Consumers Power Company

James W Cook
Vice President - Projects, Engineering and Construction

General Offices: 1945 West Parnall Road, Jackson, MI 49201 • (517) 788-0453

November 20, 1981

Harold R Denton, Director
Office of Nuclear Reactor Regulation
Division of Licensing
US Nuclear Regulatory Commission
Washington, DC 20555

RECEIVED
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U S NUCLEAR REGULATORY COMMISSION

MIDLAND PROJECT
MIDLAND DOCKET NOS 50-329, 50-330
ADDITIONAL INFORMATION
FILE: 0487.4/0505.5 SERIAL: 14880

Wm H Regan's letter of October 11, 1978 requested additional environmental information for the NRC review of our application for operating licenses for the Midland Plant Units 1 & 2. Consumers Power Company has responded with all the necessary information. To update our submittals, attached are six copies of:

> Michigan NPDES Permit Application, Revision 3,
> (Combined Discharge Permit Application), Consumers Power Company
> September 30, 1981

which was submitted to the Michigan Water Resources Commission on November 16, 1981.

James W. Cook

JWC/RFG/fms

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1/6
Limited Dist.

oc1181-0457a131

Consumers
Power
Company

80EP10.1.3
General Offices: 212 West Michigan Avenue, Jackson, Michigan 49201 • (517) 788-0550

November 16, 1981

Mr Robert J Courchaine
Executive Secretary
Michigan Water Resources
Commission
P O Box 30028
Lansing, MI 48909

Dear Mr Courchaine

On February 28, 1978 the Company submitted a State Discharge Permit application for the Midland Plant waste water discharges; the application was amended on October 20, 1978 and June 1, 1979. Amendment 3 which reflects the current plant design is enclosed. Amendment 3 has been prepared using the revised state application form per the direction of your staff.

The current schedule is for Unit 2 to begin commercial operation in December of 1983 and Unit 1 in July of 1984. As indicated in our previous submittals, there are a number of construction and preoperational testing discharges that will occur upon completion of the various plant systems prior to the start of plant commercial operation. Several of these types of discharges will require authorization in the near future. We plan to work with your staff to develop a schedule which assures timely authorization of these discharges. We ask that you assist us by assuring that the processing of these authorizations is given an appropriate priority.

Additionally, we believe it would be appropriate at this time to reaffirm the understanding between your agency and the Nuclear Regulatory Commission concerning the processing of the Draft Environmental Statement as it relates to the processing of the draft NPDES Permit. It may also be advisable at this time to develop a process schedule that accommodates the needs of both agencies.

To assure that each of the actions outlined above is initiated, as well as to address any questions you may have on Amendment 3, we request an opportunity to meet with you and appropriate members of your staff within two weeks.

Thank you for your consideration.

Yours very truly

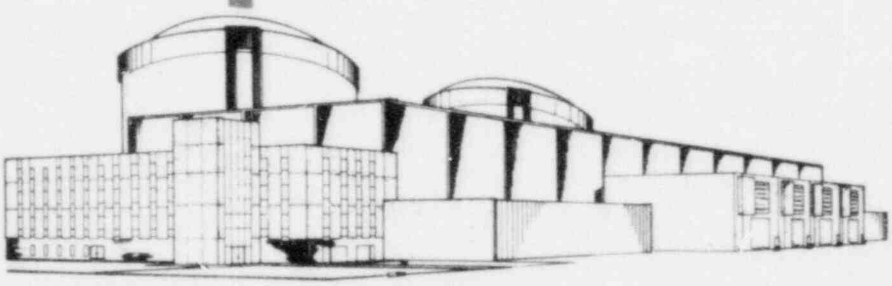
P C Hittle
Director of Environmental Department

By Ronald L Fobes

RLF/paf

MICHIGAN NPDES PERMIT APPLICATION

REVISION 3



Midland Plant Units 1&2

Consumers
Power
Company

CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2

STATE DISCHARGE PERMIT APPLICATION (Superceded)
February 28, 1978

FEDERAL STANDARD FORM C
APPLICATION FOR PERMIT TO DISCHARGE WASTEWATER (Superceded)
May 16, 1978

MICHIGAN COMBINED DISCHARGE PERMIT APPLICATION
September 30, 1981

SUPPLEMENTS

1 AMENDMENT NO 1 (STATE) OCTOBER 20, 1978

AMENDMENT NO 1 (FEDERAL) NOVEMBER 22, 1978

2 AMENDMENT NO 2 (STATE & FEDERAL) JUNE 1, 1979

3 AMENDMENT NO 3 (COMBINED DISCHARGE PERMIT APPLICATION) SEPTEMBER 30, 1981

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PART ONE

DISCHARGE PERMIT APPLICATION

Permit No. ____________

State of Michigan
Department of Natural Resources
Water Resources Commission

DISCHARGE PERMIT APPLICATION

(Please print or type all information)

Section 1. Applicant and Facility Description — unless otherwise specified on this form, all items are to be completed. If an item is not applicable, indicate "NA."

1. **Legal Name of Applicant:**

   Consumers Power Company

2. **Mailing Address of Applicant:**

   number & street 212 West Michigan Avenue

   city Jackson state MI zip code 49201 phone 517 (area code) 788-0550 (number)

3. **Applicant's Authorized Agent for further correspondence:**

   name & title P C Hittle, Director of Environmental Activities

   number & street 1945 West Parnall Road

   city Jackson state MI zip code 49201

   telephone: area code 517 number 788-1930

4. **Facility/Activity:** give name, ownership and physical location of the plant or other operating facility where discharge(s) does or will occur.

   name Consumers Power Company Midland Plant

   ownership: ____ sole owner; X corporation; MI state in which incorporation filed;

   ____ partnership; ____ governmental unit; ____ nonprofit organization.

   location:

   street & number 3500 East Miller Road

   city Midland township Midland

   county Midland ; town 14N range 2E section 27

I certify that I am familiar with the information contained in this application, and to the best of my knowledge and belief, such information is true, complete and accurate. Submitted in accordance with Section 8 (b), Act 245, Public Acts of 1929, as amended.

Signature of Applicant	Date	Signature of Site Manager	Date
James W. Cook	11/4/81	Donald B Miller Jr.	11/3/81

Print or Type Applicant's Name & Title

James W Cook
Vice President of Projects,
Engineering and Construction

Print or Type Co-Owner's Name

Donald B Miller, Jr.
Site Manager

R4898

Permit No. ____________________

NOTE: If sanitary sewage is to be discharged from housing developments, apartment buildings, shopping centers, or other commercial developments, into a system other than an approved municipal sanitary waste collection system, the following should be completed and signed by an authorized municipal official or township officer.

It is the policy of the Commission that applications involving the disposal of sewage of human origin from any entity other than local government include the local government as a co-signer of the statement, and that all proceedings and hearings against said entity will include the local unit of government as a party by appropriate notice, and all permits issued as a result of such hearings and proceedings will be jointly against the said unit and entity.

Signature of Authorized Local Government Representative: NA

Mailing Address of Local Government Representative: NA

Print or Type Name of Local Government Representative: NA

5. **Nature of Business:** describe the nature of the business or manufacturing process conducted at the plant or operating facility.

Generation of electrical energy and process steam. (See Exhibit I).

6. **Source of Water Supply:** indicate average water intake volume per day by sources (See Exhibit II and Figure 1).

municipal — name Midland Municipal Water District (23, 25)* 168,800 gallons per day

surface water intake — name Tittabawassee River (5) 28,000,000 gallons per day

private-well ** 0 gallons per day

other (specify) Precipitation (3,4,48) 1,987,900 gallons per day

7. **Facility Water Usage:** average volume in gallons per day for the following types of water usage at the facility. (See Exhibit III).

process water (including contact cooling water) (23,27,28,30) 154,800 gallons per day
plus 11,900,000 gallons per day recirculated (20).

noncontact cooling water 996,435,000 gal per day recirculated (11,65) - gallons per day

sanitary water (number of people served) ** 400 to 1300 (26) 14,000 gallons per day

other (specify) Evaporation and Seepage (8,9) 18,323,000 gallons per day

total 18,491,800 gallons per day

*Flow reference nodes. See Figure 1.

**This value does not include sanitary and domestic water obtained from private wells for the visitor/training center and outage building. Approximately 4,875 gpd and 7,500 gpd, respectively, are utilized for domestic purposes and discharged to Dow for treatment and disposal. Outage building water use value applies only during plant outage for refueling.

Permit No. ____________

8. **Facility Discharges:** specify number of discharge points and the volume of water discharged or used from the facility according to the categories below.
(See Figure 1).

	number of discharge points	Flow Reference Nodes	total volume used or discharged — gal/day
surface water	2	60,62	11,798,000
municipal sanitary sewer	-	-	0
municipal storm sewer	-	-	0
groundwater —	-	-	0
a. land application	-	-	0
b. percolation system	-	8	323,000*
well injection	-	-	0
other (specify)	-	-	0
total	2	-	12,121,000

9. **Discharge Locations**: provide a drawing or map of the facility showing each point of discharge listed in item 8. Label each discharge with the appropriate three digit serial number assigned in Section II, 1 (a).
(See Figures 2 and 3).

10. **Pollution Incident Prevention Plan**: has your facility submitted a Pollution Incident Prevention Plan?

yes X no ____ date submitted 10/8/79 date fully implemented at initial date of Commercial Operation.

11. **Critical Materials**

a. **usage**: This application contains a list of critical materials. Please indicate the amount of these materials used in, produced in, or are incidental to your operation. (See Exhibit IV).

name	amount lbs/yr.	name	amount lbs/yr.

* Seepage and percolation from cooling pond.

Section II Basic Discharge Description

(Please print or type all information)

Complete this section for each discharge indicated in Section 1, Item 8, except those discharges which enter a municipal sanitary sewer. Separate descriptions of each discharge are required even if several discharges originate in the same facility. All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

1. **Discharge Serial No. and Name**

   a. discharge serial number 0 0 1 (three digit code, 001, 002, etc.)

   b. type of waste water being discharged (Process, noncontact cooling, etc.) Combined Plant Discharge - process, noncontact cooling, and precipitation (60)*

   c. volume discharged 11,798,000 average gals/day 142,556,000 maximum gals/day

2. **Discharge Location**

   town 14N range 2E section 27

   county Midland city or town Midland

3. **Discharge Point Description** (If the discharge is to a county drain or storm sewer, indicate the receiving waters; e.g., Clear Lake via Mud Drain)

   ____ lake ______________

   X river or stream Tittabawassee River

   ____ municipal storm sewer ______________

   ____ county drain ______________

   ____ groundwater ______________

   ____ well injection ______________

   ____ other (specify) ______________

4. **Activity Description**

   give a narrative description of activity producing this discharge: (See Exhibit III).

   The proposed enterprise is a two unit nuclear power plant. Each unit consists of a pressurized water reactor, a turbine generator, and associated auxiliaries. The facility has a total combined gross capability of 1357 MWe plus 4.05×10^6 lb/hr of process steam. The electricity will be supplied to the applicant's electrical distribution system and the process steam will be supplied to The Dow Chemical Company.

*Flow reference node. See figure 1.

5. **Activity Causing Discharge:** For each S.I.C. Code which describes the activity causing this discharge, supply the type and average and maximum amount of *either* the raw materials consumed (Item 5a) or the product produced (Item 5b).

a. raw materials:

S.I.C. Code	name	average amt/day	maximum amt/day	unit (see Table II)	discharge(s) serial No. (s)

b. products:

S.I.C. Code	name	average amt/day	maximum amt/day	unit (see Table II)	discharge(s) serial No.(s)
4911	Electric Power Services		1.36	Z-1	001
4961	Steam Supply		97.2	Z-2	001

6. **Waste Abatement Practices:** Briefly describe the waste treatment practices applied to this discharge. (attach a waste flow diagram) (See Exhibit V and Figure 1).

narrative: Miscellaneous floor drainage and collected precipitation are treated by oil separation and removal equipment. Wastewater having extreme pH values is adjusted to a range of 6.0 to 9.0 by chemical addition. Wastewater with high suspended solids is routed to the cooling pond for settling. Laundry facility wastewater is filtered to remove suspended solids. Certain process wastewaters and sanitary wastes are segregated and treated or disposed of offsite. Non-contact cooling water is recirculated to the cooling pond and retained to allow the dissipation of heat and total residual chlorine. Construction site runoff is controlled by holding ponds to allow settling, rip rap to reduce water velocity, and fertilizing, seeding and mulching to control soil erosion.

a. distance of treatment facility and/or disposal area from nearest well: (See below.)

private well ______________ feet; municipal well ______________ feet.

The plant site (ie, the protected area) is located within the distribution system of the Midland Municipal Water District which draws its supply from Lake Huron. The nearest known private wells in use are located near the plant site at the visitor/training center, the outage building and Warehouse No 2 (See Figure 3).

b. if subsurface disposal, land application, or oxidation pond is proposed, nearest distance to a surface watercourse: N/A feet.

c. if discharge is to underground by injection well, include an application and/or approved permit in accordance with the provisions of Act 315, Public Acts of 1969. N/A

d. names and addresses of property owners adjacent to the facility:

name	address
(See Exhibit VI).	

7. **Wastewater Characteristics:** If you presently have a discharge permit, list all parameters reported on the current monthly operating report and compute monthly averages, maximum and minimum from the past twelve months. For the proposed discharge, describe the expected characteristics of the discharge after treatment.

Parameter	Monthly Average	Monthly Maximum	Monthly Minimum	Sample Frequency	Sample Type
(See Exhibit VII).					

8. **Critical Materals Discharged:** List those critical materials not reported in Item 7 which may be present in the discharge.

Parameter	Concentration	Units
(See Exhibit IV).		

9 **Plant Controls:** Check if the following plant controls are available for this discharge:

_____ alternate power source   __X__ alarm or emergency procedure for power or equipment failure.

10 **Residuals and Residues:** Are there any sludges, residues, or critical materials removed from or resulting from treatment or control of wastewaters produced by this discharge?

__X__ yes: _____ no: if *no* is checked, continue to Item 11. (See Exhibit V).

a. the physical state of the residue:

_____ liquid: _____ heavy sludge: _____ wet solids: _____ dry solids.

b. the liquid portion of the residue is primarily:

_____ water: _____ oil: _____ chemical solvent.

c. the residue results from:

_____ process wastewater: _____ sanitary sewage: _____ chemical production;

_____ food processing: _____ machining: _____ dust collection;

_____ paint booths: _____ water treatment: _____ other (specify).

____

d. estimate the total annual volume or weight of the material:

_____ gallons; pounds; cubic yards (circle one)

e. if you dispose of the material yourself, indicate the type of disposal site:

_____ public landfill: _____ private landfill: _____ own land.

_____ shipped out of state: _____ incinerated: _____ other (specify).

____

f. if a public or private landfill(s) is used, give name(s) and address(es):

____

____

g. if you have the material removed by commercial waste or refuse hauler(s), give name(s) and address(es):

____

____

____

h. indicate how the material is stored before disposal or removal:

_____ metal drums; _____ fiber drums; _____ aboveground tank;

_____ underground tank; _____ stockpiled on ground;

_____ holding pond/lagoon; _____ other (specify) ______________

11. **Water Treatment Additives:** if the discharge is treated with any conditioner, inhibitor, algicide, answer the following:

a. name of material(s) N/A

b. name and address of manufacturer(s) N/A

c. quantity (pounds added per million gallons of water treated) N/A

d. chemical composition of these additives:

N/A

NOTE: Complete Items 12-14 if there is a thermal discharge; e.g., associated with a steam and/or power generation plant, steel mill, petroleum refinery or any other manufacturing process.

12. **Thermal Discharge Source:** Check appropriate item(s) indicating the source of this discharge.

	node	**gallons/day**
boiler blowdown	-	0
boiler chemical cleaning	-	0
ash pond overflow	-	0
boiler water treatment — evaporation blowdown	-	0
oil or coal fired plants — effluent from air pollution control devices	-	-

12. (continued)

condenser cooling water	-	0
cooling tower blowdown	-	0
manufacturing process	-	0
other (specify) Cooling pond blowdown	7	11,700,000 (avg)

13. **Discharge Temperature:**

maximum summer 110 °F maximum winter 87 °F

average summer 101 °F average winter 69 °F

14. **Intake Temperature:**

average summer 76 °F average winter 33 °F

Section II Basic Discharge Description

(Please print or type all information)

Complete this section for each discharge indicated in Section 1, Item 8, except those discharges which enter a municipal sanitary sewer. Separate descriptions of each discharge are required even if several discharges originate in the same facility. All values for an existing discharge should be representative of the twelve previous months of operation. If this is a proposed discharge, values should reflect best engineering estimates.

1. **Discharge Serial No. and Name**

   a. discharge serial number 0 0 2 (three digit code, 001, 002, etc.)

   b. type of waste water being discharged (Process, noncontact cooling, etc.) Condensate return pumphouse drainage - process water (62)*

   c. volume discharged 0 average gals/day 12,000 maximum gals/day

2. **Discharge Location**

   town 14N range 2E section 27

   county Midland city or town Midland

3. **Discharge Point Description** (If the discharge is to a county drain or storm sewer, indicate the receiving waters: e.g., Clear Lake via Mud Drain)

   ____ lake

   ____ river or stream

   ____ municipal storm sewer

   X county drain Bullock Creek

   ____ groundwater

   ____ well injection

   ____ other (specify)

4. **Activity Description**

   give a narrative description of activity producing this discharge: (See Exhibit III).

   Gravity drainage from condensate return pumphouse to Bullock Creek. Discharge will consist of minor pipe and equipment leakage, groundwater seepage and planned drainage of the condensate pipes for maintenance. The condensate lines contain demineralized quality water.

*Flow reference node. See figure 1.

5. **Activity Causing Discharge:** For each S.I.C. Code which describes the activity causing this discharge, supply the type and average and maximum amount of *either* the raw materials consumed (Item 5a) or the product produced (Item 5b).

a. raw materials:

S.I.C. Code	name	average amt/day	maximum amt/day	unit (see Table II)	discharge(s) serial No. (s)

b. products:

S.I.C. Code	name	average amt/day	maximum amt/day	unit (see Table II)	discharge(s) serial No.(s)
4911	Electric Power Services		1.36	Z-1	002
4961	Steam Supply		97.2	Z-2	002

6. **Waste Abatement Practices:** Briefly describe the waste treatment practices applied to this discharge. (attach a waste flow diagram)

narrative None

a. distance of treatment facility and/or disposal area from nearest well: (See below)

private well ______ feet; municipal well ______ feet

The plant site (ie, the protected area) is located within the distribution system of the Midland Municipal Water District which draws its supply from Lake Huron. The nearest known private wells in use are located near the plant site at the visitor/training center, the outage building and Warehouse No 2 (See Figure 3).

b. if subsurface disposal, land application, or oxidation pond is proposed, nearest distance to a surface watercourse: N/A feet.

c. if discharge is to underground by injection well, include an application and/or approved permit in accordance with the provisions of Act 315, Public Acts of 1969. N/A

d. names and addresses of property owners adjacent to the facility:

name	address
(See Exhibit VI).	

7. **Wastewater Characteristics:** If you presently have a discharge permit, list all parameters reported on the current monthly operating report and compute monthly averages, maximum and minimum from the past twelve months. For the proposed discharge, describe the expected characteristics of the discharge after treatment.

Parameter	Monthly Average	Monthly Maximum	Monthly Minimum	Sample Frequency	Sample Type
(See Exhibit VII).					

8. **Critical Materals Discharged:** List those critical materials not reported in Item 7 which may be present in the discharge

Parameter	Concentration	Units
(See Exhibit IV).		

9. **Plant Controls:** Check if the following plant controls are available for this discharge: N/A

______ alternate power source ______ alarm or emergency procedure for power or equipment failure.

10. **Residuals and Residues:** Are there any sludges, residues, or critical materials removed from or resulting from treatment or control of wastewaters produced by this discharge?

______ yes; __X__ no; if *no* is checked, continue to item 11.

a. the physical state of the residue:

______ liquid; ______ heavy sludge; ______ wet solids; ______ dry solids.

b. the liquid portion of the residue is primarily:

______ water; ______ oil; ______ chemical solvent.

c. the residue results from:

______ process wastewater; ______ sanitary sewage; ______ chemical production;

______ food processing; ______ machining; ______ dust collection;

______ paint booths; ______ water treatment; ______ other (specify).

____

d. estimate the total annual volume or weight of the material:

______ gallons; pounds; cubic yards (circle one)

e. if you dispose of the material yourself, indicate the type of disposal site:

______ public landfill; ______ private landfill; ______ own land;

______ shipped out of state; ______ incinerated; ______ other (specify).

____

f. if a public or private landfill(s) is used, give name(s) and address(es):

____

____

g. if you have the material removed by commercial waste or refuse hauler(s), give name(s) and address(es):

____

____

____

h. indicate how the material is stored before disposal or removal:

_____ metal drums; _____ fiber drums; _____ aboveground tank;

_____ underground tank; _____ stockpiled on ground;

_____ holding pond/lagoon; _____ other (specify) ________________ ________________

11. **Water Treatment Additives:** if the discharge is treated with any conditioner, inhibitor, algicide, answer the following:

a. name of material(s) N/A

b. name and address of manufacturer(s) N/A

c. quantity (pounds added per million gallons of water treated) N/A

d. chemical composition of these additives:

N/A

NOTE: Complete Items 12-14 if there is a thermal discharge; e.g., associated with a steam and/or power generation plant, steel mill, petroleum refinery or any other manufacturing process.

12. **Thermal Discharge Source:** Check appropriate item(s) indicating the source of this discharge. N/A

	gallons/day
boiler blowdown	______
boiler chemical cleaning	______
ash pond overflow	______
boiler water treatment — evaporation blowdown	______
oil or coal fired plants — effluent from air pollution control devices	______

Permit No. ______________________ Discharge Serial No. 0 0 2

12. (continued)

condenser cooling water ____________

cooling tower blowdown ____________

manufacturing process ____________

other (specify) ____________

13. **Discharge Temperature:** N/A

maximum summer ____________°F maximum winter ____________°F

average summer ____________°F average winter ____________°F

14. **Intake Temperature:** N/A

average summer ____________°F average winter ____________°F

PART TWO

SUPPORT DOCUMENT

SUPPORT DOCUMENT
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mi0581-0354a102

EXHIBIT I
DESCRIPTION OF PROPOSED ENTERPRISE

The Midland Plant Units 1 and 2, owned and to be operated the Consumers Power Company of Michigan, is sited partially within the southern limits of the City of Midland, Michigan. Commercial operation of Unit 2 is planned for December, 1983, and commercial operation of Unit 1 is planned for July 1984. The 1235-acre plant site is on the south shore of the Tittabawassee River immediately across from the Dow Chemical Company's main industrial complex (see Figures 4 and 5).

The Midland Plant will generate approximately 1,300 megawatts of electricity for distribution to the applicant's system and that of the Michigan Power Pool of which the applicant and Detroit Edison Company are the principal partners. In addition, up to 4,050,000 pounds per hour of process steam will be delivered to the Dow Chemical Plant across the river for use in chemical processes and heating.

The two reactors for the Midland Plant are pressurized-water type supplied by the Babcock and Wilcox Company. Each reactor will operate initially at a thermal power level of 2468 MWt and will be capable of an ultimate output of 2568 MWt.

Unit 1 will have a gross electrical capability of 505 MWe, and in addition will generate up to 3,650,000 pounds per hour of 175 psig steam and up to 400,000 pounds per hour of 600 psig steam for sale to Dow Chemical Company. The gross electrical capability of Unit 2 will be 852 MWe. In normal operation, Unit 1 will generate electricity and steam while Unit 2 will generate electricity. Unit 2 can provide steam when Unit 1 is shut down. The nominal operating pressure and temperature for both reactors is 2200 psig and 579°F. The units are designed for a pressure of 2500 psig and a temperature of 650°F. An exception is the pressurizer which is designed for a temperature of 670°F.

The steam and power conversion system is designed to accept steam from the nuclear steam system. One portion of this heat energy is converted to electrical energy by the turbine generators. A second portion of the heat energy is used in the process steam evaporators to generate process steam for Dow. The circulating water system, utilizing cooling pond water, will dissipate the balance of the heat energy which is rejected by the turbine condenser.

Steam from the steam and power conversion systems is used in the process steam evaporators to generate process steam in a tertiary system for Dow. The function of the process steam evaporators is to provide physical separation between the turbine plant cycle and the process steam delivered to Dow.

Steam from the Unit 1 steam generators will pass through a two-flow, 1800 rpm, tandem-compound, high-pressure turbine and then through moisture separator reheaters and combined intercept and stop valves to one double-flow low-pressure turbine which exhausts to the main condenser. Steam from Unit 2 will pass through a similar system, except that final flow will be to two double-flow, low-pressure turbines which exhaust to a dual pressure condenser.

The Midland Plant Units 1 and 2 will generate electric power at 22 kV and 24 kV, respectively. This power will be fed through separate isolated phase buses to the unit main transformers where it will be stepped up to 345 kV transmission voltage and delivered to the switchyard on separate overhead lines.

EXHIBIT II
SOURCE OF WATER

PROCESS WATER

All water for use as process water will be provided as follows:

1. The Dow Chemical Company will provide feedwater to the evaporators (Node 20) in the process steam system. The steam thus produced is returned (Node 21) to the Dow Chemical Company for use in their process systems. This flow is expected to be continuous.

2. The Midland Municipal Water District will supply the Midland Plant makeup demineralizer system (Node 23) which in turn will supply makeup water to the Midland Plant secondary steam cycle. The Plant will maintain a link to Dow demineralized water (Node 29) as an emergency backup.

