VERMONT YANKEE NUCLEAR POWER STATION

OPERATING PROCEDURE

FOR INFORMATION ONLY

OP 2180

REVISION 39

CIRCULATING WATER/COOLING TOWER OPERATION

USE CLASSIFICATION: **REFERENCE**

RESPONSIBLE PROCEDURE OWNER: **Manager, Operations**

REQUIRED REVIEWS		Yes/No
E-Plan	10CFR50.54(q)	No
Security	10CFR50.54(p)	No
Probable Risk Analysis (PRA)		No
Reactivity Management		No

LPC No.	Effective Date	Affected Pages
1	03/08/06	Pg 1 of 52
2	03/13/06	Pg 47 of 52
3	04/10/06	Pgs 18, 28, 32, & 39 of 52; Appendix B pg 6 of 10; Appendix D pgs 1 & 7 of 12
4	05/09/06	Pgs 30 & 35 of 52
5	05/23/06	Pg 32 of 52

Implementation Statement: N/A

LPC 1
Effective Date: 02/27/06

C01

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PURPOSE

To ensure proper operation of the Circulating Water System and Cooling Towers by Operations Department personnel.

DISCUSSION

The Circulating Water/Cooling Tower Systems provide a flow of water through the main condenser to provide the heat sink needed to condense the steam flowing into the main condenser. Additionally, it is used to control the heat input to the Connecticut River within the prescribed limits to ensure compliance with the NPDES permit thermal limits.

There are three basic modes of operation of the systems:

1. Open Cycle - circulating water from the river passes through condensers directly to the discharge structure and river.

2. Hybrid Cycle - circulating water from the river and discharge structure recirc pipe passes through the condenser and is pumped from the discharge structure by the circ water booster pumps through the cooling towers with part or all of the flow being directed to the river.

3. Closed Cycle - water cooled by the cooling towers is directed back to the intake structure through the recirc pipe. A closed path is established and essentially no heat is rejected to the river.

The cooling towers are pre-wetted prior to normal operation and kept wet to maintain structural integrity during cooling tower fan operation.

Under special circumstances, such as maintenance tests or PMTs, it is acceptable to run one cooling tower fan at a time for up to two hours without running water in the towers and without performing prior cooling tower wetting.

To ensure the circ water side of the condenser remains full, a minimum of 2 circ water pumps should be running, and the vacuum priming system is placed in service as necessary to remove air from the condenser water box outlets and the discharge line just upstream of the discharge structure.

In the closed cycle mode, blowdown from the circulating water system can be maintained to control water inventory and solids formation by controlling level in the discharge basin.

Past operating experience has demonstrated that optimum plant performance is best achieved when condenser back pressure is maintained at 1.0 inch HgA. During winter months when icing is a consideration, circ water inlet temperature can be maintained greater or equal to 33°F raised by permitting flow from the discharge to the intake structure via the recirc gate.

When the Circulating Water System is placed on CLOSED cycle for extended periods, the pH will rise and for this reason, sulfuric acid will be added to maintain pH between 6.5 and 8.5 Standard Units (SU). The heat load on the main condenser will also increase, causing microbiological growth to increase fouling on the condenser tube sheet and tubes. To minimize this biological fouling, the condenser must be periodically treated with algaecide, sodium hypochlorite and sodium bromide, to keep the growth in check. The Chemistry Department is responsible for monitoring and maintaining CW chemistry. The Operations Department is responsible for bulk makeup to the sodium bromide, sodium hypochlorite tank and the sulfuric acid tank. Procedure OP 2181, Service Water/Alternate Cooling Operating Procedure, covers bulk makeup to these tanks.

[EPU – During the winter permit period, at EPU conditions, when the river flow is less than 1500 cfs, hybrid mode is required. For river temperatures 50°F or less, hybrid mode may be used depending on wet bulb temperature, river flow and temperature as shown in Figures 17 and 18. For river temperatures >50°F, hybrid mode is required, as shown in the summer nomographs. For river temperatures 62°F or higher, closed-cycle mode is required.

For low river flow conditions (≤1500 cfs) with river temperature ≤50°F the tables within Figure 17 for single tower operation or Figure 18 for two tower operation provide the operator with initial tower settings. The tables are based upon reactor and main generator output at EPU conditions and a 13.4°F river temperature rise. The tables contain the following information:

- **Up River Temperature from M036**
- **River Volume Flowrate in FT^3 per second**
- **Wet Bulb temperature Twb**
- **Thermal Capacity in cfs- °F (based upon a 13.4°F ΔT)**
- **Initial tower settings for hybrid modes for defined conditions**

The new tables are used as follows:

- **Determine Up River Temperature using M036.**
- **Determine river volume flow rate.**
- **Determine wet bulb temperature.**

Select the table with the appropriate river temperature. If the river temperature is not an exact match to any table, round down to the next lowest river temperature.

Select the appropriate river flow. If the river flow is not an exact match to any river flow on the table, then round down to the next lowest river flow.

CO2

Select the appropriate wet bulb temperature. If the wet bulb temperature is not an exact match for any wet bulb temperature on the table, then proceed as follows:

- **If wet bulb temperature is >30°F, round up to the next highest wet bulb temperature.**
- **If wet bulb temperature is <30°F, round down to the next lowest wet bulb temperature.**

Initial tower settings are at the intersection of the wet bulb temperature column and river flow. The information provided is defined as follows:

- **Hyb: This means hybrid mode.**
- **F00: This means fans and the two numbers indicate the number fans required to be running.**
- **G00: This means recirc gate and the two numbers indicate recirc gate position.**

Thus an initial setting of Hyb:F22:G03 means circ water in hybrid mode, 22 fans in service, and the recirc gate set to 3% open.

For low river flow condition with river temperature >50°F the Summer Operation Nomographs are to be used. The nomographs are revised to reflect a 100% RTP of 1912 MWth. Also included are summer derate nomographs that must be used to prevent high condenser backpressure during summer operations. These graphs provide initial power levels for acceptable back pressure based upon river thermal capacity and wet bulb temperature. Note that power reduction is only required at very low instantaneous river thermal capacities.]

ATTACHMENTS

1.	Appendix A	Valve Lineup
2.	Appendix B	Determining and Adjusting Plant Settings for NPDES Compliance **[EPU – Between the Dates of May 16 through October 14]**
3.	Appendix C	Circulating Water Hydraulic Gate Operations With Degraded Position Indication
4.	**Appendix D**	**[EPU - Determining and Adjusting Plant Settings for NPDES Compliance between the Dates of October 15 through May 15]**
5.	VYOPF 2180.01	Deleted
6.	VYOPF 2180.02	Cooling Tower Checklist
7.	VYOPF 2180.03	Deleted
8.	VYOPF 2180.04	Deleted
9.	VYOPF 2180.05	Plant Setting Change Log
10.	VYOPF 2180.06	Deleted
11.	Figure 1	Hydraulic Gate Directional Control Valve
12.	Figure 2	General Electric Psychometric Chart
13.	Figure 3	Wet Bulb Temperature (F) Based on Dry Bulb (F) and Dew Point (F) Temperatures
14.	Figure 4	90% Exceedence Values for Wet Bulb Temperature Extrapolation
15.	Figure 5	Plant Setting Nomograph for River Temperatures 50.0-54.9°F
16.	Figure 6	Plant Setting Nomograph for River Temperatures 55.0-58.9°F
17.	Figure 7	Plant Setting Nomograph for River Temperatures 59.0-62.9°F
18.	Figure 8	Plant Setting Nomograph for River Temperatures 63.0-65.9°F
19.	Figure 9	Plant Setting Nomograph for River Temperatures 66.0-69.9°F
20.	Figure 10	Plant Setting Nomograph for River Temperatures 70.0-74.9°F
21.	Figure 11	Plant Setting Nomograph for River Temperatures 75.0-79.9°F
22.	Figure 12	Recirculation Gate Position Intake A Fully Open
23.	Figure 13	Recirc Gate 60% Open/Recirc Gate 80% Open
24.	Figure 14	Deleted
25.	Figure 15	Deleted
26.	Figure 16	Deleted
27.	**Figure 17**	**[EPU – Circulating Water Plant Settings for Single Cooling Tower Winter Operation]**
28.	**Figure 18**	**[EPU – Circulating Water Plant Settings for Two Cooling Tower Winter Operation]**

QA REQUIREMENTS CROSS REFERENCE

1. None

C03

REFERENCES AND COMMITMENTS

1. Technical Specifications and Site Documents

   a. If, during power operation, an unexpected failure results in a complete loss of the cooling tower system, the Closed Cycle restrictions may be modified for a period of 24 hours to allow an orderly shutdown using the main condenser as a heat sink in the Open Cycle mode (see NPDES Permit).

2. Codes, Standards, and Regulations

   a. NPDES Permit No. 3-1199
   b. Vermont AEC Letter, dated Sept. 12, 1978 (NPDES Revision)
   c. 316 Demonstration Report
   d. Vermont Water Quality Standard Effective 1/8/87

3. Commitments

   a. UND 9047, Revision of Procedures to Reflect NPDES Permit, issued 12/5/90
   b. LER 88-01
   c. Condenser Cooling System Facilities Settings Manual (CAR 94061_02)
   d. CAR 94068_01, Leaf Accumulation at Intake Structure
   e. CAR 94061_01, River Temperatures Exceeding NPDES Permit
   f. SDR 94077, Data Sheets Calculations, Graphs Related to NPDES Temperature Limits Are Not Included in Procedures
   g. SOER 84-01, Cooling Water System Degradation Due To Aquatic Life
   h. ER950486_01, Revise OP 2180 To Include Admin. Limit of ≤100°F on West Clg Tower; Include Guidance Per Recs. 1 and 2
   i. ER96-0538, NPDES Permit Violation During the Month of June
   j. ER971025_01, Remove Operations Manager Signature Block on App. B to OP 2180 or Modify to Allow for Limited Changes
   k. ER970019_01, Unexpected Five Foot Reduction in Circulating Water Forebay level. Revise OP 2180 for Routine Use Recirc Gate During Winter as Detailed in Rec.2. (Ice Blockage, Intake, Condenser)
   l. ER97-1567, Environmental Programs/Procedural Inconsistencies
   m. ER981657_02, Revise OP 2180 to Make It Clear What VYOPF 2180.05 Data Must Be Taken When Circulating Water System is in Operation
   n. Process Computer Software Change Request 97-50, New Conn. River Flow Calc
   o. Process Computer Software Change Request 97-51, New Project Save Calcs
   p. ER991077_05, Procedure Changes
   q. ER2002-1342, Control Switch Left in Close Position
   r. OE-13646_02, Change to OP 2180 to address OE 13646
   s. ER2002-2686_01, Revise OP 2180 - NPDES Backwashing
   t. VYC-2403, Circulating Water Plant Settings for OP 2180
   u. CR-VTY-2006-00042 CA 00004, Change OP 2180

4. Supplemental References

a. DWG 191159, Service Water
b. DWG 191166, Circulating Water System
c. Letter, D.J. Marx to G.A. Johnson, "93°F Temp. Limit for Circ. Water, Deletion of Procedural Restriction for Hybrid/Open Cycle", dated Sept. 26, 1988
d. Memo ESG 98-049, JJ to MP, "Dredging Impact on Critical Cross Section (CW Intake-River)", dated 4/20/98
e. Memo, MEP to EVB, Wetting of Cooling Towers CT-1 and CT-2, dated 6/13/97
f. Memo SYSENG 2000-045, SAV to RLR, Cooling Tower Wetting, dated 4/13/2000
g. VYC-2403 Rev. 0, Circulating Water Plant Settings for OP 2180
h. VYC-2403 Rev.0, MCC1, Circulating Water Plant Settings for OP 2180
i. EN-AD-103, Document Control and Records Management Activities
j. EN-LI-102, Corrective Action Process
k. AP 0010, Situational Reporting Requirements
l. AP 0021, Work Orders
m. OP 0105, Reactor Operations
n. AP 0155, Current System Valve and Breaker Lineup and Identification
o. AP 0156, Notification of Significant Events
p. OP 2106, Oil and Hazardous Materials Spill Prevention and Control
q. OP 2160, Turbine Generator Support Systems Operation
r. OP 2181, Service Water/Alternate Cooling Operating Procedure
s. OT 3120, Condenser High Back Pressure
t. ON 3173, Loss of Circulating Water
u. OP 4650, Circulating Water System Treatment and Sampling

PRECAUTIONS/LIMITATIONS

1. Whenever the CW or SW discharge mode is changed, be aware that the sampling and monitoring valves may have to be realigned to ensure sampling requirements are met. Chemistry must be notified when this occurs. (LER 88-01)

2. CW pump "B" should not be shutdown for long periods of time when ambient air temperature is below 32°F to prevent freezing of its cooling water pipes with the ventilation louvers open.

3. During subfreezing weather conditions, ice buildup on traveling screens may cause damage/failure when rotated. More frequent screen inspection may be required. Except as required by NPDES permit Part IV, Environmental Monitoring Studies, Connecticut River, operational mode of the screens may need to be altered at the discretion of the Shift Manager due to icing. (ER2002-2686_01)

4. During 2nd week of November to 1st week in April, check Circ Water de-icing agitators placement per VYOPF 0150.01, AO Round Sheet Outside.

5. During chemical addition, operate in closed cycle. Readjust system upon verification by the Chemistry Department that circ water is within the limits of the NPDES permit.

6. Be aware that whenever the mode of operation is changed, the system requires at least 1/2 hour to reach temperature equilibrium.

7. When in Hybrid or Closed Cycle Mode changes in circulating water header pressure will affect flows to each cell in a tower. When changing Circ Water Booster Pump or tower lineups, cell flow balancing should be verified, and if required, performed.

8. Except for special circumstances, such as maintenance tests or PMTs, for which it is acceptable to run one cooling tower fan at a time for up to two hours without running water in the towers and without performing prior cooling tower wetting, do not operate cooling tower fans unless their associated cooling tower is wetted.

9. Minimize cycling of CTF 2-1.

10. Operation of radios near the hydraulic equipment can cause the gates to drift.

11. Do not operate bypass gates in the raise direction with level higher than 235' Forebay level.

12. Limit the number of 4KV pump motor starts to three starts in 5 minutes, followed by a 20 minute run or a 45 minute idle period for cooling.

13. Cooling Tower fan motor starting limits are:

    a. no more than 4 starts per hour for the 125 HP fan, CT-2-1.

    b. no more than 2 starts per hour cold (approximately 104°F or 40°C) or 1 start per hour hot (full load temp) for all the 200 HP fans.

    c. Pause at least 6.5 minutes in OFF position before changing direction of rotation.

14. Maintain the CW intake gates shut during Closed Cycle operation. Normally, during plant shutdown the intake gates should be closed unless otherwise specified by plant conditions. During Open or Hybrid Cycle operation, at least one of the intake gates should be 100% open.

15. During the period October 15 through May 15 Open or Hybrid operation is allowed provided the following:

    a. Temperature at Station 3 does not exceed 65°F.

    b. Rate of change of temperature at Station 3 does not exceed 5°F per hour as determined by calculating the difference between consecutive hourly average temperatures. (ER97-1567)

    c. Plant-induced increase in temperature above ambient at Station 3 does not exceed 13.4°F.

NOTE

The increase in temperature above ambient at Monitor 3 during steady state open cycle can be calculated using the following formula (which can also be used if ERFIS becomes inoperable from October 15 through May 15). If the formula is used, independent verification of the calculation must be obtained: (ER991077_05)

$$\Delta t_r = \frac{15.193 * C051 \text{ (MWt rejected)}}{C275 \text{ (River flow in cfs)}}$$

16. During the period May 16 through October 14 Open or Hybrid operation is allowed provided that: (UND 9047)

    a. Plant-induced increase in temperature at Station 3 does not exceed:

Station 7 Temperature	Δt_r
≥63°F	2°F
≥59°F, <63°F	3°F
≥55°F, <59°F	4°F
<55°F	5°F

17. Ph indication shall be available and maintained to ensure the following limits are adhered to:

NPDES Limits	Admin Limits
6.5 - 8.5	6.7 - 8.3

    a. If the Admin Limits during Open/Hybrid operation cannot be maintained, immediate action shall be taken to prevent violation of the NPDES Limits, up to and including establishing Closed Cycle operation.

    b. If the Admin Limits during Closed Cycle operation cannot be maintained, immediate action shall be taken to prevent violation of the NPDES Limits.

18. During Open Cycle operation, it is not necessary to modify the natural Ph of the circ water prior to discharging to the river (letter, State of Vermont to Dr. D.J. Marx, dated 12/4/86).

19. Chemistry personnel are notified of CW system mode changes (i.e., Open, Hybrid, or Closed).

20. If any limitation of the NPDES Permit is exceeded, initiate a CR and notify Chemistry supervision to initiate required reports per AP 0010, Notifications and Reports Due. The Chemistry Department will make 24 hour verbal notification to the State, followed by a five day written notification. (UND 9047)

21. During CW operation, Ph monitoring must be operable or grab samples taken by the Chemistry Department.

22. Monitor CW performance with BOP Log 7 and the BOP Condenser Performance Display, as well as "Margin to TCRIT" per Appendix B, during all modes of system operation. (SOER 84-01)

23. Maintain West Cooling Tower Deep Basin temperature in accordance with OP 2181 Admin. Limits during Hybrid/Closed Cycle operation.

24. During cold weather operations, maintain circ water inlet temperature greater than 33°F while maintaining condenser backpressure between 1.0 and 1.6 in Hg backpressure using 2 circ water pumps and recirc gate. (ER97-0019)

25. During warm weather operations, operations of the recirc gate for NPDES compliance shall not be performed until the cooling towers are placed in service. Opening the recirc gate first may lead to a rapid increase in condenser backpressure and possible Turbine trip.

26. **[EPU – Prior to performing any actions related to EPU, confirm the EPU Tech Spec Amendment has been approved.]**

27. During winter operations with wet bulb temperature ≤40°F if cooling towers are used both towers must be in service to prevent ice damage from potential valve leakage.

28. During winter operations with wet bulb temperature ≤40°F if cooling towers are used all cooling tower cells must have flow. Do not isolate flow to an individual cell.

PREREQUISITES

1. Service Water available to CW pump seals, hypochlorite and acid system, and traveling screens per OP 2181, Service Water/Alternate Cooling Operating Procedure.

2. Ensure Cooling Tower Checklist is completed before May 15th (VYOPF 2180.02).

3. 4160 V Bus 1, 2 and 5 energized.

4. 480 V MCC 8D, 7C and 7F energized.

5. Hydraulic gate operators vented, if required, and available for service.

6. Appendix A valve lineup completed.

7. Ensure CW Booster pump cooling fans are in AUTO prior to starting the pumps.

8. In freezing weather, check for ice or snow accumulation on Cooling Tower fans before starting.

9. Ensure discharge basin level is above 223 ft. before starting a CW Booster pump or the pump will trip.

10. Ensure intake basin level is above 207 ft. before starting a CW pump or the pump will trip.

11. Plant setting change log initiated and appropriate limits set by Operations management.

12. Hotwell level <6' above the bottom of the hotwell prior to operation of the CW system.

PROCEDURE

A. Hydraulic Gate Control System - Intake and Discharge Structures (Startup)

1. System Startup

a. Ensure the following conditions are satisfied:

1) If necessary, Maintenance has primed the pumps and vented the lines.

2) Oil reservoir level greater than midline on tank.

3) AC power available.

4) Valve lineup per Appendix A completed.

b. Turn the two control power breakers on the control panel to ON position.

c. Check or place keylock switches for pump #1 and #2 in AUTO.

d. Select pump #1 or pump #2 to LEAD.

e. Perform the following switch alignment:

1) Alarm test light switch to OFF.

2) CPU ON/OFF switch to ON.

3) LOCAL/REMOTE switch to REMOTE (for Control Room use).

4) RECIRC GATE switch to STOP.

B. Intake/Discharge Structure Hydraulic Gate Local Control System

1. Local Operation

a. Place the LOCAL/REMOTE switch to LOCAL.

b. Verifying Intake/Discharge Structure Hydraulic System trouble (6-D-6/7) annunciates as appropriate.

c. Place the 3-position control switch from STOP to the appropriate OPEN/CLOSE position for desired gate movement.

d. Place the 3-position control switch to STOP.

e. Place the LOCAL/REMOTE switch to REMOTE.

f. Verify Intake/Discharge Structure Hydraulic System trouble (6-D-6/7) clears as appropriate.

C. Startup of Circulating Water System

1. Verify all Prerequisites satisfied.

2. Notify the Chemistry Department so that timely plant discharge sampling can be performed for NPDES compliance.

3. If during cold weather operations, verify bubblers installed on river side.

4. Verify/establish SW supply to CW pump seals and motors at least 10 minutes before starting a CW pump as follows:

a. Seals: 10-15 gpm (FI-104-6A/B/C)

b. Motors: ≥45% (FI-104-8A/B/C)

5. Verify/establish the following:

a. CW traveling screens in AUTO (unless CW traveling screens are in winter lay up).

b. Intake gate(s) 100% open.

c. CW Ph monitor operable or Chemistry Department notified to perform daily grab sampling of the CW System.

d. CW System has been sampled by Chemistry Department to ensure water is within all limits of NPDES Permit.

6. Place CW Pump control switch to START (the discharge valve opens to approximately 20% before the pump starts) (CRP 9-6).

a. Check any idle circ water pumps, P-5-1A(B,C), for reverse rotation.

1) IF reverse rotation is observed, THEN notify the Shift Manager and System Engineering for evaluation. (OE-13646_02)

7. Request Chemistry Department verify proper operation of Discharge Basin Rad Monitor (RD-17-340/PRM-17-359).

8. Monitor Discharge Basin Rad Monitor (PRM-17-359) radiation levels for abnormal trends.

9. Refer to the Startup of Vacuum Priming System section of this procedure, and place vacuum priming system in service.

10. If the Circulating Water System is in operation to support maintaining condenser backpressure, start the second CW pump

11. If condenser backpressure increases to greater than 1.6 inches HgA, with two CW pumps in service, consider starting the third one and operating with three, considering intake level or leaf intrusion problems.

NOTE

Experience has shown that when condenser backpressure is less than 1.0 inch HgA, the loop seals on the SJAE inter condensers may be lost, thereby short-circuiting the air ejectors. This results in operational problems with the AOG system.

12. If condenser backpressure decreases to less than 1.0 inch HgA, or if there are intake level problems with three CW pumps in service, consider securing one and operating with two.

    a. Check any idle circ water pumps, P-5-1A(B,C), for reverse rotation.

