for this alternative. The cooling pond dimensions would be 300 feet long and 150 feet wide.

Blowdown from the main cooling tower would enter the pond at one end and after being sprayed by the powered spray modules, it leaves the pond at the far end. With the use of this small spray pond, the diluted blowdown temperature could be reduced to 10°F above Lake Erie temperature to give the same performance as can be attained with the 4-cell cooling tower of Subalternative F.

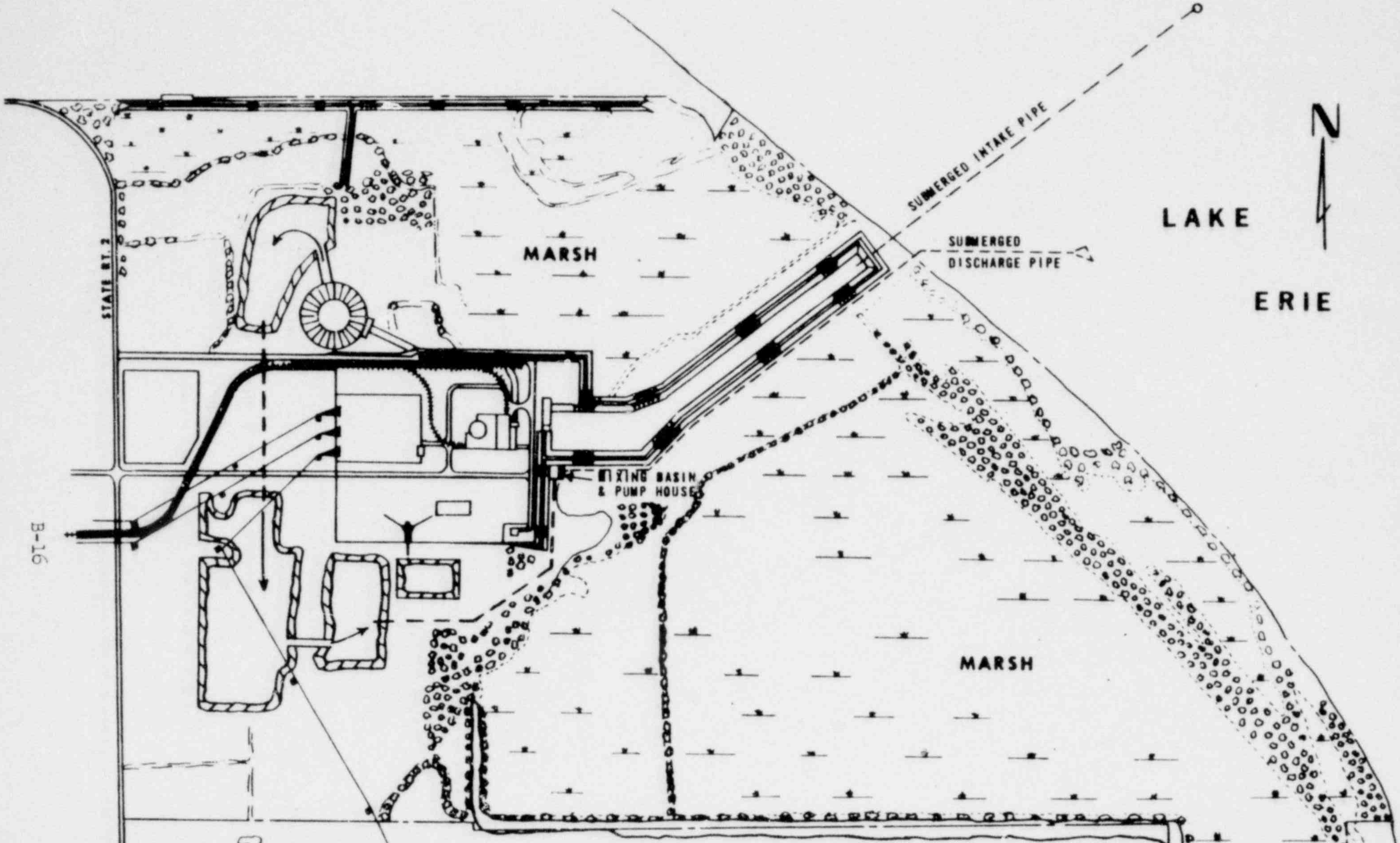

N
LAKE
ERIE
SUBMERGED INTAKE PIPE
SUBMERGED
DISCHARGE PIPE
MARSH
MARSH
STATE RT. 2
MIXING BASIN
SIX SPRAY
MODULES
0
500'
1000'
SCALE
DAVIS-BESSE NUCLEAR POWER STATION
SUBSYSTEM ALTERNATIVE G
PRESENT COOLING SYSTEM WITH 6
SPRAY MODULES TO COOL BLOWDOWN

SUBSYSTEM ALTERNATIVE H

Present Cooling System With 40-Acre Cooling Pond To Cool Blowdown

This subsystem is somewhat similar to Alternative G except that the very small pond in Alternative G has been increased in size so that a part of the total heat in the blowdown can be dissipated to the atmosphere by evaporative cooling without the requirement of the sprays.