NONCONTACT COOLING WATER

Water for use as cooling and condensing water will be withdrawn from the Tittabawassee River and pumped to the 880 acre recirculating cooling pond (Node 5). The intake structure on the river will contain traveling screens, screen wash pumps, and trash racks. The design of the intake structure has been found tentatively acceptable by the State of Michigan Department of Natural Resources pending post operational studies of the intake's efficiency and on-site velocity measurement (letter from Mr Robert J Courchaine, DNR, to Mr Paul C Hittle, Consumers Power Company, dated January 17, 1977).

Preliminary design rating of the makeup pumps was 200 cfs. The makeup pumps as built will be capable of withdrawing water from the Tittabawasee River for cooling pond makeup at a maximum capacity of 270 cfs subject to the following:

River Flow, cfs	Maximum Pond Makeup Rate, cfs
<350	0
350-650	Excess over 350 up to a maximum of 40
650 and above	Excess over 650 plus 40 but not more than 270

Expected makeup water approach velocities are presented in Table 1.

TABLE 1

EXPECTED MAKEUP WATER APPROACH VELOCITIES FOR VARIOUS WITHDRAWAL RATES

River Flow (cfs)	Withdrawal for Makeup (cfs)	Recirc (cfs)	Total Pumping[a] (cfs)	No Of Pumps Operating	Water Surface elev at Intake (ft)[b]	Estimated Approach Velocity[d] (ft/s)
350	0	67[b]	67	1	588.8	0.42
390	40	40[c]	80	1	589.0	0.24
700	80	0	80	1	589.4	0.50
744	134	22[c]	156	2	589.5	0.73
1000	158	0	158	2	590.0	0.79
1565[e]	226	0	226	3	590.8	1.00

(a) Pump output for makeup and recirculation to makeup pump inlet is a function of the river water surface elevation. Maximum pump output is 270 cfs at a water surface elevation of 608.0 ft.

(b) Recirculation to the blowdown line is for radwaste dilution only. Pump output for radwaste dilution is 67 cfs and is not a function of the river water surface elevation. Radwaste dilution may also be provided by cooling pond blowdown where available.

(c) Recirculation to makeup pump inlet.

(d) Calculated one foot in front of screen face.

(e) For river flows exceeding 1565 cfs, the average approach velocity will be less than 1 ft/s.

The circulating water intake structure on the cooling pond will contain circulating water pumps, trash racks and traveling screens. The cooling pond is designed to provide dissipation of heat removed by plant cooling and condensing systems and will be used to provide water for the plant fire protection system. Cooling pond operation is discussed in Exhibit III.

Initial Pond Filling

Water withdrawal from the Tittabawassee River for initial filling of the 12,600 acre-feet cooling pond began on April 7, 1978 and continued through May 4, 1978 (28 days). Pond filling was resumed on November 8, 1978 with periodic pumping during 10 days in November, 19 days in December and 11 days in January 1979. Pond level has been maintained by filling activities during 4 days in March 1979, 1 day in November 1980, 4 days during December 1980 and 2 days in January 1981.

Entrainment

Monitoring of ichthyoplankton and macroinvertebrate entrainment was conducted during the April and May 1978 pond fill activities and is reported in Survey and Evaluation of the Water Quality, Tittabawassee River, Near Midland, Michigan, 1978-1979 (CMU 1979). Due to the seasonal sparcity of entrainment organisms during successive pond fill or pond level maintenance activities (November and December 1978, January and March 1979), additional entrainment monitoring has not been conducted.

Impingement

Impingement monitoring was conducted during each day of pond fill or level maintenance activities. A preliminary assessment of impingement during initial pond fill is reported in Assessment of Impingement During Initial Pumping to the Midland Plant Cooling Pond, (CP Co 1979). Impingement associated with March 1979 pond level maintenance activities is reported in Aquatic Assessment of the Tittabawassee River in the Vicinity of Midland, Michigan, (LMS 1980). Additional impingement collections will be reported in an impingement and entrainment summary report anticipated by December 15, 1981. The summary report will include a review and evaluation of the complete Midland pond impingement and entrainment data base and discuss the importance and potential impact of entrainment and impingement associated with proposed operational intake activities.

SANITARY WATER

Domestic water for the power block and associated facilities will be supplied by the Midland Municipal Water District (Node 25). Domestic water for the visitor/training center and the outage building and sanitary water for Warehouse No 2 will be supplied from wells located adjacent to each structure. Sanitary wastewater from all sources on the plant site will be transported to Dow for treatment and disposal, except wastewater from Warehouse No 2 which is discharged to an adjacent septic tank and drainfield.

PRECIPITATION

Precipitation falling on the plant site will be transported via roof drains and site storm drains to Bullock Creek, the Tittabawassee River, and the cooling pond (Nodes 1, 2 and 3 and Figure 3). Precipitation falling on areas where oil contamination may occur such as transformer areas, and oil storage areas (Node 48) is routed to the oily waste collection system. Precipitation falling on the cooling pond (Node 4) slightly decreases cooling pond makeup water requirements. The maximum precipitation rate is based on the 100 year, 24 hour rainfall since 1932 which was 4.6 inches. The average annual precipitation is about 30 inches.

REFERENCES

H L Linn, et al, 1979. Survey and Evaluation of the Water Quality, Tittabawassee River, Near Midland, Michigan, 1978-1979 (Volume II), Central Michigan University.

I H Zeitoun, et al, 1979. Assessment of Impingement During Initial Pumping to the Midland Plant Cooling Pond, Consumers Power Company.

Lawler, Matusky and Skelly Engineers, 1980. Aquatic Assessment of the Tittabawassee River in the Vicinity of Midland, Michigan.

EXHIBIT III
WATER USAGE

PROCESS WATER

Process water is derived from the Midland Municipal Water District and from The Dow Chemical Company. Midland city water is used in the makeup demineralizer system, the laundry facility, sanitary, and laboratory fixtures. All of the process water used in the process steam system is supplied by Dow Chemical.

Dow Condensate Usage

Condensate and demineralized water from the DOW Chemical Company are stored in separate tanks near the plant site and adjacent to the condensate return pumphouse. Water from the demineralized water storage tank is used as makeup for the condensate storage tank. Pumps in the condensate return pumphouse take suction from both the demineralized water and the condensate storage tanks. Demineralized water is directed through miscellaneous sample panel and monitor coolers prior to discharge to the process steam evaporators. Condensate (Node 20) is pumped to the evaporators for conversion to steam. Floor drainage from the condensate return pumphouse is directed via gravity flow to Bullock Creek. Evaporator feedwater is conditioned by the addition of Na_2SO_3, Na_2HPO_4 and Na_3PO_4 (Chemical Node D). The process steam produced in the evaporators is then returned to Dow (Node 21) for use in their chemical processes and heating.

Condensate collected from the steam traps on the Dow process steam line will be routed to the site storm drainage system. Blowdown from the evaporators (Node 22) will be pumped to the Dow Chemical Company via the sanitary waste collection system for treatment and discharge or may alternately be routed to the liquid radwaste system for treatment and disposal in the event of unacceptable levels of radioactivity. This blowdown is expected to be continuous.

Midland City Water Usage

Midland city water is transferred (Node 23) through the makeup demineralizer system to the plant water storage and transfer system (Node 34). The makeup demineralizers are periodically regenerated by the addition of H_2SO_4 and NaOH (Chemical Node F) and the regeneration products are routed (Node 36) to the evaporator building neutralizing sump for treatment and discharge.

The plant water storage and transfer system consists of condensate storage tanks, a demineralized water storage tank, a utility water storage tank, and a primary water storage tank. Water from the condensate storage tank and demineralized water storage tank is used for makeup in the Units 1 and 2 condensate and feedwater systems (Node 41) and the auxiliary boilers (Nodes 32 and 33) with the addition of NH_3 and N_2H_4 (Chemical Nodes G, H & O). Intermittent blowdown from the permanent auxiliary boilers (Node 37) and the temporary high-pressure auxiliary boilers (Node 72) is routed to the oily waste collection system. Blowdown from the ermanent auxiliary boilers may begin as early as December 1981 and will c'.tinue for the life of the Midland Plant. The high pressure auxiliary boiler will be used for testing and startup between June 1982 and June 1985. Initial blowdown is scheduled during May 1982.

Water from the utility water storage tank and the primary water storage tank is used in the Units 1 and 2 reactor plant systems (Node 54) with the addition of H_3BO_3 and LiOH (Chemical Node K) and N_2H_4 and morpholine (Chemical Node P). These tanks will also supply the initial fill for the component cooling water system. Approximately 12.5 lb of N_2H_4 and 2 lb of morpholine will be used annually to inhibit corrosion in this system (chemical Node P). An anticorrosion water chemistry will be maintained in the containment spray system with Na_3PO_4 and N_2H_4 following initial filling from the Borated Water Storage Tank. No annual consumption of these materials is anticipated after initial charging of the containment spray system. Small amounts of these corrosion inhibitors may be discharged to nearby floor drains during routine maintenance or repair activities.

Overflow and drainage from the demineralized water storage tank are routed to the river via the site storm drainage system, while overflow and drainage from the condensate storage tanks are routed to the cooling pond via the site storm drainage system. Overflow and drainage from the utility water storage and primary water storage tanks are routed to the Boron Recovery System. The discharge of demineralized water via the makeup demineralizer storage tank overflow/drain line would be extremely infrequent, occurring only when the water level in the storage tank exceeds normal or when the tank is required to be drained for maintenance. The tank is equipped with a high level alarm and a high level switch which automatically shuts down the makeup demineralizer system. This instrumentation is designed to preclude or prevent overflow occurrences. The storage tank will not be routinely drained for maintenance on any scheduled basis. It is expected the tank may require maintenance less than once per year. The rated tank capacity is 50,000 gallons of demineralized water.

Midland city water will be distributed throughout the plant to the laundry facility (Node 27), laboratory fixtures (Nodes 28 and 30), and miscellaneous drinking fountains, safety showers, etc. Domestic wastewater from sanitary fixtures is routed to Dow Chemical via the sanitary waste collection system (Node 24) for treatment and discharge. Laundry facility wastewater is discharged (Node 52) to the laundry waste treatment system. Drainage from the secondary plant laboratory fixtures in the turbine building will be routed on a continuing basis (Node 35) to the Unit 2 neutralizing sump for treatment and discharge. Intermittent sink drainage from the evaporator building laboratory fixtures is routed to the evaporator building neutralizing sump. Primary and Health Physics laboratory sink drainage is routed to the Liquid Radwaste System via the Boron Recovery System.

Midland City water will be used for initial fill and subsequent makeup to the plant heating, chilled water and diesel-generator cooling water systems. A commercial borate-nitrite additive will be used to inhibit corrosion. The plant heating system will also contain ethylene glycol for freeze protection and improved heat transfer. Small quantities of these materials may be discharged to nearby floor drains during routine maintenance or repair activities.

NONCONTACT COOLING WATER

The cooling pond receives makeup water from the Tittabawassee River (Node 5) and from precipitation, both directly (Node 4) and indirectly via the site storm drainage system (Nodes 64 and 3). Water from the river can also be diverted directly to the laundry/radwaste dilution line (Node 6). The pond provides noncontact cooling water for the Units 1 and 2 condensers (Node 11) and for additional plant cooling requirements via the Units 1 and 2 service water systems (Node 13). Plant circulating water is treated with H_2SO_4 (Chemical Node B) and with NaOCl (Chemical Node A), is passed through the Units 1 and 2 condensers and is returned to the cooling pond.

In order for the service water system to perform its cooling functions, the service water entering the plant must not exceed its design temperature limit. The service water cooling tower (Nodes 14-17) will be put into operation as needed to maintain the service water intake temperature below its design limit. Blowdown from the service water cooling tower will be returned to the cooling pond (Node 18). Both NaOCl (Chemical Node C) and H_2SO_4 (Chemical Node N) are injected into the service water system.

Service water (Node 46) is used to generate sodium hypochlorite onsite for use in controlling biological growths on heat transfer surfaces exposed to cooling pond water. NaCl (Chemical Node L) is used in the manufacture of sodium hypochlorite. NaOCl will be injected twice daily for a period of one half hour each into the Units 1 and 2 condenser cooling water and service water systems (Chemical Nodes A and C). Use of sodium hypochlorite will be limited as determined by operation requirements. A chlorine residual as a result of this operation is not expected to persist in the pond for a sufficient time to circulate to the point from which pond blowdown is withdrawn.

Sulfuric acid will be injected into the service water and condenser cooling water systems to reduce the formation of carbonate scale on heat transfer surfaces (Chemical Nodes N and B). This will slightly increase the sulfate concentration that would otherwise be present in the pond. Some sodium chloride will be present in the effluent produced by the onsite sodium hypochlorite generation system, but this will have negligible effect on the pond sodium and chloride concentrations.

Pond water loss mechanisms include seepage (Node 8), and evaporation (Node 9) and intermittent flow to the fire protection system (Node 10). Fire protection water is ultimately routed via floor drains to the oily waste collection system. The site dewatering system removes groundwater and returns it to the cooling pond (Node 63).

SANITARY WATER USAGE

Midland city water is used in sanitary facilities (Node 26) and is discharged to the sanitary waste collection system Well water is used in sanitary facilities at the Visitor/Training Center, Outage Building and Warehouse No 2. Sanitary wastewater from the Visitor/Training Center and the Outage Building is discharged to the sanitary waste collection system while a septic tank and drainfield receives sanitary wastewater from Warehouse No 2.

PLANT DISCHARGES PRIOR TO COMMERCIAL OPERATION

Prior to commercial operation, the plant will use well water, City of Midland water and demineralized water for purposes of performing hydrostatic tests and water flushes on various plant systems during construction and testing phases as described below:

1. Hydrostatic Tests - These tests are used to ensure integrity of welds and connections within a system. This test consists of holding pressurized test water within the system to be tested for given times and pressures.

   The water does not become chemically contaminated in any way and present plans call for the discharge of such waters into either the cooling pond or the Tittabawassee River dependent upon the physical location of the hydrostatic testing activities. (However, no discharge will be made to the Tittabawassee without appropriate approvals.)

2. Flushes

   a. Water Flushes - Water flushes differ from hydrostatic tests in that the purpose of the flush is to ensure proper functioning of a system and to remove any obstructions that may somehow have gotten into a system. These flushes will also utilize well water, City of Midland water or demineralized water.

      Large piping is delivered to the plant site with end caps installed. The only contamination that the flush water could pick up would be minute amounts of rust, dust or oil in the form of thin residual film around pipe ends resulting from pipe beveling or preparation for welding. Minor flushes and hydrostatic tests, performed on components or small systems, will be drained to various building sumps which discharge to the cooling pond.

      Two systems are scheduled for flushing as early as November 1981. Approximately 100,000 gallons and 20,000 gallons of flush water will be routed to the cooling pond from the Condensate Storage and Transfer System and the Demineralized Water Storage and Transfer System Header, respectively. In April 1982, the condensate system will also be flushed. Other major flushes or hydrostatic tests will be performed on all or parts of the following systems: feedwater, part of main steam, bleed steam condenser and possibly part of piping to Dow. All major flushes will be drained to the cooling pond. Various stainless steel systems will be flushed with demineralized water which will also be drained to the cooling pond.

   b. Chemical Flushes - The use of chemical flushes at the Midland site is planned for the condensate and feedwater systems. The chemical flush will be performed by a qualified subcontractor using a single system volume, two step process. The degreasing step will be done using Vertan 662, a corrosion inhibitor and F082 surfactants at a pH of 4.5. The iron and millscale removal stage will be completed by raising the system pH with NH_4OH followed by an injection of H_2O_2 for surface passivation. This method will generate one system volume of chemical waste and one to two system volumes of rinse water waste. All waste will be neutralized prior to discharge to the cooling pond. Table 5 of Exhibit VII indicates the expected chemical characteristics of the wastewater that will be discharged to the pond. This data is based upon the best available information since subcontractor selection is still in progress at this time.

The permanent auxiliary boilers will receive an alkaline boil out as part of system startup. Each boiler will receive one system volume using Trisodium phosphate, Disodium phosphate and a wetting agent and two system volumes of rinse water as early as January 1982. Table 5 of Exhibit VII lists the expected chemical characteristics of the wastewater that will be discharged to the pond.

A subcontractor will also chemically clean eleven low pressure evaporators and two high pressure evaporators on the tube side (secondary). The chemicals will be shipped to the site in tank trucks by the subcontractor and removed in tank trucks following chemical cleaning. Evaporator cleaning materials would, therefore, not be discharged into either the pond or the river.

3. Construction Chemistry Lab Trailer Wastes - Small amounts of waste chemicals resultant from wet chemistry analysis performed in the temporary lab trailer during construction will be discharged to Dow. Use of the temporary lab trailer is expected to terminate with the completion of the permanent laboratory facilities currently scheduled for early 1982.

EXHIBIT IV

CRITICAL MATERIALS, TOXIC & HAZARDOUS SUBSTANCES

PART 1

A listing of materials to be reported in Item 11 of Section I of the Discharge Permit Application (ie, materials used in, produced in, or incidental to the plant's operation) was developed after careful review of selected documents:

Reference 1

Michigan Water Resources Commission Critical Materials Register published October 1, 1980 and a list of those US EPA Priority Pollutants not found in the current Critical Materials Register as presented in Tables IV and V, respectively of the State Discharge Application Supplement.

Reference 2

Appendix D to 40 CFR Part 122, US EPA Consolidated Permit Regulations published May 19, 1980:

Table II - Organic Toxic Pollutants in Each of Four Fractions in Analysis by GC/MS.

Table III - Other Toxic Pollutants; Metals, Cyanide, and Total Phenols

Table IV - Conventional & Nonconventional Pollutants

Table V - Toxic Pollutants and Hazardous Substances

Table 1 of Exhibit IV provides a list of these materials for the Midland Plant. The materials listed in Table 1 under the "other use" category are expected or proposed to be used in plant operations as decribed below:

Ammonia: Ammonia will be utilized in the plant secondary steam cycle and auxiliary steam system for pH control.

Copper: The plant main condensers are tubed with admiralty metal. The value reported is an estimate of the circulating water copper pick-up.

Hydrazine: Hydrazine will be utilized in the plant steam cycle, auxiliary steam system, and reactor coolant system (temporary shutdown only) for oxygen scavenging. A solution of hydrazine-morpholine is added in the component cooling system to inhibit corrosion.

Hypochlorite: Sodium hypochlorite will be used to control biological growth on the main condensers and service water heat transfer surfaces.

Lithium: Lithium hydroxide will be used for pH control in the reactor coolant systems.

Dimethyl Amine: This chemical will be used as a reagent in the on-line steam cycle sodium analyzers.

Triaryl Phosphate Esters: A triaryl phosphate ester will be used in the steam turbine electro-hydraulic control systems. Estimated quantities are not available because a vendor has not been selected.

Other compounds listed on the Critical Materials Register may be included in commercially obtained formulations of various solvents, fluids, and solutions which are incidental to plant operation. However, these commercially obtained formulations will be used in accordance with manufacturer's instructions and will not be produced or altered on-site.

Only appropriate herbicides approved by EPA and the Food and Drug Administration may be used on-site for grounds maintenance. They will be applied by licensed applicators in strict compliance with manufacturer's specified solution strengths and rates of application.

PART 2

Item 8 of Section II, Basic Discharge Description of the Discharge Permit Application requires a listing of critical materials discharged. The listing of Critical Materials, Toxic and Hazardous Substances described by References 1 and 2 above has been thoroughly reviewed. Based on this review, only those parameters listed in Table 2 may be present in the plant discharge.

TABLE 1

MATERIALS USAGE LISTING

Use Category	Chemical	lbs/yr (est)
A. Secondary laboratory use:	Total Organic Carbon	0.3
	Formaldehyde	2
	Vanadium	0.1
	Copper	0.3
	Lead	0.3
	Nickel	0.3
	Zinc	0.3
	Hydrazine	0.3
	Hydrogen Sulfide	1
B. Primary laboratory use:	Strontium	0.3
	Lithium	0.3
C. Other use:	Ammonia	38,000
	Copper	7,600
	Hydrazine[(a)]	25,000
	Hypochlorite[(b)]	693,000
	Lithium	20
	Dimethyl Amine	10,000
	Triaryl Phosphate Esters	Not available
	Lead[(c)]	-
	Mercury[(c)]	-
	Nickel[(c)]	-
	Silver[(c)]	-
	Zinc[(c)]	-
	Uranium[(d)]	390,000
	Zirconium[(d)]	280,000

(a) Hydrazine will decompose prior to release.

(b) Hypochlorite will decompose in the cooling pond prior to release.

(c) This material has been detected in the plant's proposed cooling water supply (Tittabawassee River) in the concentrations listed below. As such it is incidental to the plant's operation and discharge.

Pb	0.033 mg/l
Hg	0.005 mg/l
Ni	0.02 mg/l
Ag	0.007 mg/l
Zn	0.033 mg/l

(It is anticipated that these materials will be concentrated in the cooling pond blowdown to the same extent as pond cycles of concentration, see Exhibit VII, Table 2.)

(d) Uranium and zirconium are the principal constituents of the nuclear fuel used in the plant. Each nuclear core contains approximately 1.95×10^5 pounds of uranium and 1.4×10^5 pounds of zirconium when it is initially loaded into the reactor. During each refueling, one-third of the fuel is removed to the spent fuel storage area and is replaced with one-third core of new fuel.

TABLE 2

MATERIALS DISCHARGED LISTING

Source	Chemical	lbs/year (est)	Max Conc mg/l (est)
A. Secondary laboratory[a]:			
	Total Organic Carbon	0.3	-
	Formaldehyde	2	-
	Vanadium	0.1	-
	Copper	0.3	-
	Lead	0.3	-
	Nickel	0.3	-
	Zinc	0.3	-
	Hydrazine	0.3	-
	Hydrogen Sulfide	1	-
B. Primary laboratory[b]:			
	Strontium	0.3	-
	Lithium	0.3	-
C. Other:			
	Copper	7,600	-
	Lead	(c)	0.17
	Mercury	(c)	0.02
	Nickel	(c)	(c)
	Silver	(c)	(c)
	Zinc	(c)	0.22
	Cyanide	(d)	(d)
	Aluminum	(d)	(d)
	Ammonia	38,000	2.0
	Chlorinated Organic Compounds	(e)	(e)
	Phenols	(c)	0.05
	Beryllium	(c)	(c)
	Cadmium	(c)	(c)

(a) These materials will discharge to the river via the turbine building neutralizer sump.

(b) These materials will be routinely processed in the liquid radwaste system. There is a possibility of discharge via the laundry waste system.

(c) Unable to predict. This material has been detected in the plant's proposed cooling water supply (Tittabawassee River), and therefore is expected to be present in the combined plant discharge. Plant operation is not expected to contribute additional material.

(d) Unable to determine. Material is expected to be present in main plant laboratory.

(e) Chloramines may result from shock chlorination.

EXHIBIT V
DESCRIPTION OF WASTE
ABATEMENT PRACTICES

Selected waste abatement practices improve the quality of wastewater discharged from the Midland Plant. These practices, including separation, pH adjustment, sedimentation, filtration, recirculation, retention, segregation and offsite treatment or disposal, are applied to the waste water streams prior to their discharge to the Tittabawassee River.

PROCESS WATER

Oil Separation

The oily waste treatment system processes plant floor drainage and precipitation collected from areas which may be contaminated by oil. Sources of wastewater include:

- o Permanent auxiliary boiler blowdown (Node 37).
- o Temporary high-pressure auxiliary boiler blowdown (Node 72).
- o The outdoor transformer area (Node 48).
- o Floor drains in the areas of the Units 1 and 2 condensate feedwater and main steam systems, fire protection system and the evaporator building (Nodes 68 and 10).

Oily wastes are collected and transferred to a 300,000 gallon oily waste storage tank by individual pumps located throughout the plant site. The storage tank combined with oil removal equipment and a waste oil tank treat the collected wastewater to remove oil contamination. Inside the oily waste storage tanks, underflow and overflow weirs (analogous to an API separator) retain free oil and suspended solids until manually removed to avoid carryover into the tank effluent line. The active capacity (above the overflow weir) is sufficient to retain three inches of rainfall on outdoor collection areas plus the maximum firewater usage event. If this capacity is exceeded due to an additional simultaneous event, an overflow from the effluent side of the underflow and overflow weirs is routed to the cooling pond via the storm drainage system.

The oily waste treatment system removes any oil which may not have been retained in the oily waste storage tank (ie, emulsified or dispersed oils). This remaining oil is separated by physical means in a "package plant" by oil removal equipment. The oil free effluent is discharged directly to the Tittabawassee River while the waste oil is transferred to the waste oil storage tank pending removal from the site by a licensed industrial waste hauler.

pH Adjustment

The evaporator building neutralizing sump and the Units 1 and 2 neutralizing sumps receive process wastes and floor drainage from several wastewater sources that are expected to have extreme pH values. Some of these wastewater sources include:

- Evaporator building laboratory fixtures.
- The makeup demineralizer system.
- Chemical addition and storage area floor drains.
- Condensate demineralizer regenerative wastes.
- The secondary plant laboratory fixtures.

Air mixers, acid and caustic injection equipment and recirculating pumps located at these neutralizing sumps allow pH adjustment of the wastewater in a batch operation.

Following adjustment to the desired pH, the evaporator building neutralizing sump contents and the Units 1 and 2 neutralizing sump contents are discharged to the Tittabawassee River via the miscellaneous waste and cooling pond blowdown lines (Discharge No 001). If the effluent from the Units 1 and 2 neutralization sump contains unacceptable levels of radioactivity, the wastewater is diverted to the liquid radwaste system for subsequent treatment.