        1) IF reverse rotation is observed, THEN notify the Shift Manager and System Engineering for evaluation. (OE-13646_02)

13. If Plant is operating during October 15 through May 15:

a. Monitor the following:

- Temperature at Station 3 (M037)
- Rate of change of temperature at Station 3 (no ERFIS point)
- Plant-induced increase in temperature above ambient at Station 3 (C019)

b. If it is anticipated that any of the following limits will be exceeded, shift to hybrid **[EPU – per Figures 17 or 18]** or closed cycle or reduce reactor power to prevent exceeding the limits:

- Temperature at Station 3 (M037) approaches 65°F
- Rate of change of temperature at Station 3 (no ERFIS point) approaches 5°F per hour
- Plant-induced increase in temperature above ambient at Station 3 (C019) approaches 13.4°F
- IF M037 is out of service refer to the Loss of River Temperature Recorder Sensing Points (M036 or M037) section of this procedure.

14. If Plant is operating during May 16 through October 14:

a. Monitor the following:

- Station 7 Temperature (M036)
- Plant-induced increase in temperature above ambient at Station 3 (C019)

b. If it is anticipated that any of the following limits will be exceeded, shift to hybrid or closed cycle or reduce reactor power to prevent exceeding the limits:

Station 7 Temperature	Increase in Temperature Above Ambient at Station 3
≥63°F	2°F
≥59°F, <63°F	3°F
≥55°F, <59°F	4°F
<55°F	5°F

NOTE

If plant conditions require CTF 2-1 use, the fan should be utilized. Starting and stopping should be minimized to prevent excessive wear to breaker contacts.

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15. If any of the following ERFIS values are unavailable, perform either of the actions below per Manager Operations approval.

- River Up/Down Temp Rise - C019
- Heat Reject to River - C064
- Conn River Flow - C275
- Margin to TCrit - C276
- Instantaneous River Thermal Cap - C277
- Condenser Inlet - F052, F053, F054, F055
- Condenser Outlet - F056, F057,F058, F059
- East Tower Outlet - F078
- West Tower Outlet - F079

NOTE

This calculation is only valid when the plant is in open cycle.

a. Verify river temperature rise is within limits using the following formula, provided the plant is at steady state operation.

$$\Delta T_r = \frac{15.193*(\text{MWt rejected})}{(\text{River flow in cfs})}$$

where: MWt rejected (C051) = 1593 [EPU – 1912] *(%RTP)-generator gross MWe

River flow in cfs (C275) = Vernon reported flow from Wilder

b. Place Circulating Water System in hybrid cycle with full recirculation flow (recirc gate >85% open), at least 21 cooling tower fans operating, and intake gates open.

D. Operation of Vacuum Priming System

NOTE

The vacuum priming system should be operated as necessary to prevent the accumulation of non-condensables in the water boxes. The system may be placed in a standby condition when at least two circ water pumps are running.

Placing in service:

1. Ensure at least one CW pump is operating.
2. Check Condenser Priming Tank level between empty and 1/4 full.
3. Check seal water valve lineup.
4. Place A or B Vacuum Priming Pump control switch in RUN.
5. Place annunciator 6-B-5, CIRC WTR PRIMING TANK VAC LO, alarm card select switch or jumper in NO (CRP 9-6).

Removing from service/Placing in Standby:

1. Place vacuum Priming Pump control switch to OFF.
2. Place annunciator 6-B-5, CIRC WTR PRIMING TANK VAC LO, alarm card select switch or jumper in NC (CRP 9-6).

E. Shifting from Open to Hybrid Cycle Mode

1. Verify all Prerequisites and Admin. Limits are satisfied.
2. If this is the first time of the season hybrid cycle mode is entered, request Chemistry verify proper operation of Discharge Basin Rad Monitor (RD-17-340/PRM-17-359).
3. Confirm normal trends on Discharge Basin Rad Monitor (PRM-17-359).

NOTES

- Each switch operates both tower inlet valves. The red valve position light on CRP 9-6 will energize only when both valves are open.
- When adjusting plant parameters for NPDES compliance, the recirc gate shall not be repositioned until the cooling towers are placed in service.

4. Open/verify open cooling tower inlet #1 (riser) valves CW-6A/B or cooling tower #2 inlet (riser) valves CW-6C/D.

5. Close both bypass gates until tower Forebay/discharge basin level is 230-233' (LI-104-10).

6. Operate towers and CW Booster pumps in the following combination:

   a. 1 pump = 1 tower
   b. 2 pumps = 2 towers
   c. 3 pumps = 2 towers

7. Ensure cooling fan control switches for circ water booster pumps to be started are in AUTO.

8. Start CW Booster pump and allow piping to fill for at least 10 minutes:

   a. When at least 10 minutes have elapsed, flag CWB pump control switch to START again, to fully open pump discharge valve.

   b. Ensure seal water flow for selected pump is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

   c. Ensure cooling water flow for the selected pump is approximately 1 gpm (FI-104-67A/B/C).

9. If second CWB pump is required, perform the following:

   a. Wait at least 5 minutes after completion of Step D.8.

   b. Start second CWB pump.

   c. When pump amps are steady, flag pump control switch to START again, to fully open pump discharge valve.

d. Ensure seal water flow for selected pump is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

e. Ensure cooling water flow for the selected pump is approximately 1 gpm (FI-104-67A/B/C).

10. If third CWB pump is required, perform the following:

a. Check Tower Forebay/Discharge Basin level has stabilized.

b. Start third CWB pump.

c. When pump amps are steady, flag pump control switch to START again, to fully open pump discharge valve.

d. Ensure seal water flow for selected pump is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

e. Ensure cooling water flow for the selected pump is approximately 1 gpm (FI-104-67A/B/C).

NOTE

Distribution valves close by turning handle clockwise (stem rises).

11. Fully raise both bypass gates.

12. Check flow through all cells is balanced.

a. If required, adjust distribution valves as necessary when all three CWB pumps are running.

NOTES

- Experience has shown that when condenser backpressure is less than 1.0 inch HgA, the loop seals on the SJAE inter condensers are lost, thereby short-circuiting the air ejectors. This results in operational problems with the AOG system.
- Monitor Bus 5 amperage during fan starts.

13. When cooling towers are wetted (per Tower Wetting Section), operate tower fans and then adjust recirc gate as necessary to maintain the following:
    - Condenser backpressure in range of 1.0 to 5.0 inches HgA.
    - CT-2-1 Deep Basin Temp (ERFIS point F074) in accordance with OP 2181 Admin. Limits.
    - As required by Appendix B, Determining and Adjusting Plant Settings for NPDES Compliance Between the Dates of May 16 through October 14.
    - As required by Appendix D, Determining and Adjusting Plant Settings for NPDES Compliance Between the Dates of October 15 through May 15.

14. If desired, shut Circ Water Intake Gate C (North) to 0% to limit the rise in Service Water inlet temperature.

F. Shifting from Hybrid to Closed Cycle Mode

1. Verify all Prerequisites and Admin Limits satisfied.

2. Ensure all CW and CWB pumps running.

NOTE

Monitor Bus 5 amperage during fan starts.

3. Operate cooling tower fans as necessary to maintain condenser backpressure in range of 1.0 to 5.0 inches HgA.

4. If system is being placed in closed cycle for purpose of chemical addition/treatment, verify with Chemistry Department if treatment of the service water system will occur simultaneously.

   a. If chemically treating service water simultaneously with circulating water, perform the following:

      1) Refer to OP 2181, Service Water/Alternate Cooling Water Operating Procedure, and secure the service water strainers.

      2) Place all control switches for traveling screens to OFF.

   b. If tower wetting is required within the next day and cooling tower operation is not anticipated, then continue tower operations as needed to meet the 4 hour tower wetting requirements.

5. Open recirc gate to >85% open and verify afterbay/discharge weir level is <225 ft (LI-104-10-1).

6. Establish/check established cooling tower blowdown as follows:

   a. Throttle open Aux. CT Blowdown Throttle Valve, CW-7 as necessary to restrict flow over discharge weir.

NOTE
If intake structure level falls to 209 ft., the intake gates will open automatically. They cannot be reclosed until level is above 209 ft.

7. Close all intake gates while monitoring intake level.

8. Monitor condenser backpressure.

   a. If required, reduce power as necessary to maintain backpressure <5" HgA.

G. Shifting from Closed to Hybrid Cycle Mode

1. While shifting to Hybrid Cycle mode, closely monitor ERFIS points per Appendix B **[EPU – or Appendix D]** to ensure thermal limits of the NPDES permit are not exceeded.

2. Request Chemistry take appropriate samples to ensure limitations of NPDES permit are not exceeded.

3. If chemical addition/treatment of service water system is complete, perform the following:

   a. When notified by Chemistry, refer to OP 2181, Service Water/Alternate Cooling Water Operating Procedure, and place service water strainers in service.

   b. Restore traveling screens per Shift Manager direction.

4. Open the intake gate(s) to 100%.

CAUTION

When operating the recirc gate in the Closed direction, operate the gate such that the thermal limits of the NPDES permit are not exceeded by monitoring ERFIS points per Appendix B [EPU – or Appendix D].

5. Operate towers and CW Booster pumps in the following combination:

   a. 1 pump = 1 tower
   b. 2 pumps = 2 towers
   c. 3 pumps = 2 towers

6. Adjust recirc gate and cooling tower fans as necessary to maintain the following:

   - Condenser backpressure in range of 1.0 to 5.0 HgA.
   - CT-2-1 Deep Basin Temp (ERFIS point F074) in accordance with OP 2181 Admin. Limits.
   - As required by Appendix B, Determining and Adjusting Plant Settings for NPDES Compliance **[EPU - Between the Dates of May 16 through October 14].**
   - As required by Appendix D, Determining and Adjusting Plant Settings for NPDES Compliance **[EPU - Between the Dates of October 15 through May 15].**

NOTE
It may be desirable to secure one CW Booster pump as long as NPDES permit limits are met.

7. If desired to secure one CW Booster pump, THEN

   a. Open (lower) A(B) CW Bypass Gate to lower Forebay level to 230-233" as read on LI-104-10.

   b. Secure one CW Booster pump, then OPEN (lower) A(B) CW Bypass Gates, as needed, to maintain Forebay level 230-233" as read on LI-104-10.

   c. Verify limits in Step 5 above are maintained.

8. If desired to restart the third booster pump, then refer to Section D, Shifting from Open Cycle to Hybrid.

H. Shifting from Hybrid to Open Cycle Mode

1. Open/check open intake gate(s) to 100%.

2. When operating the recirc gate in the Closed direction, operate the gate such that the thermal limits of the NPDES permit are not exceeded by monitoring ERFIS points per Appendix B or Appendix D.

3. Fully close the Recirc Gate if plant conditions permit. Place the Recirc Gate in the required position for plant conditions considering NPDES requirements and condenser backpressure.

4. Secure all cooling tower fans.

5. Adjust discharge structure Forebay level to 230-233' as indicated on LI-104-10 by opening (lowering) A(B) CW bypass gate.

6. Secure a CW booster pump and immediately open (lower) the A(B) bypass gate to maintain Forebay level 230-233'.

7. Continue securing CW booster pumps and adjusting Forebay level.

8. When all CW booster pumps are secure, fully open (lower) the A(B) bypass gate.

9. During cold weather operations, adjust recirc gate as necessary to maintain circ water inlet temperature greater than 33°F while maintaining condenser backpressure between 1.0 and 1.6 in Hg backpressure.

10. Closely monitor Project Save ERFIS points per Appendix B or Appendix D to ensure applicable thermal limits of NPDES Permit are not exceeded.

I. Operation of Circ Water Traveling Screens

1. Refer to OP 2181, Service Water/Alternate Cooling Operating Procedure.

J. Shutdown of Circ Water/Cooling Towers

1. Request Chemistry Department sample CW discharge and determine if discharge is within limits of NPDES permit.

2. If in service, secure cooling tower fans.

NOTE

CW Booster pumps will stop immediately upon placing the control switch to stop, but CW pumps will continue to run until respective discharge valve is 20% closed.

3. Secure one CW Booster pump if running, and one CW pump:

   a. Monitor basin levels. Maintain discharge structure Forebay level <235' as read on LI-104-10.

4. When securing all CW pumps ensure pumps are not needed to remove heat from main condenser.

NOTE

The last CW pump stops as soon as its control switch is placed in STOP.

5. Secure the other CW Booster pumps if running, and CW pumps in similar manner.

6. Notify Chemistry CW System is secured and that the CW Sample Pump must be secured.

7. Close all CW intake gates.

8. Open (lower) CW bypass gates.

9. During cold weather operations, ensure de-icing agitators are moved into circ water bay.

K. Circ Water Sample System

1. The Circ Water Sample System will normally be placed in operation by Chemistry Department personnel.

L. Initial Tower Wetting

LPC 3

1. **[EPU – If between the dates of May 16 through October 14, wet the tower(s) as follows:]**

NOTE

Cooling tower(s) may be considered wetted when one of the following conditions have been met (memo, M.E. Palionis to E.V. Bowman, Subject: Wetting of Cooling Towers CT-1 and CT-2 dated 6/13/97 and Memo SYSENG 2000-045).

- Circ Water Booster Pump(s) have been pumping water to a tower(s) for greater than 24 hours following a long term shutdown (>7 days).
- Less than or equal to 7 days have elapsed since 4 continuous hours or more of Circ Water Booster Pump Operation.

a. If towers do not meet the criteria of the above Note, perform the following:

1) Ensure sufficient number of CW booster pumps operable (one required to wet down one tower, two required to wet down both towers).

2) If required to wet the East Cooling Tower, open Cooling Tower 1 Inlet (riser) CW-6A/6B.

3) If required to wet the West Cooling Tower, open Cooling Tower 2 Inlet (riser) CW-6C/6D.

4) Close (raise) North (Gate A) and South (Gate B) Circ Water Booster Bypass Gates until tower Forebay/discharge basin level is 230-233 feet (LI-104-10).

5) Ensure cooling fan control switches in AUTO for CW booster pumps to be started.

6) Start CW booster pump and allow piping to fill for at least 10 minutes.

a) When at least 10 minutes have elapsed, flag pump control switch to START again, to fully open discharge valve.

b) Ensure selected CW booster pump seal water flow is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

c) Ensure selected CW booster pump cooling water flow is approximately 1 gpm (FI-104-67A/B/C).

7) If second CW booster pump is required, perform the following:

a) Wait at least 5 minutes after start of first CW booster pump.

b) Start second CW booster pump.

c) When pump amps are steady, flag pump control switch to START again, to fully open pump discharge valve.

d) Ensure seal water flow for selected pump is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

e) Ensure cooling water flow for the selected pump is approximately 1 gpm (FI-104-67A/B/C).

8) Check flow through all cells is balanced.

a) If required, adjust distribution valves as necessary.

b) If changes to Circ Water booster pump or tower lineups are made during tower wetting operation, cell flow balancing shall be verified, and if required, performed.

9) Run each operable cooling tower fan, one at a time, as requested by Maintenance, to allow preventative maintenance activities to occur.

10) Continue CW booster pump operation for at least 24 hours.

11) When Cooling Tower wetting requirements are satisfied, place Circ Water System in mode required by river or plant conditions.

2. [EPU – If between the dates of October 15 through May 15, wet the towers as follows:

NOTE

Cooling tower(s) may be considered wetted when one of the following conditions has been met (memo, M.E. Palionis to E.V. Bowman, Subject: Wetting of Cooling Towers CT-1 and CT-2 dated 06/13/97 and Memo SYSENG 2000-045):

- Circ Water Booster Pump(s) have been pumping water to a tower(s) for greater than 24 hours following a long term shutdown (>7 days).
- Less than or equal to 7 days have elapsed since 4 continuous hours or more of Circ Water Booster Pump Operation.

a. If towers do not meet the criteria of the above Note, perform the following:

1) Operate towers and CW Booster pumps in the following combination:

a) 1 pump = 1 tower
b) 2 pumps = 2 towers

2) Initially adjust the recirc gate in small increments to obtain a condenser exit temperature (average of F056, F057, F058 and F059) per the table below:

Wet Bulb (F)	Cond Exit Temp (F)
≤-5	≥65
0	≥60
10	≥55
20	≥50
30	≥45
≥35	≥40

LPC4

3) If required to wet the East Cooling Tower, open/check open Cooling Tower 1 Inlet (riser) CW-6A/6B.

4) If required to wet the West Cooling Tower, open/check open Cooling Tower 2 Inlet (riser) CW-6C/6D.

5) Close (raise) North (Gate A) and South (Gate B) Circ Water Booster Bypass Gates until tower Forebay/discharge basin level is 230-233 feet (LI-104-10).

6) Ensure cooling fan control switches in AUTO for CW booster pumps to be started.

7) Start CW booster pump and allow piping to fill for at least 10 minutes.

   a) When at least 10 minutes have elapsed, flag pump control switch to START again, to fully open discharge valve.

   b) Ensure selected CW booster pump seal water flow is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

   c) Ensure selected CW booster pump cooling water flow is approximately 1gpm (FI-104-67A/B/C).

8) Adjust the North (Gate A) and South (Gate B) Circ Water Booster Bypass Gates to maintain tower Forebay/discharge basin level at 230-233 feet (LI-104-10).

9) If two towers will be wetted a second CWB pump is required, perform the following:

   a) Wait at least 5 minutes after completion of Step 7)a).

   b) Start second CWB pump.

   c) When pump amps are steady, flag pump control switch to START again, to fully open pump discharge valve.

   d) Ensure seal water flow for selected pump is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

   e) Ensure cooling water flow for the selected pump is approximately 1 gpm (FI-104-67A/B/C).

10) Check that flow through all cells is balanced.

a) If required, adjust distribution valves as necessary.

b) If changes to Circ Water booster pump or tower lineups are made during tower wetting operation, cell flow balancing shall be verified, and if required, performed.

c) If exterior leaks are identified, initiate a WOR for repair.

11) Periodically adjust the recirc gate to achieve and maintain cooling tower outlet temperature (F078 or F079) greater than:

LPC 3

LPC 5

Wet Bulb (F)	Cooling Tower Outlet Temp (F)
≤ - 5	≥65
0	≥60
10	≥55
20	≥50
30	≥45
≥35	≥40

12) Continue CW booster pump operation for at least 24 hours.

13) When Cooling Tower wetting requirements are satisfied, place Circ Water System in mode required by river or plant conditions.]

M. Maintaining Cooling Towers Wet

1. **[EPU – If between the dates of May 16 through October 14, maintain the tower(s) wet as follows:]**

> **NOTE**
>
> Cooling tower(s) may be considered wetted when one of the following conditions have been met (memo, M.E. Palionis to E.V. Bowman, Subject: Wetting of Cooling Towers CT-1 and CT-2 dated 6/13/97 and Memo SYSENG 2000-045).
>
> - Circ Water Booster Pump(s) have been pumping water to a tower(s) for greater than 24 hours following a long term shutdown (>7 days).
> - Less than or equal to 7 days have elapsed since 4 continuous hours or more of Circ Water Booster Pump Operation.

a. Ensure sufficient number of CW booster pumps operable (one required to wet down one tower, two required to wet down both towers).

b. If required to maintain the East Cooling Tower wet, open/check open Cooling Tower 1 Inlet (riser) CW-6A/6B.

c. If required to maintain the West Cooling Tower wet, open/check open Cooling Tower 2 Inlet (riser) CW-6C/6D.

d. Close (raise) North (Gate A) and South (Gate B) Circ Water Booster Bypass Gates until tower Forebay/discharge basin level is 230-233 feet (LI-104-10).

e. Ensure cooling fan control switches in AUTO for CW booster pumps to be started.

f. Start CW booster pump and allow piping to fill for at least 10 minutes.

1) When at least 10 minutes have elapsed, flag pump control switch to START again, to fully open discharge valve.

2) Ensure selected CW booster pump seal water flow is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

3) Ensure selected CW booster pump cooling water flow is approximately 1 gpm (FI-104-67A/B/C).

g. If two towers will be maintained wet a second CW booster pump is required, when at least five minutes have elapsed after placing first CW booster pump in service, perform the following:

1) Start second CW booster pump.

2) When pump amps are steady, flag pump control switch again to fully open pump discharge valve.

3) Ensure selected CW booster pump seal water flow is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).

4) Ensure selected CW booster pump cooling water flow is approximately 1 gpm (FI-104-67A/B/C).

h. Fully close (raise) both bypass gates.

i. Check flow through all cells is balanced.

1) If required, adjust distribution valves as necessary.

2) If changes to Circ Water booster pump or tower lineups are made during tower wetting operation, cell flow balancing shall be verified, and if required, performed.

j. Continue CW booster pump operation for at least 4 hours.

k. When Cooling Tower wetting requirements are satisfied, place Circ Water System in mode required by river or plant conditions.

2. [EPU – If between the dates of October 15 through May 15, maintain the tower(s) wet as follows:

NOTE

Cooling tower(s) may be considered wetted when one of the following conditions have been met (memo, M.E. Palionis to E.V. Bowman, Subject: Wetting of Cooling Towers CT-1 and CT-2 dated 6/13/97 and Memo SYSENG 2000-045).