The existing borrow pits on the site have a total surface area of more than 40 acres and this alternative includes the necessary interconnecting pipes and canals to permit the blowdown water to flow through all of these borrow pits in series. The efficiency of these cooling ponds without spraying is not as high as it would be with sprays, but a substantial part of the heat in the blowdown is removed.



DAVIS-BESSE NUCLEAR POWER STATION

SUBSYSTEM ALTERNATIVE H

PRESENT COOLING SYSTEM WITH 40 ACRE COOLING POND TO COOL BLOWDOWN

TABLE B-1

ALTERNATIVE COOLING SYSTEMS

EVALUATION OF COSTS AND CAPACITY LOSSES

All Dollar Figures Are Dollars X 1000	As Is	Open System	Alternate Closed System			As Is-Supp. Cooling With		
	A	B	C	D	E	F	G	H
	Nat. Draft	Once-through	Mech. Dr.	Spray Mod.	Big Pond	Mech. Dr.	Spray Mod	Small Pond
Spent for cooling twr. as of 6/1/72	$ 3,973	$ 3,973	$ 3,973	$ 3,973	$ 3,973	$ 3,973	$ 3,973	$ 3,973
Cost to complete or remove	4,863	2,000	2,000	2,000	2,000	4,863	4,863	4,863
Mech. cooling tower, found & equip.	--	--	5,940	--	--	340	--	--
Circ. water conduits, canals, & valves	6,218	2,500	6,218	6,218	6,218	6,218	6,218	6,218
Pipe connections & valves to existing pipe	--	560	560	560	560	--	--	--
Circ. water conduit & canal extensions	--	4,000	1,200	1,800	4,200	120	120	245
Additional pumphouse & pumps	--	--	--	750	750	--	--	100
Spray modules incl. labor to install	--	--	--	3,500	--	--	250	--
Electrical	140	140	950	1,670	340	197	227	160
Purchase land for pond	--	--	--	--	6,800	--	--	--
Dikes, Fill, or Excavation	--	--	(F)420	(D)350	(D&E)1,980	(F)40	(F&D)60	(D&E)100
Rock excav. & Berms	--	6,206	--	--	--	--	--	--
Earth excav. & Berms	--	2,215	--	--	--	--	--	--
Intake & discharge structures	757	2,055	757	757	757	757	757	757
Dewatering	1,600	2,000	1,600	1,600	1,600	1,600	1,600	1,600
Condenser	3,869	3,869	3,869	3,869	3,869	3,869	3,860	3,869
Screens, racks, pumps, chlorination	470	992	470	470	470	470	470	470
Circ. water pumps & drives	1,255	1,255	1,255	1,255	1,255	1,255	1,255	1,255
Intake canal	508	508	508	508	508	508	508	508
Makeup pumps, piping & valves	920	300	920	920	920	920	920	920
Total Direct Cost	$24,573	$32,573	$30,640	$30,200	$36,200	$25,130	$25,090	$25,038
Escal. & Contingency at 15%	3,686	4,886	4,596	4,530	5,430	3,766	3,762	3,754
	28,259	37,459	35,236	34,730	41,630	28,896	28,852	28,792
IDC at 7% & 7-1/2%/year 18%	5,087	6,743	6,342	6,251	7,493	5,202	5,194	5,184
	$33,346	$44,202	$41,578	$40,981	$49,123	$34,098	$34,046	$33,976
Cost Difference $x1000	Base	10,856	8,232	7,635	15,777	752	700	630
Annual Maintenance $x1000	Base	20	50	75	60	20	30	10
Lost Capacity-KW	Base	(25,000)	4,400	9,100	0	250	400	0
Heat Rate-Btu/KWH Net Loss	Base	(113)	53	110	0	0	0	0
Delay in Construction - months	Base	12	12	12	18	0	0	0