Sedimentation

Wastewater from the Units 1 and 2 clean waste sump and the iron removal sump is discharged to the cooling pond for settling of suspended solids. The clean waste sumps receive condensate polisher backwash and rinse water from the condensate feedwater and main steam systems. Since this wastewater is very low in total dissolved solids, the effluent from the clean waste sump is routed directly to the cooling pond for disposal. The suspended solids in the effluent (ie, ion exchange resin fines and corrosion products such as iron and copper oxides) are assimilated by the cooling pond sediment.

The magnetic filters remove suspended iron oxides from the evaporator condensate before it is returned to the condensate feedwater and main steam systems. These filters require periodic backwashing to remove collected iron oxides. This backwash water is routed through the iron removal sump and into the cooling pond (via the site storm drainage system) where suspended iron oxides are assimilated in the cooling pond sediment.

If the effluent from the Units 1 and 2 clean waste sump contains unacceptable levels of radioactivity, the wastewater is routed to the liquid radwaste system for subsequent treatment. If the magnetic filter backwash water contains unacceptable levels of radioactivity, the backwash will be sent to the liquid radwaste system or the filters will be taken out of service.

Filtration

Various articles of protective clothing are cleaned in the laundry facility with non-phosphate detergents. Wastewater from this facility is filtered to remove suspended solids in the laundry waste treatment system. Following treatment, the laundry wastewater is discharged to the Tittabawassee River via the miscellaneous waste and cooling pond blowdown lines (Discharge No 001). If this waste stream contains unacceptable levels of radioactivity the flow is diverted to the liquid radwaste system for subsequent treatment.

Segregation and Treatment or Disposal Offsite

Process steam system evaporator blowdown is normally transported offsite and treated by the Dow Chemical Company. Metal cleaning wastes from periodic steam system cleaning and debris removed from both makeup and circulating water intake structures are transported offsite for disposal. The only exception to this procedure involves the evaporator blowdown. If this waste stream contains unacceptable levels of radioactivity, the flow is diverted to the liquid radwaste system for subsequent treatment.

Radioactive Waste Treatment

Radioactive process wastewater and potentially contaminated drainage is collected and treated in the radwaste treatment systems. The major sources of these radioactive or potentially contaminated wastewaters may include: (1) laundry waste treatment system, (2) reactor systems and solid radwaste system floor drains, (3) Units 1 and 2 neutralization sump, (4) Units 1 and 2 clean waste sump, (5) evaporator blowdown, (6) magnetic filter backwash, (7) effluent from the reactor systems and solid radwaste system and (8) the once through steam generators. Radioactive wastewater treatment involves a combination of filters, ion exchangers, evaporators, and solid waste packaging equipment. Solids removed from the influent liquid radwastes are packaged and transported to a licensed burial site for disposal. The purified water is recycled to the reactor plant systems or discharged to the Tittabawassee River via the miscellaneous waste and cooling pond blowdown lines (Discharge No 001).

NONCONTACT COOLING WATER

Recirculation

The 880 acre recirculating cooling pond provides cooling water for the Units 1 and 2 condensers and for various plant cooling requirements via the Units 1 and 2 service water systems. Condenser cooling water is recirculated to the cooling pond to minimize the discharge of heated effluent to the Tittabawassee River. Blowdown from the cooling pond is taken from the coolest point in the pond and discharged through three 2-1/2 foot diameter valved pipes. These pipes are oriented perpendicular to the river flow and provide control of the blowdown rate and discharge velocity by valve throttling and closure. This blowdown control mechanism combined with the recirculation of noncontact cooling water minimizes the release of thermal effluent to the Tittabawassee River (Discharge No 001).

Retention

To control biological growth on heat transfer surfaces exposed to cooling pond water, sodium hypochlorite is injected into the Units 1 and 2 condenser cooling water and service water systems. Due to the extensive retention period, a chlorine residual is not expected to persist in the noncontact cooling water effluent for a sufficient time to circulate to the cooling pond blowdown discharge point.

SANITARY WATER

Sanitary wastewater is collected from the plant site and transported to the Dow Chemical Company through a sanitary waste pipeline for subsequent treatment (Node 24). Approximately 100 to 300 gpd of sanitary wastewater from Warehouse No 2 is discharged to a septic tank and drainfield for treatment and disposal.

OTHER

Construction Site Runoff Control

In addition to the construction impact control measures specified in the Company's Supplemental Environmental Report and the AEC's Final Environmental Statement, several additional measures are also being implemented for the control of surface runoff. These additional construction impact control measures include:

- o Construction of holding ponds in ditches near any source of runoff and near dewatering operations to control siltation.
- o Rip-rap applied to Waite and Debolt Drain, Branch #1 Drain and Bullock Creek at changes of grade and at changes of direction to minimize erosion.
- o Embankments seeded, fertilized and mulched to control soil erosion.

The construction impact control program follows standard practices presented in the following publications:

- o Michigan Soil Erosion and Sedimentation Control Guidebook, prepared for Michigan Department of Natural Resources, et al by Beckett Jackson Raeder, Inc, February 1975.
- o Soil Erosion and Sediment Control: Standards and Specifications for Bay, Midland and Saginaw Counties, US Department of Agriculture, Soil Conservation Service, December 1974.
- o Engineering Field Manual for Conservation Practices, US Department of Agriculture, Soil Conservation Service, 1969.

Residuals and Residues

Sludges and residues resulting from the treatment or control of wastewaters are contained in the waste oil storage tank, evaporator building neutralizing sump and Unit 1 and 2 neutralizing sumps. Disposal of waste oil and associated sludges or residues is discussed in this Exhibit under the heading of PROCESS WATER, OIL SEPARATION. Accumulated sediments incidental to the operation of the evaporator building neutralizing sump and the Unit 1 and 2 neutralizing sumps are removed on an annual or as needed basis and transported from the site by a licensed industrial waste hauler. In addition, accumulated sediments in miscellaneous plant sumps and Unit 1 and 2 clean waste sumps are removed on an annual or as needed basis. Although these residuals do not result from the treatment or control of wastewater, the removed sediments are disposed of in similar fashion as described above.

Residues or residuals generated by the radioactive waste treatment facilities (ie, liquid radwaste and solid radwaste systems) are packaged in accordance with 10 CFR 71 and shipped offsite for ultimate disposal. If the sediments collected from any of the sumps listed above contain unacceptable levels of radioactivity, these wastes are considered radioactive and processed in a similar fashion as other radioactive wastes.

EXHIBIT VI

PROPERTY OWNERS ADJACENT TO PROPOSED ENTERPRISE

The owners of property adjacent to the Midland Plant are listed below. This information was compiled from the December 31, 1977, City Assessor and County Equalization platt maps.

The Dow Chemical Company
Michigan Division
Midland, Michigan 48640

Bullock Creek School
Poseyville Road
Midland, Michigan 48640

Consumers Power Company
212 West Michigan Avenue
Jackson, Michigan 49201

Mr Wm Linton
Rt 10, 3156 E Gordonville Rd
Midland, Michigan 48640

Francis Goulette
4439 N Eastman Road
Midland, Michigan 48640

Mr Jerry Bare
702 West Ellsworth
Midland, Michigan 48640

Mr Earl Roebuck
Rt 10
Midland, Michigan 48640

Mr Roy Robertson
Rt 10, 3412 E Gordonville Rd
Midland, Michigan 48640

Mr Wm Wineland
3632 E Gordonville Road
Midland, Michigan 48640

Mr Clayton Badgero
3248 Miller Road
Midland, Michigan 48640

Mr Arthur Fisher
3239 E Bullock Creek Drive
Midland, Michigan 48640

Fisher Contracting Company
921 Jefferson Avenue
Midland, Michigan 48640

Mr Wm Sasse
Rt 10
Midland, Michigan 48640

Mr Daniel Hart
Rt 2
Freeland, Michigan 48623

Ellsie Spangler
Rt 10
Midland, Michigan 48640

Mr John Holmes
Rt 10, 3422 E Gordonville Rd
Midland, Michigan 48640

Mr Walter Bennett
1555 Sassee Road
Midland, Michigan 48640

Mr Wm Mergard
323 Potawaton
Royal Oak, Michigan 48067

EXHIBIT VII
DESCRIPTION OF EXPECTED WASTEWATER CHARACTERISTICS

PROCESS WASTEWATERS

The process wastewaters listed below are normally discharged directly to the Tittabawassee River at Discharge No 001, expect for condensate return pump house drainage which is routed to Bullock Creek at Discharge No 002. The expected characteristics of these process wastewaters are presented in Table 1:

o Evaporator Building Neutralizing Sump

o Laundry Waste Treatment

o Oily Waste Treatment

o Auxiliary Boilers (via oily waste treatment)

o Liquid Radwaste System

o Condensate Return Pump House Drainage

o Demineralized Water Storage Tank

o Units 1 and 2 Neutralizing Sump

COOLING POND BLOWDOWN

Chemical Characteristics

Certain process wastewaters are discharged to the cooling pond on a routine or intermittent basis. Evaporator Building Neutralizing Sump effluent may be discharged to the cooling pond on an optional basis (See Process Wastewater above). This wastewater combines in the cooling pond with the Units 1 and 2 condenser cooling water and service water systems discharge (recirculated) and form the cooling pond blowdown effluent. Expected wastewater characteristics of the pond blowdown are described in Table 2.

Routine

o Iron Removal Sump

o Units 1 and 2 Clean Waste Sump

o Sodium Hypochlorite Generation System

Intermittent

- o Oily Waste Storage Tank Overflow
- o Miscellaneous Water Storage Tank Overflows and Drains
- o Service Water Cooling Tower Blowdown
- o Steam Trap Drainage
- o Steam Generator Drains (after wet layup)

Thermal

Table 3 presents the surface area and length of the 5°F isotherm for various river flows. Physical Model Testing at Alden Research Laboratories was used in deriving Table 3. River flows used in preparing these temperature distributions were based on long range average values. River water temperatures downstream of the mixing zone are not expected to exceed the values given in R323.1075 (2) and (3b) of the Michigan Administrative Code, Part 4, Michigan Water Quality Standards, as a result of the combined Plant discharge (Node 60, Figure 1). Estimated distances for closure of the 1°F isotherms are given in Table 4.

Appendices A and B provide an overview of the simulation models used as well as the effects of the Plant's thermal plume on the Tittabawassee River. Appendix A provides a detailed description of the field survey, physical model and mathematical model used in the Plant thermal plume simulation. Appendix B provides a general discussion of the plume in terms of its effects in the near field and far field based on preliminary modeling results.

COMBINED PLANT DISCHARGE WASTEWATER

Table 2 of this exhibit presents the expected characteristics of the cooling pond blowdown after being combined with process wastewaters and discharged to the Tittabawassee River as combined Plant Discharge Wastewater. The total dissolved solids concentration in the Tittabawassee River at Freeland Road is not expected to exceed a monthly average of 500 mg/l nor an instantaneous maximum of 750 mg/l as a result of this discharge.

The combined Plant discharge (Node 60, Figure 1) will not exceed the phosphorus limit of 1 mg/l as set forth in the Rule 323.1060 of the Michigan Administrative Code. This limit is more stringent than the daily average phosphate limit of 35 lb (exclusive of pond reconcentration of existing levels in the river) that was set forth in the agreement reached between Consumers Power Company and the AEC Regulatory Staff Counsel, Thomas F Englehardt.

CONDENSATE RETURN PUMPHOUSE DRAINAGE

Table 1 of this exhibit presents the expected characteristics of condensate and demineralized water drainage from the condensate return pumphouse. The quality of this water is carefully maintained by DOW to prevent cross-contamination from their processes. This high quality water may reach Bullock Creek as a result of incidental leakage or system drainage for maintenance purposes.

PLANT DISCHARGES PRIOR TO COMMERCIAL OPERATION

Table 5 of this exhibit presents the expected characteristics of preoperational wastewater discharges to the cooling pond prior to commercial operation. Also included in this table is a summary of the chemical discharges from the construction chemistry lab trailer to the cooling pond for the period September 5, 1978 through April 20, 1979. As noted in Exhibit III, hydrostatic test water will be discharged to either the Tittabawassee River or the cooling pond. The characteristics of this waste water are also included in Table 5.

The frequency of flush water, hydrostatic test water, and layup discharges is listed in Table 5 as "varies". This may be construed as several times a week for flush water, approximately once per week for hydrostatic test water, and perhaps a few times each month for system layup discharges. It should be noted that these frequencies are only approximations. Under field conditions, there may be weeks without discharges. As construction progresses towards completion, these discharges may become more frequent.

The cooling pond holds approximately four billion gallons of water when full. The total estimated discharge of flush water and hydrostatic test water for 1981, 1982 and 1983 is approximately 15 million gallons. To illustrate the effect on pond chemistry, even if the total volume of both these wastewater streams for all three years were discharged all at once to the full pond, the dilution factor would be approximately 270 to 1. There would be no effect on pond pH. Pond TDS and TSS would be increased by less then 1 mg/l.

Similarly, the effect on pond chemistry of the other preoperational discharges would be very slight because the dilution becomes much larger as smaller volumes are discharged. Hydrazine (N_2H_4) rapidly disassociates into water, ammonia and nitrogen gas when exposed to air and, so, can be disregarded.

In addition to the discharge listed in Table 5, there are two small volume discharges associated with the temporary fire protection system. Well leakoff from the temporary firewater pumphouse and seepage from the temporary firewater tank (capacity of 500,000 gallons) drain to Bullock Creek through construction site runoff ditches. Both of these minor discharges will cease following commercial operation when the temporary fire protection system is eliminated.

Groundwater from the sanitary water well adjacent to Warehouse No 2 is pumped continuously and discharged to a nearby road drainage ditch to prevent pipe freezing during winter months. The road drainage discharges to Bullock Creek. This discharge will be terminated following commercial operation.

TABLE 1

EXPECTED CHEMICAL CHARACTERISTICS
OF PROCESS WASTEWATERS

1. Evaporator Building Neutralizing Sump (Node 47)

Parameter	Average/Maximum Value
Average Daily Volume, gals	32,500
Maximum Daily Volume, gals	220,000
pH	6.0-9.0
TSS, mg/l	<30
TDS, mg/l	5,200
Ca, mg/l	190
Mg, mg/l	100
Na, mg/l	1,300
SO_4, mg/l	3,100
Cl, mg/l	260
P, mg/l	1.04
NH_3, mg/l	<2

2. Units 1 & 2 Neutralizing Sumps[(a)] (Node 45)

Parameter	Value
Average Daily Volume, gals	16,000
Maximum Daily Volume, gals	104,000
pH	6.0-9.0
TSS, mg/l	30
TDS, mg/l	14,300
Ca, mg/l	200
NH_3, mg/l	1,200
Na, mg/l	3,000
SO_4, mg/l	9,960

3. Laundry Waste Treatment (Node 53)

Parameter	Average/Maximum Value
Daily Volume, gals	600/8,000
pH	6.0/9.0
TSS, mg/l	<30
Conductivity, umho/cm	1,400/2,000
TDS, mg/l	840/6,200

TABLE 1 (CONTD)

4. Oily Waste Treatment (Node 51)

Parameter	Average/Maximum Value
Daily Volume, gals	64,000/288,000
pH	6.0-9.0
TSS, mg/l	<30/<100
Oil and Grease, mg/l	<15/<20
TDS, mg/l	980/2,290

5. Magnetic Filter Backwash (Prior to Settling, Node 40)

Parameter	Value[(b)]
Average Daily Volume, gals	586
Maximum Daily Volume, gals	1,758
pH	9.0-9.5
TDS, mg/l	0.3/5.0
TSS, as Fe_3O_4 mg/l	<1,500
Oil and Grease, mg/l	<15

6. Permanent Auxiliary Boiler Blowdown (Node 37)

Parameter	Value[(b)]
Frequency, days per year/boiler	35
Average Daily Volume,[(d)] gals	0
Maximum Daily Volume,[(d)] gals	19,000
pH	9.0-9.5
TDS, mg/l	<200
TSS, mg/l	<30
Fe, mg/l	<1[(c)]
Cu, mg/l	<1[(c)]
Oil and Grease, mg/l	<15
NH_3, mg/l	<10
N_2H_4, mg/l	12-25

TABLE 1 (CONTD)

7. Units 1 & 2 Clean Waste Sumps (Node 44)

Parameter	Average/Maximum Value
Average Daily Volume, gals	28,900
Maximum Daily Volume, gals	193,000
pH	6.0-9.0
TDS, mg/l	<50
TSS, mg/l	20/100
Oil and Grease, mg/l	<15

8. Makeup Demin Storage Tank Overflow/Drain

Parameter	Value (Maximum Design)
Frequency of Discharge	<once/yr (est)
Maximum Daily Volume, gals	50,000
Conductivity µmho/cm @ 25°C	<0.50
Silica, mg/l SiO_2 (soluble)	<0.025
pH	6.5-3.0
Cl mg/l	<0.1

9. Temporary High Pressure Auxiliary Boiler Blowdown (Node 72)

Parameter	Value
Frequency, days per year/boiler	46
Average Daily Volume, gals	1238
Maximum Daily Volume, gals	5524
pH	8.0-9.5
TDS, mg/l	<1250
TSS, mg/l	<30
Fe, mg/l	<0.05
Cu, mg/l	<0.03
Oil and Grease, mg/l	<15
NH_3, mg/l	<1.0
N_2H_4, mg/l	12-25

10. Liquid Radwaste System (Node 59)

Parameter	Value
Average Daily Volume, gals	200
Maximum Daily Volume, gals	40,000[e]
pH	6.0-9.0
TDS, mg/l	5[f]
TSS, mg/l	<30

TABLE 1 (CONTD)

11. Condensate Return Pump House Drainage (Node 62)

Parameter	Value
Average Daily Volume, gals	0
Maximum Daily Volume, gals	12,000[(g)]

	Average/Maximum Value[(h)]	Average/Maximum Value[(i)]
pH	8.5/9.0	8.0/10.0
Conductivity, μmho	2.5/5.0	6.0/22
Silica, mg/l SiO_2	0.02/0.02	-
Cl, mg/l	0/0	0.3/0.6
Na, mg/l	-	0.3/0.5
Fe, mg/l	0.03/0.04	0.04/0.05
Cu, mg/l	0/0	0.027/0.055
Oil and Grease, mg/l	0/0	0/0

Footnotes

(a) Trace amounts of certain reagents may be present in this waste stream. See Table 1a.

(b) Values for concentration parameters are estimated maximums.

(c) During the startup of the auxiliary boiler, total iron and copper concentrations in the boiler blowdown may exceed 1 mg/l for a few hours.

(d) Both auxiliary boilers in operation.

(e) Maximum daily discharge rate is higher than the rate of accumulation. This value based on operator experience.

(f) [illegible]usive of boric acid and chemicals added to adjust pH and remove oxygen.

(g) Flow rate for maximum value is estimated at 100 gpm for up to four hours if entire suction header must be drained. Normal composition of drainage may ≦ 40% demineralized water and ≧ 60% polished condensate.

(h) Demineralized water characteristics.

(i) Polished condensate characteristics.

TABLE 1a

CHEMICAL REAGENTS USED IN THE SECONDARY PLANT LABORATORY

The following reagents are expected to be used in the secondary plant laboratory. Occasionally trace amounts of these reagents may be present in the secondary plant laboratory drainage to the Unit 1 neutralizing sump.

REAGENT	ANALYSIS	REAGENT	ANALYSIS	REAGENT	ANALYSIS
Nitric Acid	Phosphate	Manganous Sulfate	Oxygen	1,2 Napthoquinone	Morpholine
Ferric Alum	Chloride	Potassium Iodide	Oxygen Chromate	4 Sulfonic Acid	
Mercuric Thiocyanate	Chloride	Sodium Thiosulfate	Oxygen	Mopholine Standard	Morpholine
Methanol	Chloride	Stabilized Starch	Oxygen Chromate	Ammonium Molybdate	Phosphate, Silica
	Hydrazine	Sulfuric Acid	Oxygen, Fluoride Phosphate,	Oxalic Acid	Silica
Glycerol (Clycerin)	Oxygen		Alkalinity	1-Amino 2-Napthol	Silica, Phosphate
	Sulfate	Hydrochloric Acid	Chromate, Fluoride	4-Sulfonic Acid	
Indigo Carmine	Oxygen		Silica, Hydrazine	Sodium Sulfite	Silican Phosphate
Dextrose	Oxygen	Paradimethylamino- benzaldehyde	Hydrazine	Manganese Standard	Manganese
Potassium Hydroxide	Oxygen	Mercuric Iodide	Ammonia	Boric Acid	Ammonia
Sodium Standard	Sodium	Mercuric Iodide	Ammonia	Sodium Metabisulfite	Phosphate
pH Buffers	Various	Sodium Hydroxide	Ammonia	Sodium Bisulfite	Silica
Fluoride	Fluoride	Zinc Sulfate	Ammonia	Barium Chloride	Sulfate
Lithium Standard	Lithium	Sodium Potassium Tartrate	Ammonia	Sodium Chloride Sodium Chloride	Sulfate Sulfate
Alizarin Red S	Fluoride	Calcium Standard	Calcium	Phenolphtalein Indicator	Alkalinity
Zirconyl Chloride - Octahydrate	Fluoride	Magnesium Standard Copper Standard Iron Standard	Magnesium Copper Iron	Methyl Orange Indicator Methyl Purple Indicator	Alkalinity Alkalinity

TABLE 2

EXPECTED CHEMICAL CHARACTERISTICS OF COOLING POND BLOWDOWN AND COMBINED PLANT DISCHARGE

Parameter	Cooling Pond Blowdown (Node 7) Average/Maximum Concentration	Combined Plant Discharge (Node 60) Average/Maximum Concentration[c]
pH	7.0-9.0	6 0-9.0
TSS, mg/l	<100	<100
TDS, ppm	980/2,290	991/2,461
Ca, mg/l	150/360	149/322
Mg, mg/l	40/85	40/79
Na, mg/l	70/220	73/267
SO_4, mg/l	375/840	390/908
Cl, mg/l	145/425	145/383
P, mg/l	0.06/0.3	0.06/0.3
NH_3, mg/l as N[a]	≦2.0	≦2.0
Ag, mg/l[b]	0.006/0.04	0.006/0.04
Hg, mg/l[b]	0.003/0.02	0.003/0.02
Pb, mg/l[b]	0.04/0.18	0.04/0.17
Ni, mg/l[b]	0.03/0.11	0.03/0.11
Zn, mg/l[b]	0.05/0.22	0.05/0.22
Oil and Grease	<15/<20	<15/<20
Total Residual Chlorine, mg/l	<0.2/<0.3	<0.2/<0.3

(a) See Exhibit G.

(b) Concentrations listed for these materials result from pond evaporative concentration of ambient levels of these materials, see Exhibit IV, Table 1, Note (c).

(c) Maximum concentrations were computed using the minimum blowdown flow (5 cfs) and the maximum instantaneous waste discharge rates.

TABLE 3

AREA AND LENGTH OF THE 5°F ISOTHERM FROM ALDEN RESEARCH LABORATORY TEST DATA

Q (cfs)	Laboratory Test No	Q_B (cfs)	ΔT_B (°F)	Area (acres)	Length X (ft)
835	292	25	15.0	0.18	540
	288	13	19.5	0.32	860
	290	9	25.1	0.17	600
1,305	329	73	12.2	0.40	1,210
	336	23	22.6	0.39	1,090
	331	130	10.0	0.17	210
	333	11	35.3	0.37	1,100
2,065	355	137	12.3	0.21	200
	354	73	13.9	0.29	820
	343	73	13.3	0.29	830
	342	73	24.2	0.71	1,350
	345	35	23.8	0.51	1,230
	298	20	29.5	0.27	800
	301	15	39.5	0.27	810
3,015	307	73	19.5	0.32	830
	[illegible]1	25	42.3	0.50	1,260
	350	100	18.1	0.30	720
	305	73	29.7	0.51	1,200
3,515	322	143	17.8	0.63	1,010
	320	73	28.5	0.58	740
	278	45	40.0	0.37	740
	317	73	35.9	0.37	550

Where, Q = River flow rate directly upstream of the blowdown (including plant makeup and Dow discharge).

Q_B = Blowdown Flowrate.

ΔT_B = Temperature of the blowdown minus ambient river temperature.

X = Distance from blowdown discharge structure to point of isotherm closure.

TABLE 4

ESTIMATED DISTANCE FOR CLOSURE OF 1°F ISOTHERM FOR THE LABORATORY TESTS WITH THE LONGEST ISOTHERM IN EACH RIVER FLOW

Q (cfs)	Laboratory Test No	Q_B (cfs)	ΔT_B (°F)	Length X (ft)
835	292	25	15.0	11,000
1,305	329	73	12.2	13,000
2,065	342	73	24.2	42,000
3,015	305	73	29.7	21,000
3,515	322	143	17.8	42,000

Where, Q = River flowrate directly upstream of the blowdown (including Plant makeup and Dow discharge).

Q_B = Blowdown flowrate.

ΔT_B = Temperature of the blowdown minus ambient river temperature.

X = Distance from blowdown discharge structure to point of isotherm closure.

TABLE 5

EXPECTED CHEMICAL CHARACTERISTICS OF PLANT DISCHARGES PRIOR TO COMMERCIAL OPERATION

1. Flush Water (waste water from flushing systems after construction)

Parameter	Expected Value
Frequency of Discharge	Varies
Volume of Discharge	4,000,000 gal/yr for 1981, 1982 & 1983
pH	6-8
TDS, mg/l	<200
TSS, mg/l	<100
Effect of discharge to pond	No Measurable effect

2. Hydrostatic Test Water (waste water from hydrostatic testing of systems)

Parameter	Expected Value
Frequency of Discharge	Varies
Volume of Discharge	1,000,000 gal/yr for 1981, 1982 & 1983
pH	6-8
TDS, mg/l	<200
TSS, mg/l	<100
Uranine Dye, mg/l (fuel pool leaks only)	
Effect if discharged to pond	No measurable effect

Rhodamine WT Dye is recommended as a backup to Uranine Dye.