- Circ Water Booster Pump(s) have been pumping water to a tower(s) for greater than 24 hours following a long term shutdown (>7 days).
- Less than or equal to 7 days have elapsed since 4 continuous hours or more of Circ Water Booster Pump Operation.

a. Operate towers and CW Booster pumps in the following combination:

1) 1 pump = 1 tower
2) 2 pumps = 2 towers

b. Adjust the recirc gate in small increments to obtain a condenser exit temperature (average of F056, F057, F058 and F059) per the table below:

Wet Bulb (F)	Cond Exit Temp (F)
≤ -5	≥65
0	≥60
10	≥55
20	≥50
30	≥45
≥35	≥40

LPC 4

c. If required to maintain the East Cooling Tower wet, open/check open Cooling Tower 1 Inlet (riser) CW-6A/6B.

d. If required to maintain the West Cooling Tower wet, open/check open Cooling Tower 2 Inlet (riser) CW-6C/6D.

e. Close (raise) North (Gate A) and South (Gate B) Circ Water Booster Bypass Gates until tower Forebay/discharge basin level is 230-233 feet (LI-104-10).

f. Ensure cooling fan control switches in AUTO for CW booster pumps to be started.

g. **Start CW booster pump and allow piping to fill for at least 10 minutes.**

1) **When at least 10 minutes have elapsed, flag pump control switch to START again, to fully open discharge valve.**

2) **Ensure selected CW booster pump seal water flow is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).**

3) **Ensure selected CW booster pump cooling water flow is approximately 1gpm (FI-104-67A/B/C).**

h. **Adjust the North (Gate A) and South (Gate B) Circ Water Booster Bypass Gates to maintain tower Forebay/discharge basin level at 230-233 feet (LI-104-10).**

i. **If two towers will be maintined wet a second CWB pump is required, perform the following:**

1) **Wait at least 5 minutes after completion of Step g.1.**

2) **Start second CWB pump.**

3) **When pump amps are steady, flag pump control switch to START again, to fully open pump discharge valve.**

4) **Ensure seal water flow for selected pump is at least 2 gpm (FI-104-69A/B/C) or 15-30 psig (PI-104-68A/B/C).**

5) **Ensure cooling water flow for the selected pump is approximately 1 gpm (FI-104-67A/B/C).**

j. **Check that flow through all cells is balanced.**

1) **If required, adjust distribution valves as necessary.**

2) **If changes to Circ Water booster pump or tower lineups are made during tower wetting operation, cell flow balancing shall be verified, and if required, performed.**

k. **Continue CW booster pump operation for at least 4 hours.**

l. **When Cooling Tower wetting requirements are satisfied, place Circ Water System in mode required by river or plant conditions.]**

N. Subfreezing Operation of Cooling Towers

NOTE

The basic rule of thumb is to increase cooling tower inlet temperature as high as practicable while keeping operating cells at full water flow. This will allow the warm water to flow across the outer edges of fill to prevent or correct ice formation.

1. If possible, secure #1 fan in west tower before all others in an attempt to minimize alternate cooling cell duty.

2. For mild icing (1/2" ice on fill and temperatures above 20°F), alternately sequence each fan OFF (at least every 10 minutes every hour).

3. For severe icing conditions, adjust the recirc gate or secure fans (maintaining TCrit positive) to maintain cooling tower exit temperature in the range of 70-90°F.

4. For more severe icing and while maintaining the margin to TCrit positive:

   a. Allow each fan to coast to a minimum speed for at least 6.5 minutes before reversing direction.

   b. Place every other fan in REVERSE as needed to control ice formation.

   c. Swap direction hourly.

NOTE

Isolating flow to cells should start at #1 (North End) and progress South to ensure there are no dead legs in the distribution pipe.

5. If heavy icing continues to occur, cooling tower inlet temperature is too low and should be raised by performing 5.a, 5.b or both.

   a. Incrementally open the recirc gate.

   b. With the concurrence of the Operations Manager, isolate cells by:

      - Opening the header valve to FULL OPEN position to flush out any debris that may have accumulated on the valve disc and seat.
      - Closing the header valve after flushing.
      - Closing off cooling cells to keep all operating cells at full flow (water level at the top distribution pan should be 4-6 inches).
      - Stopping fans on any isolated cell.

6. Continue to sequence fans OFF or in REVERSE as necessary.

O. Removing Condenser Water Boxes from Service for Maintenance

1. Notify ISO New England of the intention to reduce reactor power.

LPC3

2. Reduce reactor power to <58.32% per OP 0105, Reactor Operations.

NOTE

The extent of the power reduction should be based on river temperature and condenser cleanliness and the number of water boxes to be removed from service. Trial isolation of a water box can be performed to determine if further power reduction is required prior to completion of the tagging order and draining of the water box.

3. Reduce the number of running CW pumps and CW Booster pumps if running, to two each.

CAUTIONS

- **Do not isolate both water boxes in one condenser.**
- **Removing a water box from service will cause the applicable ERFIS points, F052 to F059, to become inaccurate and may result in exceeding the NPDES permit. See Appendix B [EPU – or Appendix D] for compensatory action as required. (ER 2002-2181)**

4. Isolate and drain the water box(es) per Step a. or b.:

   a. If cooling tower operation is required:

      1) Close inlet and outlet water box valves:

         - CW-2A(B,C,D), and
         - CW-3A(B,C,D),

      2) Close water box vacuum system isolation valve CWP-9(10,11,12),

      3) Connect hoses from water box drain valves to the TBCCW area sump:

         - CW-61A(B,C,D), and
         - CW-62A(B,C,D)

4) Obtain a Discharge Permit,

5) Open the following valves:

- Drain valves CW-61A(B,C,D) and CW-62A(B,C,D)
- Vent valve CW-60A(B,C,D)

b. If cooling tower operation is not required:

1) Open bypass gates to full open position,

2) Close inlet and outlet water box valves CW-2A(B,C,D) and CW-3A(B,C,D)

3) Open respective ACBs for the inlet and outlet water box valves closed above,

4) Close water box vacuum system isolation valve CWP-9(10,11,12),

5) Manually open the outlet water box outlet valve, CW-3A(B,C,D) approximately 10%,

6) Open vent valve CW-60A(B,C,D).

5. Monitor the following turbine-generator parameters:

a. Condenser back pressure on computer points F013 and F014.

b. Turbine thrust bearing metal temperature on recorder TR-110-/R-1.

1) If required, reduce reactor power as necessary to maintain parameters within limits set in OP 2160, Turbine Generator Support Systems Operation.

6. When maintenance reports clear:

a. Notify Chemistry waterbox is to be returned to service.

b. Restore system lineup to normal.

7. Increase power per OP 0105, Reactor Operations.

P. Loss of River Temperature Recorder Sensing Points (M036 or M037) (ER-2003-0353_01)

1. Between the dates May 16 and October 14:

   a. If M036 is lost, assume TCRIT River Temp Rise Limit (SYS012) is 2°F and adjust plant settings per Appendix B, Determining and Adjusting Plant Settings for NPDES Compliance **[EPU – Between the Dates of May 16 through October 14]**.

2. **[EPU – Between the dates of October 15 and May 15 adjust plant settings per Appendix D, Determining and Adjusting Plant Settings for NPDES Compliance.]**

3. Anytime of year:

   a. Loss of valid data indication for either M036 or M037 renders the river monitoring system inoperative and shall be declared "Out of Service". This condition places the Plant in non-compliance with State NPDES Regulations.

   b. Notify Chemistry Management immediately. (CR-VTY-2006-00042 CA 00004)

   c. Initiate a Work Order Request indicating in the text that the Plant is in Non-Compliance with the NPDES Permit. (CR-VTY-2006-00042 CA 00004)

   d. Initiate a Condition Report. (CR-VTY-2006-00042 CA 00004)

   e. Note loss on VYOPF 0150.03A CRO Round, OATC/BOP Turnover Sheet, or VYOPF 0150.04A Shutdown CRO Round, OATC/BOP Turnover Sheet, as applicable. (CR-VTY-2006-00042 CA00004)

Q. Total Loss of River Temperature Indication

1. Calculate the degree rise above ambient in open cycle using the following formula:

$$\frac{\text{(MWt-MWe(Gross) x 15.193}}{\text{River Flowrate (cfs)}} = \text{°F Rise}$$

Computer Points

$$\frac{\text{(CO47-G002) x 15.193}}{\text{C275}} = \text{°F Rise}$$

a. Independently verify the calculation. (ER991077_05)

2. Service Water pump discharge temperature TI-34 and TI-36 will furnish inlet river temperature.

3. Downriver temperature can be calculated by adding °F rise and SW pump discharge temperature.

R. Hydraulic Gate Control System - Intake and Discharge Structures (Shutdown)

1. System Shutdown

a. Turn the two control power breakers on the control panel to OFF position.

S. Loss of Hydraulic Gate Control System

1. Manual Operations with Supplied Air (Assumes pumps are inoperable)

a. At the Intake Structure:

1) Connect an air hose to CWHA-2A from SA-107 K or L.

2) Open the following valves:

- SA-107K or SA-107L
- CWHA-2A to Control Air Pump Power

3) Select direction of gate movement on local panel.

4) When gate movement is complete, close the following valves:

- CWHA-2A
- SA-107K or SA-107L

b. At the Discharge Structure - two 8 in. adjustable wrenches required.

1) Install quick connect (located in Enclosure B) on IA-993.

2) Connect air hose to CWHA-2B from IA-993.

3) Open the following:

- IA-993
- CWHA-2B to Control Air Pump Power

4) Select direction of gate movement on local panel.

5) When gate movement is complete, close the following valves:

- CWHA-2B
- IA-993

2. Manual Gate Control - Loss of Control Power (See Figure 1)

a. Verify hydraulic pressure available from either:

1) Electric driven hydraulic pump in MANUAL operation.

2) Air driven hydraulic pump operating.

b. Position gate by inserting a small Phillips screwdriver, or equivalent, into the appropriate directional control valve block to drive the gate UP and DOWN.

NOTE

The following step is used to clear drift alarms from the "A" Bypass Gate while it is tagged out. It will allow operation of the other Bypass gate and the Recirc gate from the Control Room.

3. To restore manual operation, perform the following:

   a. Place both of the control switches for the discharge structure hydraulic system pumps in OFF.

   b. Place the hydraulic system for the discharge structure gates in LOCAL control.

   c. Momentarily depress the "A" Bypass gate OPEN pushbutton.

   d. Reset the alarms.

   e. Place both of the control switches for the discharge structure hydraulic system pumps in AUTO.

   f. Place the hydraulic system for the discharge structure gates in REMOTE control.

4. See Appendix C for Hydraulic Gate Operations with degraded Position Indication.

T. Use of Hotwell for Condensate Storage

1. Open/verify open the North and South Circ Water Booster Bypass Gates.

2. Secure all running CW pumps.

3. Wait a minimum of 15 minutes prior to performing the next step to ensure the water boxes are drained to the discharge block.

4. Close the Condenser Inlet, CW-2A(B,C,D), and Condenser Outlet CW-3A(B,C,D), valves.

   a. Danger tag the CRP 9-6 Control Switches for CW-2A(B,C,D) and CW-3A(B,C,D) for the Shift Manager

5. Uncap and open the Outlet Water Box Drains, CW-62A(B,C,D), to provide a vent for the water boxes.

   a. Danger tag open the Outlet Water Box Drains, CW-62A(B,C,D), for the Shift Manager.

6. Monitor condensate conductivity.

7. Sample each water box for radioactivity prior to returning it to service.

U. Operation with Low Vernon Pond Elevation

NOTES

- When Vernon Pond elevation is ≤212 feet, reduction of river flow into the CW intake bay may be necessary, in order to preclude excessive sediment transport into the SW system due to high water velocity (i.e., >1 fps) in the river offshore of the intake structure. (ER 97-1120)
- The following Step 1 provides guidance to ensure that the CW system is operated such that the inflow into the intake structure from the river is the equivalent of two-thirds or less of full CW system flow. This will ensure that river flow velocity in the vicinity of the intake is less than 1 fps when Vernon Pond elevation is <212 feet.
- At Vernon Pond elevation <212 ft., SW inlet temperature can be affected when operating with the CW intake gates open and with the recirc gate open about 60% or more.

1. If it is known that the elevation of Vernon Pond will go <214 ft., perform the following as required:

   a. If CW system is operating with 2 CW pumps or operating in Closed Cycle mode, then no further action is required.

   b. If CW system is operating with 3 CW pumps in Open Cycle or Hybrid Cycle mode, perform the following:

NOTE

Operation with all CW intake gates full open is permitted, provided the recirc gate is at least 25% open.

1) Open recirc gate to at least 25%.

2) If condenser vacuum cannot be maintained below 5 inches HgA, perform either of the following:

a) Enter OT 3120, Condenser High Back Pressure.

b) Enter ON 3173, Loss of Circulating Water.

c) Shift CW system to hybrid or closed cycle per this procedure.

2. If it is known that the elevation of Vernon Pond will go below 212 ft., perform the following:

1) Enter OT 3120, Condenser High Back Pressure.

2) Enter ON 3173, Loss of Circulating Water.

3) Shift CW system to hybrid or closed cycle per this procedure.

4) Refer to OP 0105, Reactor Operations, and reduce reactor power at ≤10% CTP/min.

V. Determining and Adjusting Plant Settings

1. Refer to Appendix B, Determining and Adjusting Plant Settings for NPDES Compliance **[EPU – Between the Dates of May 16 through October 14]**, as appropriate.

2. **[EPU – Refer to Appendix D, Determining and Adjusting Plant Settings for NPDES Compliance Between the Dates of October 15 through May 15, as appropriate.]**

W. Clearing of Debris from Intake Trash Racks

NOTES

- If intake structure level falls to 209 ft., the intake gates will open automatically. They cannot be reclosed until level is above 209 ft.
- If intake structure level falls to 207 ft., the circ water pumps will trip. The circ water pumps cannot be restarted until intake level is above 207 ft.
- Operation of the recirc gate at low intake structure water levels will result in reduced flow to the deicing line due to the elevation difference between the recirc line (195.25 ft centerline) and the deicing line (217 ft centerline). As a result, the deicing of the SW bay may not occur.

LPC 2

1. If significant ice or trash accumulates at racks or the floating boom, do the following: (CAR 94068_01)

   a. Place the traveling screens in Manual as soon as time permits.

   b. Dispatch an operator to the discharge structure.

   c. Open the recirc gate to 50% until condenser backpressure approaches 3.0" HgAbs.

   d. Throttle the recirc gate to maintain 3.0 to 3.5" HgAbs until ice or trash has been pushed into mainstream of river, or ceases to move.

   e. Close the recirc gate.

   f. When the recirc gate has been closed for at least 30 minutes, place the traveling screens in Auto.

   g. If leaves or trash are observed moving back toward the trash racks or floating boom, open recirc gate to 5%.

X. Operation of Cooling Tower Lights

NOTE

Cooling tower lights are normally secured and require Operations and Security permission to turn them on.

1. Turning On the Cooling Tower Lights

   a. Obtain permission from the Security Shift Supervisor and the Ops Shift Manager to turn on the tower lights.

   b. At LP-1X, close CKT 20 (Tower Ltg Photo Cell) and check closed CKT 1 through 7 and CKT 9 to energize west cooling tower lights.

   c. At LP-1W, close CKT 14 (Tower Ltg Photo Cell) and check closed CKT 1 through 7 and CKT 9 to energize east cooling tower lights.

2. Turning Off the Cooling Tower Lights

   a. At LP-1X, open CKT 20 to de-energize west cooling tower lights.

   b. At LP-1W, open CKT 14 to de-energize east cooling tower lights.

Y. Individual Cooling Tower Fan Operation

NOTES

- Tower wetting is not required to perform this surveillance.
- The fan may operate for up to two hours without running water in the towers and without performing prior cooling tower wetting.

1. Verify the selected cooling tower fan is clear of obstructions or debris.

2. Verify the selected cooling tower fan has normal oil level.

3. On panel 9-6, place the selected cooling tower fan control switch to FWD and observe the time.

4. Verify the selected cooling tower fan starts.

5. Locally verify no unusual noise or vibration is evident.

6. When ≤2 hours have elapsed from fan start, place the selected cooling tower fan control switch to STP.

Z. Initial Tower Balancing Post Maintenance or on System Start-up

NOTES

- The cooling tower distribution valves are reverse threaded and reverse seated. As a result they are operated **Clockwise to Close** and **Counter Clockwise to Open** as normal valves.
- The following steps should be followed for each of the tower distribution valves. The valves may be positioned in any order, but all should be checked before tower operation or after tower maintenance that may have changed the valve positions.

1. Turn the tower distribution valves clockwise to close.

2. Open each valve to the initial position as follows:

   - Cells 1-5, OPEN each valve 8 turns.
   - Cells 6-11, OPEN each valve 9 turns.

CAUTION

If a cell is overflowing badly, significant ground erosion can quickly occur. This situation needs to be promptly addressed.

3. To prevent ground washout, if a cell is overflowing badly, adjust that cell first or secure CWB pumps as needed.

4. If needed, rebalance the towers as follows:

   - If a cell is overflowing, evenly close the 4 distribution valves in that cell until overflow stops.
   - If water depth on the cell distribution platform is less than about 1/2 of the way to the top of the retaining berm, OPEN evenly the 4 cell distribution valves until the water depth is about 1/2 to 3/4 the height of the berm.
   - Adjust cells as necessary until none overflow and water depth is approximately equal in each cell.

AA. Circulating Water Traveling Screen Winter Layup

1. Manually wash circ water traveling screen, TS-1-1A(B,C) per the Traveling Screen Operation section of OP 2181, Service Water Alternate Cooling Operating Procedure.

2. When approximately 20 minutes have elapsed place TS-1-1A(B,C) control switch of OFF.

3. On MCC-8D at the intake structure open the following breakers:

   - TS1-1A Circ. Water Traveling Screen A
   - TS1-1B Circ. Water Traveling Screen B
   - TS1-1C Circ. Water Traveling Screen C

4. If Service Water traveling screens are washed and ready for winter layup close SW-6, MN Travel Screen Wash.

5. If Service Water traveling screens are not ready for winter layup, place the Service Water traveling screens in winter layup per OP 2181, Service Water/Alternate Cooling Operating Procedure.

BB. Circulating Water Traveling Screen Winter Layup Restoration

1. Locally verify or place TS-1-1A(B,C) local control switch to OFF.

2. Verify or slowly open SW-6, MN Travel Screen Wash.

3. On MCC-8D at the intake structure close the following breakers:

   - TS1-1A(B,C) Circ. Water Traveling Screen A(B,C)

NOTE

The following steps minimize the potential of carryover of debris into the system.

4. Establish communication between an operator at the screen to be returned to service and the Traveling Screen Control Panel.

5. Open the Traveling Screen access door to be placed in service to monitor screen condition.

6. Place TS-1-1A(B,C) local control switch to MANUAL.

7. IF debris is observed on the screen above the backwash spray path, THEN notify the operator at the Traveling Screen Control Panel to place the TS-1-1A(B,C) to OFF.

8. IF notified, the operator at the Traveling Screen Control Panel immediately places the TS-1-1A(B,C) local control switch to OFF.

9. If debris removal is required perform the following:

   a. Obtain appropriate fire hose from spares or Stores.

   b. Inspect the hose(s) and couplings to be used for the following:

NOTE
In addition to the service test pressure the hose stencil may also include a reference to NFPA 1962 or UL or FM.

   1) Hose:

      a) Hose marking (stenciled) includes "Service Test to 250 psi". (If specified pressure is >250 psi it is acceptable.)

      b) Hose has not been vandalized.

      c) Free of debris.

      d) No evidence of mildew or rot.

      e) No evidence of damage by chemicals, burns, cuts, abrasion, or vermin.

   2) Couplings:

      a) Damaged threads.

      b) Corrosion.

      c) Slippage on the hose.

      d) Out of round.

      e) Swivel not rotating freely.

f) Missing lugs.

g) Other defects that impair operation.

3) Replace any degraded hose gaskets.

c. Rig a fire hose from a hydrant to the intake structure.

1) Ensure fire hose(s) are secure to prevent whip prior to pressurizing and operating.

2) Consider using two persons to man the hose so as to perform operations safely.

d. When ready to wash debris, start the Electric Fire Pump in accordance with OP 2186.

NOTE

Use care not to wash debris into the pump suction side of the traveling screen when performing the next step.

e. Wash the debris from the screen through the access door.

10. Re-perform Steps 6, 7, 8 and 9.d and 9.e as appropriate until TS-1-1A(B,C) make at least one full revolution past the backwash header.

11. Locally place TS-1-1A(B,C) local control switch to AUTO or MANUAL as directed by the Control Room Supervisor.

12. IF debris removal was required, THEN secure the Electric Fire Pump in accordance with OP 2186.

13. Dry and store any fire hose used as follows:

a. Dry hoses used by laying them out to dry on the ramp by the intake structure OR use the hanger by the Turbine Building loading bay door OR both.

b. Store fire hose(s) used as directed by Operations Shift Management.

FINAL CONDITIONS

1. Required forms completed and returned to Operations office for filing per EN-AD-103 and Retrieval of QA Records, and AP 0155, Current System Valve and Breaker Lineup and Identification.

APPENDIX A

VALVE LINEUP

Valve Number	Description	Position	Initial
	CRP 9-6		
CW-1A	Circulating Water Pump 1A Disch	AS REQ:OPEN/CLOSED	_____
CW-1B	Circulating Water Pump 1B Disch	AS REQ:OPEN/CLOSED	_____
CW-1C	Circulating Water Pump 1C Disch	AS REQ:OPEN/CLOSED	_____
CW-2A	Condenser 1A North Inlet	OPEN	_____
CW-2B	Condenser 1A South Inlet	OPEN	_____
CW-2C	Condenser 1B North Inlet	OPEN	_____
CW-2D	Condenser 1B South Inlet	OPEN	_____
CW-3A	Condenser 1A North Outlet	OPEN	_____
CW-3B	Condenser 1A South Outlet	OPEN	_____
CW-3C	Condenser 1B North Outlet	OPEN	_____
CW-3D	Condenser 1B South Outlet	OPEN	_____
CW-6A	Cooling Tower 1 Inlet	AS REQ:OPEN/CLOSED	_____
CW-6B	Cooling Tower 1 Inlet	AS REQ:OPEN/CLOSED	_____
CW-6C	Cooling Tower 2 Inlet	AS REQ:OPEN/CLOSED	_____
CW-6D	Cooling Tower 2 Inlet	AS REQ:OPEN/CLOSED	_____
Circ Wtr Intake Gate A		AS REQ:OPEN/CLOSED	_____
Circ Wtr Intake Gate B		AS REQ:OPEN/CLOSED	_____
Circ Wtr Intake Gate C		AS REQ:OPEN/CLOSED	_____
Recirculation Bypass Gate		AS REQ:OPEN/CLOSED	_____
North Circ Water Booster Bypass Gate		AS REQ:OPEN/CLOSED	_____
South Circ Water Booster Bypass Gate		AS REQ:OPEN/CLOSED	_____
CW-5A	CWB Pump A Disch	AS REQ:OPEN/CLOSED	_____
CW-5B	CWB Pump B Disch	AS REQ:OPEN/CLOSED	_____
CW-5C	CWB Pump C Disch	AS REQ:OPEN/CLOSED	_____

Valve Number	Description	Position	Initial
	INTAKE STRUCTURE HYDRAULIC SYSTEM		
CWHO-1A	Down Drive Isolation - Intake A Gate	OPEN	_____
CWHO-2A	Up Drive Isolation - Intake A Gate	OPEN	_____
CWHO-3A	Down Drive Isolation - Intake B Gate	OPEN	_____
CWHO-4A	Up Drive Isolation - Intake B Gate	OPEN	_____
CWHO-30A	Intake Gate B Actuator Up Drive Line Vent	CLOSED	_____
CWHO-31A	Intake Gate B Actuator Down Drive Line Vent	CLOSED	_____
CWHO-5A	Down Drive Isolation - Intake C Gate	OPEN	_____
CWHO-6A	Up Drive Isolation - Intake C Gate	OPEN	_____
CWHO-34A	Intake Gate C Actuator Up Drive Line Vent	CLOSED	_____
CWHO-35A	Intake Gate C Actuator Down Drive Line Vent	CLOSED	_____
CWHO-7A	Flow Control Isolation - A Gate	OPEN	_____
CWHO-8A	Flow Control Isolation - A Gate	OPEN	_____
CWHO-9A	Flow Control Isolation - B Gate	OPEN	_____
CWHO-10A	Flow Control Isolation - B Gate	OPEN	_____
CWHO-11A	Flow Control Isolation - C Gate	OPEN	_____
CWHO-12A	Flow control Isolation - C Gate	OPEN	_____
CWHO-16A	4A Lube Oil Filter Pump Suction Isolation	OPEN	_____
CWHO-17A	Intake Gate A Actuator High Point Vent	CLOSED	_____
CWHO-18A	Intake Gate A Actuator Low Point Drain	CLOSED	_____
CWHO-28A	Intake Gate B Actuator High Point Vent	CLOSED	_____
CWHO-29A	Intake Gate B Actuator Low Point Drain	CLOSED	_____
CWHO-32A	Intake Gate C Actuator High Point Vent	CLOSED	_____
CWHO-33A	Intake Gate C Actuator Low Point Vent	CLOSED	_____
CWHO-19A	Reservoir Drain	CLOSED	_____
CWHO-21A	PI-104-134A Isolation	THROTTLED AS REQ	_____

Valve Number	Description	Position	Initial
CWHO-22A	PI-104-135A Isolation	THROTTLED AS REQ	_____
CWHO-23A	PI-104-132A Isolation	THROTTLED AS REQ	_____
CWHO-24A	PI-104-133A Isolation	THROTTLED AS REQ	_____
CWHO-25A	PI-91A Isolation	THROTTLED AS REQ	_____
CWHO-26A	PI-104-130A Isolation	THROTTLED AS REQ	_____
CWHO-27A	PI-104-136A Isolation	THROTTLED AS REQ	_____
CWHA-1A	Air Pump Isolation	OPEN	_____
CWHA-2A	Service Air Isolation	CLOSED	_____
CWHA-3A	Depressurizing Valve	CLOSED	_____
	OFFICE BUILDING NORTH OUTSIDE		
CW-42A	CW Pumps Discharge Intake Pipe Vent	CLOSED	_____
CW-42B	CW Pumps Discharge Intake Pipe Vent	CLOSED	_____
	INTAKE STRUCTURE		
CW-54A	PI-6A Circ Water Pump A Disch	OPEN	_____
CW-54B	PI-6B Circ Water Pump B Disch	OPEN	_____
CW-54C	PI-6C Circ Water Pump C Disch	OPEN	_____
CWD-55A	PI-60A Dilution Pump A Disch	OPEN	_____
CWD-55B	PI-60B Dilution Pump B Disch	OPEN	_____
CWD-56A	FE-71 and 72 Dilution Pumps Disch	CLOSED	_____
CWD-56B	FE-71 and 72 Dilution Pumps Disch	CLOSED	_____
CWD-7A	Dilution Pump A Disch	CLOSED	_____
CWD-7B	Dilution Pump B Disch	CLOSED	_____
CWI-GATE-DEICE	Service Water De-Icing Gate	*AS REQ:OPEN/CLOSED	_____

Valve Number	Description	Position	Initial
	TURBINE BUILDING		
CW-50A	Dpi-65A-2 Condenser A East	OPEN	_____
CW-50B	Dpi-65A-2 Condenser A West	OPEN	_____
CW-50C	Dpi-65A-1 Condenser A East	OPEN	_____
CW-50D	Dpi-65A-1 Condenser A West	OPEN	_____
CW-51A	Dpi-65B-2 Condenser B East	OPEN	_____
CW-51B	Dpi-65B-2 Condenser B West	OPEN	_____
CW-51C	Dpi-65B-1 Condenser B East	OPEN	_____
CW-51D	Dpi-65B-1 Condenser B West	OPEN	_____
CW-37	Hypochlorite Panel Drain	*AS REQ:OPEN/CLOSED	_____
CW-38	Ph Sensor Supply	*AS REQ:OPEN/CLOSED	_____
CW-10A	Condenser A North Cl and Ph Sample	*AS REQ:OPEN/CLOSED	_____
CW-10C	Condenser A South Cl and Ph Sample	*AS REQ:OPEN/CLOSED	_____
CW-10B	Condenser B North Cl and Ph Sample	*AS REQ:OPEN/CLOSED	_____
CW-10D	Condenser B South Cl and Ph Sample	*AS REQ:OPEN/CLOSED	_____
CW-52A	PX-58A-1 Condenser A North Outlet	CLOSED	_____
CW-52B	PX-58A-2 Condenser A South Outlet	CLOSED	_____
CW-52C	PX-59B-2 Condenser B North Outlet	CLOSED	_____
CW-52D	PX-58B-1 Condenser B South Outlet	CLOSED	_____
CW-62A	Condenser A North Outlet Water Box Drain	CLOSED	_____
CW-62B	Condenser A South Outlet Water Box Drain	CLOSED	_____
CW-62C	Condenser B North Outlet Water Box Drain	CLOSED	_____
CW-62D	Condenser B South Outlet Water Box Drain	CLOSED	_____
CW-61A	Condenser A North Inlet Water Box Drain	CLOSED	_____
CW-61B	Condenser A South Inlet Water Box Drain	CLOSED	_____

Valve Number	Description	Position	Initial
CW-61C	Condenser B North Inlet Water Box Drain	CLOSED	_____
CW-61D	Condenser B South Inlet Water Box Drain	CLOSED	_____
CW-53A	A North Inlet Sample	CLOSED	_____
CW-53B	A South Inlet Sample	CLOSED	_____
CW-53C	B North Inlet Sample	CLOSED	_____
CW-53D	B South Inlet Sample	CLOSED	_____
CWP-14A	Priming Pump A SW Inlet	OPEN	_____
CWP-22A	Priming Pump A Strainer Drain	CLOSED	_____
CWP-18A	Priming Pump A SW Solenoid Bypass	CLOSED	_____
CWP-SN-74-1A	Priming Pump A Cooling Water Throttle Valve	THROTTLED AS REQ	_____
CWP-14B	Priming Pump B SW Inlet	OPEN	_____
CWP-22B	Priming Pump B Strainer Drain	CLOSED	_____
CWP-18B	Priming Pump B SW Solenoid Bypass	CLOSED	_____
CWP-SN-74-1B	Priming Pump B Cooling Water Throttle Valve	THROTTLED AS REQ	_____
CWP-19A	Priming Pump A Solenoid Inlet	OPEN	_____
CWP-19B	Priming Pump B Solenoid Inlet	OPEN	_____
CWP-20A	Priming Pump A Solenoid Outlet	OPEN	_____
CWP-20B	Priming Pump B solenoid Outlet	OPEN	_____
CWP-21A	Priming Pump A PI-56-A Isolation	OPEN	_____
CWP-21B	Priming Pump B PI-56-B Isolation	OPEN	_____
CWP-3A	Priming Pump A Drain	CLOSED	_____
CWP-3B	Priming Pump B Drain	CLOSED	_____
CWP-22	P52-1B Suction Drain and Tank Vent	CLOSED	_____
CWP-23A	Sight Glass Priming Tank Hi	OPEN	_____
CWP-23B	Sight Glass Priming Tank Lo	OPEN	_____
CWP-24	Priming Tank Drain	CLOSED	_____

Valve Number	Description	Position	Initial
CWP-17	Priming Tank Instrumentation	OPEN	_____
CWP-2A	Priming Pump A Suction	OPEN	_____
CWP-2B	Priming Pump B Suction	OPEN	_____
CWP-4	Condenser A North Suction	OPEN	_____
CWP-5	Condenser A South Suction	OPEN	_____
CWP-6	Condenser B North Suction	OPEN	_____
CWP-7	Condenser B South Suction	OPEN	_____
CWP-8	Discharge Block Suction	AS REQ:OPEN/CLOSED	_____
CWP-9	Condenser A North Suction	OPEN	_____
CWP-10	Condenser A South Suction	OPEN	_____
CWP-11	Condenser B North Suction	OPEN	_____
CWP-12	Condenser B South Suction	OPEN	_____
CWP-13	Discharge Block Suction	AS REQ:OPEN/CLOSED	_____
CW-60A	Waterbox Manual Vent	CLOSED	_____
CW-60B	Waterbox Manual Vent	CLOSED	_____
CW-60C	Waterbox Manual Vent	CLOSED	_____
CW-60D	Waterbox Manual Vent	CLOSED	_____

Valve Number	Description	Position	Initial
	DISCHARGE STRUCTURE HYDRAULIC SYSTEM		
CWHO-1B	Down Drive Isolation - Recirc Gate	OPEN	_____
CWHO-2B	Up Drive Isolation - Recirc Gate	OPEN	_____
CWHO-3B	Down Drive Isolation - Bypass Gate B	OPEN	_____
CWHO-4B	Up Drive Isolation - Bypass Gate B	OPEN	_____
CWHO-5B	Down Drive Isolation - Bypass Gate A	OPEN	_____
CWHO-6B	Up Drive Isolation - Bypass Gate A	OPEN	_____
CWHO-7B	Flow Control Isolation - Recirc Gate	OPEN	_____
CWHO-8B	Flow Control Isolation - Recirc Gate	OPEN	_____
CWHO-9B	Flow Control Isolation - Bypass Gate B	OPEN	_____
CWHO-10B	Flow Control Isolation - Bypass Gate B	OPEN	_____
CWHO-11B	Flow Control Isolation - Bypass Gate A	OPEN	_____
CWHO-12B	Flow Control Isolation - Bypass Gate A	OPEN	_____
CWHO-16B	4B Lube Oil Filter Pump Suction Isolation	OPEN	_____
CWHO-17B	Recirc Gate Actuator High Point Vent	CLOSED	_____
CWHO-18B	Recirc Gate Actuator Low Point Drain	CLOSED	_____
CWHO-19B	Reservoir Drain	CLOSED	_____
CWHO-21B	PI-104-134B Isolation	THROTTLED AS REQ	_____
CWHO-22B	PI-104-135B Isolation	THROTTLED AS REQ	_____
CWHO-23B	PI-104-132B Isolation	THROTTLED AS REQ	_____
CWHO-24B	PI-104-133B Isolation	THROTTLED AS REQ	_____
CWHO-25B	PI-104-130B Isolation	THROTTLED AS REQ	_____
CWHO-26B	PI-104-131B Isolation	THROTTLED AS REQ	_____
CWHO-27B	PI-104-136B Isolation	THROTTLED AS REQ	_____
CWHO-28B	Bypass Gate A High Point Vent	CLOSED	_____
CWHO-29B	Bypass Gate A Low Point Drain	CLOSED	_____

Valve Number	Description	Position	Initial
CWHO-30B	Bypass Gate B High Point Vent	CLOSED	_____
CWHO-31B	Bypass Gate B Low Point Drain	CLOSED	_____
CWHA-1B	Air Pump Isolation	OPEN	_____
CWHA-2B	Service Air Isolation	CLOSED	_____
CWHA-3B	Depressurizing Valve	CLOSED	_____
CW-8A	CWB Pump A Seal Water Filter A Inlet	One filter on line with each pump inlet and outlet valves open. Other filter inlet and outlet valves closed with filter in repair or standby condition. These valves routinely operated by operators and mechanics to change filters.	
CW-8D	CWB Pump A Seal Water Filter B Inlet		
CW-9A	CWB Pump A Seal Water Filter A Outlet		
CW-9D	CWB Pump A Seal Water Filter B Outlet		
CW-8B	CWB Pump B Seal Water Filter A Inlet		
CW-8E	CWB Pump B Seal Water Filter B Inlet		
CW-9B	CWB Pump B Seal Water Filter A Outlet		
CW-9E	CWB Pump B Seal Water Filter B Outlet		
CW-8C	CWB Pump C Seal Water Filter A Inlet		
CW-8F	CWB Pump C Seal Water Filter B Inlet		
CW-9C	CWB Pump C Seal Water Filter A Outlet		
CW-9F	CWB Pump C Seal Water Filter B Outlet		
CW-59A	CWBP A Seal Water Cooling Loop Drain Valve	CLOSED/CAPPED	_____
CW-59B	CWBP B Seal Water Cooling Loop Drain Valve	CLOSED/CAPPED	_____
CW-59C	CWBP C Seal Water Cooling Loop Drain Valve	CLOSED/CAPPED	_____
CW-1	CWBP A Seal Press PI-68A	OPEN	_____
CW-2	CWBP B Seal Press PI-68B	OPEN	_____
CW-3	CWBP C Seal Press PI-68C	OPEN	_____
CW-4	CWBP A Seal/Thrust Brg. Cooling Water Supply	OPEN	_____
CW-7A	CWBP A Thrust Brg. Cooling Water Disch.	THROTTLED AS REQ	_____
CW-58A	CWBP A Discharge Pressure Gauge Isolation Valve	OPEN	_____

Valve Number	Description	Position	Initial
CW-5	CWBP B Seal/Thrust Brg. Cooling Water Supply	OPEN	_____
CW-7B	CWBP B Thrust Brg. Cooling Water Disch.	THROTTLED AS REQ	_____
CW-58B	CWBP B Discharge Pressure Gauge Isolation Valve	OPEN	_____
CW-6	CWBP C Seal/Thrust Brg. Cooling Water Supply	OPEN	_____
CW-7C	CWBP C Thrust Brg. Cooling Water Disch.	THROTTLED AS REQ	_____
CW-58C	CWBP C Discharge Pressure Gauge Isolation Valve	OPEN	_____
CW-7	Aux. CT Blowdown Throttle Valve	THROTTLED AS REQ	_____
CW-8	Aux. CT Blowdown Valve	OPEN	_____
	CW SAMPLE SYSTEM		
CW-29	Disch Bay Suction	OPEN	_____
CW-30	Pump B Suction	OPEN	_____
CW-31	Pump B Disch Solenoid Manual Isolation	*THROTTLED AS REQ	_____
CW-68-2	Pump B Solenoid Disch Operates With Pump		
CW-46	Pump A and B Min Flow	OPEN	_____
CW-32	Sample Pump Disch Cross Connect	CLOSED	_____
CW-27	Sample Pump Disch Cross Connect	CLOSED	_____
CW-21	Sample Tank B Drain	*CLOSED	_____
CW-23	Sample Tank B Sample	*CLOSED	_____
CW-48	River Suction	*OPEN	_____
CW-47	Radwaste Dilution Sample	*CLOSED	_____
CW-11	Drain	CLOSED	_____
CW-24	River/Dilution Pipe Suction	OPEN	_____
CW-25	Pump A Suction	OPEN	_____
CW-26	Pump A Disch Solenoid Manual Isolation	*THROTTLED AS REQ	_____
CW-68-1	Pump A Disch Solenoid Operates With Pump		
CW-20	Sample Tank A Drain	*CLOSED	_____

Valve Number	Description	Position	Initial
CW-22	Sample Tank A Sample	*CLOSED	_____
CW-28	Pump Suction Cross Connect	CLOSED	_____
CW-11A	River Suction Line Flush	*CLOSED	_____
	COOLING TOWERS		
CW-57E	East Tower East Inlet Hdr Vent/Drain	CLOSED	_____
CW-57A	Sample Cooling Tower No. 1 Inlet (East)	*CLOSED	_____
CW-57F	East Tower Inlet Header Vent/Drain	CLOSED	_____
CW-57B	Sample Cooling Twr No. 1 Inlet (West)	*CLOSED	_____
CW-57G	West Tower Inlet Header Vent/Drain	CLOSED	_____
CW-57C	Sample Cooling Twr No. 2 Inlet (East)	*CLOSED	_____
CW-57D	West Tower Inlet Header Vent/Drain	CLOSED	_____
	SPRAY POND/TOWER WETTING SYSTEM		
BS-2	Blowdown Spray Pump Priming Header	CLOSED	_____
BS-3A	Blowdown Spray Pump A Priming	**OPEN	_____
BS-3B	Blowdown Spray Pump B Priming	**OPEN	_____
BS-3C	Blowdown Spray Pump C Priming	**OPEN	_____
Deleted			
Deleted			
Deleted			
BS-14A	Blowdown Spray Pump A Casing Vent	CLOSED	_____
BS-14B	Blowdown Spray Pump B Casing Vent	CLOSED	_____
BS-14C	Blowdown Spray Pump C Casing Vent	CLOSED	_____
Deleted			
BS-12	Tower Header Drain (at pit)	**OPEN	_____
BS-13	Tower Header Drain (at pit)	**OPEN	_____

* These valves normally operated by Chemistry Technician for chemical addition/sampling but should be in the position show.

** Open to provide winter freezing protection. Tower Wetting System and Blowdown Spray Pond are retired in place.

REMARKS:

Reviewed By_____ /_____
Shift Manager (Print/Sign) Date

APPENDIX B

DETERMINING AND ADJUSTING PLANT SETTINGS FOR NPDES COMPLIANCE
[EPU - BETWEEN THE DATES OF MAY 16 THROUGH OCTOBER 14]
(SDR 94077)

NOTES

- Operations Management may implement changes to the "TCRIT Delta T Margin" or "TCRIT River Temp Rise Limit" based on instrument inaccuracy or a need to modify our limits based on previous performance.
- In addition to the normal phone service, Wilder Station (Trans Canada) can also be contacted at 1-888-291-8221, 1-800-291-8105, and 1-800-291-8000.

CAUTION

Removing a water box from service will cause the applicable ERFIS points, F052 to F059, to become inaccurate and may result in exceeding the NPDES permit. (ER 2002-2181)

1. Monitoring the plant settings is accomplished by using the following trends on ERFIS:

   a. Trend 70 contains a graph of (1) Margin to TCRIT - C276, (2) Instantaneous River Thermal Capacity - C277, and (3) Heat Rejected To River - C064.

   b. Trend 71 contains a graph of (1) Up River Temp - M036, (2) USGEN River Flow - C278, and (3) River Temperature Rise - C019.

   c. Trend 72 contains a graph of Margin to TCRIT - C276, set on a 1 hour scale to enhance definition.

2. To determine plant settings:

   a. Obtain a value for:

      1) C277 "INST RIVER THERMAL CAPACITY"

      2) C174 "OUTDOOR WET BULB TEMPERATURE" or equivalent wet bulb temperature

      3) M036 "UP RIVER TEMPERATURE"

      4) River Temperature Correction Factor, as specified by Operations Management

   b. Apply to the nomographs (Figures 5 through 11) for the present River Temperature plus the River Temperature Correction Factor, Wet Bulb Temperature, and Instantaneous River Thermal Capacity, to arrive at the estimated plant setting.

   c. To make changes to plant settings refer to the appropriate section of the operating procedure.

3. When the schedule for Vernon Hydro will result in a reduction in river flow, the adjustments should be made at least 30 minutes prior to the scheduled Vernon Hydro change, for increases in river flow adjustments should be made after the Vernon Hydro change is complete as follows:

   a. Determine Instantaneous River Thermal Capacity as follows:

      IRTC = River Flow * (SYS012 - SYS013)

      Where: SYS012 = TCRIT River Temp Rise Limit
      SYS013 = TCRIT Delta T Margin

   b. Apply to the nomographs (Figures 5 through 11) for the present River Temperature plus the River Temperature Correction Factor, Wet Bulb Temperature, and Instantaneous River Thermal Capacity, to arrive at the estimated plant setting.

   c. Record on plant setting change log changes in:

      1) CW/CWB Pumps

      2) Number of cooling tower fans

      3) Gate positions

CAUTION

2. **Monitoring of up river temperature is critical to the proper operation of the Project Save, due to the manually inputted numbers for river temperature when river temperature is changing.**

3. **When adjusting plant parameters for NPDES compliance, the recirc gate shall not be opened until the cooling towers are placed in service.**

4. By frequently monitoring the ERFIS trends, adjustments to plant settings can be fine tuned to attain the most desirable output. 30 minutes is required to attain steady state conditions after adjustments are made.

   a. Margin to TCRIT should be maintained above "0", but because of variances in inputs it may drop below "0" momentarily (ERFIS alarm). Verify that the area of the curve below "0" will be less than the area of the curve above "0" for each hour (HR00 to HR59). Take steps to reduce thermal discharge as necessary to provide sufficient margin to ensure compliance for the hourly Margin to TCRIT.

   b. Heat Rejected to the River should be maintained below the Instantaneous River Thermal Capacity. This will ensure that the plant does not exceed the river capacity.

   c. The River Up/Down Temp. Rise should be maintained below the allowable temperature rise from the Precautions/Limitations based on current up river temperature.

d. The "TCRIT River Temp. Rise Limit" (point ID 'SYS012') is a manually inputted point that is updated by the operator. As up river temperature increases, SYS012 should be changed ½ degree before reaching the next temperature range. As up river temperature decreases, SYS012 should be changed ½ degree after reaching the next temperature range. To change the value refer to the table below:

NOTE

If M036 is not available on ERFIS assume up river temperature = 63°F.

M036 + River Temperature Correction Factor	Δt_r
≥63°F	2°F
≥59°F, <63°F	3°F
≥55°F <59°F	4°F
<55°F	5°F

Write a Condition Report for any condition that violates or challenges NPDES limits.

e. The "TCRIT Delta T Margin" (point ID 'SYS013') is a manually inputted point that is updated by the operator on direction from Operations Management per Step 5.

NOTE

If the C278 USGEN RIVER FLOW signal becomes invalid, then a fixed value (SYS010) of 1,250 CFS will be fed into C275 CONN RIVER FLOW. The flow value of SYS010 may be adjusted by Control Room personnel once they are able to obtain the correct river flow from Wilder Dam personnel (802-291-8105). If a microwave signal problem is indicated, additional information regarding the microwave signal problem may be obtained from National Grid (508-389-2441) or Northeast Utilities (860-665-6000).