3. System Lay-Up Discharges (as necessary to drain systems for rework after chemical lay-up)

Parameter	Expected Value
Frequency of Discharge	Varies
Volume of Discharge	1,000,000 gal/yr for 1981, 1982 & 1983
pH	9.3-9.5
TDS, mg/l	<50
TSS, mg/l	<10
NH_3, mg/l	2-20
N_2H_4, mg/l	200-500
Effect of discharge to pond	All chemicals would be diluted approximately 4,000 to 1

TABLE 5 (CONTD)

4. Auxiliary Boiler Cleaning (wastes generated during initial boiler boil out)

Parameter	Expected Value
Frequency of Discharge	Once
Volume of Discharge	50,000 gal
pH	9-11
TDS, mg/l	<10,000
TSS, mg/l	<1,000
Fe, mg/l	<1,000
PO_4, mg/l	<5,000
Effect of discharge to pond	All chemicals would be diluted by at least 80,000 to 1

5. Condensate and Feedwater Chemical Cleaning (Unit 1 and Unit 2)

Parameter	Expected Value
Frequency of Discharge	Twice
Volume of Discharge	100,000 gal/each
pH	6.5-9.5
Temp °F	<200
TDS, mg/l	<25,000
TSS, mg/l	<1,500
Oil/Grease, mg/l	<50
NH_3, mg/l	<4,000
EDTA, mg/l	<25,000
Fe, mg/l	<4,000
Effect of discharge to pond	All chemicals would be diluted approximately 40,000 to 1 (per unit)

6. Construction Chemistry Lab Trailer Wastes

Summary of Chemical Discharge to cooling pond, September 5, 1978 through April 20, 1979.

Chemical	Total Amount Discharged in Kg
Amino Napthol Sulfonic Acid	0.004
Ammonium Molybdate	0.008
Ascorbic Acid	0.280
Boric Acid	0.099
CDTA	0.008
Disodium EDTA	0.536
Ferrous Ammonium Sulfate	0.110
Glacial Acetic Acid	0.069

TABLE 5 (CONTD)

Hydrochloric Acid	0.298
Lead Perchlorate	0.001
Nitric Acid	0.432
Oxalic Acid	0.080
Phenolphatelein	0.008
Potassium Biphtalate	0.057
Potassium Chloride	0.165
Potassium Hydroxide	0.530
Silver Nitrate	0.040
Sodium Borate	0.010
Sodium Chloride	0.009
Sodium Fluoride	0.116
Sodium Hydrogen Sulfite	0.240
Sodium Hydroxide	0.924
Sodium Metasilicate	0.002
Sodium Phosphate	0.108
Sodium Sulfite	0.008
Sulfuric Acid	0.078
Zinc Acetate	1.760
Total	5.980

After April 20, 1979, wastes generated by wet chemistry performed in the temporary Lab are sent to DOW for treatment and disposal.

PART THREE

APPENDICES

APPENDICES

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APPENDIX A
THERMAL PLUME SIMULATION STUDY

DESCRIPTION OF FIELD SURVEY STUDY

Field surveys of the plume resulting from Dow Chemical Company's tertiary pond effluent into Tittabawassee River were made in the months of July and October of 1977, for a river flow of about 400 and 1100 cfs respectively. The Dow discharge was located about 2000 feet upstream of the Plant river intake structure during the field tests and has subsequently been relocated approximately 200 feet downstream of the Plant river intake structure. The conductivity of the teritary pond effluent was used as a tracer. Data was collected at 5 to 11 cross sections during each survey. The cross sections were spaced approximately 1200 feet apart except in the vicinity of Dow's discharge where a few sections were spaced approximately 150 feet apart, and around bends where sections 600 feet apart were surveyed. The total length of the river reach surveyed was about 12,000 feet and the location of the cross sections is shown in Figure A2. Measurements consisted of river depth, velocity, and conductivity readings taken in 20 to 30 vertical intervals of each cross section. A Price current meter obtained from the US Geological Survey (USGS) was used for velocity measurements. A top-setting wading rod was used to position the meter during the July surveys when the river was shallow and a boat, mounted with the necessary measuring equipment [6], was used during the October surveys. Standard USGS procedures (6) were followed for the velocity measurements and subsequent discharge calculations. Conductivity was measured simultaneously with velocity measurements using a Yellow Springs conductivity meter (YSI Model 33). Conductivities near the water surface and near the river bottom were measured to check the vertical variation of conductivity which was found to be substantially constant with depth, indicating that complete mixing occurred in the vertical direction.

Analysis of the survey data began by plotting the measured river depth, velocity, and conductivity versus transverse distance for each cross section. Survey results for October 16, 1977 are shown in Figures A3 and A4. Values of the dimensionless cumulative discharge from the right bank looking downstream were computed and conductivity versus dimensionless discharge profiles were constructed and are shown in Figure A5. The concentration profiles were developed in this manner so that the stream-tube model described in the mathematical model section of this attachment can be applied. The conductivity of ambient river was either actually measured or estimated from measured concentration profiles. The ambient value was subtracted from the measured conductivity level so that the "excess conductivity" could be defined and used in the stream-tube model.

The excess conductivity profiles established above were used in the mathematical model as upstream boundary conditions. This required dividing each profile into 10 to 15 segments and determining an equivalent line source for each segment. Additional data consisted of the total river discharge, and estimated value of the constant diffusion factor D for the river reach under consideration, and the distance to the downstream section where a conductivity profile was measured. The D value was then adjusted by making multiple runs of the mathematical model until a best fit of computed excess conductivity profile to the measured downstream concentration profile was obtained. The measured downstream profile was then used as the upstream boundary condition for the adjacent downstream reach. By repeating this procedure, D values for each river reach were determined. The constant diffusion factors which yield the best fit to the survey data are given in Table A2. The transverse diffusion coefficient K_y and the dimensionless constant B, both defined in the mathematical section, were computed from D and river flow characteristics and are also listed in Table A2. The estimated B values vary from 0.2 to 2.7 for the various reaches for the Tittabawassee River that were studied. In order to be conservative in modeling the physical effects of the Plant discharge (Reference Attachment B) and in modeling radionuclide transport B value of 0.23 was used.

DESCRIPTION OF THE PHYSICAL MODEL

A reach of the Tittabawassee River extending 100 feet upstream to 2000 feet downstream of the river intake structure is simulated in the physical model (Figure A1) at a scale of 1:15. The model topography is constructed on a wood frame consisting of templates cut to reproduce the river bottom contours and is covered with plywood to conform to the topography determined from field surveys. The plywood is sealed with a layer of polyester resin. The detailed features such as the river intake structure and the Dow Chemical Company and Midland Plant discharge outfalls, shown in Figure A1, are also constructed in plywood sealed with a resin coating. The flow field downstream from the Plant discharge structure can be divided into two regions; the near field, and the far field. In the near field the dilution of effluent with the river is primarily due to jet mixing. dilution in the far field is achieved mainly be transverse convection and turbulent diffusion processes. To model the hydrodynamic mixing in the near field, it is essential to have undistorted geometry and to ensure the equivalence of the Froude numbers in both the prototype and the model. The Reynolds number is not modeled, but it must be kept high enough to ensure turbulent flow from the model discharge structure. Equating the prototype and model Froude numbers yields

$$F_p = \frac{U_p}{gH_p} = F_m = \frac{U_m}{gH_m} \qquad \text{(a)}$$

where the subscripts p and m denote prototype and model, U ahd H denote a characteristic velocity and depth, respectively and g is the gravitational acceleration. This equality ensures that phenomena influenced by the weight of fluid will be similar in both the model and the prototype.

It is also necessary to equate the densimetric Froude numbers in both the model and the prototype to ensure proper representation of buoyancy effects

$$F_p = \frac{U_p}{(\Delta\rho/\rho)_p gH_p} = F_m = \frac{U_m}{(\Delta\rho/\rho)_m gH_m} \qquad \text{(b)}$$

or

$$F_r = U_r \left(\frac{\Delta\rho}{\rho} H\right)_r^{-1/2} \qquad (c)$$

where the subscript r density the ration between model and prototype, and $\Delta\rho/\rho$ is the initial density difference which depends on both temperature and Total Dissolved Solids (TDS) concentration. The selection of a length scale ratio of 1:15 resulted in the scale ratios of Table A1 which were calculated from the continuity equation and equations (a) and (b).

Two methods of operation were employed for modeling conveniences; once-through operation and recirculation of the model river flow. For the once-through operation, a constant-head reservoir supplied the flow via a supply line. Flowrates were measured by a Venturi meter in the line. The flow was then introduced into the model at the upstream trough. Baffles were used to distribute the flow across the entire width of the model river. At the downstream end of the water flowed over a tailgate and was discarded. Air temperature inside the building housing the model was lowered to a level close to the model river water temperature so that undesirable heat transfer from the air to the model was minimized. For the recirculation operation, water flowed into a sump after leaving the model and was pumped back into the supply line. A small amount of water in the sump was replaced by cold fresh water from outside so the model river water temperature could be maintained at a constant level.

The Dow Chemical Company tertiary treatment pond discharge was simulated using a hot water boiler connnected in parallel to a saturated brine storage tank. The relative density of the discharge flow was maintained by controlling the temperature and brine (TDS) concentration in the flow. The discharge flow was continually monitored with an in-line orifice plate metering section. The Plant discharge was similarly modeled, although its relative density was maintained by adjusting only the water temperature which was achieved with a boiler and a mixing network. The cooling pond makeup water was withdrawn through a geometrically similar structure via a small pump. The withdrawal flow as well as the discharge flow were monitored by in-line orifice plate metering sections.

Surface and near bottom water velocity measurements were made with a calibrated miniature propeller meter. Temperature measurements in the model were accomplished using a matrix of about 230 copper/constantan thermocouples. These probes were used to measure surface and vertical temperature profiles throughout the model, in addition to critical temperatures for model operation such as air temperature, discharge temperatures, and river inflow temperatures. The ambient river temperature was monitored by three probes located in the upstream flow distribution trough. The thermocouples could be scanned at desired time intervals and the excess temperature (water temperature less ambient river temperature) at various locations could be displayed according to thermocouple positions. Further details of the model and its operation are contained in Reference 1.

DESCRIPTION OF THE MATHEMATICAL MODEL FOR TRANSVERSE MIXING OF SOLUTES IN NATURAL STREAMS

The mathematical model is basically the stream tube model originally proposed by Yotsukura and Cobb [2] adopted by the US Nuclear Regulatory Commission [3]. The model was developed for the transverse diffusion of solutes from steady sources placed in a natural stream with steady discharge. Density of water is assumed to be homogeneous throughout the system. Vertical variations of solute concentration, velocity, and diffusion coefficient are neglected through the use of depth averaged values. As a result of these assumptions, the predicted solute plume is two-dimensional. The applicability of the stream tube model to the Tittabawassee River was verified by a number of field surveys of a conductivity plume resulted from Dow Chemical Company's tertiary pond effluent into the Tittabawassee River near the Plant. A description of the field surveys has been previously described.

The theoretical development of the model involves the derivation of a diffusion equation by balancing inflow and outflow of solute mass in a control volume. The dependent variable is the solute concentration and the two independent variables are longitudinal distance along the river and transverse cumulative discharge, q, from the river bank:

$$q = \int_{o}^{y} ud \, dy \qquad \text{(d)}$$

where y = transverse distance from river bank
u = local river velocity at y
d = local river depth

The use of the cumulative discharge instead of the transverse distance from the river bank enables a closed form solution to be found for natural rivers with irregular channel cross-sections. Boundary conditions are zero solute concentration gradient at both river banks and a known solute concentration profile at the upstream end of the river reach to be studied.

The stream-tube model [2] as originally formulated only applied to situations where the upstream solute concentration profile resembles a point source or a constant strength line source perpendicular to the river flow. To treat variable solute concentration at the upstream boundary, a collection of short constant strength line sources was used to approximate the variable solute concentration profile. The stream-tube model was applied repeatedly with each short line source as the upstream boundary condition and the solutions were added. The solution obtained by this superposition is valid since the diffusion equation is linear.

The only parameter appearing in the diffusion equation is the constant diffusion factor D. The evaluation of D requires a separate estimation of the diffusion coefficient K_y which, in turn, can be determined from the river properties and river flow using Elder's empirical equation[4]:

$$K_y = BU^*\bar{d} \qquad (e)$$

Where $\bar{d}$ = average river depth, ft
U^* = shear velocity, ft/sec
B = a dimensionless constant

Values of d and U* can be calculated from field measurements of river cross section shape, depth, flow and water surface slope. The value of B can be determined from the stream-tube model, field measured solute concentration profiles, and the river data mentioned above. For straight rivers, B has a value of approximately 0.23[2, 3]. For curved channels, B is larger than 0.23 due to increased transverse mixing by secondary currents[3, 5].

The constant diffusion factor D can be calculated utilizing the value of K_y obtained from Equation (e):

$$D = \frac{K_y}{Q} = \int_o^Q ud^2dq \qquad (f)$$

where Q is the total river flow

The values of B and D for the stretch of the Tittabawassee River adjacent to the Plant during July and October of 1977 were estimated from field data and are tabulated in Ta'

After finding D for a river reach and after defining the upstream solute concentration versus cumulative discharge, a profile of concentration versus cumulative discharge at the downstream end of the reach can be computed from the mathematical model. For the next reach downstream, this profile is used as the upstream boundary condition together with a new value of D to compute the concentration profile at the downstream end of the reach. By repeating this procedure the lateral transport of a solute over a large distance downstream can be evaluated. By knowing the solute concentration versus cumulative discharge profiles and the distribution of river flow within each river cross section, the transport of a solute in the river can be adequately described.

REFERENCES

1. Alden Research Laboratories, "Hydrothermal Model Studies, Cooling Pond Blowdown Discharge, Midland Nuclear Plant" Final Report 45-79/M124AF, April, 1979.

2. Yotsukura, N and E D Cobb, "Transverse Diffusion of Solutes in Natural Streams," US Geological Survey Professional Paper 582-C, 1972.

3. US Nuclear Regulatory Commission Regulatory Guide 1.113, "Estimating Aquatic Dispersion of Effluents from Accidental and Routine Reactor Releases for the Purpose of Implementing Appendix I," May ,4z01976.

4. Elder, J W, "The Dispersion of Marked Fluid in Turbulent Shear Flow," Journal of Fluid Mechanics, No 5, pp 544-560, 1959.

5. Yotsukura, N and W W Sayre, "Transverse Mixing in Natural Channels," Water Resources Research, Vol 12, No 4, August, 1976.

6. US Geological Survey, "Discharge Measurements at Gaging Stations," Chapter A8 of Techniques of Water Resources Investigations of the USGS, 1969.

TABLE A1

MODEL SCALE RATIOS

Characteristics	Dimension	Model to Prototype Scale Ratio
Length	L	L_r = 1:15
Area	L^2	A_r = 1:225
Velocity	L/t	V_r = 1:3.87
Time	t	t_r = 1:3.87
Discharge	L^3/t	Q_r = 1:871.4
Temperature	°F	T_r = 1:1
TDS	ppm	C_r = 1:1

TABLE A2

SUMMARY OF TITTABAWASSEE RIVER FIELD STUDY RESULTS

River Cross Section Number	Date of Survey	Measured: Discharge (cfs)	Average Velocity (ft/s)	Average Depth (ft)	Ambient River Conductivity (umho/cm)	Reach Length (ft)	Computed Diffusion Parameters: $D(ft^3/s^2)$	$Ky(ft^2/s)$	B
7	7-16-77 am	410	1.41	1.4	660	600	2.5	0.31	1.6
8	7-16-77 pm	390	1.46	2.1	660	600	0.7	0.09	0.4
9	7-16-77 pm	360	1.01	1.9	660	600	0.7	0.12	0.6
10	7-16-77 pm	380	1.09	1.8	660	600	0.7	0.94	0.5
11	7-16-77 pm	390	1.20	1.5	660	600	0.7	0.06	0.4
12	7-17-77 pm	380	1.15	1.6	620	1200	0.2	0.02	0.2
13	7-16-77 pm	360	1.29	1.3	660	600	0.7	0.10	0.7
14	7-17-77 pm	380	1.34	1.5	620	600	0.7	0.09	0.6
15	7-17-77 pm	380	0.99	1.3	620	1200	0.7	0.14	1.0
16	7-17-77 am	410	1.12	1.4	620	1200	0.7	0.13	0.8
17	7-17-77 am	450	1.18	1.8	620				
7	10-8-77 pm	1150	1.72	2.1	450	500	14	0.52	1.2
8	10-8-77 am	1160	1.54	4.0	450	1300	3	0.10	0.2
10	10-8-77 pm	1220	1.60	2.3	450	1220	8	0.38	1.1
12	10-9-77 am	1180	1.70	3.0	450	1840	5	0.27	0.8
14	10-9-77 pm	1240	1.53	2.1	450	1910	4	0.27	0.8
16	10-9-77 pm	1270	1.44	3.0	450				
3	10-15-77 am	1080	1.57	2.6	440	950	6	0.44	1.6
7	10-15-77 pm	1050	1.62	1.9	440	1800	7	0.57	2.7
10	10-16-77 am	1050	1.66	1.9	440	4970	1.5	0.11	0.4
16	10-16-77 pm	1000	1.36	2.5	440	4590	10	0.38	0.2
20	10-16-77 pm	950	0.64	6.2	440				

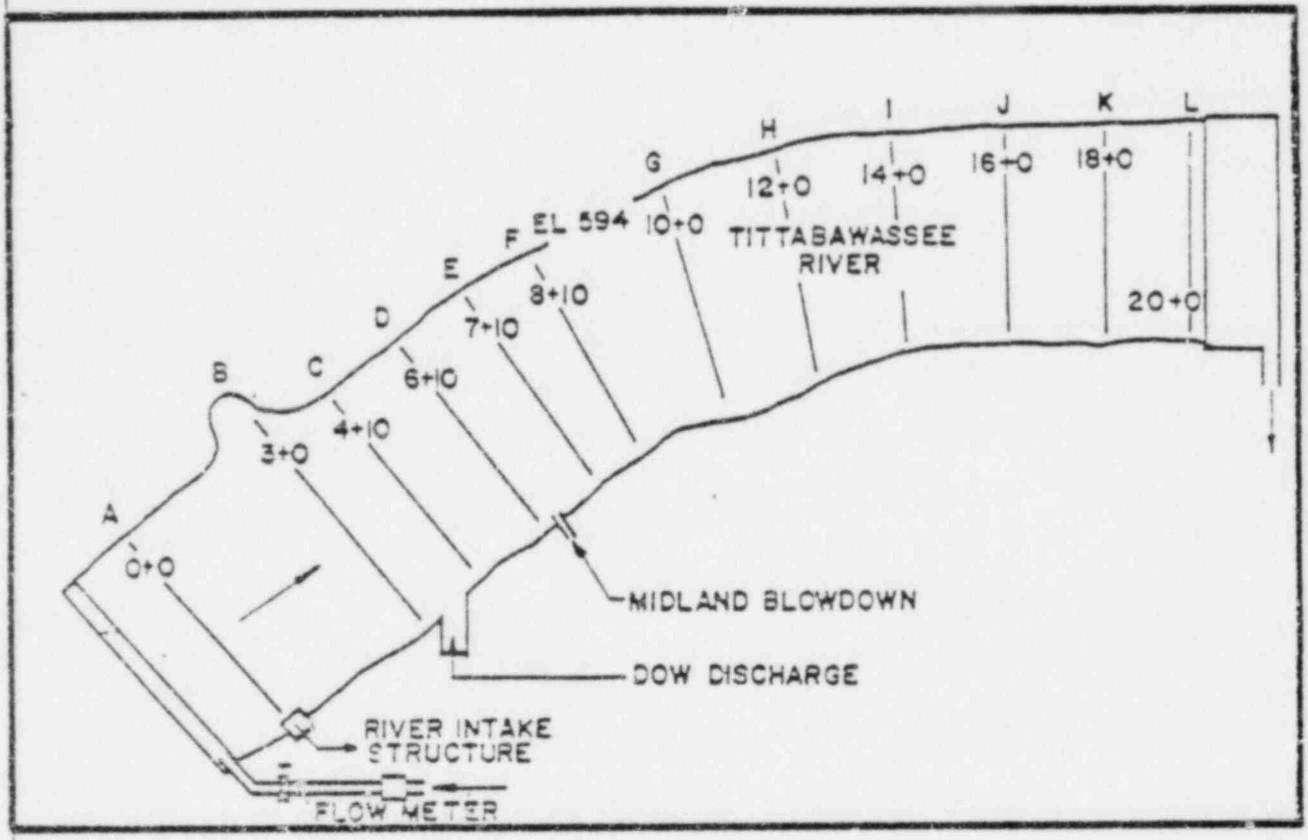


FIGURE A-1

PHYSICAL MODEL LAYOUT

MIDLAND PLANT UNITS 1 & 2

CONSUMERS POWER COMPANY

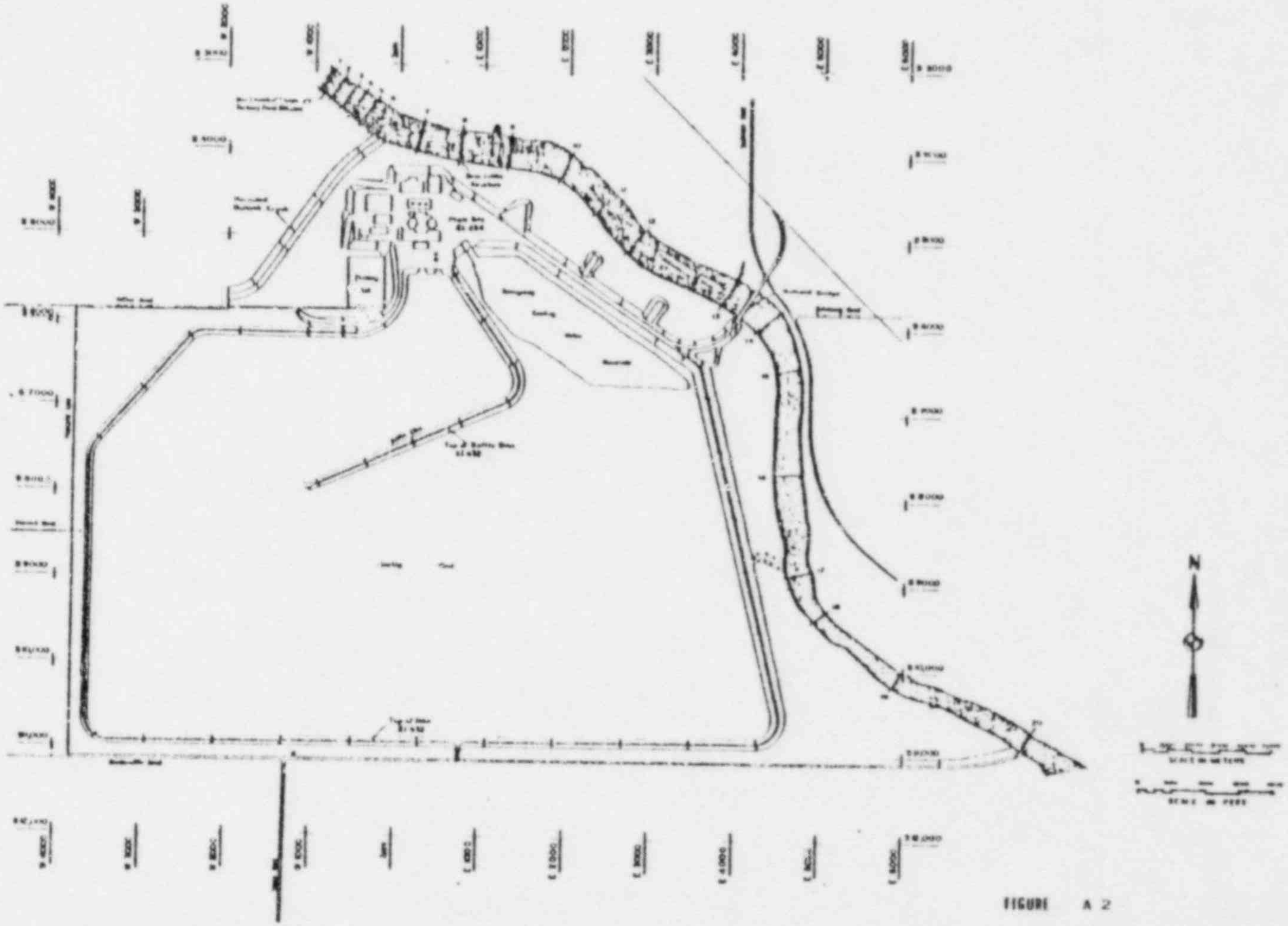


FIGURE A 2

LOCATION OF CROSS SECTIONS
FOR TITTABAWASSEE RIVER
FIELD STUDIES

MIDLAND PLANT UNITS 1 & 2

CONSUMERS POWER COMPANY

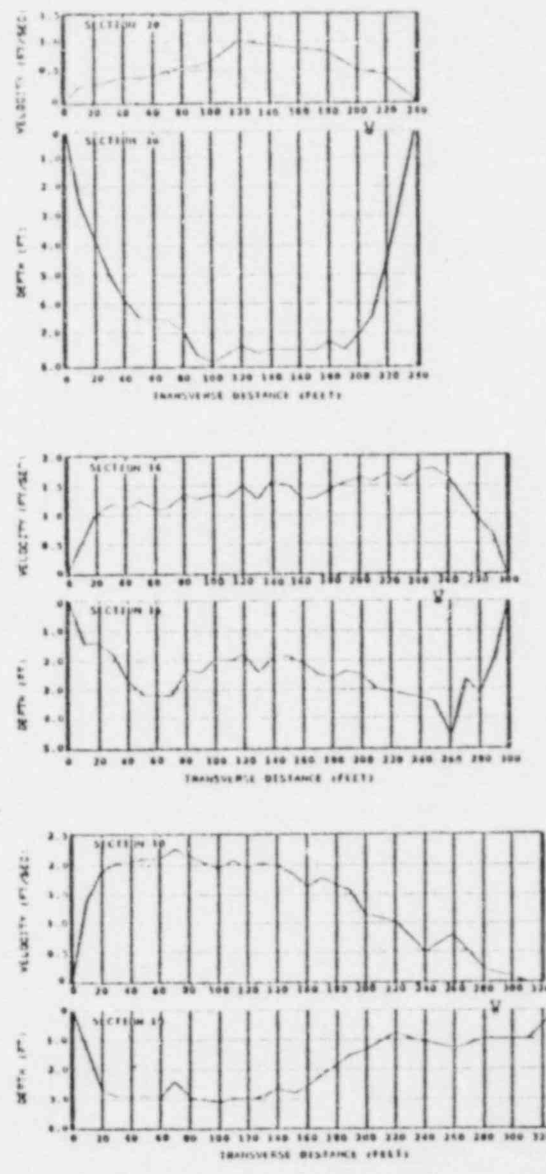


FIGURE A 1
TITTABAWASSEE RIVER FIELD STUDY OF 10/16/77 RIVER DEPTH AND VELOCITY VS TRANSVERSE DISTANCE FOR SECTIONS 10, 16 AND 20
MIDLAND PLANT UNITS 1&2
CONSUMERS POWER COMPANY