5. To change the value of the manually inputted points above perform the following:

NOTE

Changing the value of manually inputted points may impact the margin to TCRIT.

a. On the ERFIS computer keyboard, press the 'CAV' button.

b. Log in to the User Security Password screen by typing the appropriate password and pressing the Enter key.

c. Using the cursor, click on the PTID field.

d. At Data Point Selection window, type in appropriate point ID in the Point Search/Text space and then hit 'Find'.

e. Verify PTID updated to appropriate Point ID on 'CAV' screen.

f. Move cursor to VALUE field and enter new Point ID value. Press enter on the ERFIS computer keyboard.

g. Verify computer point updated using CRO alarm typer.

h. Record ERFIS point ID, original, and final values on plant setting change log.

i. Update appropriate block on plant setting change log.

j. Have a second operator verify the as left value of the computer point being changed and make a note on plant setting change log.

NOTE

If plant conditions require CTF 2-1 use, the fan should be utilized. Starting and stopping should be minimized to prevent excessive wear to breaker contacts.

6. LPC3 If any of the following ERFIS values are unavailable, perform either of the actions below per Operations Manager approval.

- USGEN River Flow - C278
- River Up/Down Temp Rise - C019
- Heat Reject to River - C064
- Conn. River Flow - C275
- Margin to TCRIT - C276
- Instantaneous River Thermal Cap. - C277
- Condenser Inlet - F052, F053, F054, F055
- Condenser Outlet - F056, F057, F058, F059
- East Tower Outlet - F078
- West Tower Outlet - F079

a. Verify river temperature rise is within ΔT_r limits using the following formula, provided the plant is at steady state operation.

NOTE

This calculation is only valid when the circulating water system is in open cycle.

$$\Delta T_r = \frac{15.193*(\text{MWt rejected})}{(\text{River flow in cfs})}$$

LPC3 where: MWt rejected (C051) = 1912*(%CTP)-generator gross MW
River flow in cfs = USGEN River Flow C278 **OR**
Conn River Flow C275 **OR**
Vernon reported flow from Wilder

1) Independently verify the calculation. (ER991077_05)

b. Place Circulating Water System in hybrid cycle with full recirculation flow (recirc gate >85% open), at least 21 cooling tower fans operating, and intake gates open.

c. Document calculation and results on plant setting change log form VYOPF 2180.05, to maintain a copy of the calculation for review by the Environmental Engineer at a later date.

NOTE

Plant Setting Change Log must be completed daily. (ER981657 02)

7. Maintain Plant Setting Change Log as follows:

a. Daily, at 0000, record the following:

- River Temperature Correction Factor (supplied by Operations management)
- M036 ("UPRIVER TEMPERATURE")
- SYS010 ("USGEN RIVER FLOW C278," CFS),
- SYS012 ("TCRIT RIVER TEMP RISE LIMIT," DEGF), and
- SYS013 ("TCRIT DELTAT MARGIN," DEGF) (supplied by Operations Management)
- C275 (CONN RIVER FLOW)
- C278 (USGEN RIVER FLOW)

b. Log any of the following:

- Major changes to Plant settings (system mode, number of operating fans, recirc gate position).
- Plant settings based on anticipated Vernon Dam load changes per Step 3.
- Unannounced Vernon schedule changes.
- Other information pertinent to plant settings.
- Changes in manually inputted data per Step 5 above.
- When the OATC is relieved, the oncoming OATC signs into the log using the current shift position turnover icon.

c. If plant conditions exist that cause concern about Margin to TCrit for any given hour, perform the following:

1) Print Trend 72 graph as close to the hour as possible to include the entire hour in question (HR 00 to HR 59).

2) Attach graph to log.

d. At midnight each day, perform the following:

1) Calculate the number of hours the cooling towers were operated that day, to the nearest whole hour.

a) Log the number as part of the last log entry for that day "total for the day."

2) Calculate "running total for the month" by adding "total for the day" at 2400 to the 0000 "running total for the month" and log this number in the last entry for that day as well as the first entry for the next day. The "running total for the month" will be returned to zero at 0000 on the first day of each month. (See example below.)

	143	"running total for the month"
	+ 16	"total for the day"
entry at 2400 &		
next day entry at 0000	159	"running total for the month"

3) Turn over the log. SM/CRS approve the log. Print an official copy of the log.

4) Print a copy of the following and attach to previous day's log:

- Trend 70
- Trend 71

5) Forward previous day's log and trend graphs to Operations Administrative Assistant.

8. The control room operator will fill out form VYOPF 0150.03A, CRO Round Turnover Sheet, to document component failures of equipment associated with Project Save that cause actions to be taken to change plant settings. Changes to plant settings shall be documented on PLANT SETTING CHANGE LOG. Out of service components shall be maintained on VYOPF 0150.03A until component is returned to service.

   a. If the network/software becomes unavailable, perform the following:

      1) Maintain the log on VYOPF 2180.05.

      2) Submit a Condition Report.

      3) When the log software has been restored, enter the log in the software in a timely manner.

9. Listing of Project Save ERFIS Computer Points

POINT ID	DESCRIPTION	UNITS
C019	RIVER DOWN/UP TEMP RISE	F
C051	COND HEAT REJECTION	MW
C064	HEAT REJECT TO RIVER	CFSF
C102	NUMBER OF CIRC WATER PUMPS ON	
C103	NUMBER OF CIRC BOOST PUMPS ON	
C275	CONN RIVER FLOW	CFS
C276	MARGIN TCRIT	DEGF
C277	INST RIVER THERMAL CAPACITY	CFSF
C278	USGEN RIVER FLOW	CFS
F052	CONDENSER 1A CIRC WATER INLET	DEG F
F053	CONDENSER 2A CIRC WATER INLET	DEG F
F054	CONDENSER 1B CIRC WATER INLET	DEG F
F055	CONDENSER 2B CIRC WATER INLET	DEG F
F056	CONDENSER 1A CIRC WATER OUTLET	DEG F
F057	CONDENSER 2A CIRC WATER OUTLET	DEG F
F058	CONDENSER 1B CIRC WATER OUTLET	DEG F
F059	CONDENSER 2B CIRC WATER OUTLET	DEG F
F078	CIRC WATER OUT COOLING TOWER A	DEG F
F079	CIRC WATER OUT COOLING TOWER B	DEG F
F084	CW INTAKE GATE A POSITION	
F089	CW INTAKE GATE B POSITION	
F090	CW INTAKE GATE C POSITION	
F085	CW RECIRC GATE POSITION	
M036	UP RIVER TEMPERATURE	DEG F
M037	DOWN RIVER TEMPERATURE	DEG F
SYS010*	USGEN RIVER FLOW C278	CFS
SYS012*	TCRIT RIVER TEMP RISE LIMIT	DEGF
SYS013*	TCRIT DELTAT MARGIN	DEGF

* Manually entered per Operations Management's Direction

APPENDIX C

CIRCULATING WATER HYDRAULIC GATE OPERATIONS WITH DEGRADED POSITION INDICATION

1. Send an operator to the discharge structure.

2. Verify or place both hydraulic pumps in AUTO.

3. Place one pump in OFF.

4. Notify the Control Room to position the gate(s) to the desired position(s).

5. When directed by the Control Room turn off the operating pump.

6. When a gate needs to be re-positioned:

   6.1. Send an operator to the discharge structure.

   6.2. Start one hydraulic pump and notify the control room to position the gate(s) as desired.

   6.3. When directed by the Control Room turn off the operating pump.

7. When the degraded position indication has been repaired, place both hydraulic pumps back in AUTO.

[EPU - APPENDIX D

DETERMINING AND ADJUSTING PLANT SETTINGS FOR NPDES COMPLIANCE BETWEEN THE DATES OF OCTOBER 15 THROUGH MAY 15 (SDR 94077)]

[EPU -

LPC3

NOTES

- Operations Management may implement changes to the "TCRIT Delta T Margin" or "TCRIT River Temp Rise Limit" based on instrument inaccuracy or a need to modify our limits based on previous performance.
- In addition to the normal phone service, Wilder Station (Trans Canada) can also be contacted at 1-888-291-8221, 1-800-291-8105, and 1-800-291-8000.
- If a manual calculation is performed, document the calculation and results on the VYOPF 2180.05 form to maintain a copy of the calculation.

CAUTION

Removing a water box from service will cause the applicable ERFIS points, F052 to F059, to become inaccurate and may result in exceeding the NPDES permit. (ER 2002-2181)

1. Monitoring the plant settings is accomplished by using the following trends on ERFIS:

   a. Trend 70 contains a graph of (1) Margin to TCRIT - C276, (2) Instantaneous River Thermal Capacity - C277, and (3) Heat Rejected To River - C064.

   b. Trend 71 contains a graph of (1) Up River Temp - M036, (2) USGEN River Flow - C278, and (3) River Temperature Rise - C019.

   c. Trend 72 contains a graph of Margin to TCRIT - C276, set on a 1 hour scale to enhance definition.

2. **To determine plant settings:**

   a. **Obtain a value for:**

      1) **C277 "INST RIVER THERMAL CAPACITY"**

      2) **C174 "OUTDOOR WET BULB TEMPERATURE" or equivalent wet bulb temperature**

      3) **M036 "UP RIVER TEMPERATURE"**

      4) **River Temperature Correction Factor, as specified by Operations Management**

      5) **C275 "CONN RIVER FLOW"**

   b. **Apply the obtained values as follows to obtain estimated settings:**

      1) **IF UP RIVER TEMPERATURE IS ≤50°F, THEN refer to Figure 17 for single cooling tower operation or Figure 18 two tower operation as follows:**

         a) **Apply Up River Temperature, the River Temperature Correction Factor, the Wet Bulb Temperature, and River Flow to arrive at the estimated plant setting.**

         b) **IF the obtained readings are not exact matches for the values on the tables, round the values as follows:**

            - **If the river temperature is not an exact match to any table, round down to the next lowest river temperature.**
            - **If the river flow is not an exact match to any river flow on the table, then round down to the next lowest river flow.**
            - **If wet bulb temperature is >30°F, round up to the next highest wet bulb temperature.**
            - **If wet bulb temperature is <30°F, round down to the next lowest wet bulb temperature.**

         c) **Initial tower settings are at the intersection of the wet bulb temperature column and river flow.**

2) **IF UP RIVER TEMPERATURE IS >50°F, THEN refer to the nomographs, Figure 5 through 11, for the present River Temperature plus the River Temperature Correction Factor, Wet Bulb Temperature, and Instantaneous River Thermal Capacity to arrive at the estimated plant setting. These settings are expected to be very conservative.**

c. **To make changes to plant settings refer to the appropriate section of the operating procedure.**

3. **When the schedule for Vernon Hydro will result in a reduction in river flow, the adjustments should be made at least 30 minutes prior to the scheduled Vernon Hydro change, for increases in river flow adjustments should be made after the Vernon Hydro change is complete as follows:**

a. **Determine Instantaneous River Thermal Capacity as follows:**

IRTC = River Flow * (SYS012 - SYS013)

Where: SYS012 = TCRIT River Temp Rise Limit
SYS013 = TCRIT Delta T Margin

b. **Apply the obtained values as follows to obtain estimated settings:**

1) **IF UP RIVER TEMPERATURE IS ≤50°F, THEN refer to Figure 17 for single cooling tower operation or Figure 18 two tower operation as follows:**

a) **Apply Up River Temperature, the River Temperature Correction Factor, the Wet Bulb Temperature, and River Flow to arrive at the estimated plant setting.**

b) **IF the obtained readings are not exact matches for the values on the tables, round the values as follows:**

- **If the river temperature is not an exact match to any table, round down to the next lowest river temperature.**
- **If the river flow is not an exact match to any river flow on the table, then round down to the next lowest river flow.**
- **If wet bulb temperature is >30°F, round up to the next highest wet bulb temperature.**
- **If wet bulb temperature is <30°F, round down to the next lowest wet bulb temperature.**

c) **Initial tower settings are at the intersection of the wet bulb temperature column and river flow.**

2) **IF UP RIVER TEMPERATURE IS >50°F, THEN refer to the nomographs, Figure 5 through 11, for the present River Temperature plus the River Temperature Correction Factor, Wet Bulb Temperature, and Instantaneous River Thermal Capacity to arrive at the estimated plant setting. These settings are expected to be very conservative.**

c. **Record on plant setting change log changes in:**

1) **CW/CWB Pumps**

2) **Number of cooling tower fans**

3) **Gate positions**

CAUTIONS

- **Monitoring of up river temperature is critical to the proper peration of the Project Save, due to the manually inputted numbers for river temperature when river temperature is changing.**
- **When adjusting plant parameters for NPDES compliance, the recirc gate shall not be opened until the cooling towers are placed in service.**
- **During winter operations the recirc gate is routinely positioned to prevent intake structure freezing. However, when adjusting plant parameters for NPDES compliance, the recirc gate should not be repositioned until the cooling towers are placed in service.**

4. **By frequently monitoring the ERFIS trends, adjustments to plant settings can be fine tuned to attain the most desirable output. 30 minutes is required to attain steady state conditions after adjustments are made.**

a. **Margin to TCRIT should be maintained above "0", but because of variances in inputs it may drop below "0" momentarily (ERFIS alarm). Verify that the area of the curve below "0" will be less than the area of the curve above "0" for each hour (HR00 to HR59). Take steps to reduce thermal discharge as necessary to provide sufficient margin to ensure compliance for the hourly Margin to TCRIT.**

b. **Heat Rejected to the River should be maintained below the Instantaneous River Thermal Capacity. This will ensure that the plant does not exceed the river capacity.**

c. **The River Up/Down Temp. Rise should be maintained below the allowable temperature rise from the Precautions/Limitations based on current up river temperature.**

d. **The "TCRIT River Temp. Rise Limit" (point ID 'SYS012') is a manually inputted point that is updated by the operator. As up river temperature increases, SYS012 should be changed ½ degree before reaching the next temperature range. As up river temperature decreases, SYS012 should be changed ½ degree after reaching the next temperature range. For the period October 15 to May 15 TCRIT Temp. Rise Limit is equal to 65F-M036 not to exceed 13.4 ΔT.**

e. **Write a Condition Report for any condition that violates or challenges NPDES limits.**

f. **The "TCRIT Delta T Margin" (point ID 'SYS013') is a manually inputted point that is updated by the operator on direction from Operations Management per Step 5.**

NOTE

If the C278 USGEN RIVER FLOW signal becomes invalid, then a fixed value (SYS010) of 1,250 CFS will be fed into C275 CONN RIVER FLOW. The flow value of SYS010 may be adjusted by Control Room personnel once they are able to obtain the correct river flow from Wilder Dam personnel (802-291-8105). If a microwave signal problem is indicated, additional information regarding the microwave signal problem may be obtained from National Grid (508-389-2441) or Northeast Utilities (860-665-6000).

5. **To change the value of the manually inputted points above perform the following:**

NOTE

Changing the value of manually inputted points may impact the margin to TCRIT.

a. **On the ERFIS computer keyboard, press the 'CAV' button.**

b. **Log in to the User Security Password screen by typing the appropriate password and pressing the Enter key.**

c. **Using the cursor, click on the PTID field.**

d. **At Data Point Selection window, type in appropriate point ID in the Point Search/Text space and then hit 'Find'.**

e. **Verify PTID updated to appropriate Point ID on 'CAV' screen.**

f. **Move cursor to VALUE field and enter new Point ID value. Press enter on the ERFIS computer keyboard.**

g. **Verify computer point updated using CRO alarm typer.**

h. **Record ERFIS point ID, original, and final values on plant setting change log.**

i. **Update appropriate block on plant setting change log.**

j. **Have a second operator verify the as left value of the computer point being changed and make a note on plant setting change log.**

NOTE

If plant conditions require CTF 2-1 use, the fan should be utilized. Starting and stopping should be minimized to prevent excessive wear to breaker contacts.

6. **IF any of the following ERFIS values are unavailable and upstream river temperature is greater than 51.6°F, OR upstream temperature is <51.6°F and river flow is ≤1500 cfs, THEN perform either of the actions below per Operations Manager approval.**

- **USGEN River Flow - C278**
- **River Up/Down Temp Rise - C019**
- **Heat Reject to River - C064**
- **Conn. River Flow - C275**
- **Margin to TCRIT - C276**
- **Instantaneous River Thermal Cap. - C277**
- **Condenser Inlet - F052, F053, F054, F055**
- **Condenser Outlet - F056, F057, F058, F059**
- **East Tower Outlet - F078**
- **West Tower Outlet - F079**

a. **IF the plant is at steady state operation and the circulating water system is in the open cycle, THEN verify river temperature rise is within limits using the following formula:**

$$\Delta T_r = \frac{15.193*(\text{MWt rejected})}{(\text{River flow in cfs})}$$

LPC3

where: **MWt rejected (C051) =** **1912*(%CTP)-generator gross MW**
River flow in cfs = **USGEN River Flow C278 OR**
Conn River Flow C275 OR
Vernon reported flow from Wilder

1) **Independently verify the calculation. (ER991077_05)**

b. **IF the result is not within the ΔT_r limit OR the calculation cannot be performed, THEN place the circulating water system in a hybrid cycle based upon the following assumptions, per Figure 17 for single cooling tower operation or Figure 18 for two cooling tower operation if river temperature is ≤50°F, or nomographs (Figures 5 through 11) if river temperature is >50°F.**

- **1250 cfs river flow**
- **Use last wet bulb temperature, IF within four hours of taking the reading. IF >4 hours have elapsed since taking the reading, THEN obtain actual wet bulb temperature using I&C M&TE equipment or ERFIS point C174, if available.**
- **Obtain river temperature. Use methods in OP 2181, Local Sample Service Water Temperature Monitoring, if normal river temperature indication is not available.**
- **Calculate Instantaneous River Thermal Capacity as follows. For winter operations limit IRTC to ≤16750 cfs- °F.**

  IRTC = 1250 cfs * (65°F – River Temperature)

c. **Adjust tower settings per the appropriate Table. Interpolate as follows:**

1) **Select the table with the appropriate river temperature. If the river temperature is not an exact match to any figure, round down to the next lowest river temperature.**

2) **Select the appropriate river flow. If the river flow is not an exact match to any river flow on the figure, then round down to the next lowest river flow if Figures 17 or 18 are used.**

3) **Select the appropriate IRTC if Figure(s) 5 through 11 are used.**

4) **Select the appropriate wet bulb temperature. If the wet bulb temperature is not an exact match for any wet bulb temperature on Figure 17 or 18, then proceed as follows:**

   - **If wet bulb temperature is >30°F, round up to the next highest wet bulb temperature.**
   - **If wet bulb temperature is <30°F, round down to the next lowest wet bulb temperature.**

5) For Figure 17 or 18 initial tower settings are at the intersection of the wet bulb temperature column and river flow. The information provided is defined as follows:

- Hyb: This means hybrid mode.
- F00: This means fans and the two numbers indicate the number fans required to be running.
- G00: This means recirc gate and the two numbers indicate recirc gate position.
- For example on Figure 17 or 18, an initial setting of Hyb:F22:G03 means circ water in hybrid mode, 22 fans in service, and the recirc gate set to 3% open.

6) For Figure 5 through 11 make initial tower settings per the nomograph.

d. Document calculation and results on plant setting change log form VYOPF 2180.05, to maintain a copy of the calculation for review by the Environmental Engineer at a later date.

NOTE

Plant Setting Change Log must be completed daily. (ER981657_02)

7. Maintain Plant Setting Change Log as follows:

a. Daily, at 0000, record the following:

- River Temperature Correction Factor (supplied by Operations management)
- M036 ("UPRIVER TEMPERATURE")
- SYS010 ("USGEN RIVER FLOW C278," CFS),
- SYS012 ("TCRIT RIVER TEMP RISE LIMIT," DEGF), and
- SYS013 ("TCRIT DELTAT MARGIN," DEGF) (supplied by Operations Management)
- C275 (CONN RIVER FLOW)
- C278 (USGEN RIVER FLOW)

b. **Log any of the following:**

- **Major changes to Plant settings (system mode, number of operating fans, recirc gate position).**
- **Plant settings based on anticipated Vernon Dam load changes per Step 3.**
- **Unannounced Vernon schedule changes.**
- **Other information pertinent to plant settings.**
- **Changes in manually inputted data per Step 5 above.**
- **When the OATC is relieved, the oncoming OATC signs into the log using the current shift position turnover icon.**

c. **If plant conditions exist that cause concern about Margin to TCrit for any given hour, perform the following:**

1) **Print Trend 72 graph as close to the hour as possible to include the entire hour in question (HR 00 to HR 59).**

2) **Attach graph to log.**

d. **At midnight each day, perform the following:**

1) **Calculate the number of hours the cooling towers were operated that day, to the nearest whole hour.**

a) **Log the number as part of the last log entry for that day "total for the day."**

2) **Calculate "running total for the month" by adding "total for the day" at 2400 to the 0000 "running total for the month" and log this number in the last entry for that day as well as the first entry for the next day. The "running total for the month" will be returned to zero at 0000 on the first day of each month. (See example below.)**

	143	"running total for the month"
	+16	"total for the day"
entry at 2400 &		
next day entry at 0000	159	"running total for the month"

3) **Turn over the log. SM/CRS approve the log. Print an official copy of the log.**

4) **Print a copy of the following and attach to previous day's log:**

- **Trend 70**
- **Trend 71**

5) **Forward previous day's log and trend graphs to Operations Administrative Assistant.**

8. **The control room operator will fill out form VYOPF 0150.03A, CRO Round Turnover Sheet, to document component failures of equipment associated with Project Save that cause actions to be taken to change plant settings. Changes to plant settings shall be documented on VYOPF 2180.05, PLANT SETTING CHANGE LOG. Out of service components shall be maintained on VYOPF 0150.03A until component is returned to service.**

a. **If the network/software becomes unavailable, perform the following:**

1) **Maintain the log on VYOPF 2180.05.**

2) **Submit a Condition Report.**

3) **When the log software has been restored, enter the log in the software in a timely manner.**

9. **Listing of Project Save ERFIS Computer Points**

POINT ID	DESCRIPTION	UNITS
C019	RIVER DOWN/UP TEMP RISE	F
C051	COND HEAT REJECTION	MW
C064	HEAT REJECT TO RIVER	CFSF
C102	NUMBER OF CIRC WATER PUMPS ON	
C103	NUMBER OF CIRC BOOST PUMPS ON	
C275	CONN RIVER FLOW	CFS
C276	MARGIN TCRIT	DEG F
C277	INST RIVER THERMAL CAPACITY	CFSF
C278	USGEN RIVER FLOW	CFS
F052	CONDENSER 1A CIRC WATER INLET	DEG F
F053	CONDENSER 2A CIRC WATER INLET	DEG F
F054	CONDENSER 1B CIRC WATER INLET	DEG F
F055	CONDENSER 2B CIRC WATER INLET	DEG F
F056	CONDENSER 1A CIRC WATER OUTLET	DEG F
F057	CONDENSER 2A CIRC WATER OUTLET	DEG F
F058	CONDENSER 1B CIRC WATER OUTLET	DEG F
F059	CONDENSER 2B CIRC WATER OUTLET	DEG F
F078	CIRC WATER OUT COOLING TOWER A	DEG F
F079	CIRC WATER OUT COOLING TOWER B	DEG F
F084	CW INTAKE GATE A POSITION	
F089	CW INTAKE GATE B POSITION	
F090	CW INTAKE GATE C POSITION	
F085	CW RECIRC GATE POSITION	
M036	UP RIVER TEMPERATURE	DEG F
M037	DOWN RIVER TEMPERATURE	DEG F
SYS010*	USGEN RIVER FLOW C278	CFS
SYS012*	TCRIT RIVER TEMP RISE LIMIT	DEG F
SYS013*	TCRIT DELTA T MARGIN	DEG F

*** Manually entered per Operations Management's Direction]**

COOLING TOWER CHECKLIST

		INITIAL/DATE
1.	Construction work on cooling towers complete.	____/____
2.	Maintenance on CWB pumps complete; pumps are operable.	____/____
3.	Maintenance on CWB pump ACBs complete.	____/____
4.	New seal water filters installed for CWB pumps, spare filters available.	____/____
5.	Intake, recirc and bypass gates are operable.	____/____
6.	Preventive maintenance on cooling tower fans scheduled for completion during initial tower wetting (oil samples, vibration readings and amp readings).	____/____
7.	Instrumentation calibrated and operable to support cooling tower operations.	____/____
8.	Hypochlorite and acid systems available for pH control and chlorination.	____/____
9.	CW system WRs and tagging orders reviewed for impact.	____/____
10.	Fan Balancing completed if required; fans are operable.	____/____
11.	Initial tower wetting performed prior to normal cooling tower operation.	____/____

Comments/Exceptions:

Checklist Completed:_____ _____
Print/Sign Date

PLANT SETTING CHANGE LOG

Date:_____

C275 CONN RIVER FLOW		SYS013 TCRIT DELTAT MARGIN	
C278 USGEN RIVER FLOW		M036 UP RIVER TEMPERATURE	
SYS010 (C278 USGEN RIVER FLOW)		RIVER TEMPERATURE CORRECTION FACTOR	
SYS012 TCRIT RIVER TEMP RISE LIMIT		M036 + RIVER TEMPERATURE CORRECTION FACTOR	
RIVER TEMPERATURE (CIRCLE ONE)		INCREASING STEADY DECREASING	

TIME	ENTRY	INITIALS

0500 RO _____ CRS _____ SM_____
(Print/Sign) (Print/Sign) (Print/Sign)

1700 RO _____ CRS _____ SM_____
(Print/Sign) (Print/Sign) (Print/Sign)

FIGURE 1

HYDRAULIC GATE DIRECTIONAL CONTROL VALVE

INSERT PHILLIPS SCREWDRIVER INTO THE APPROPRIATE DIRECTIONAL CONTROL VALVE TO RE-POSITION GATE:

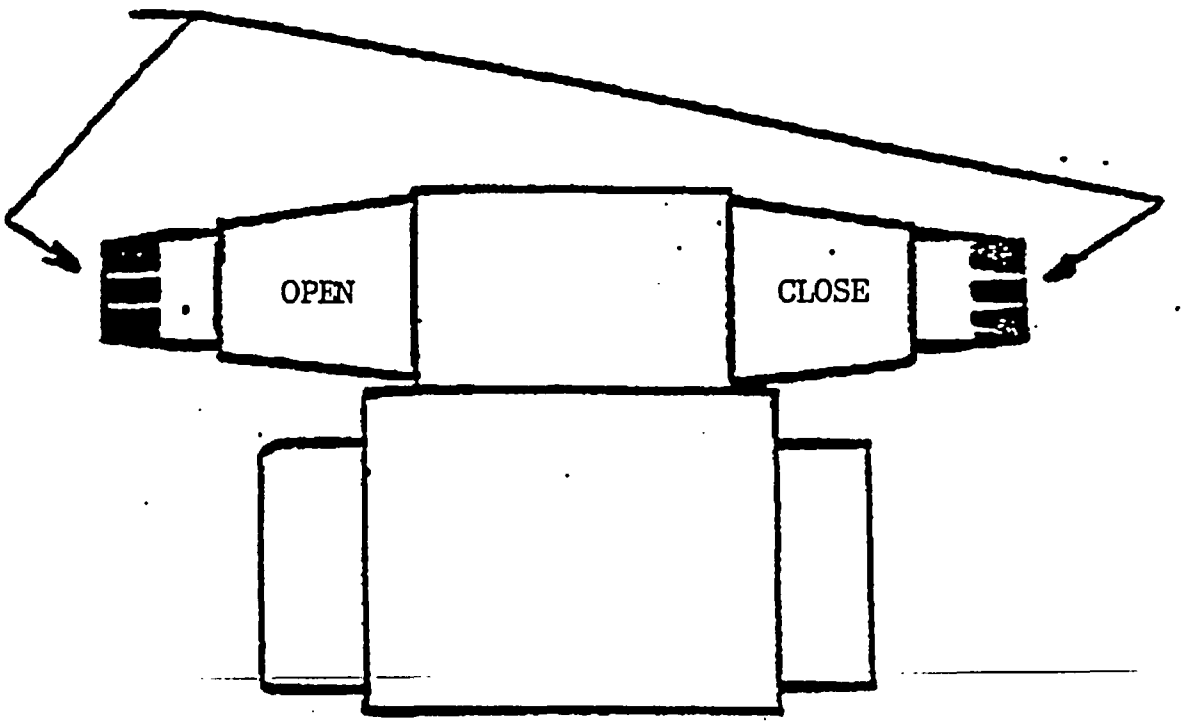

FIGURE 2
GENERAL ELECTRIC PSYCHROMETRIC CHART

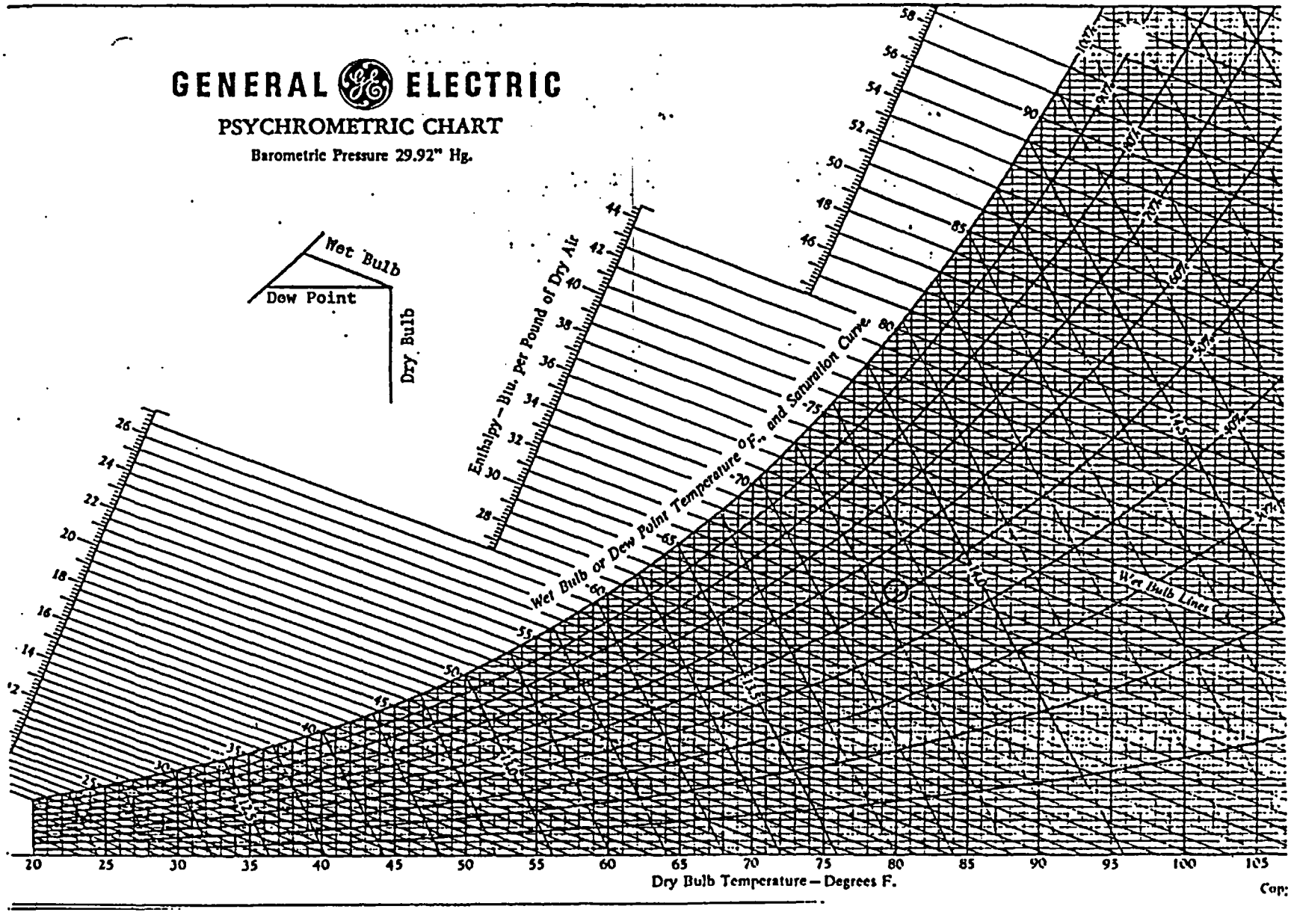

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FIGURE 3

WET BULB TEMPERATURE (F) BASED ON DRY BULB (F) AND DEW POINT (F) TEMPERATURES

Dry Bulb	Dew Point																												
	10	20	25	30	35	40	45	50	52	54	56	58	60	62	64	66	68	70	72	74	76	78	80	82	84	86	88	90	95
10	10																												
20	18	20																											
25	21	24	25																										
30	24	27	28	30																									
35	27	30	31	33	35																								
40	30	33	34	36	38	40																							
45	33	35	37	38	40	43	45																						
50	36	38	39	41	43	45	47	50																					
52	38	39	41	42	44	46	48	51	52																				
54	39	40	42	43	45	47	49	52	53	54																			
56	40	42	43	44	46	48	50	52	54	55	56																		
58	41	43	44	45	47	48	51	53	54	56	57	58																	
60	42	44	45	46	48	49	52	54	55	56	58	59	60																
62	44	45	46	47	49	50	52	55	56	57	58	59	61	62															
64	45	46	47	48	50	51	53	56	57	58	59	60	61	63	64														
66	46	47	48	49	51	52	54	56	57	58	60	61	62	63	65	66													
68	47	48	49	50	52	53	55	57	58	59	60	61	63	64	65	67	68												
70	48	50	50	52	53	54	56	58	59	60	61	62	63	64	66	67	69	70											
72	50	51	52	53	54	55	57	59	60	61	62	63	64	65	66	68	69	71	72										
74	51	52	53	54	55	56	58	60	61	61	62	63	65	66	67	68	70	71	73	74									
76	52	53	54	55	56	57	59	61	61	62	63	64	65	66	68	69	70	72	73	75	76								
78	53	54	55	56	57	58	60	61	62	63	64	65	66	67	68	69	71	72	73	75	77	78							
80	54	56	56	57	58	59	61	62	63	64	65	66	67	68	69	70	71	72	74	75	77	79	80						
82	56	57	57	58	59	60	62	63	64	65	66	66	67	68	69	71	72	73	74	76	77	79	81	82					
84	57	58	59	59	60	61	63	64	65	66	66	67	68	69	70	71	72	74	75	76	78	79	81	83	84				
86	58	59	60	60	61	62	64	65	66	67	67	68	69	70	71	72	73	74	75	77	78	80	81	83	85	86			
88	59	60	61	62	62	63	65	66	67	67	68	69	70	71	72	73	74	75	76	77	79	80	81	83	85	87	88		
90	61	61	62	63	64	65	66	67	68	68	69	70	71	71	72	73	74	75	77	78	79	80	82	83	85	87	89	90	
95	64	65	65	66	66	67	68	70	70	71	71	72	73	73	74	75	76	77	78	79	80	82	83	84	86	87	89	91	95
100	67	68	68	69	69	70	71	72	73	73	74	74	75	76	76	77	78	79	80	81	82	83	84	85	87	88	90	91	96

Note: Above values based on following equation from EPA Report #16130FDQ by Thackston, E.L. and F.L. Parker of Vanderbilt University in Nashville, TN entitled "Effect of Geographical Location on Cooling Pond Requirements and Performance," published March 1971.

Wet Bulb = Dry Bulb x (0.655 + 0.36 x exp[9500.8 x ([1/(460+Dry Bulb)]-[1/(460+Dew Point)])])

FIGURE 4

90% EXCEEDENCE VALUES FOR WET BULB TEMPERATURE EXTRAPOLATION

FIGURE 4

90% EXCEEDENCE VALUES FOR WET BULB TEMPERATURE EXTRAPOLATION

Lead Time (hrs)	Present Time																							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
1	2.0	2.2	2.4	2.7	3.0	3.3	3.6	3.8	3.9	4.0	4.0	3.9	3.8	3.6	3.3	3.0	2.7	2.4	2.2	2.0	1.8	1.8	1.8	1.8
2	2.1	2.6	3.1	3.7	4.3	4.8	5.3	5.6	5.8	5.9	5.8	5.6	5.3	4.8	4.3	3.7	3.1	2.6	2.1	1.8	1.5	1.5	1.5	1.8
3	2.2	2.9	3.7	4.6	5.4	6.2	6.8	7.2	7.4	7.4	7.2	6.8	6.2	5.4	4.6	3.7	2.9	2.2	1.5	1.1	0.9	0.9	1.1	1.5
4	2.6	3.6	4.7	5.9	6.9	7.8	8.5	8.9	9.0	8.9	8.5	7.8	6.9	5.9	4.7	3.6	2.6	1.7	1.0	0.6	0.4	0.6	1.0	1.7
5	3.3	4.6	6.0	7.3	8.5	9.4	10.1	10.5	10.5	10.1	9.4	8.5	7.3	6.0	4.6	3.3	2.1	1.1	0.5	0.1	0.1	0.5	1.1	2.1
6	4.2	5.8	7.3	8.8	10.1	11.0	11.6	11.8	11.6	11.0	10.1	8.8	7.3	5.8	4.2	2.7	1.5	0.5	-0.1	-0.3	-0.1	0.5	1.5	2.7
7	5.3	7.0	8.8	10.3	11.6	12.5	12.9	12.9	12.5	11.6	10.3	8.8	7.0	5.3	3.5	2.0	0.7	-0.1	-0.6	-0.6	-0.1	0.7	2.0	3.5
8	6.5	8.4	10.2	11.8	13.0	13.7	14.0	13.7	13.0	11.8	10.2	8.4	6.5	4.6	2.8	1.2	0.1	-0.7	-0.9	-0.7	0.1	1.2	2.8	4.6
9	7.9	9.9	11.7	13.1	14.2	14.7	14.7	14.2	13.1	11.7	9.9	7.9	5.8	3.8	2.0	0.5	-0.5	-1.0	-1.0	-0.5	0.5	2.0	3.8	5.8
10	9.3	11.3	13.0	14.3	15.1	15.4	15.1	14.3	13.0	11.3	9.3	7.1	5.0	3.0	1.2	-0.1	-0.9	-1.2	-0.9	-0.1	1.2	3.0	5.0	7.1
11	10.6	12.5	14.1	15.2	15.8	15.8	15.2	14.1	12.5	10.6	8.5	6.2	4.1	2.2	0.6	-0.5	-1.1	-1.1	-0.5	0.6	2.2	4.1	6.2	8.5
12	11.8	13.6	15.0	15.9	16.1	15.9	15.0	13.6	11.8	9.8	7.5	5.3	3.2	1.5	0.1	-0.8	-1.1	-0.8	0.1	1.5	3.2	5.3	7.5	9.8
13	12.9	14.5	15.6	16.1	16.1	15.6	14.5	12.9	11.0	8.8	6.6	4.4	2.5	0.9	-0.2	-0.8	-0.8	-0.2	0.9	2.5	4.4	6.6	8.8	11.0
14	13.7	15.0	15.8	16.1	15.8	15.0	13.7	12.0	10.0	7.8	5.7	3.7	1.9	0.6	-0.2	-0.5	-0.2	0.6	1.9	3.7	5.7	7.8	10.0	12.0
15	14.2	15.2	15.8	15.8	15.2	14.2	12.7	10.9	8.9	6.9	4.8	3.1	1.6	0.5	0.0	0.0	0.5	1.6	3.1	4.8	6.9	8.9	10.9	12.7
16	14.4	15.1	15.4	15.1	14.4	13.2	11.7	9.9	7.9	6.0	4.2	2.7	1.5	0.7	0.5	0.7	1.5	2.7	4.2	6.0	7.9	9.9	11.7	13.2
17	14.3	14.8	14.8	14.3	13.4	12.1	10.6	8.9	7.1	5.4	3.8	2.6	1.7	1.2	1.2	1.7	2.6	3.8	5.4	7.1	8.9	10.6	12.1	13.4
18	13.9	14.1	13.9	13.3	12.3	11.1	9.6	8.0	6.5	5.0	3.7	2.8	2.2	2.0	2.2	2.8	3.7	5.0	6.5	8.0	9.6	11.1	12.3	13.3
19	13.3	13.3	12.9	12.2	11.3	10.1	8.8	7.4	6.1	4.9	3.9	3.3	2.9	2.9	3.3	3.9	4.9	6.1	7.4	8.8	10.1	11.3	12.2	12.9
20	12.4	12.3	11.9	11.2	10.3	9.3	8.1	7.0	6.0	5.1	4.4	4.0	3.8	4.0	4.4	5.1	6.0	7.0	8.1	9.3	10.3	11.2	11.9	12.3
21	11.5	11.3	10.8	10.2	9.5	8.6	7.8	7.0	6.2	5.6	5.2	4.9	4.9	5.2	5.6	6.2	7.0	7.8	8.6	9.5	10.2	10.8	11.3	11.5
22	10.4	10.2	9.8	9.4	8.8	8.3	7.7	7.2	6.7	6.3	6.1	6.0	6.1	6.3	6.7	7.2	7.7	8.3	8.8	9.4	9.8	10.2	10.4	10.5
23	9.4	9.3	9.0	8.8	8.5	8.2	7.9	7.7	7.5	7.3	7.2	7.2	7.3	7.5	7.7	7.9	8.2	8.5	8.8	9.0	9.3	9.4	9.5	9.5
24	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5	8.5
25	7.8	8.0	8.2	8.5	8.8	9.1	9.3	9.5	9.7	9.8	9.8	9.7	9.5	9.3	9.1	8.8	8.5	8.2	8.0	7.8	7.6	7.5	7.5	7.6
26	7.3	7.8	8.3	8.9	9.4	10.0	10.4	10.8	11.0	11.1	11.0	10.8	10.4	10.0	9.4	8.9	8.3	7.8	7.3	6.9	6.7	6.6	6.7	6.9
27	7.1	7.8	8.7	9.5	10.3	11.1	11.7	12.1	12.4	12.4	12.1	11.7	11.1	10.3	9.5	8.7	7.8	7.1	6.5	6.0	5.8	5.8	6.0	6.5
28	7.2	8.2	9.3	10.4	11.5	12.4	13.1	13.5	13.6	13.5	13.1	12.4	11.5	10.4	9.3	8.2	7.2	6.3	5.6	5.2	5.0	5.2	5.6	6.3
29	7.5	8.8	10.2	11.5	12.7	13.7	14.3	14.7	14.7	14.3	13.7	12.7	11.5	10.2	8.8	7.5	6.3	5.3	4.7	4.3	4.3	4.7	5.3	6.3
30	8.1	9.7	11.3	12.8	14.0	15.0	15.6	15.8	15.6	15.0	14.0	12.8	11.3	9.7	8.1	6.7	5.4	4.5	3.8	3.6	3.8	4.5	5.4	6.7
36	14.8	16.6	18.0	18.8	19.1	18.8	18.0	16.6	14.8	12.7	10.5	8.3	6.2	4.4	3.1	2.2	1.9	2.2	3.1	4.4	6.2	8.3	10.5	12.7
48	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7	10.7

EXAMPLE:

Problem –† Estimation of maximum wet bulb needed for time period from 1100 to 2100