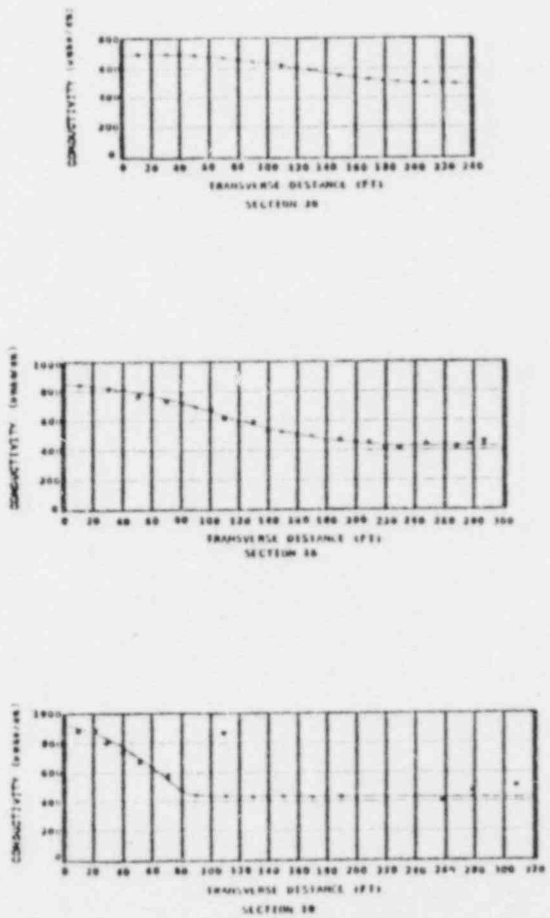


FIGURE A 4
TITTABAWASSEE RIVER FIELD STUDY OF 10/16/77
CONDUCTIVITY VS TRANSVERSE DISTANCE FOR SECTIONS 10, 16 AND 20

MIDLAND PLANT UNITS 1 & 2

CONSUMERS POWER COMPANY

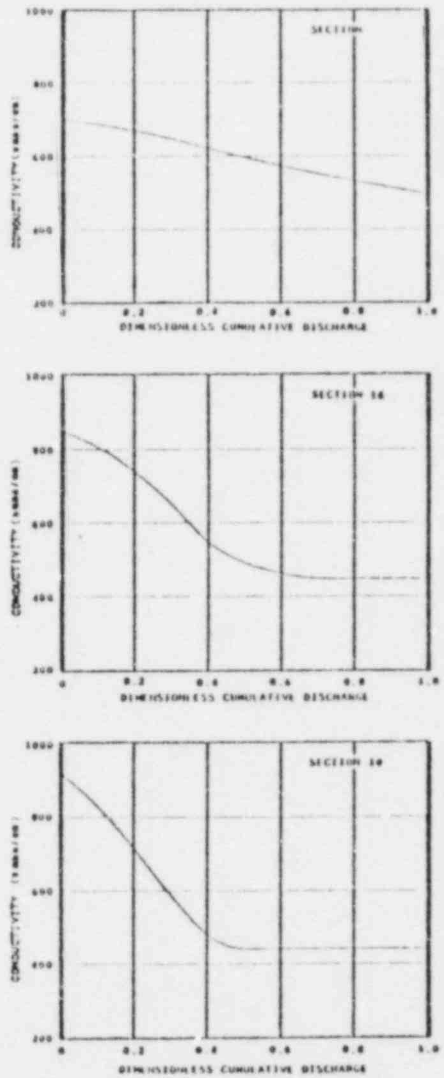


FIGURE A 5
TITTABAWASSEE RIVER FIELD
STUDY OF 10/16/77
CONDUCTIVITY VS DIMENSIONLESS DISCHARGE FOR SECTIONS
10, 16 AND 20

MIDLAND PLANT UNITS 1&2

CONSUMERS POWER COMPANY

APPENDIX B

THERMAL PLUME EFFECTS

Operation of the cooling pond blowdown system forms a thermal plume in the Tittabawassee River. The thermal plume consists of two parts, the near field and the far field. In the near field the blowdown discharge dilutes rapidly with river water through a jet mixing process. Further mixing in the far field is mainly due to transverse convection and turbulent diffusion. The thermal plume is simulated by a physical river model for the near field and by a mathematical model for the far field as described in Attachment A. Heat loss from the thermal plume into the atmosphere was not considered.

Dow Chemical Company discharges its tertiary pond effluent into the Tittabawassee River at about 300 feet upstream from the Plant blowdown structure. Both discharges are at the south bank of the river and are shown in Figure A1. The excess temperature (temperature of the effluent less ambient natural river temperature) of Dow's effluent is incorporated into the Plant thermal plume simulation.

Physical model test results (Reference 1) in the near field resulted to the 1°F isotherms shown in Figures B1 to B5. To extend those isotherms in the far field, the transverse convection-diffusion mathematical model of Yotsukura and Cobb (Reference 2) was used. Parameters needed in the mathematical model include river cross-sections and their velocity distribution as well as diffusion factors.

The Tittabawassee River geometry, river flow distribution, and excess temperature at the end of the near field (Section A shown in Figure B6) are used to initiate the far field thermal plume mathematical modeling. The linkage between near field and far field is based on an excess temperature versus dimensionless cumulative discharge profile at Section A which is used as the upstream boundary condition in the mathematical model.

Diffusion factors for the reach of the river extending from the near field to Section B (shown in Figure B6 at Gordonville Road) have been computed for a range of river discharges based on field data collected during July and October of 1977. Although no detailed field data is available for the reach of the river downstream of Section B, the Corps of Engineers has made a survey at the Smith's Crossing Road bridge which is shown as cross-section No 10 in Figure 2.4.19 of Reference 3. This cross-section is quite similar to Section B. The river was also observed on several occasions at the Smith's Crossing and Freeland Road bridges (Sections C and D shown in Figure B7), approximately 0.5 and 4.5 mile downstream of Section B, respectively. The river cross-sections at those locations resemble that of Section B, having steep banks, slow moving current, and a deep channel. Based on these observations, it was assumed that the Tittabawassee River characteristics downstream of Section B are similar to those of Section B. The diffusion factor for this part of the river was, therefore, determined from the hydraulic properties measured at Section B.

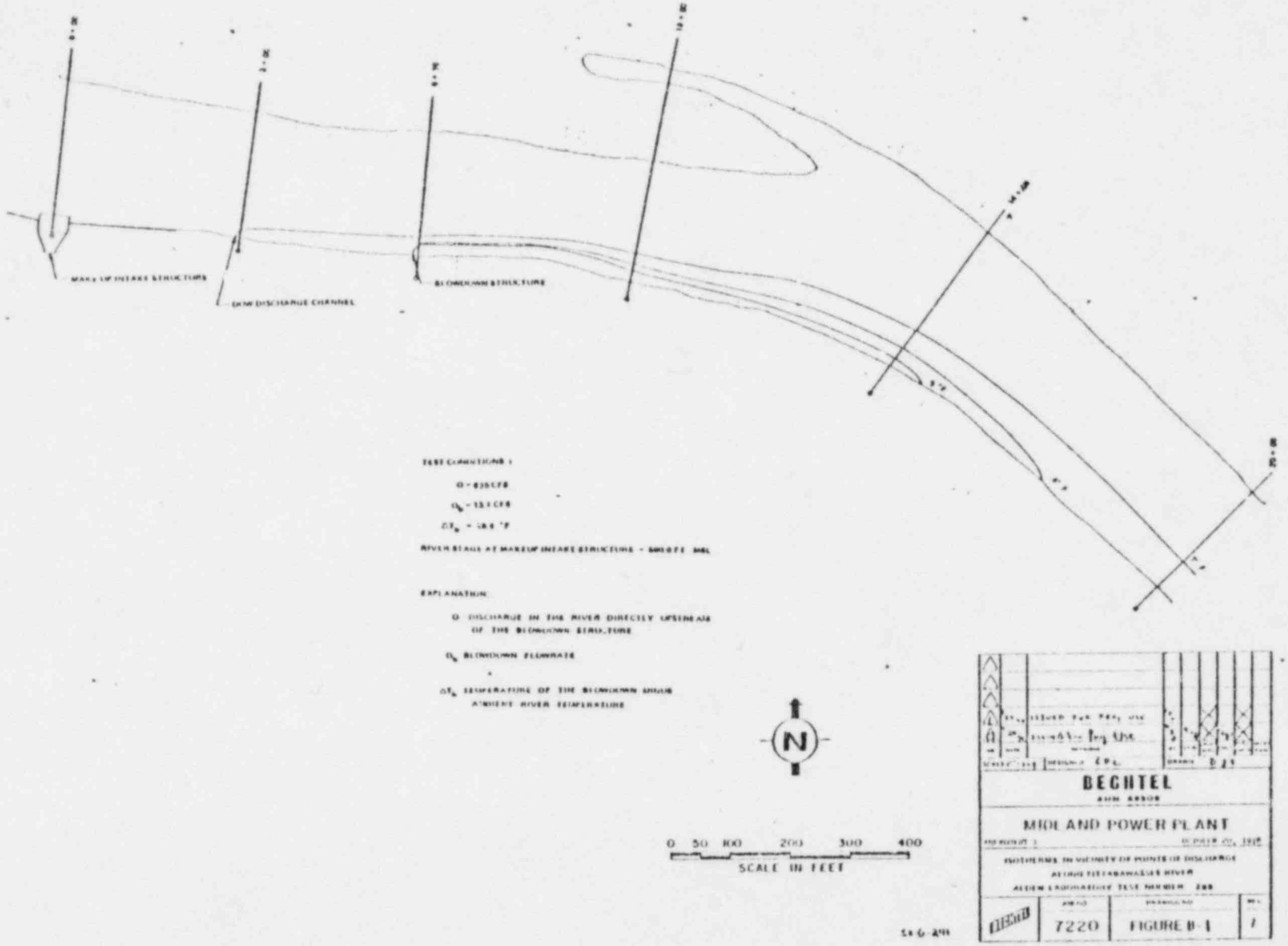
After determining the diffusion factor for a river reach and after defining the excess temperature versus cumulative discharge, a profile of excess temperature versus cumulative discharge at the downstream end of the reach was computed from the mathematical model. For the next reach downstream, this profile was used as an upstream boundary condition together with a new value of the diffusion factor to compute the excess temperature profile at the downstream end of the reach. By repeating this procedure, the lateral transport of the thermal discharge over a large distance downstrem was evaluated resulting to the lengths of the 1°F isotherms listed in Table 4 for each river discharge. The distances should be conservative since the mathematical model does not account for surface heat transfer to the atmosphere. Due to the lack of information on river cross-sectional shapes and velocity profiles downstream from Section B, isotherms could not be drawn for the far field.

REFERENCES

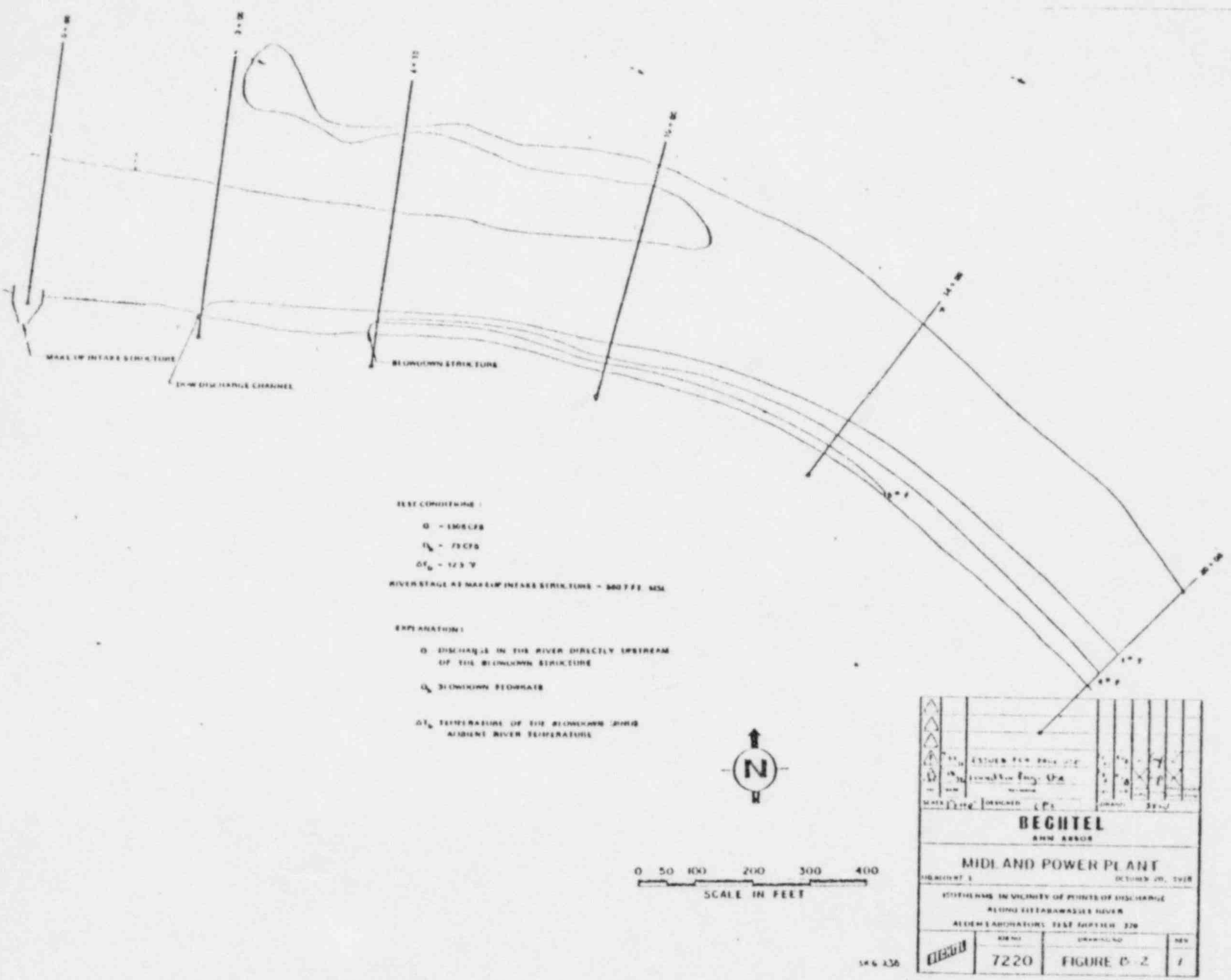
1. Alden Research Laboratories, "Hydrothermal Model Studies; Cooling Pond Blowdown Discharge, Midland Nuclear Plant" Final Report 45-79/M124AF, April, 1979.

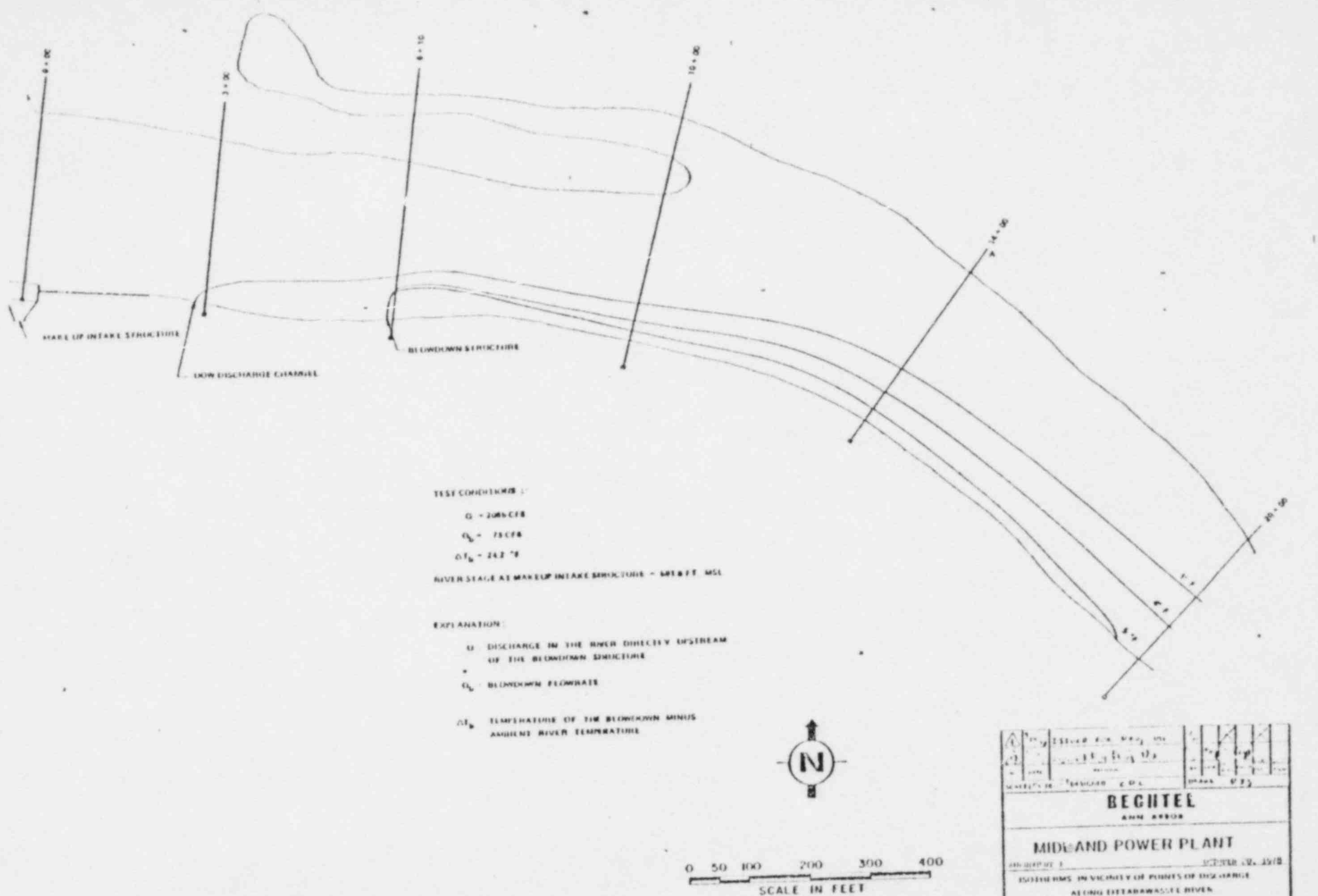
2. N Yotsukura and E D Cobb, Transverse Diffusion of Solutes in Natural Streams, Professional Paper 582-C (1972), US Geological Survey.

3. Consumers Power Company, Final Safety Analysis Report, Midland Plant-Units 1 and 2.



MAKE UP INTAKE STRUCTURE
BLOWDOWN STRUCTURE
TEST CONDITIONS:
EXPLANATION
Q DISCHARGE IN THE RIVER DIRECTLY UPSTREAM OF THE BLOWDOWN STRUCTURE
Q_b BLOWDOWN FLOWRATE
ΔT_b TEMPERATURE OF THE BLOWDOWN ABOVE AMBIENT RIVER TEMPERATURE
N
0 50 100 200 300 400
SCALE IN FEET
BECHTEL
ANN ARBOR
MIDLAND POWER PLANT
7220
FIGURE B-1


MAKEUP INTAKE STRUCTURE
DISCHARGE CHANNEL
BLOWDOWN STRUCTURE
TEST CONDITIONS:
RIVER STAGE AT MAKEUP INTAKE STRUCTURE
EXPLANATION:
Q DISCHARGE IN THE RIVER DIRECTLY UPSTREAM OF THE BLOWDOWN STRUCTURE
Q_b BLOWDOWN FLOWRATE
ΔT_b TEMPERATURE OF THE BLOWDOWN ABOVE AMBIENT RIVER TEMPERATURE
N
0 50 100 200 300 400
SCALE IN FEET
BECHTEL
ANN ARBOR
MIDLAND POWER PLANT
7220
FIGURE B-2



TEST CONDITIONS :

Q = 2086 CFS

Q_b = 75 CFS

ΔT_b = 24.2 °F

RIVER STAGE AT MAKEUP INTAKE STRUCTURE = 641.8 FT. MSL

EXPLANATION :

Q DISCHARGE IN THE RIVER DIRECTLY UPSTREAM OF THE BLOWDOWN STRUCTURE

Q_b BLOWDOWN FLOWRATE

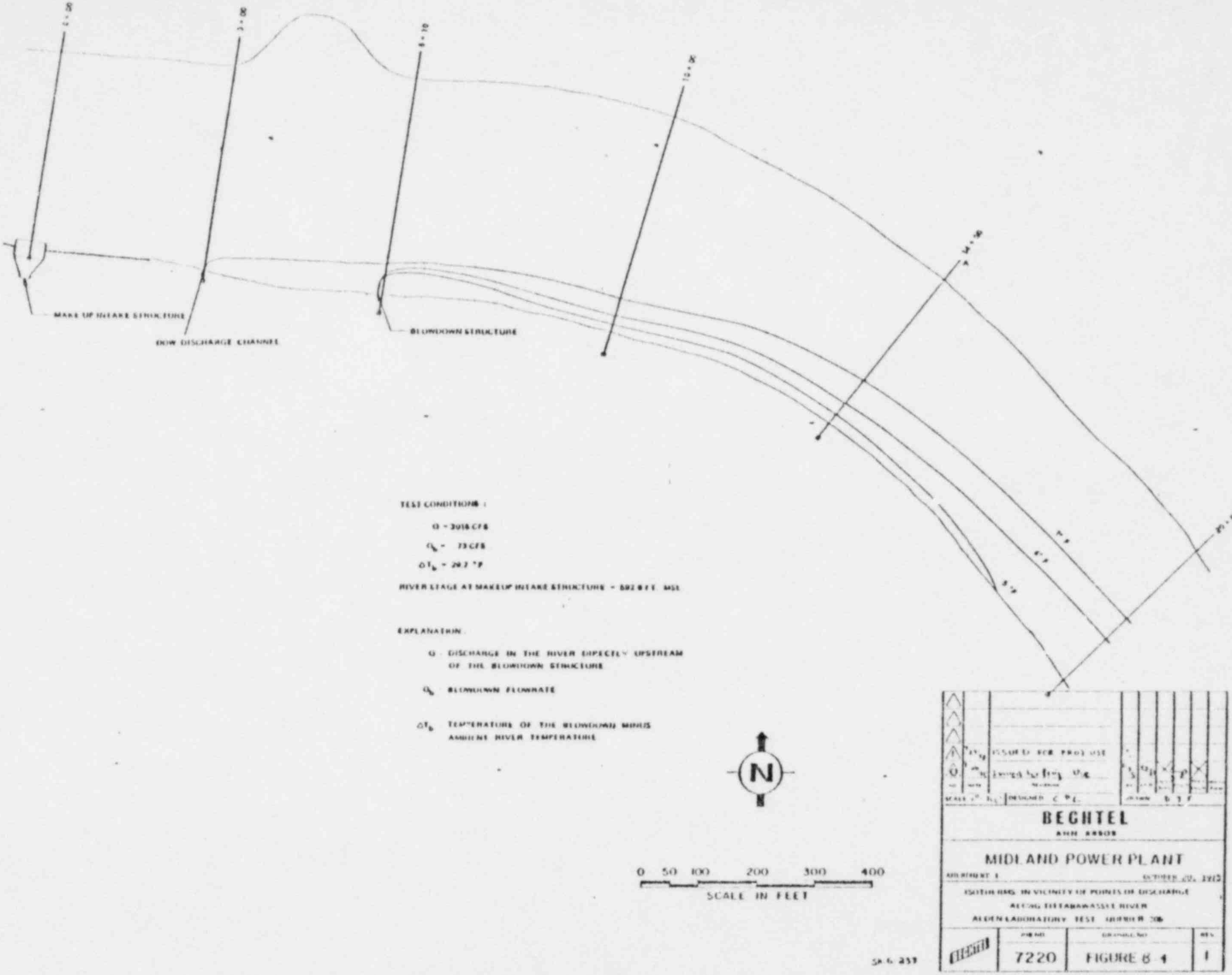
ΔT_b TEMPERATURE OF THE BLOWDOWN MINUS AMBIENT RIVER TEMPERATURE

BECHTEL
ANN ARBOR

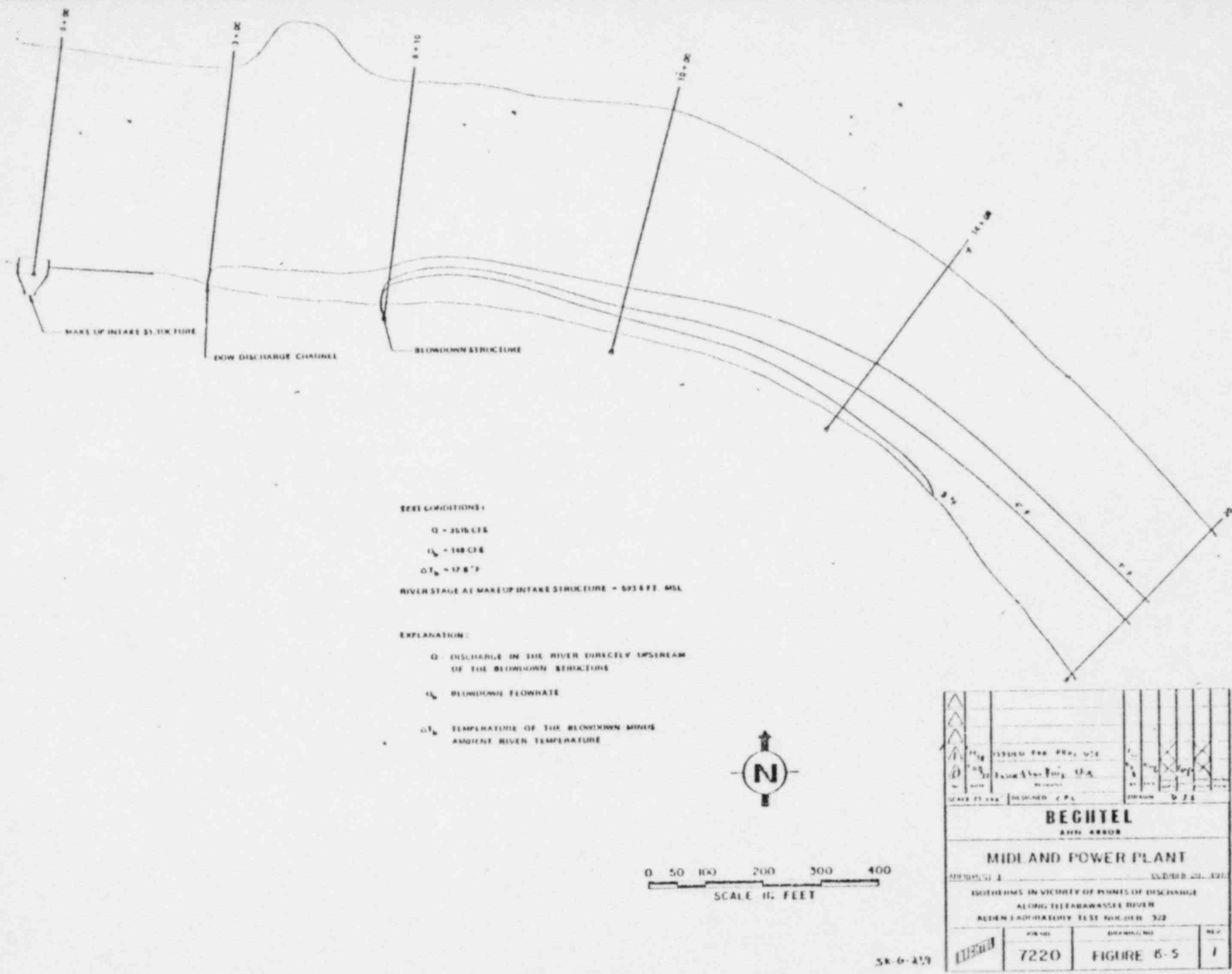
MIDLAND POWER PLANT

ISOTHERMS IN VICINITY OF POINTS OF DISCHARGE
ALONG TITTABAWASSEE RIVER
ALDEN LABORATORY TEST NUMBER 342

	JOB NO.	DRAWING NO.	REV.
	7220	FIGURE 8-3	1

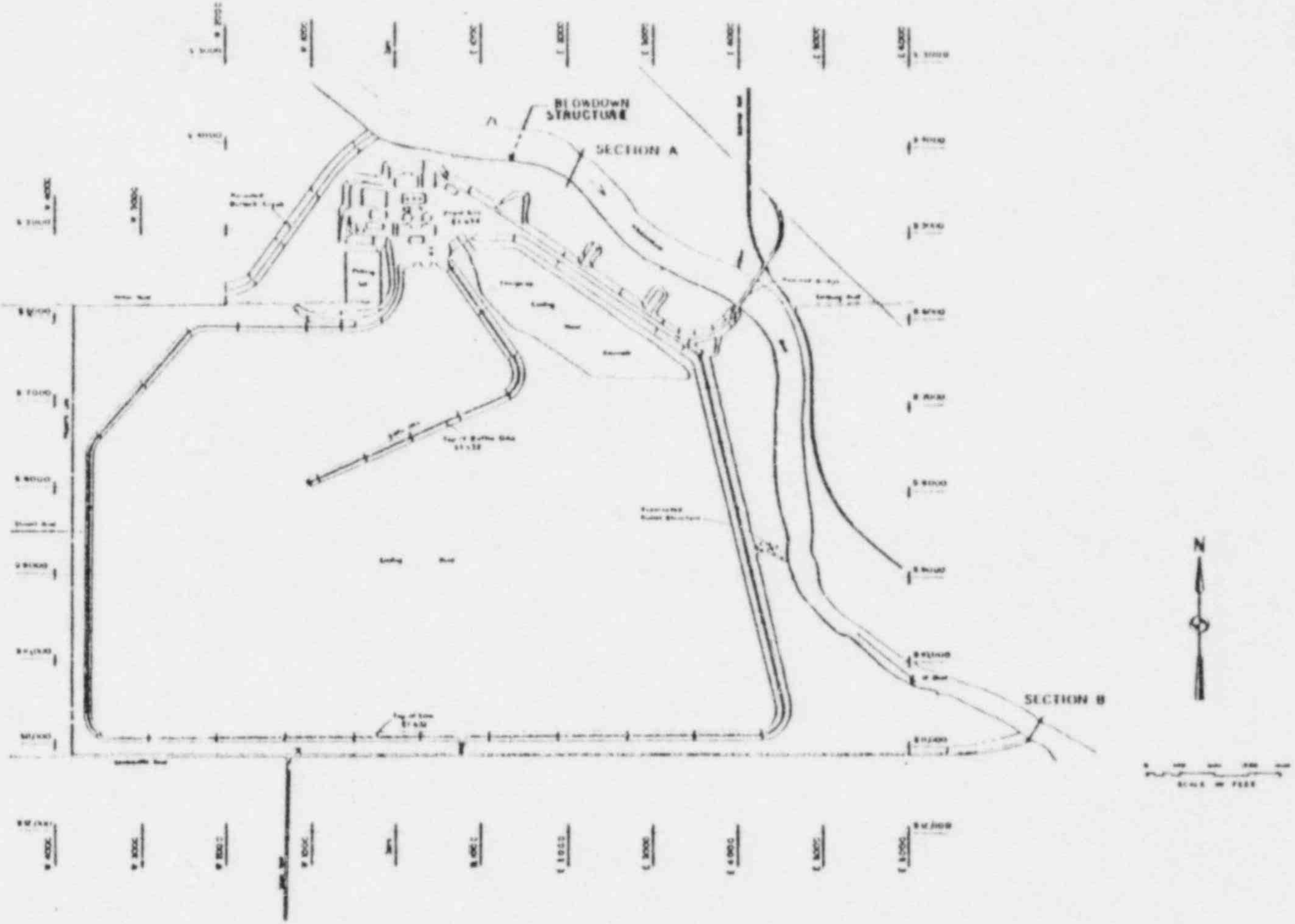


MAKE UP INTAKE STRUCTURE
DOW DISCHARGE CHANNEL
BLOWDOWN STRUCTURE
TEST CONDITIONS :
Q = 2018 CFS
Qb = 73 CFS
ΔTb = 20.2 °F
RIVER STAGE AT MAKEUP INTAKE STRUCTURE = 602.8 FT. MSL
EXPLANATION:
Q DISCHARGE IN THE RIVER DIRECTLY UPSTREAM OF THE BLOWDOWN STRUCTURE
Qb BLOWDOWN FLOWRATE
ΔTb TEMPERATURE OF THE BLOWDOWN MINUS AMBIENT RIVER TEMPERATURE
N
0 50 100 200 300 400
SCALE IN FEET
ISSUED FOR PROJ USE
BECHTEL
ANN ARBOR
MIDLAND POWER PLANT
AMENDMENT 1
OCTOBER 29, 1973
ISOTHERMS IN VICINITY OF POINTS OF DISCHARGE
ALONG TITTABAWASSEE RIVER
ALDEN LABORATORY TEST NUMBER 206
7220
FIGURE 8-4
1



MAKE UP INTAKE STRUCTURE
DOW DISCHARGE CHANNEL
BLOWDOWN STRUCTURE
TEST CONDITIONS:
Q = 3516 CFS
Q_b = 140 CFS
ΔT_b = 17.8°F
RIVER STAGE AT MAKEUP INTAKE STRUCTURE = 593.4 FT. MSL
EXPLANATION:
Q - DISCHARGE IN THE RIVER DIRECTLY UPSTREAM OF THE BLOWDOWN STRUCTURE
Q_b - BLOWDOWN FLOWRATE
ΔT_b - TEMPERATURE OF THE BLOWDOWN MINUS AMBIENT RIVER TEMPERATURE
N
0 50 100 200 300 400
SCALE IN FEET
BECHTEL
ANN ARBOR
MIDLAND POWER PLANT
ISOTHERMS IN VICINITY OF POINTS OF DISCHARGE
ALONG TITTABAWASSEE RIVER
ALDEN LABORATORY TEST NUMBER 322
7220
FIGURE 8-5
1

SK-G-239



BECHTEL ANN ARBOR	
MIDLAND POWER PLANT	
LOCATION OF RIVER CROSS SECTIONS IN COOLING POND BLOWDOWN STUDY	
JOB NO. 7220	DRAWING NO. FIGURE 16

SK 6 235

AMENDMENT 1 OCTOBER 20, 1978

BECHTEL

ANN ARBOR

MIDLAND POWER PLANT

TITTABAWASSEE RIVER DOWNSTREAM OF PLANT BOUNDARIES

JOB NO. 7220

FIGURE

AMENDMENT 1

OCTOBER 20, 1978

APPENDIX C

ANALYSIS OF MIDLAND PLANT COOLING POND OPERATION

INTRODUCTION

The cooling pond has been designed to adequately dissipate the waste heat resulting from the generation of approximately 1300 MWe of electricity and four million pounds per hour of steam. The pond will effectively transfer waste heat to the atmosphere through evaporation, back radiation and conduction processes.

The cooling pond makeup and blowdown operation is designed to control the pond Total Dissolved Solids (TDS) concentrations which originate from use of Tittabawassee River water. TDS input from the plant operation, circulting water acid and hypochlorite addition and the possible discharge of condensate demineralizer regeneration waste are not significant. As evaporation losses of pond water resulting from the heat dissipation process will result in total dissolved solids accumulation, the cooling pond blowdown and makeup process will allow for TDS control within the pond operating requirements.

A description of the basic regulations, assumptions and data utilized in this analysis follows:

1. Regulations

   Discharging cooling pond blowdown into the Tittabawassee River has two primary effects: Creating a thermal plume and adding TDS to the river. To protect the water quality of the river, the following rules of the Michigan Water Resources Commission (MWRC) must be maintained.

   a. Heat load to the river shall not warm the receiving water at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

Month:	J	F	M	A	M	J	J	A	S	O	N	D
°F:	41	40	50	63	76	84	85	85	79	68	55	43

   b. Heat load to the river shall not warm the receiving water at the edge of the mixing zone more than 5°F.

   c. The size of the mixing zone is limited such that it does not contain more than 25% of the cross-sectional area and volume of flow of the river at any river transect.

   d. The controllable addition of TDS to the river shall not increase the river TDS concentration beyond 500 ppm as a monthly average nor more than 750 ppm at any time.

Dow Chemical Company discharges its tertiary pond effluent into the Tittabawassee River about 300 ft upstream from the location of the cooling pond blowdown discharge. Both discharges are at the south bank of the river. Dow's effluent also adds heat and TDS to the river.

2. Physical Assumptions

Simulation of the daily operation and the TDS concentration levels of the cooling pond are based on the following physical assumptions:

a. Total dissolved solids in the cooling pond come from the Tittabawassee River only. TDS input from plant operation, circulating water acid and hypochlorite addition and the possible discharge of condensate demineralizer regeneration waste, is not significant and is not considered.

b. Cooling pond volume gain by precipitation is assumed to be equal to the volume loss of seepage. This is a conservative assumption since an annual average precipitation of 30 inches over the pond surface of 880 acres is equivalent to 3 cfs which is larger than the estimated pond seepage loss of 0.5 cfs.

c. No credit is taken for TDS loss from the cooling pond via seepage.

d. Pond TDS is uniformly distributed throughout the pond volume.

e. The effluent of Dow Chemical Company's tertiary pond is assumed to be a continuous discharge having a flowrate of 67 cfs with an excess temperature of 5°F and a TDS concentration of 2500 ppm.

f. Average daily Tittabawassee River flows for water years 1937 to 1977 are used in the operation study. (This assumption was utilized for analytical purposes only. River flow may vary widely over a day due to operation of Sanford Dam. Operating controls will assure continuous compliance with the withdrawal schedule set forth in Exhibit II.)

g. The assumptions that the cooling pond is full and that pond TDS is at a concentration of 500 ppm are used as initial conditions for the simulation of the pond operation.

3. Operation Assumptions

In this study, the operation of the cooling pond (timing and amount of makeup and blowdown), is governed by the following assumptions:

a. The annual refueling period for each unit is assumed to be one month. Refueling occurs in September for Unit 1 and in April for Unit 2. The heat load to the cooling pond is 3370×10^6 Btu/hr for April, 5680×10^6 Btu/hr for September, and 9050×10^6 Btu/hr for the remaining months of the year.

b. Maximum allowable blowdown flowrates as determined from the Alden Research Laboratory (ARL) test program are a function of the river flow and blowdown excess temperature (blowdown temperature less natural river temperature). Blowdown flowrates used in the pond operation study were kept below a set of maximum allowable values shown in Figure C-1 derived from the ARL test program and consideration of thermal constraints in the Tittabawassee River.

c. Makeup flowrates are kept as high as possible without filling the pond above elevation 627 ft. The constraints on makeup flowrates are listed in Subsection 3.4 of the Environmental Report. The maximum makeup flow utilized in the pond operation simulation is 270 cfs corresponding to the makeup pumps runout conditions.

d. In order to simulate pond operation under the most stringent conditions, Dow effluent discharge into the Tittabawassee River is given priority over the Midland Plant cooling pond blowdown discharge. The Midland Plant blowdown flow will be controlled so that it will not cause the river TDS to exceed 500 ppm.

e. The maximum blowdown flowrate is limited to 220 cfs because of hydraulic characteristics of the gravity fed blowdown scheme. The minimum flowrate is 5 cfs due to difficulty in throttling for flows below 5 cfs.

f. The pond water surface elevation imposes the following limits on the makeup and blowdown flowrates:

   1. When pond level is above 627 ft, no makeup is permitted and blowdown may be discharged at its maximum allowable flowrate.

   2. When pond level is 626.5 ft, no blowdown is permitted and makeup withdrawal may be made at its maximum allowable flowrate.

   3. When pond level is between 627 ft and 626.75 ft, both makeup withdrawal and blowdown discharge may be made at their maximum allowable flowrates.

   4. When pond level is between 626.75 ft and 626.5 ft, makeup flowrate may be set at its maximum allowable value and the blowdown flowrate is limited so that the pond level is not lowered because of the blowdown discharge.

g. Pond blowdown discharge is terminated when daily average natural river temperatures are within 5°F of the monthly maximum temperatures.

4. <u>Data</u>

a. The US Geological Survey gaging station on the Tittabawassee River is located some 4700 ft upstream from the Midland Plant river intake structure. Daily average river flows published by the USGS from water years 1937 to 1977 were used in the cooling pond operation simulation.

b. Natural river temperatures on a daily average basis from October 1, 1975 to September 30, 1978 as recorded by the Dow Chemical Company at the Dow dam were extracted and used to develop a model relating long term daily natural river temperatures and daily dry bulb temperatures. From dry bulb temperatures recorded at the Bishop Airport of Flint, Michigan, natural river temperatures were generated from March 1, 1949 to September 30, 1978 and were used in the pond operation simulation.

c. Daily natural river TDS concentrations were either directly obtained or estimated from the natural river conductivities contained in the monthly Operating Report of Dow Chemical Company from October 1975 to September 1977. Conservatively, the higher 1976 TDS concentrations were used repeatedly in the study.

d. A transient cooling pond mathematical model was used to estimate daily average blowdown temperatures and pond evaporative losses.

e. A physical model was utilized to determine the quantity of blowdown that could be discharged into the Tittabawassee without resulting in a mixing zone more than 1700 feet long and not exceeding the 25% cross-sectional limits for the thermal mixing zone.

   Both the Dow tertiary pond discharge and the cooling pond blowdown were simulated in the physical model. A matrix of 275 thermocouples, positioned throughout the model, were used to determine the maximum allowable blowdown flowrate for a given blowdown excess temperature and river flow. For all data provided, the edge of the thermal plume is based on the location of the 5°F excess temperature isotherm as determined by the average temperatures obtained from 25 scans of each of the thermocouples.

5. Simulation of Pond Operation

A computer program was written for the daily simulation of the cooling pond operation. For each day, the makeup and blowdown flowrates (if any), pond volume and pond TDS concentration are calculated from known blowdown excess temperatures (blowdown temperature less natural river temperature) and natural river TDS concentrations. The logic of the program incorporates all assumptions and operation rules previously outlined.

6. Conclusions

The following conclusions resulted from the simulation of the cooling pond operation based on the assumptions presented previously. Pond blowdown will be controlled by measuring the actual river flow, upstream river temperature, excess temperature of blowdown, upstream river TDS and Dow discharge conditions.

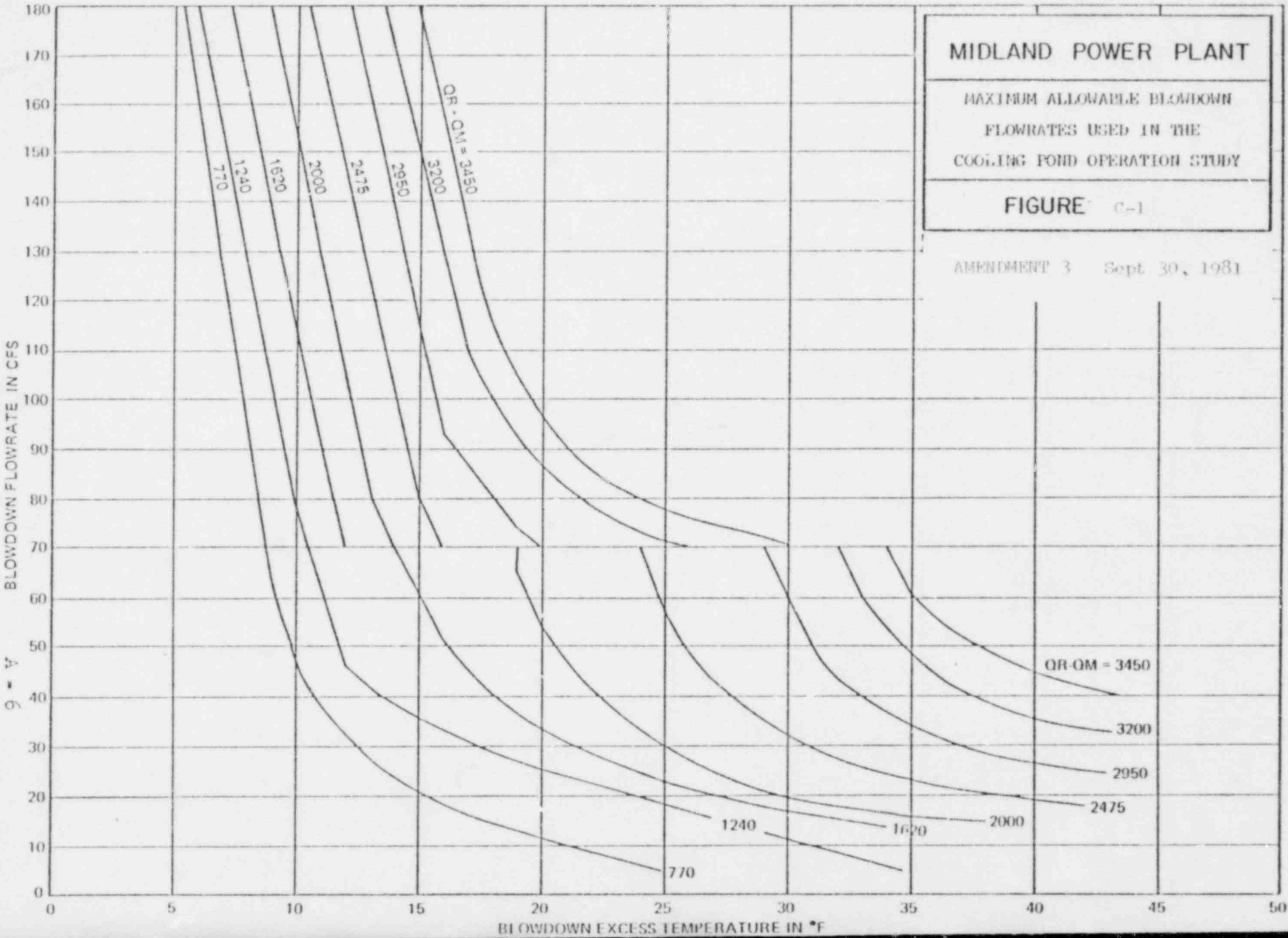
a. It is feasible to control the pond TDS level by a makeup-blowdown scheme. Based on the available data, the operational assumptions set forth result in pond TDS concentrations that are acceptable for the circulating water and service water system hardware.

b. On an average temperature basis, the thermal plume shall not cover more than 25% of cross-sectional area or volume of river flow at any transect of the river, and its length shall not exceed 1700 feet.

c. On a long term basis, cooling pond blowdown and the resulting thermal plumes will exist in the Tittabawassee River about 27% of the time.

   Fifty percent of the time, blowdown is withheld because Dow effluent uses the whole TDS capacity of the river. Eight percent of the time, blowdown cannot be discharged because natural river temperatures are within 5°F of the monthly maximum temperatures set by MWRC. The pond water level was below 626.5 ft 2% of the time and no blowdown was discharged. The calculated blowdown flowrates are below the present minimum blowdown flowrate of 5 cfs 13% of the time, so that no blowdown takes place.

Variations between actual values of the parameters which will control pond blowdown and assumptions used in the study may result in increased frequency and blowdown rates. The combined effects of the cooling pond blowdown and the Dow Chemical Company discharge shall comply with Michigan Water Quality Standards regarding temperatures, TDS, mixing zone length and width.



MIDLAND POWER PLANT

MAXIMUM ALLOWABLE BLOWDOWN FLOWRATES USED IN THE COOLING POND OPERATION STUDY

FIGURE C-1

AMENDMENT 3 Sept 30, 1981

APPENDIX D

BLOWDOWN AND MAKEUP CONTROL SYSTEM

An automatic control system is provided to minimize the TDS concentration in the cooling pond by maximizing blowdown and makeup flowrates. The frequent changes in the variables, particularly river flow, dictate the need for an automatic rather than a manual system.

The combined effects of the cooling pond blowdown and the Dow Chemical Company discharge shall comply with Michigan Water Quality Standards regarding temperatures, TDS, mixing zone length and width. The cooling pond is generally kept full when possible and therefore blowdown will usually be voluntarily restricted when makeup cannot keep up with pond losses.

BLOWDOWN CONTROL

1. Blowdown flowrate is determined by calculating the flowrate that satisfies the TDS requirements and separately calculating the flowrate that satisfies the thermal requirements. The lower of the two flowrates is selected and is then checked to verify that it is within the physical range of the blowdown system. Pond level and makeup rate are also checked to make certain that blowing down will not decrease the pond level.

   The calculated blowdown rate is then set by an automatic adjustment of the three blowdown control valves. Flow measurement is provided in each blowdown line. Periodically the flowrate is recalculated and reset as required (every 15 minutes to 1 hour - to be determined based on operating experience).

2. The blowdown flowrate to satisfy thermal requirements is calculated from the Alden Research Laboratory model testing program results. Calculations can be done by interpolation for all river flowrates up to the maximum rate tested. For higher river flowrates, extapolation of the test data and proportioning are used to calculate blowdown flowrates.

   The measured parameters required for this calculation of blowdown are river flowrate, the cooling pond blowdown temperature and the natural river temperature. If the natural river temperature approximates the monthly maximums stated in the water quality standards, the blowdown is reduced or terminated, as necessary, to preclude exceeding the monthly maximum.