Present Conditions –† Time, 1000; Wet Bulb, 57.3°F

Predictions –† Maximum correction from 1 to 11 hours from present time is 10.3°F

Wet bulb not exceeded 90% of the time from 1100 to 2100 is 67.6°F

FIGURE 5

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 50.0-54.9°F

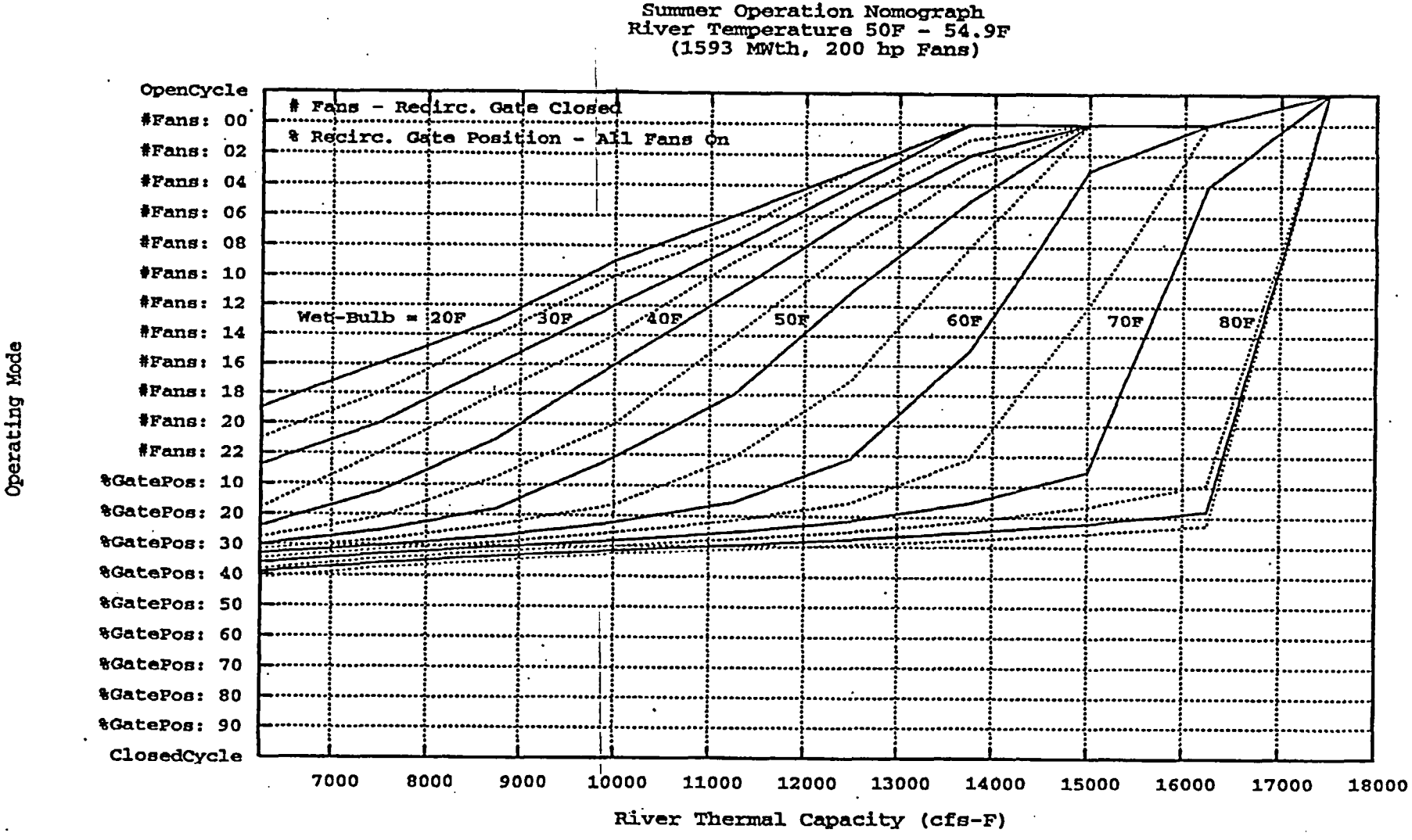

FIGURE 5 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 50°F – 54.9 °F
(1912 MWth, 200 hp Fans)]

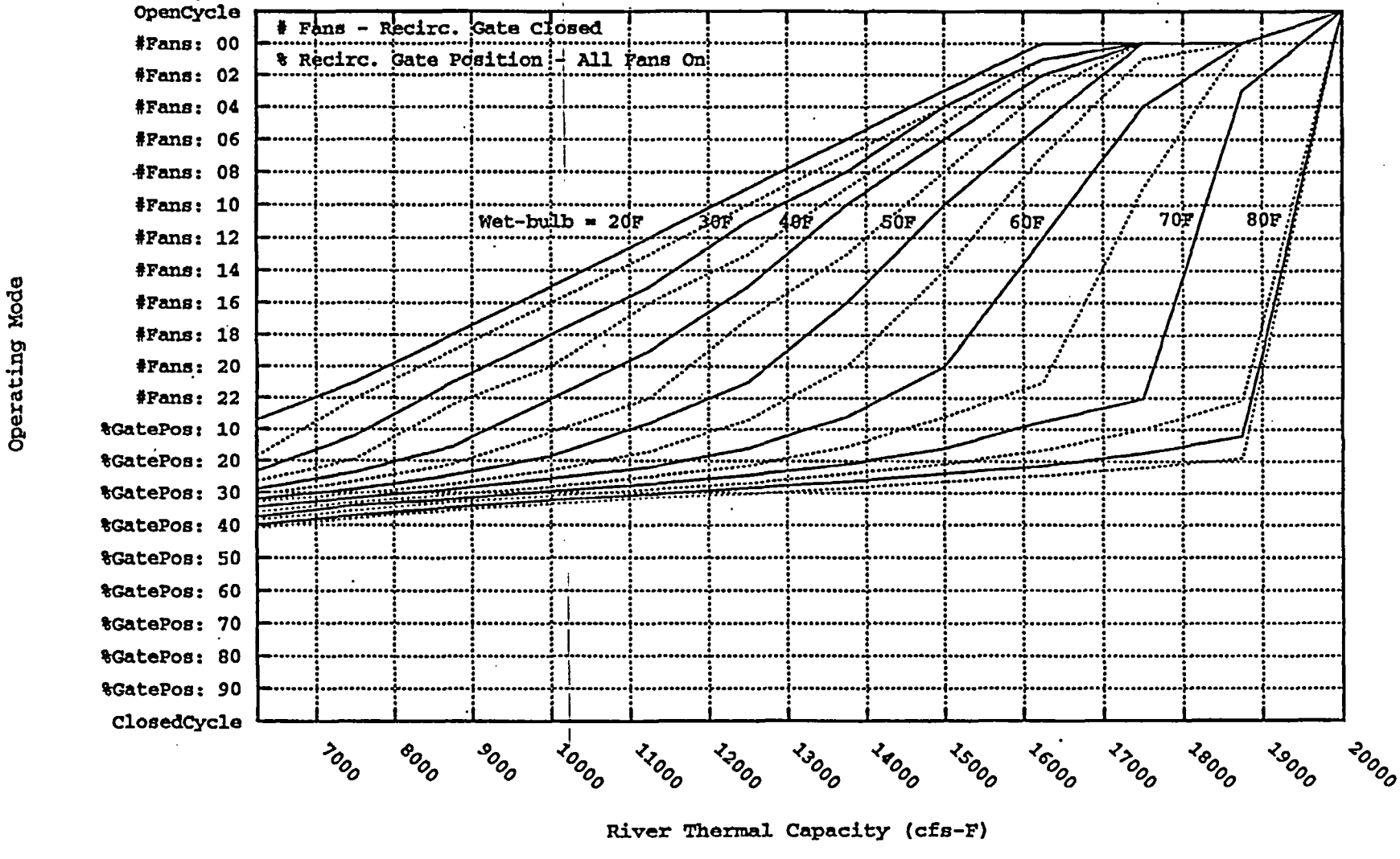

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FIGURE 5 (Continued)

Summer Derate Nomograph
River Temperature 50°F – 54.9 °F
(1912 MWth, 200 hp Fans)]

NO DERATE REQUIRED

FIGURE 6

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 55.0-58.9°F

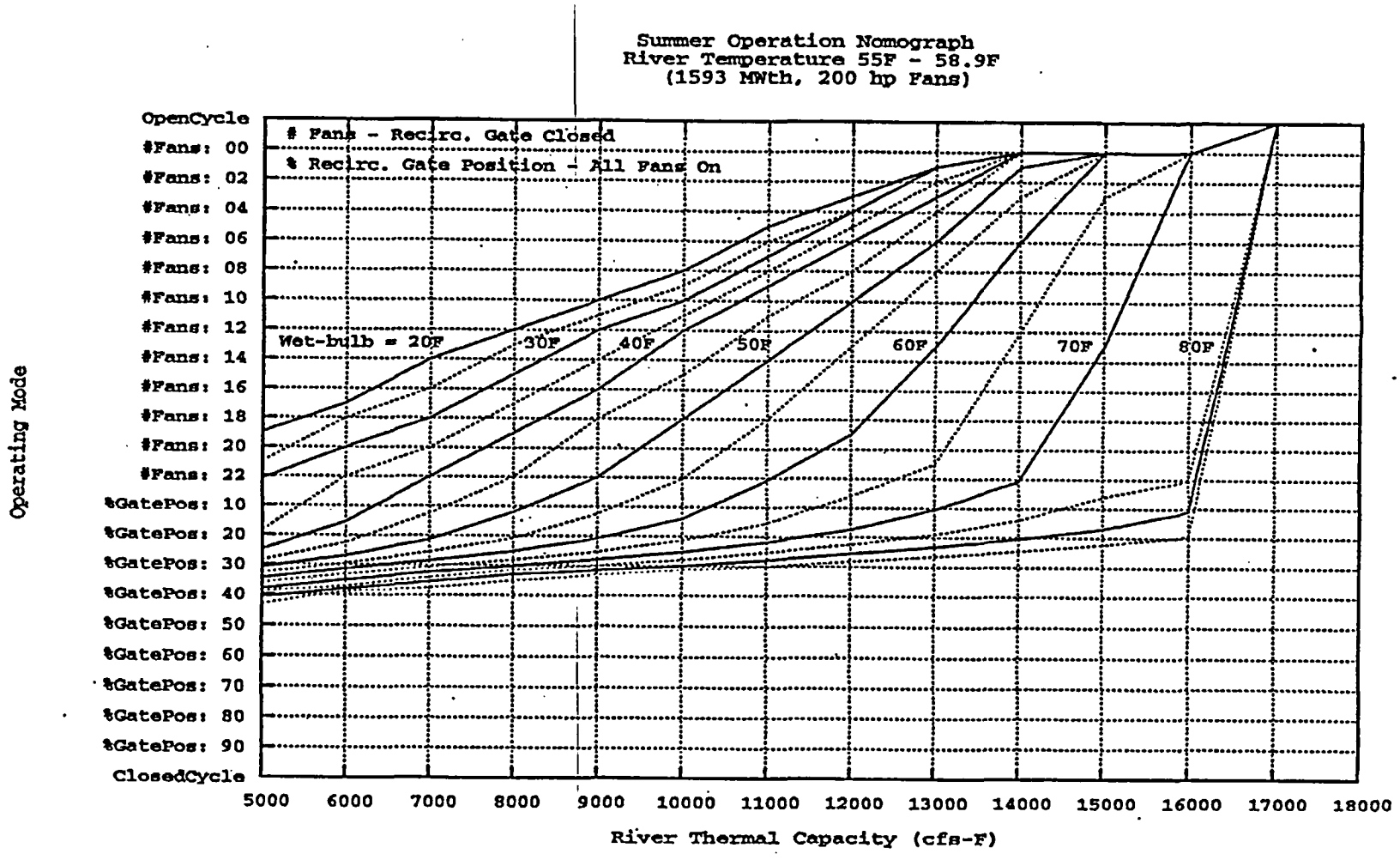

FIGURE 6 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 55°F – 58.9 °F
(1912 MWth, 200 hp Fans)]

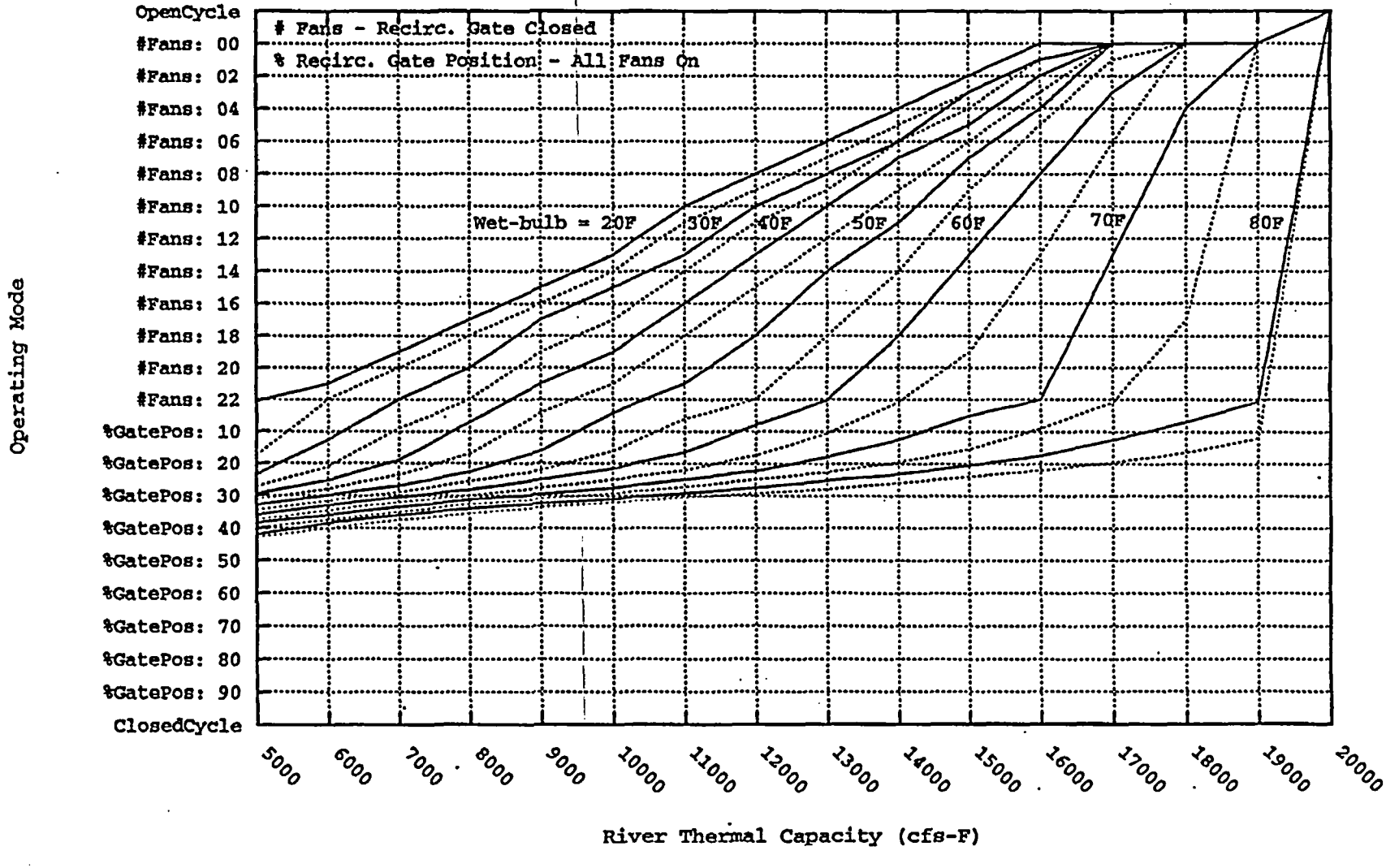

FIGURE 6 (Continued)

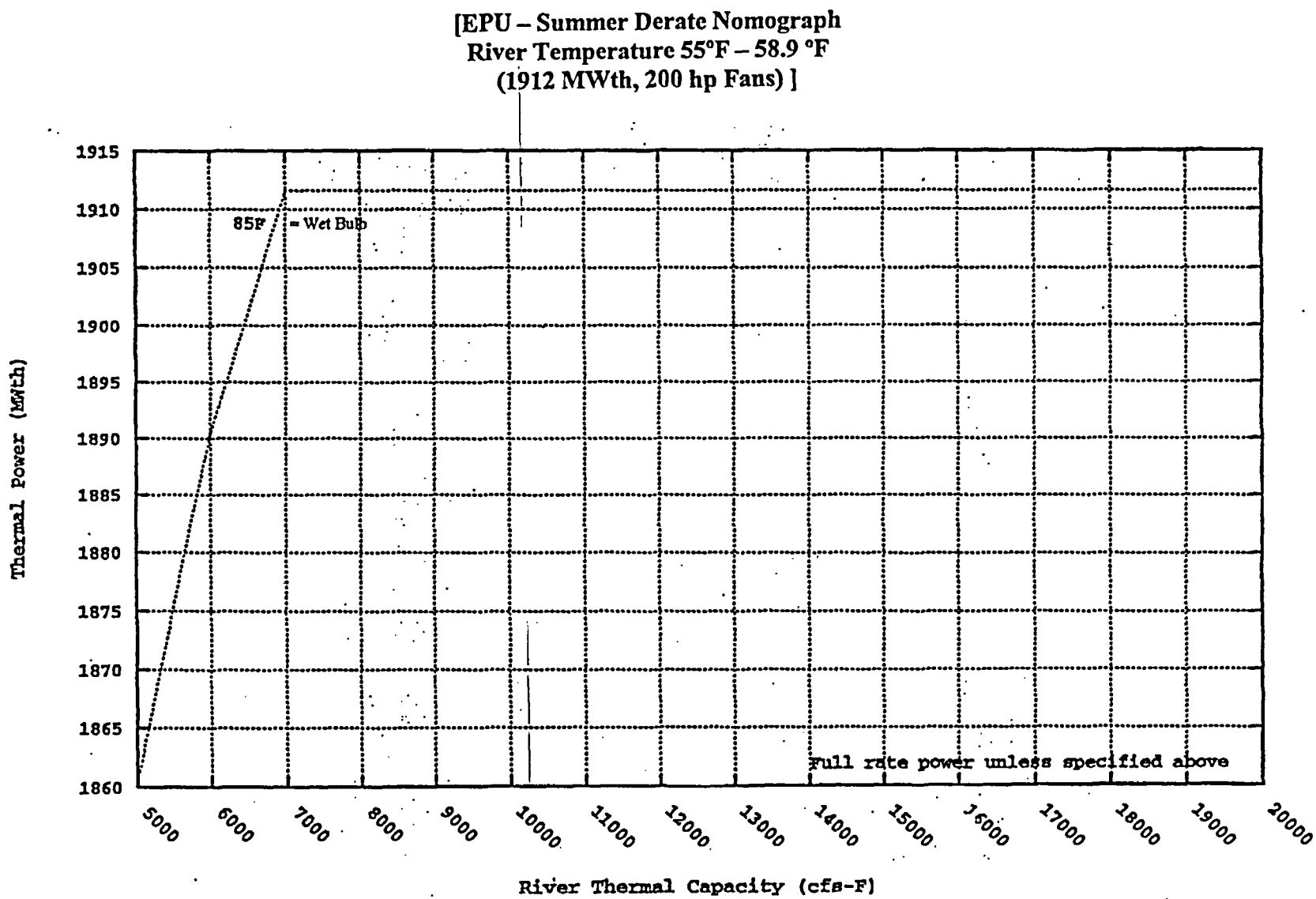

FIGURE 7

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 59.0-62.9°F

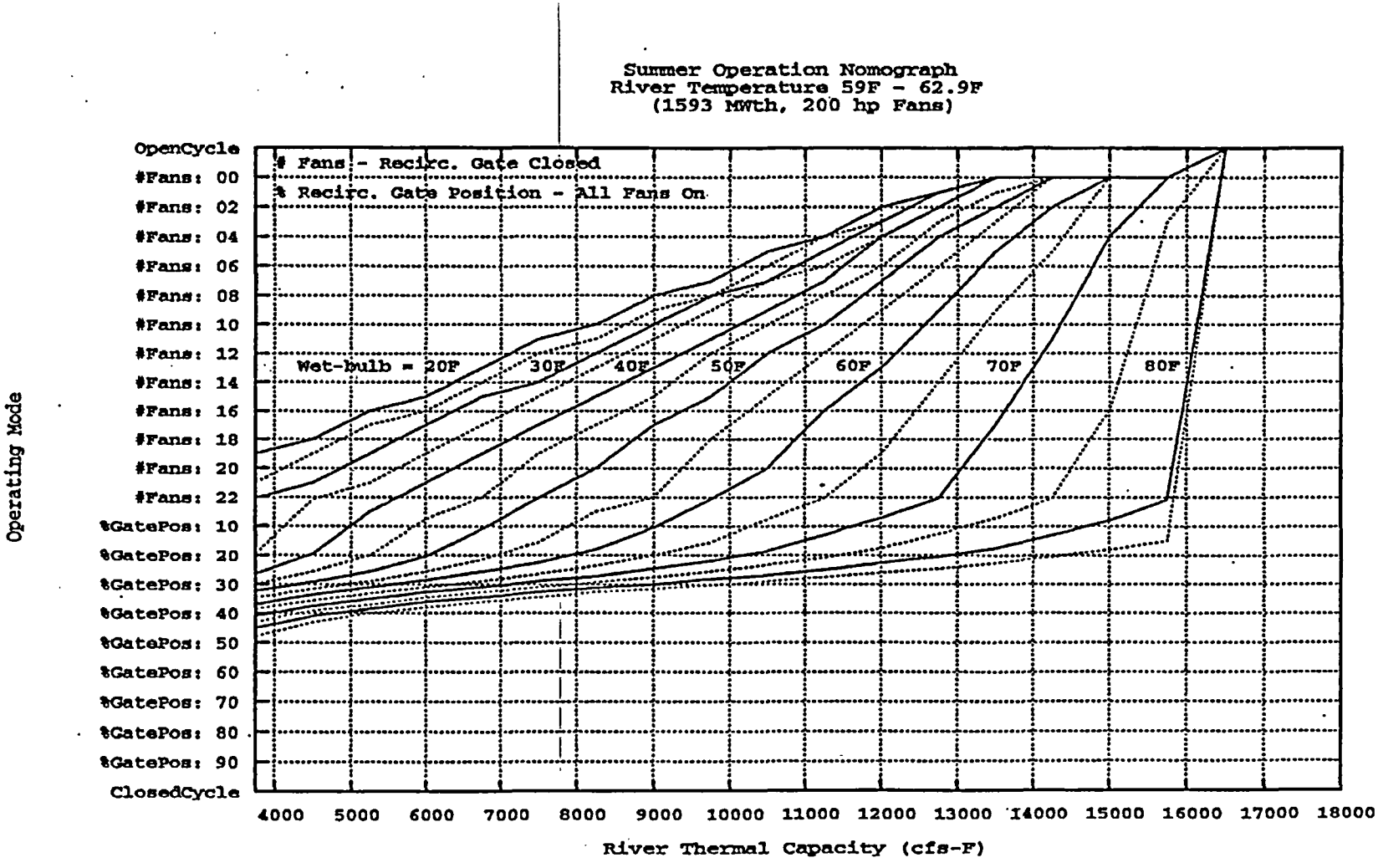

FIGURE 7 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 59°F – 62.9 °F
(1912 MWth, 200 hp Fans)]