3. The blowdown flowrate to satisfy river TDS requirements is calculated by doing a fully mixed mass balance using measured values of river flow and TDS concentration, the Dow discharge flow and TDS concentration and the blowdown TDS concentration. The allowable TDS river concentrations are 500 ppm as a daily average and 750 ppm as an instantaneous maximum.

MAKEUP CONTROL

1. The measured river flowrate is used to select a makeup flowrate that complies with both the makeup withdrawal schedule and the maximum 1 ft/sec velocity in front of the intake structure traveling screens requirement.

2. The calculated flowrate is established by starting the required number of pumps and adjusting the control valve in the recirculation line to bypass the excess flow. Flow measurement is provided to determine both net makeup and bypass.

3. Makeup is automatically terminated when the pond is full.

RADWASTE DISCHARGE DILUTION

1. Pond blowdown is used for radwaste dilution when the blowdown flow is adequate.

2. Radwaste dilution flow from the discharge of the makeup pumps will be used when pond blowdown flow is <45efs. Pond blowdown will be temporarily suspended when radwaste dilution flow is in operation.

APPENDIX E

ANALYSIS OF THE MIDLAND PLANT THERMAL PLUME AND THE DOW CHEMICAL COMPANY DISCHARGE INTERACTION

BACKGROUND

On July 28, 1978, the Michigan DNR staff requested Consumers Power to analyze the possible interaction between critical materials discharged from The Dow Chemical Company and thermal effluent from the Midland Plant. A September 13, 1978 letter from Mr Robert Basch provided a list of critical materials that should be included in the scope of the analysis. This list originated from Dow's annual wastewater report of critical materials discharged during 1977. The resulting analysis was provided in Amendment 1 to the State Discharge Permit Application dated October 20, 1978.

APPENDIX F
THERMAL PLUME EFFECT ON DISSOLVED OXYGEN LEVELS

Background

On July 28, 1978, the MDNR Staff requested Consumers Power to assess the effect of the Midland Plant's thermal discharge on dissolved oxygen levels in the Tittabawassee River. Under certain conditions, the cooling pond discharge could reduce dissolved oxygen levels in the river as a result of the limited solubility of oxygen in heated water and the potentially high biological oxygen demand of the Midland effluent. In response to the Staff's request, the company engaged Lawler, Matusky and Skelly Engineers (LMS) to evaluate the impact of Midland Plant discharges on dissolved oxygen levels in the Tittabawassee River. The results of this analysis are reported in LMS (1980) and summarized in the following discussion.

Analysis

To assess the effect of cooling pond discharges on dissolved oxygen levels in the Tittabawassee River, a water quality mathematical model was developed. This model was calibrated with the results of an intensive water quality study (Gannon 1963), thus allowing the accurate reproduction of dissolved oxygen, carbonaceous biochemical oxygen demand and temperature. The calibrated model was used to determine the separate and combined effects of the Midland Plant discharge and the Midland Wastewater Treatment Plant waste loads on dissolved oxygen levels in the river. The model included the various Dow Chemical Company withdrawals and discharges. These effects were simulated under a variety of plant and river flow, temperature, and loading conditions.

An analysis of average monthly river and plant flows and temperatures determined that the month with the greatest potential dissolved oxygen decrease was April. Study results for average April conditions are summarized in Table F-1.

The following conclusions arise from the (April) spring model results:

1. The present (and operational) monthly average river DO levels for April are (and will be) significantly higher than the State Water Quality Standard requiring a 5.0 mg/l daily average with no single value less than 4.0 mg/l (Rule 323.1064 of the Michigan Administrative Code).

2. The influence of organic activities (CBOD) is not expected to cause a significant drop in river DO levels.

3. For the average monthly April condition, the effect of the Midland blowdown on DO levels in the river appears to be minimal. The largest decrease is 0.3 mg/l (from 9.3 to 9.0 mg/l).

Average seasonal conditions were also analyzed for impact on river DO levels. These results are summarized in Table F-2.

The effects of the Midland Plant discharge on river DO levels for the average seasonal conditions listed in Table F-2 are minimal and below their spring counterparts.

The study results for the combined effects of the Midland Plant and proposed wastewater treatment plant waste loads are summarized in Table F-3.

Conclusions

The following conclusions are drawn:

1. A study of average seasonal conditions indicates that the effect of the Midland Plant discharge on Tittabawassee River dissolved oxygen is minimal, and DO levels will remain well above the State Water Quality Standard for DO (Rule 323.1064).

2. The Tittabawassee River is capable of handling the present and proposed waste loads without contravention of this standard.

3. Under critical low flow conditions, it appears that the Tittabawassee River is marginally capable of handling the proposed loadings of the power and wastewater treatment plants. Extreme climatic conditions could cause the DO to approach the 5 mg/l daily average, but the level will be well above the 4 mg/l single sample value.

TABLE F-1

RUN DESCRIPTION	COOLING POND BLOWDOWN FLOW (cfs)	DO DECREASE AT MIDLAND (mg/1) FROM	DO DECREASE AT MIDLAND (mg/1) TO	DO DECREASE AT FREELAND (mg/1) FROM	DO DECREASE AT FREELAND (mg/1) TO
High CBOD Level in Discharge (5 mg/1)	79	9.7	9.5	9.3	9.1
Extreme CBOD Level in Discharge (10 mg/1)	79	9.7	9.5	9.3	9.1
Most Likely Conditions CBOD = 2.5 mg/1)	79	9.7	9.5	9.3	9.1
Maximum Blowdown at Average Discharge Temperature	116	9.7	9.5	9.3	9.0

TABLE F-2

SEASON	RANGE OF DO DECREASE AT MIDLAND (mg/1)	RANGE OF DO DECREASE AT FREELAND (mg/1)	LOWEST DO VALUE AT FREELAND (mg/1)
Ave Winter Conditions	0.1-0.1	0.1-0.1	12.1
Ave Summer Conditions	0.0-0.1	0.0-0.1	6.5
Ave Fall Conditions	0.0-0.1	0.0-0.1	10.3

TABLE F-3

FLOW CONDITIONS	RANGE OF DO DECREASE AT MIDLAND (mg/1)	RANGE OF DO DECREASE AT FREELAND (mg/1)	LOWEST DO VALUE BELOW MIDLAND (mg/1)
Extreme Drought Conditions	no power plant discharge	0.1-0.1[a]	5.7
Summer Low Flow	0.1-0.1	0.0-0.1	5.6
Maximum WWTP Discharge, Ave October Conditions	0.1-0.1	0.1-0.2	9.0

[a]Due to WWTP discharge

References

Gannon, John J. 1963. River BOD Abnormalities - A Case Study Approved.

University of Michigan School of Public Health, November 1963.

Lawler, Matusky and Skelly Engineers. 1980. Effect of Midland Power Plant on Tittabawassee River Dissolved Oxygen.

APPENDIX G

AMMONIATED WASTEWATER PROCESSING

BACKGROUND

During normal operation, the condensate polishers remove various chemical and particulate contaminants from the secondary system condensate. In addition, the resins pick up ammonia used to control pH levels in the steam cycle. When regenerated, the resins release the accumulated ammonia in the backwash water resulting in up to 1200 mg/1 of ammonia. Approximately 16,000 to 53,000 gallons of ammoniated wastewater is generated daily by the condensate polishers.

Previous versions of the Midland Plant NPDES Permit Application indicated that the condensate polisher regenerates would be neutralized in the Units 1 and 2 Neutralizing Sump and discharged to the Tittabawassee River. However, the resulting wastewater could contain levels of ammonia which may lower the dissolved oxygen concentrations in the river. This, in combination with existing river conditions, may cause the water quality standard for dissolved oxygen to be exceeded.

ANALYSIS

The Company is evaluating several methods aimed at reducing the effects of the ammoniated wastewater discharge. A primary criteria for evaluating these methods is a maximum concentration of 2 mg/1 of ammonia in the wastewater discharged to the Tittabawassee River.

The Company is studying ammonia processing methods that would result in a wastewater discharge to either the Tittabawassee River or to the cooling pond. An engineering evaluation of these systems is nearing completion. An assessment is also underway to determine if the long term routing of condensate polisher regenerates directly to the cooling pond would potentially result in ammonia concentrations in excess of 2 mg/1 in the pond blowdown.

CONCLUSIONS

The Company is continuing to review various options for the disposal of condensate polisher regeneration wastes. Following completion of these engineering studies, the Company will identify its specific plans for disposal of the condensate polisher regeneration wastes.

APPENDIX H

DETERMINATION OF NATURAL RIVER TEMPERATURE

In response to a December 13, 1978 Staff's suggestion, the Company proposed a monitoring program for determining the natural water temperature in the Tittabawassee River, on February 20, 1979. Staff's concurrence on the proposal was received on February 28, 1979. The monitoring program was accomplished as proposed during 1979. However, the dismantling and relocation of the Dow Chemical Company's temperature probe and the determination that the Dow H-flume discharge influenced water temperatures near the Midland Plant, required additional data collection and analyses during 1981 to complete the natural river temperature assessment.

The 1981 program is designed to: provide data describing water temperatures at the relocated Dow monitoring probe, determine the relationship between water temperature at a sampling location above Dow Dam and the Dow probe, determine the water temperature relationship between the Midland Plant intake and the Dow probe, and determine the effect of the H-flume on water temperatures collected at the Dow probe and Plant intake locations. Data will be collected at the 13 locations sampled in the 1979 monitoring effort plus the H-flume outfall, a cooling pond location, and the Dow probe. Data evaluation will include correction factors to adjust current Dow probe and intake temperatures to upriver water temperatures, if applicable. The assessment is scheduled for completion by December 31, 1981.

PART FOUR

FIGURES

FIGURES
TABLE OF CONTENTS

NAME OF FLOW	FLOW REFERENCE	DAILY FLOW (1000'S OF GALLONS PER DAY) MAXIMUM POWER (NOTE 14) AVERAGE	MAXIMUM	COMMEN
SITE STORM DRAINAGE TO BULLOCK CREEK	1	14.1	781	
SITE STORM DRAINAGE TO THE TITTABAWASSEE RIVER	2	5.6	309	
SITE STORM DRAINAGE TO THE COOLING POND	3	25.9	1419	
PRECIPTATION TO THE COOLING POND	4	1961	108,957	SEE NOTE 8
COOLING POND MAKEUP	5	28,000	174,500	SEE NOTE 2
LAUNDRY/RADWASTE DILUTION WATER	6	0	43,400	SEE NOTES
COOLING POND BLOWDOWN	7	11,700	142,000	SEE NOTE 2
SEEPAGE FROM COOLING POND	8	323	323	SEE NOTE 2
EVAPORATION FROM COOLING POND	9	18,000	54,700	SEE NOTE 2
FIRE PROTECTION SYSTEM INTAKE	10	0	303	SEE NOTE 2
CIRCULATING WATER PUMPS INTAKE	11	942,700	942,700	SEE NOTE 2
CONDENSER COOLING WATER RETURN	12	942,700	942,700	SEE NOTE 2
SERVICE WATER PUMPS INTAKE	13	53,800	53,800	SEE NOTE 2
SERVICE WATER SYSTEM TO COOLING TOWER	14	0	53,735	SEE NOTES
DRIFT FROM THE COOLING TOWER	15	0	3	SEE NOTE 5
EVAPORATION FROM THE COOLING TOWER	16	0	949	SEE NOTE 5
COOLING TOWER RETURN TO SERVICE WATER PUMPS	17	0	48,273	SEE NOTES
COOLING TOWER BLOWDOWN	18	0	4510	SEE NOTES
SERVICE WATER RETURN TO COOLING POND	19	53,735	53,735	SEE NOTE 2
CONDENSATE RETURN FROM DOW	20	11,900	11,900	
PROCESS STEAM	21	9.72×10^7 lb/DAY	9.72×10^7 lb/DAY	SEE NOTE 4
EVAPORATOR BLOWDOWN	22	60	120	
MAKEUP DEMIN SYSTEM WATER SUPPLY	23	153.2	912	
SANITARY WASTE WATER	24	74	165.5	
DOMESTIC WATER SUPPLY	25	15.6	49.5	
DOMESTIC WATER TO SANITARY FIXTURES	26	14	45.5	
DOMESTIC WATER TO THE LAUNDRY FACILITY	27	0.6	2	
DOMESTIC WATER TO MAIN PLANT LAB FIXTURES	28	0.5	1	
MAKEUP DEMIN WATER SUPPLY FROM DOW	29	0	912	
DOMESTIC WATER TO EVAPORATOR BLD LAB FIXTURES	30	0.5	1	
STEAM LOSSES FROM MAIN STEAM SYSTEM	31	5.9×10^4 lb/DAY	1.1×10^5 lb/DAY	
PERMANENT AUXILIARY BOILER FEEDWATER MAKEUP	32	0	19	
TEMP HIGH PRESSURE AUX BOILER FEEDWATER MAKEUP	33	1.238	5.524	
MAKEUP DEMIN TO THE PLANT WATER STORAGE	34	120.7	720	SEE NOTE 1
MAIN PLANT LAB FIXTURES WASTEWATER	35	0.5	1	
MAKEUP DEMIN REGEN WASTES	36	32.5	192	SEE NOTE 2
AUXILIARY BOILER BLOWDOWN	37	0	19	
SECONDARY STEAM TO EVAPORATORS	38	1.05×10^8 lb/DAY	1.05×10^8 lb/DAY	SEE NOTE 4
SECONDARY CONDENSATE RETURN	39	12,960	12,960	SEE NOTE 4
MAGNETIC FILTER FLUSH	40	0.586	1.758	
PLANT WATER STORAGE TO COND & FEEDWATER SYSTEMS	41	118	305	SEE NOTE 1
CONDENSATE & FEEDWATER TO PLANT WATER STORAGE	42	0	160	SEE NOTE 1
CONDENSATE DEMIN REGEN WASTES	43	44.4	148	SEE NOTE 7
UNIT 1 & 2 CLEAN WASTE SUMP DISCHARGE	44	28.9	96.2	SEE NOTES
UNIT 1 & 2 NEUT SUMP DISCHARGE	45	[illegible]	52.8	SEE NOTES
SERVICE WATER TO SODIUM HYPOCHLORITE GEN SYSTEM	46	65	202	SEE NOTE 2
EVAPORATOR BLDG NEUT SUMP DISCHARGE	47	32.5	192	SEE NOTE 2
PRECIPITATION TO THE TRANSFORMER AREA	48	1	48	SEE NOTE 8
DISCHARGE TO OILY WASTE STORAGE TANK	49	64	137	
WASTE OIL TO STORAGE TANK	50	<0.01	<0.01	
OILY WASTE TREATMENT SYSTEM DISCHARGE	51	64	288	
LAUNDRY FACILITY WASTEWATER	52	0.6	2	
LAUNDRY WASTE TREATMENT SYSTEM DISCHARGE	53	0.6	2	SEE NOTES
PLANT WATER STORAGE TO THE NUCLEAR SYSTEM	54	9.6	33.1	SEE NOTE 1
EVAPORATION FROM FUEL POOL	55	2.1	NOT KNOWN	
LIQUID RADWASTE TO SOLID RADWASTE	56	0.53	0.8	
SOLID RADWASTE TO LIQUID RADWASTE	57	0.53	0.8	
RADIOACTIVE LAUNDRY WASTEWATER	58	0	2	
BLOWDOWN FROM LIQUID RADWASTE	59	0.200	20	SEE NOTE 2
COMBINED PLANT DISCHARGE	60	11,814	142,556	
HYPOCHLORITE CATCH BASIN DISCHARGE	61	65	202	
COND RETURN PUMPHOUSE DRAINAGE	62	0	12	
SITE DEWATERING SYSTEM DISCHARGE	63	144	605	
PRECIPITATION TO SITE STORM DRAINAGE	64	45.6	2509	SEE NOTE 8
SERVICE WATER	65	53,735	53,800	SEE NOTE 2
REACTOR PLANT SYSTEMS TO LIQUID RADWASTE	66	5.7	12.3	
LIQUID RADWASTE TO REACTOR PLANT SYSTEMS	67	0.20	0.26	
COND, FEEDWATER & MAIN STEAM AREA FLOOR DRAINS	68	63.3	135.3	
NUCLEAR SYSTEMS FLOOR DRAIN	69	2	10	
NUCLEAR SYSTEMS TO PLANT WATER STORAGE	70	7.26	11	SEE NOTE 1
SERVICE WATER PUMP MAKEUP	71	0	5462	SEE NOTES
TEMP HIGH PRESSURE AUX BOILER BLOWDOWN	72	1.238	5.524	

NOTES

1. EVAPORATION FROM THE COOLING POND WAS COMPUTED FOR THE AVERAGE METEOROLOGICAL CONDITIONS OF JULY 1946 AND AVERAGE WIND SPEED OF MARCH 1950. AMONG THE METEOROLOGICAL DATA RECORDED AT LANSING, MICHIGAN FROM 1910-1976, JULY 1946 HAD THE MAXIMUM DEW POINT DEPRESSION AND MARCH 1950 HAD THE HIGHEST WIND SPEED.

2. FOR THE MAKEUP WATER, COOLING POND, SERVICE WATER SYSTEM & COOLING TOWER, THE NORMAL CONDITIONS ARE BASED ON AVERAGE YEARLY VALUES AS SHOWN IN THE COOLING POND THERMAL PERFORMANCE SUMMARY REPORT FOR MIDLAND PLANT UNITS 1 & 2, CONSUMERS POWER COMPANY, AUGUST 1973, AND THE FINAL COOLING POND OPERATION STUDY, MARCH 1979.

3. THE RADWASTE DILUTION WATER IS USED TO SUPPLY WATER FOR DILUTION OF THE LAUNDRY WASTES DURING PERIODS WHEN THE POND BLOWDOWN IS LESS THAN 45 CFS.

4. HIGH PRESSURE STEAM WILL BE SENT TO DOW AT $0.4X10^4$ LB/HR AND 600 PSIG. LOW PRESSURE STEAM WILL BE SENT TO DOW AT $3.65X10^4$ LB/HR AND 175 PSIG.

5. THE SERVICE WATER COOLING TOWER IS USED DURING THE SUMMER MONTHS ONLY, SO AS TO MAINTAIN THE SERVICE WATER INLET TEMPERATURE AT A MAXIMUM OF 92°F MAKEUP TO THE SERVICE WATER PUMP IS PROVIDED TO ACCOUNT FOR TOWER LOSSES.

6. (NOT USED)

7. UNIT 1 CONDENSATE DEMINERALIZER IS OPERATED IN NH_4^+ CYCLE. IT IS REGENERATED ONCE EVERY 5 DAYS. UNIT 2 DEMINERALIZER IS OPERATED IN H^+ CYCLE AND IS REGENERATED ONCE PER DAY. THE MAXIMUM FREQUENCY IS ASSUMED TWO REGENERATIONS PER DAY PER UNIT. TYPICALLY, THE WASTE IS DISTRIBUTED 65% TO THE CLEAN WASTE SUMP AND 35% TO THE NEUTRALIZING SUMP.

8. NORMAL PRECIPITATION IS BASED ON AN AVERAGE RAINFALL AS DETERMINED FROM A TOTAL YEARLY RAINFALL OF 30". MAXIMUM PRECIPITATION IS BASED ON THE 100 YEAR STORM/24 HOUR TIME PERIOD WHICH RESULTS IN 4.6 INCHES OF RAIN PER DAY. ALL NORMAL TRANSFER RATES ARE BASED ON A RAINFALL INTENSITY OF 3.5 IN/HR (10 YR STORM/15 MIN tc). ALL MAXIMUM TRANSFER RATES ARE BASED ON A RAINFALL INTENSITY OF 5.25 IN/HR (10 YR STORM/10 MIN tc).

9. (NOT USED)

10. (NOT USED)

11. (NOT USED)

12. THE CHEMICAL UNLOADING AREA SUMP FLOW WILL CONSIST OF SPILLAGE WHEN UNLOADING AN ACID (H_2SO_4), CAUSTIC OR SALT TRUCK.

13. CHEMICAL WASTE PRODUCTS FROM THE HYPOCHLORINATION GENERATION SYSTEM CONSIST OF SODIUM CHLORIDE, SODIUM HYPOCHLORITE AND SODIUM HYDROXIDE.

14. MAXIMUM POWER IS DEFINED AS UNIT 1 TURBINE OPERATING AT BACK END LIMITED AND UNIT 2 WITH VALVES WIDE OPEN.

15. (NOT USED)

16. (NOT USED)

17. DAILY FLOWS DO NOT TAKE REFUELING PERIODS INTO ACCOUNT FOR EITHER UNIT.

18. PLANT WATER STORAGE AND TRANSFER REPRESENTS THE FOLLOWING TANKS: CONDENSATE STORAGE TANKS, DEMINERALIZED WATER STORAGE TANK, UTILITY WATER STORAGE TANK, AND THE PRIMARY WATER STORAGE TANK.

19. (NOT USED)

20. (NOT USED)

21. (NOT USED)

22. THE MAXIMUM DAILY DISCHARGE RATE OF WASTEWATER FOR THE FOLLOWING NODE IS HIGHER THAN THE RATE OF ACCUMULATION. THESE NUMBERS ARE BASED ON OPERATOR EXPERIENCE AND MAY OCCUR:

    NODE 45, Unit 1 & 2 NEUT SUMP DISCHARGE, MAX = 104,000 GPD

    NODE 53, LAUNDRY WASTE, MAX = 8,000 GPD

    NODE 59, LIQUID RADWASTE, MAX = 40,000 GPD

    NODE 47, EVAP BLDG NEU SUMP, MAX = 220,000 GPD

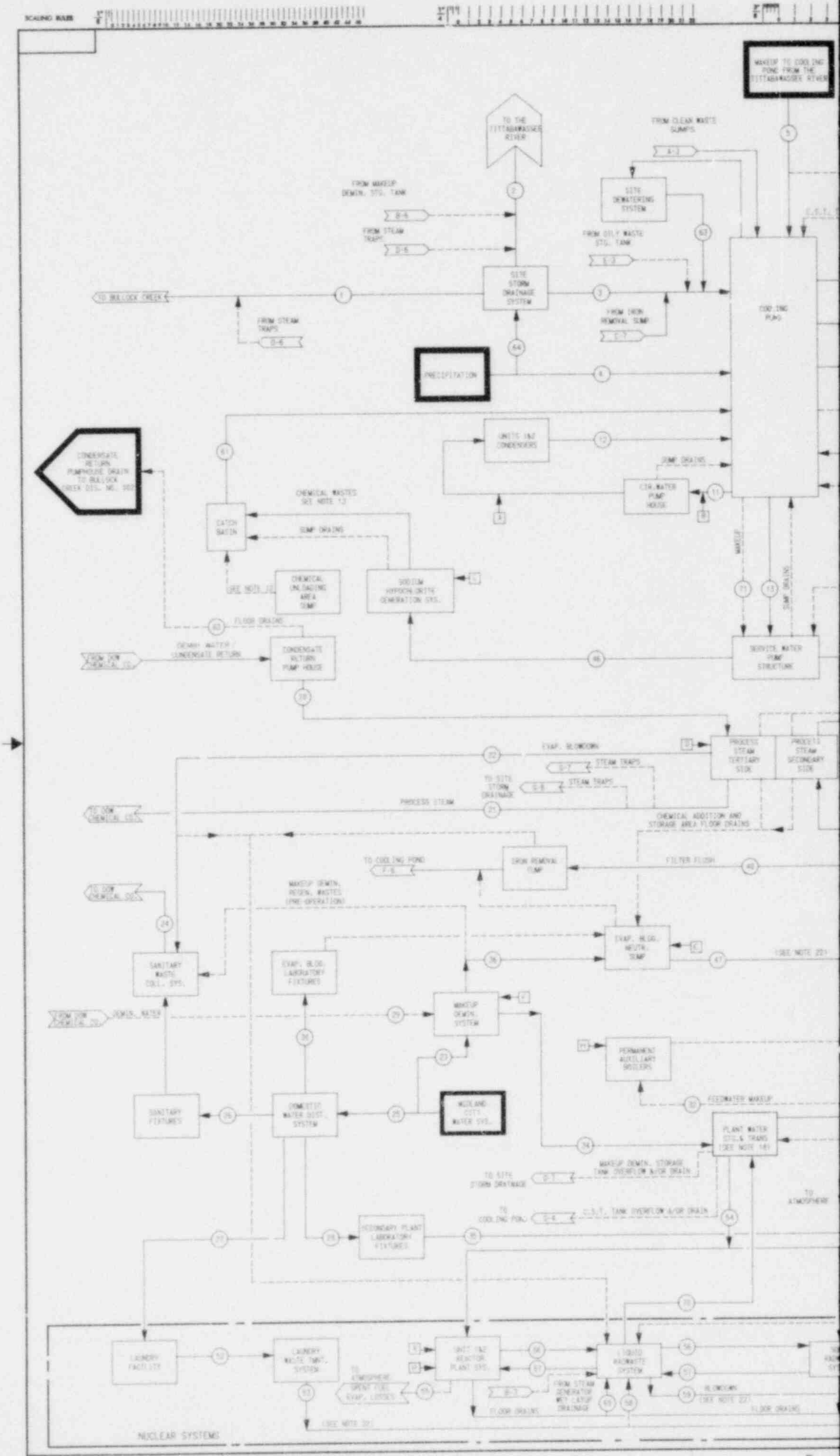
    NODE 44, UNIT 1 & 2 CLEAN WASTE SUMP, MAX = 193,000 GPD

GENERAL COMMENTS

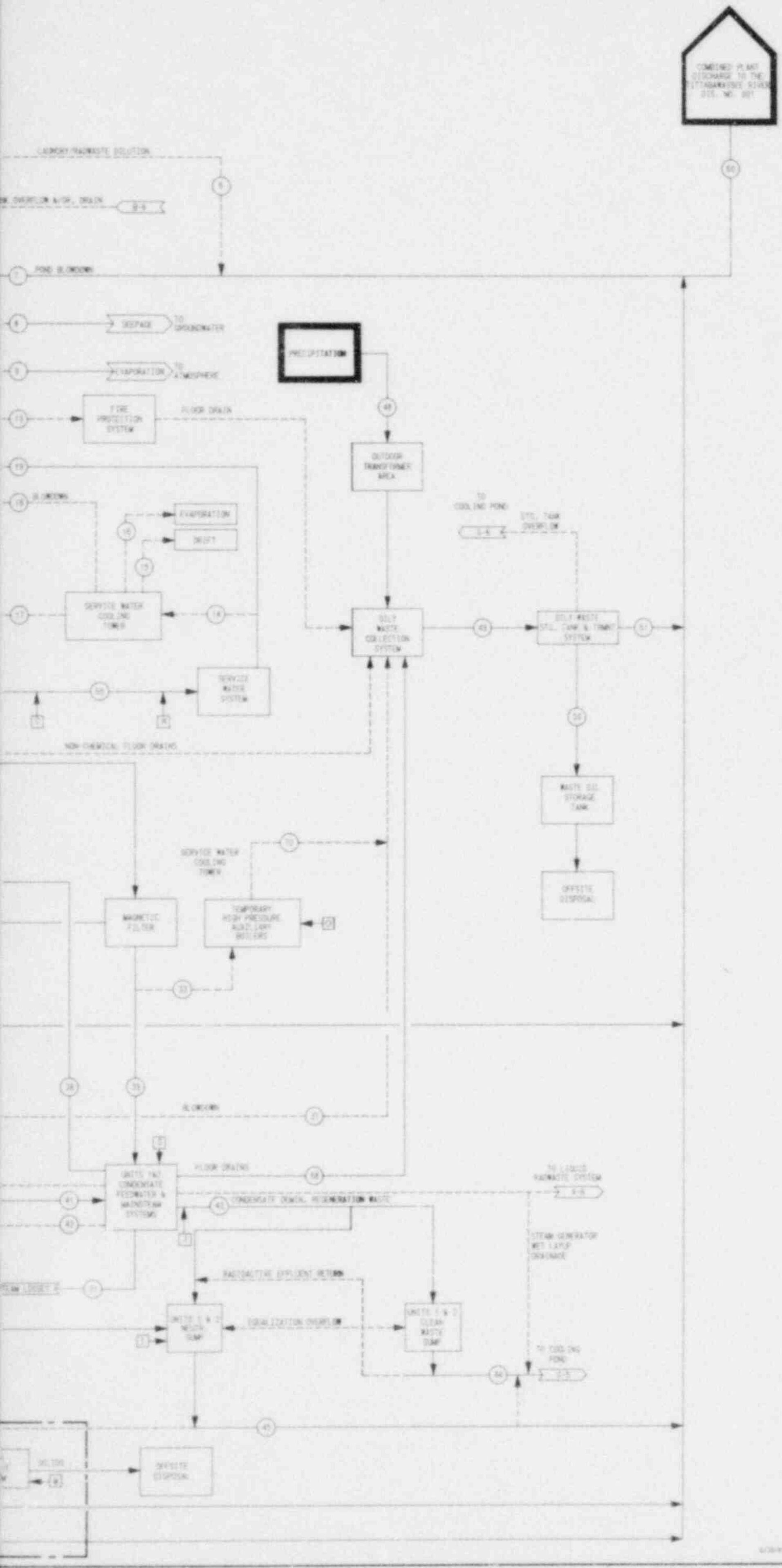
A. DAILY FLOWS ARE EXPRESSED IN 1000's OF GALLONS PER DAY UNLESS OTHERWISE SPECIFIED.

B. EMERGENCY INFREQUENT, AND OPTIONAL FLOWS ARE INDICATED BY DASHED LINES AND ARE NOT INCLUDED IN TOTAL FLOW RATES.

C. THIS DIAGRAM IS BALANCED FOR THE MAXIMUM POWER AVERAGE DAILY FLOW CONDITION ONLY.



SCALING RULER
MAKEUP TO COOLING POND FROM THE TITTABAWASSEE RIVER
TO THE TITTABAWASSEE RIVER
FROM CLEAN WASTE SUMPS
SITE DEWATERING SYSTEM
FROM MAKEUP DEMIN. STG. TANK
FROM STEAM TRAPS
FROM OILY WASTE STG. TANK
SITE STORM DRAINAGE SYSTEM
TO BULLOCK CREEK
FROM IRON REMOVAL SUMP
COOLING POND
PRECIPITATION
CONDENSATE RETURN PUMPHOUSE DRAIN TO BULLOCK CREEK DIS. NO. 002
UNITS 1&2 CONDENSERS
SUMP DRAINS
CIR.WATER PUMP HOUSE
CHEMICAL WASTES SEE NOTE 13
CATCH BASIN
CHEMICAL UNLOADING AREA SUMP
SODIUM HYPOCHLORITE GENERATION SYS.
FLOOR DRAINS
MAKEUP
SERVICE WATER PUMP STRUCTURE
DEMIN WATER / CONDENSATE RETURN
CONDENSATE RETURN PUMP HOUSE
EVAP. BLOWDOWN
PROCESS STEAM TERTIARY SIDE
PROCESS STEAM SECONDARY SIDE
STEAM TRAPS
TO SITE STORM DRAINAGE
PROCESS STEAM
CHEMICAL ADDITION AND STORAGE AREA FLOOR DRAINS
TO COOLING POND
IRON REMOVAL SUMP
FILTER FLUSH
MAKEUP DEMIN. REGEN. WASTES (PRE-OPERATION)
EVAP. BLDG. NEUTR. SUMP
(SEE NOTE 22)
SANITARY WASTE COLL. SYS.
EVAP. BLDG. LABORATORY FIXTURES
MAKEUP DEMIN. SYSTEM
DEMIN. WATER
PERMANENT AUXILIARY BOILERS
FEEDWATER MAKEUP
SANITARY FIXTURES
DOMESTIC WATER DIST. SYSTEM
MIDLAND CITY WATER SYS.
PLANT WATER STG.& TRANS. (SEE NOTE 14)
MAKEUP DEMIN. STORAGE TANK OVERFLOW &/OR DRAIN
C.S.T. TANK OVERFLOW &/OR DRAIN
TO ATMOSPHERE
SECONDARY PLANT LABORATORY FIXTURES
LAUNDRY FACILITY
LAUNDRY WASTE TRMT. SYSTEM
UNIT 1&2 REACTOR PLANT SYS.
LIQUID RADWASTE SYSTEM
SPENT FUEL EVAP. LOSSES
FROM STEAM GENERATOR WET LAYUP DRAINAGE
BLOWDOWN (SEE NOTE 22)
FLOOR DRAINS
(SEE NOTE 22)
NUCLEAR SYSTEMS
8
7
6
5



CHEMICAL USAGE		
□	CHEMICAL	Lb/YR
A	NaOCl	$6.4x10^5$
B	H_2SO_4	$2.1x10^7$
C	NaOCl	$5.3x10^4$
D	Na_2SO_3	$1.4x10^5$
	Na_2HPO_4	$1.0x10^4$
	Na_3PO_4	$1.7x10^4$
E	H_2SO_4	$1.5x10^4$
	NaOH	$6.1x10^4$
F	H_2SO_4	$4.6x10^5$
	NaOH	$3.4x10^5$
G	NH_3	$1.2x10^5$
	N_2H_4	$2.5x10^4$
H	NH_3	$3.5x10^3$
	N_2H_4	130
	H_2SO_4	$1.7x10^5$
	NaOH	$6.9x10^5$
J	H_2SO_4	$1.5x10^6$
	NaOH	$6.0x10^5$
	$Ca(OH)_2$	$5.3x10^4$
K	H_3BO_3	4400
	LiOH	20
L	NaCl	$1.4x10^6$
M	ASPHALT	$1.0x10^6$
N	H_2SO_4	$1.0x10^6$
O	NH_3	$5.4x10^3$
	N_2H_4	200
P	N_2H_4	12.5
	MORPHOLINE	2

LEGEND

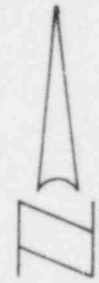
- —○— FLOW REFERENCE NODE
- □→ CHEMICAL USAGE
- —— ROUTINE FLOW CONDITION
- - - - INTERMITTENT FLOW CONDITION

FIGURE 1
SCHEMATIC OF WATER FLOW AND CHEMICAL USE

CONSUMERS POWER COMPANY
MIDLAND PLANT UNITS 1 & 2
MIDLAND, MICHIGAN

AMENDMENT 3 SEPT 30, 1981

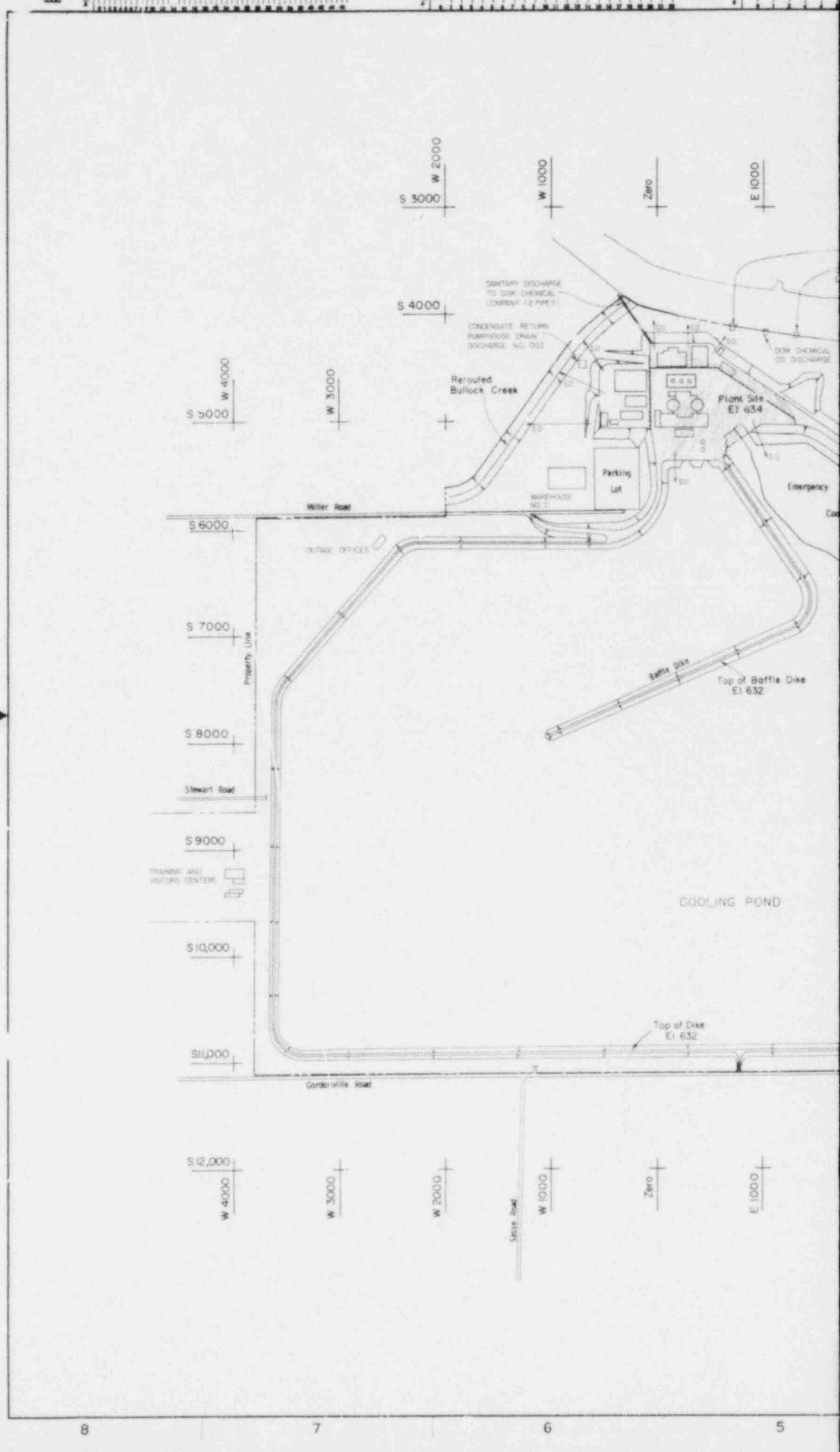

ALAMANDO
NORTH BRADLEY
J E R O M E
L I N C O L N
G E N E V A
SANFORD
AVERILL
OLSON
H O M E
OIL CITY
DICE CORNER
G R E E N D A L E
L E E
ST. ELMO
FLOYD
GORDON-VILLE
MICHIGAN
PORTER
PLEASANT VALLEY
M O U N
J A S P E R
P O R T E R
REDSTONE
NORTH WHEELER
ISABELLA
SAGINAW
GRATIOT
R 2 W
R 1 W
CO



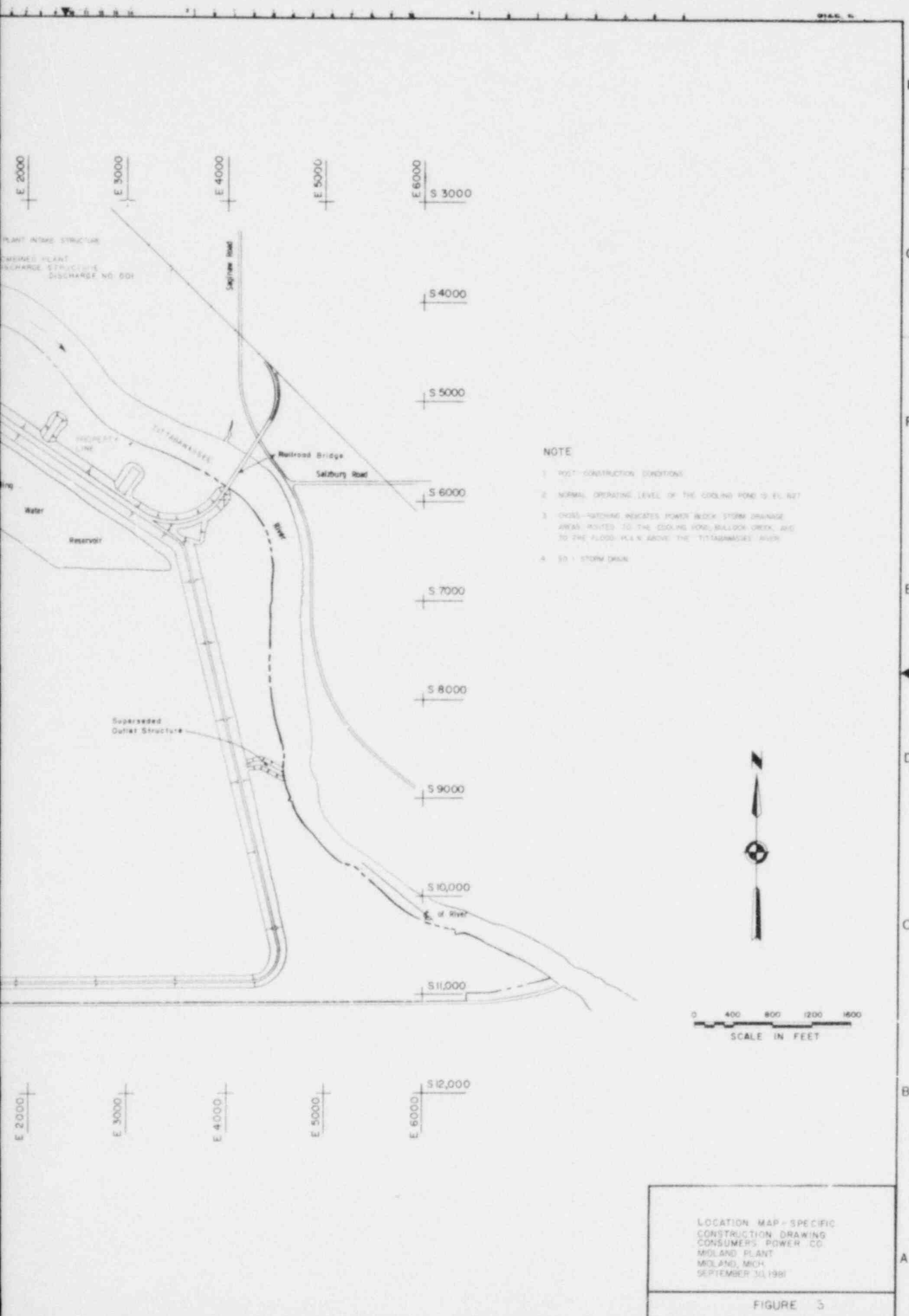
LOCATION MAP — GENERAL
MICHIGAN STATE HIGHWAY COMMISSION
DEPARTMENT OF STATE HIGHWAYS

CONSUMERS POWER COMPANY
MIDLAND PLANT
MIDLAND, MICHIGAN
SEPTEMBER 30, 1981

FIGURE 2

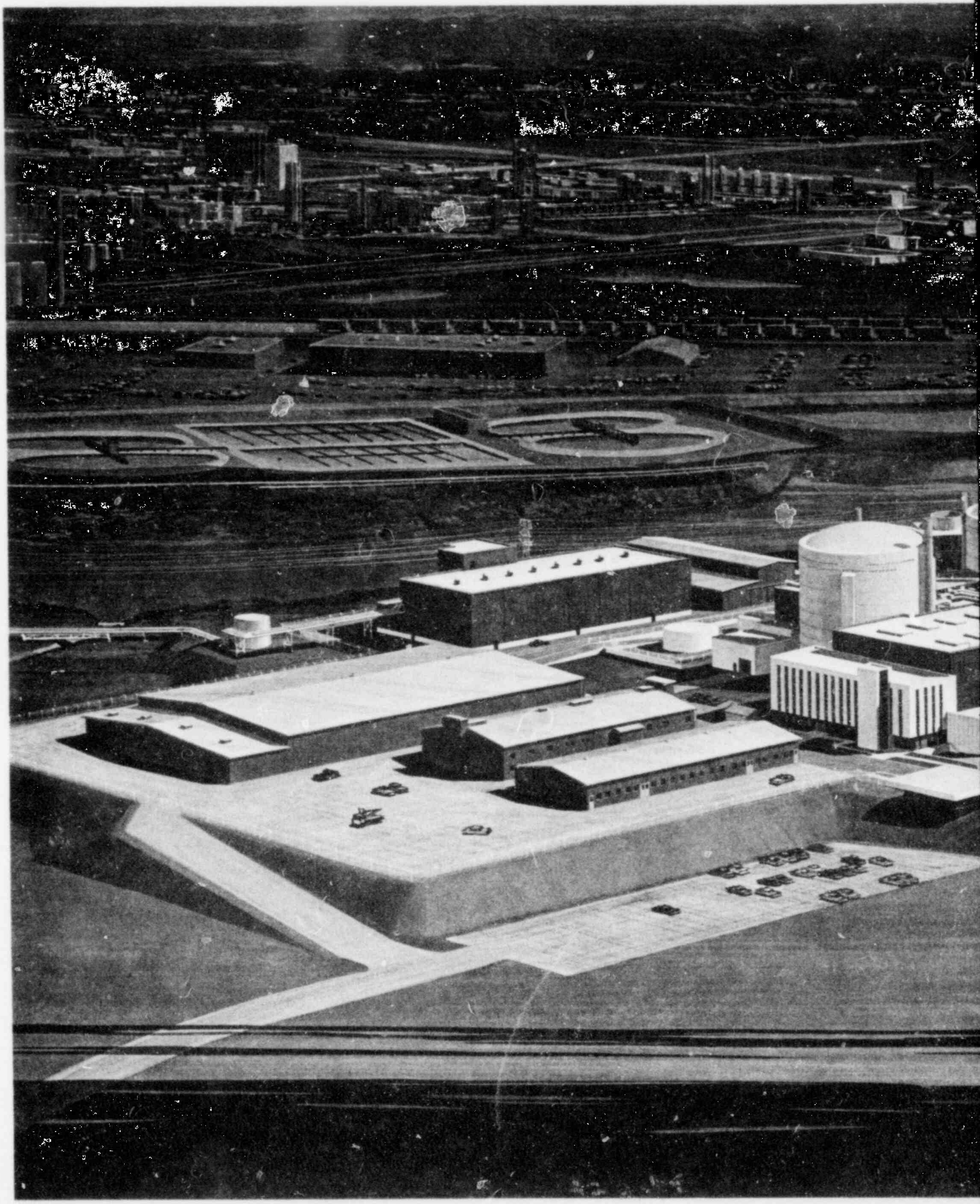


S 3000
W 2000
W 1000
Zero
E 1000
SANITARY DISCHARGE TO DOW CHEMICAL COMPANY (2 PIPES)
S 4000
CONDENSATE RETURN PUMPHOUSE DRAIN DISCHARGE NO. 002
DOW CHEMICAL CO. DISCHARGE
W 4000
W 3000
Rerouted Bullock Creek
S 5000
Plant Site El 634
Parking Lot
Emergency
WAREHOUSE NO 2
Miller Road
S 6000
OUTAGE OFFICES
S 7000
Property Line
Baffle Dike
Top of Baffle Dike El 632
S 8000
Stewart Road
S 9000
TRAINING AND VISITORS CENTERS
COOLING POND
S10,000
Top of Dike El 632
S11,000
Gordonville Road
S12,000
W 4000
W 3000
W 2000
Sasse Road
W 1000
Zero
E 1000
8
7
6
5



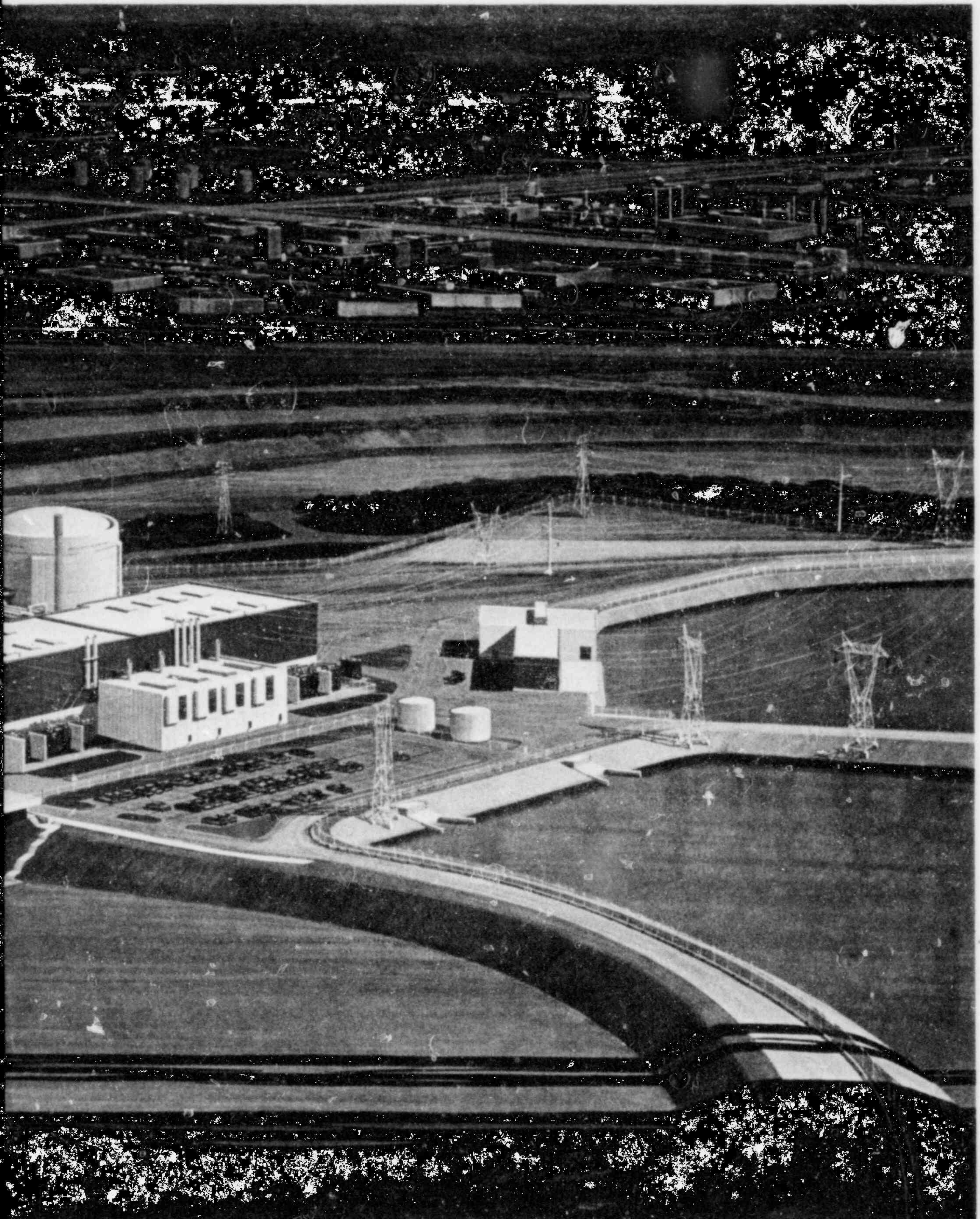
LOCATION MAP - SPECIFIC
CONSTRUCTION DRAWING
CONSUMERS POWER CO.
MIDLAND PLANT
MIDLAND, MICH.
SEPTEMBER 30, 1981

FIGURE 5



COMPLETED PLANT

FIGURE 4



-ARTIST RENDERING

COOLING POND-AR

FIGURE 5

TIST RENDERING