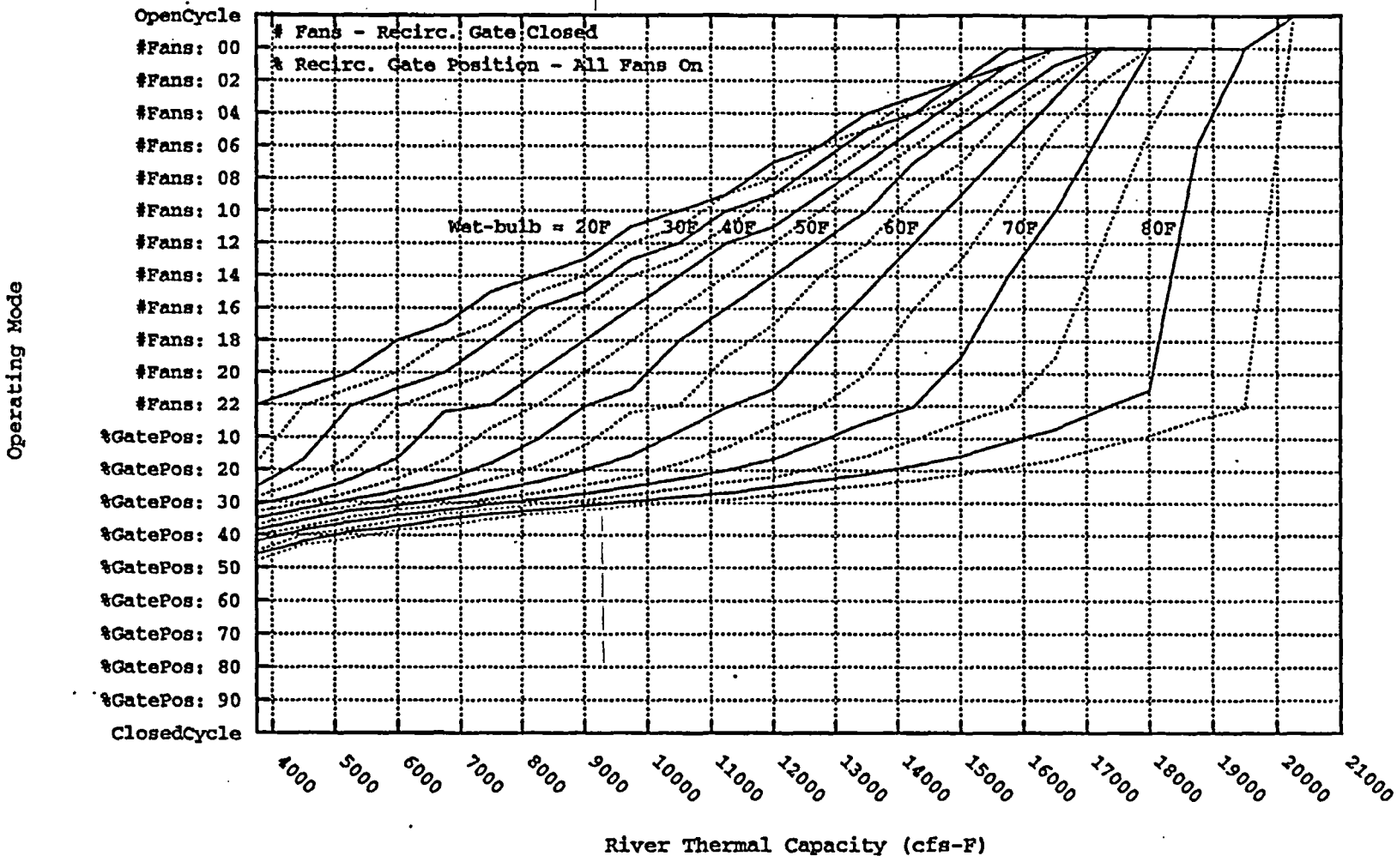

FIGURE 7 (Continued)

[EPU – Summer Derate Nomograph
River Temperature 59°F – 62.9 °F
(1912 MWth, 200 hp Fans)]

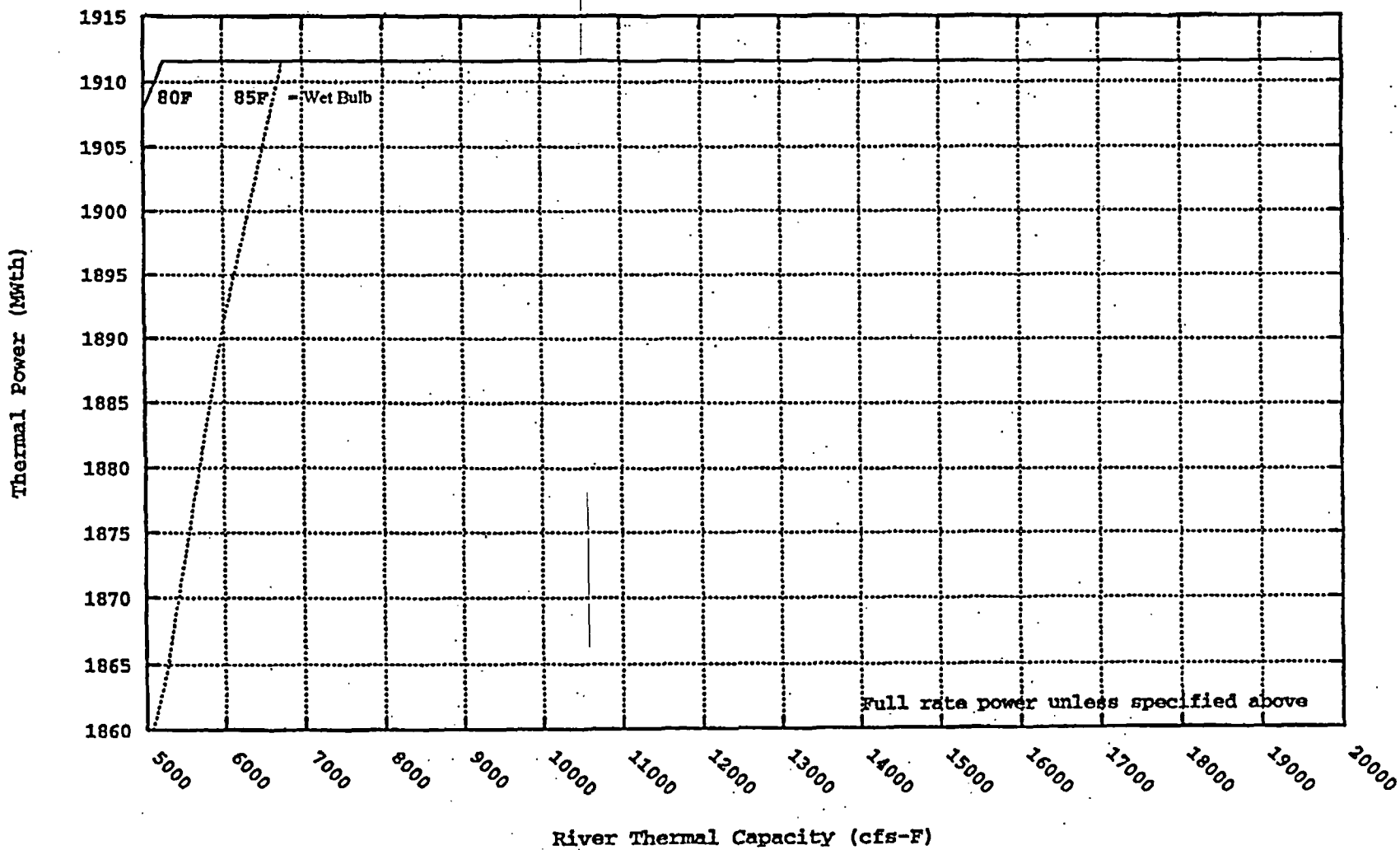

FIGURE 8

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 63.0-65.9°F

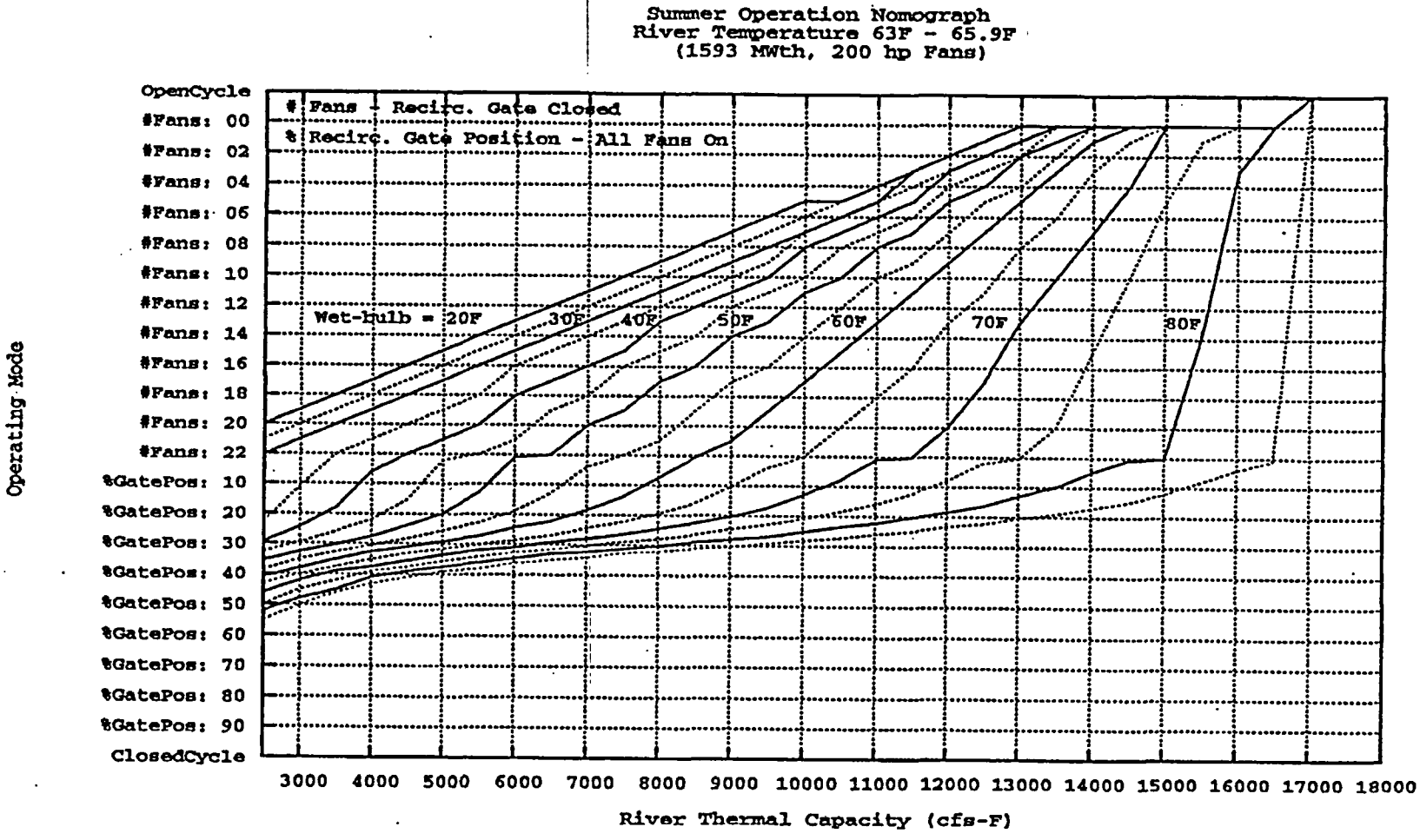

FIGURE 8 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 63°F – 65.9 °F
(1912 MWth, 200 hp Fans)]

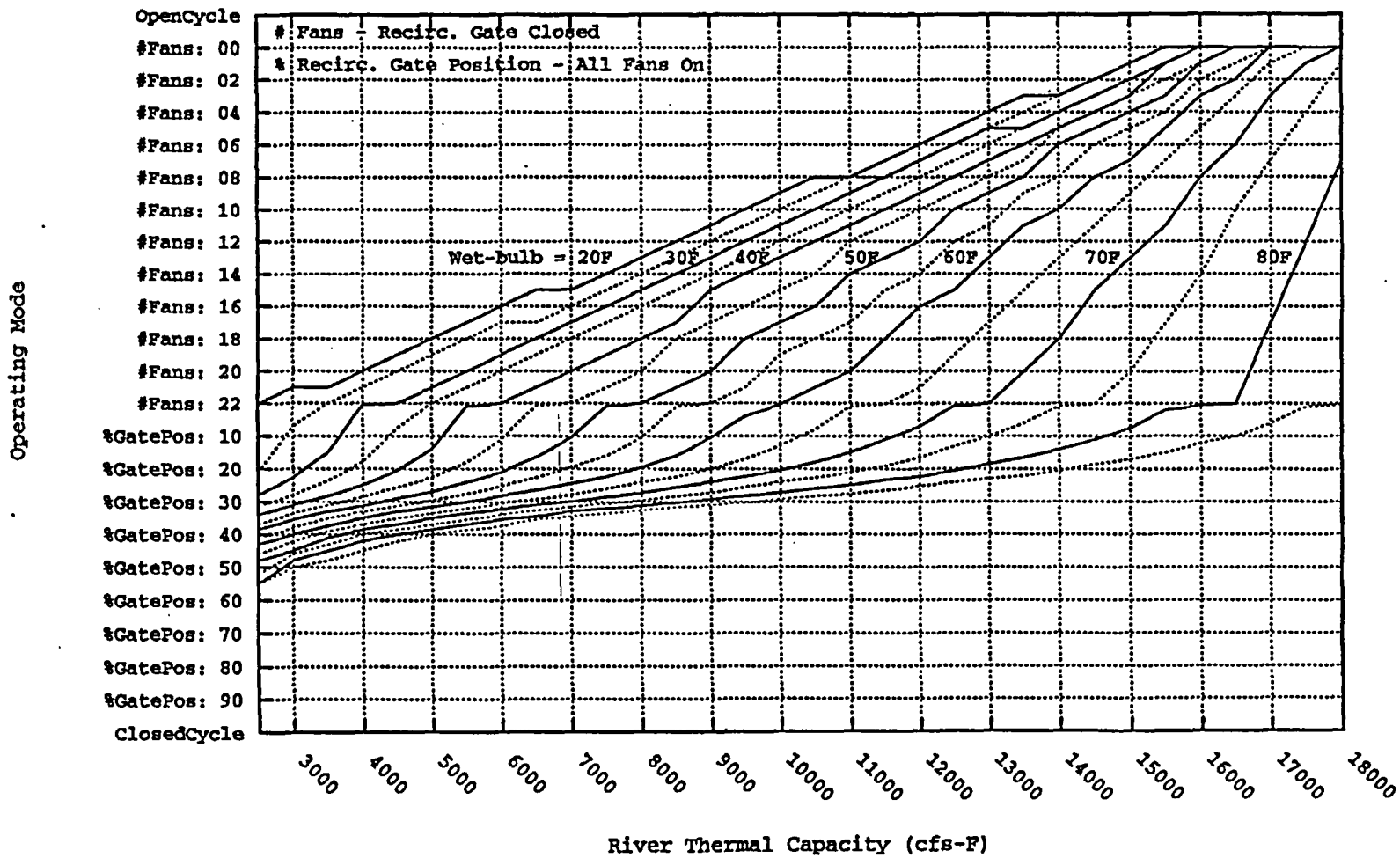

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FIGURE 8 (Continued)

[EPU – Summer Derate Nomograph
River Temperature 63°F – 65.9 °F
(1912 MWth, 200 hp Fans)]

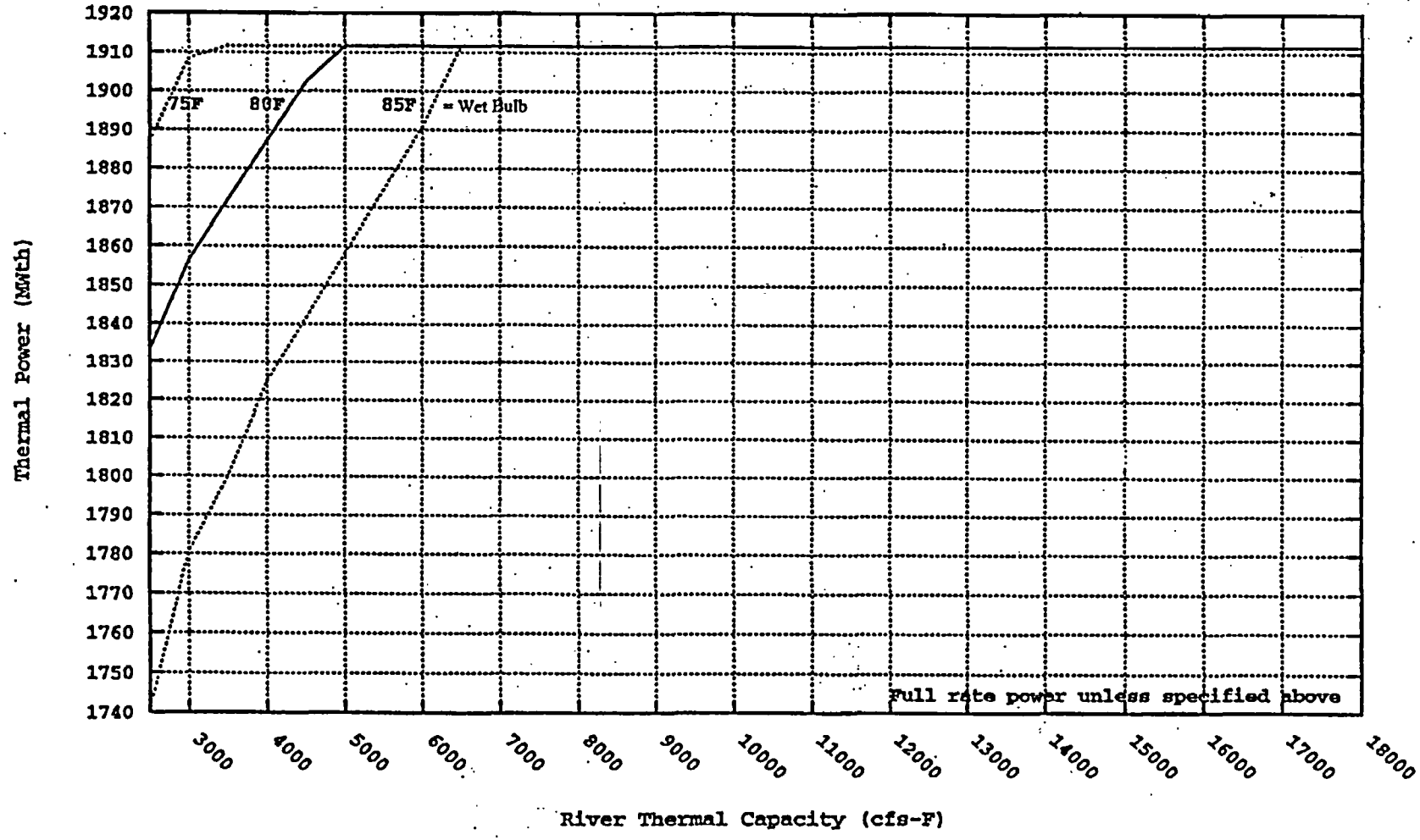

FIGURE 9

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 66.0-69.9°F

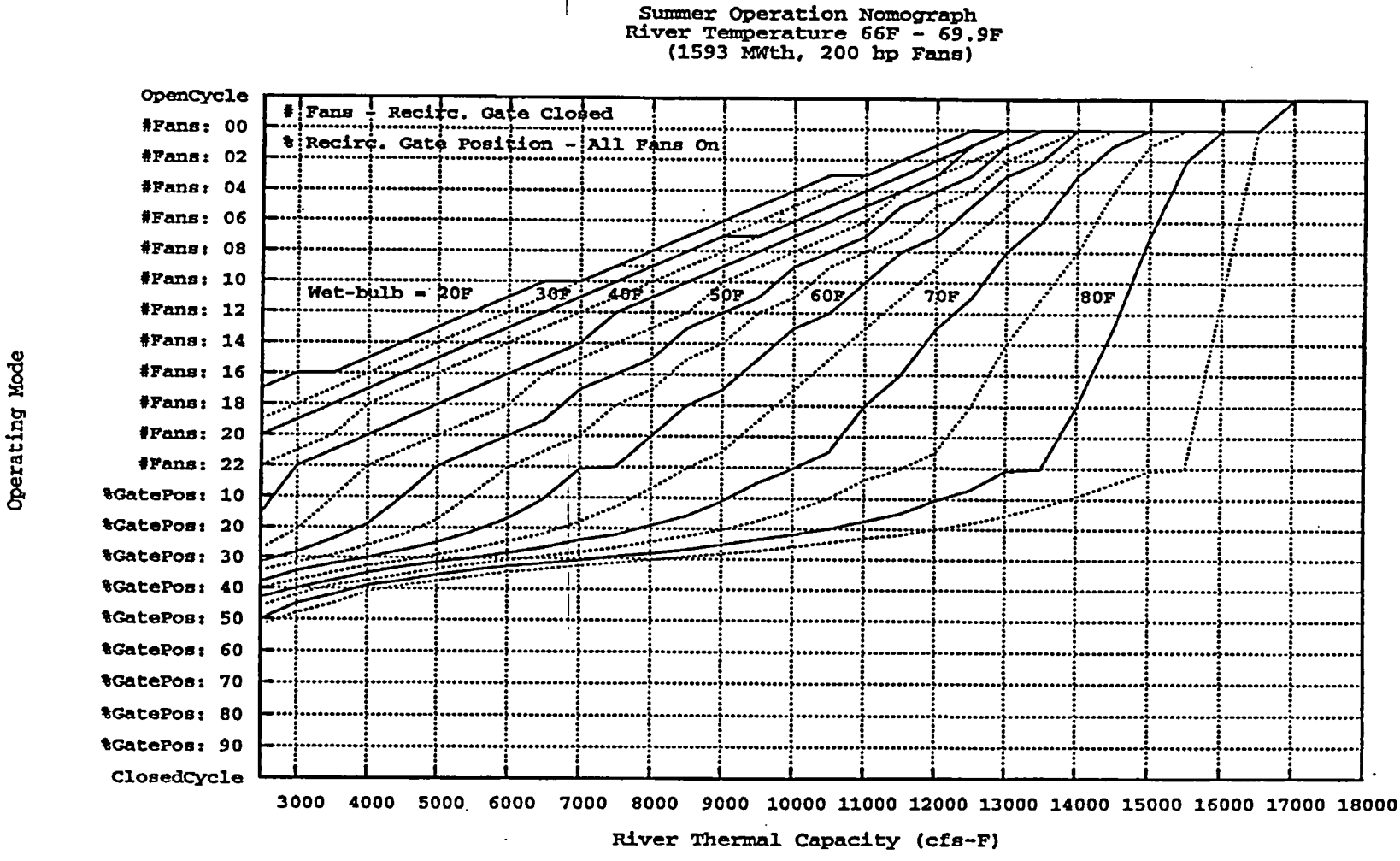

FIGURE 9 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 66°F – 69.9 °F
(1912 MWth, 200 hp Fans)]

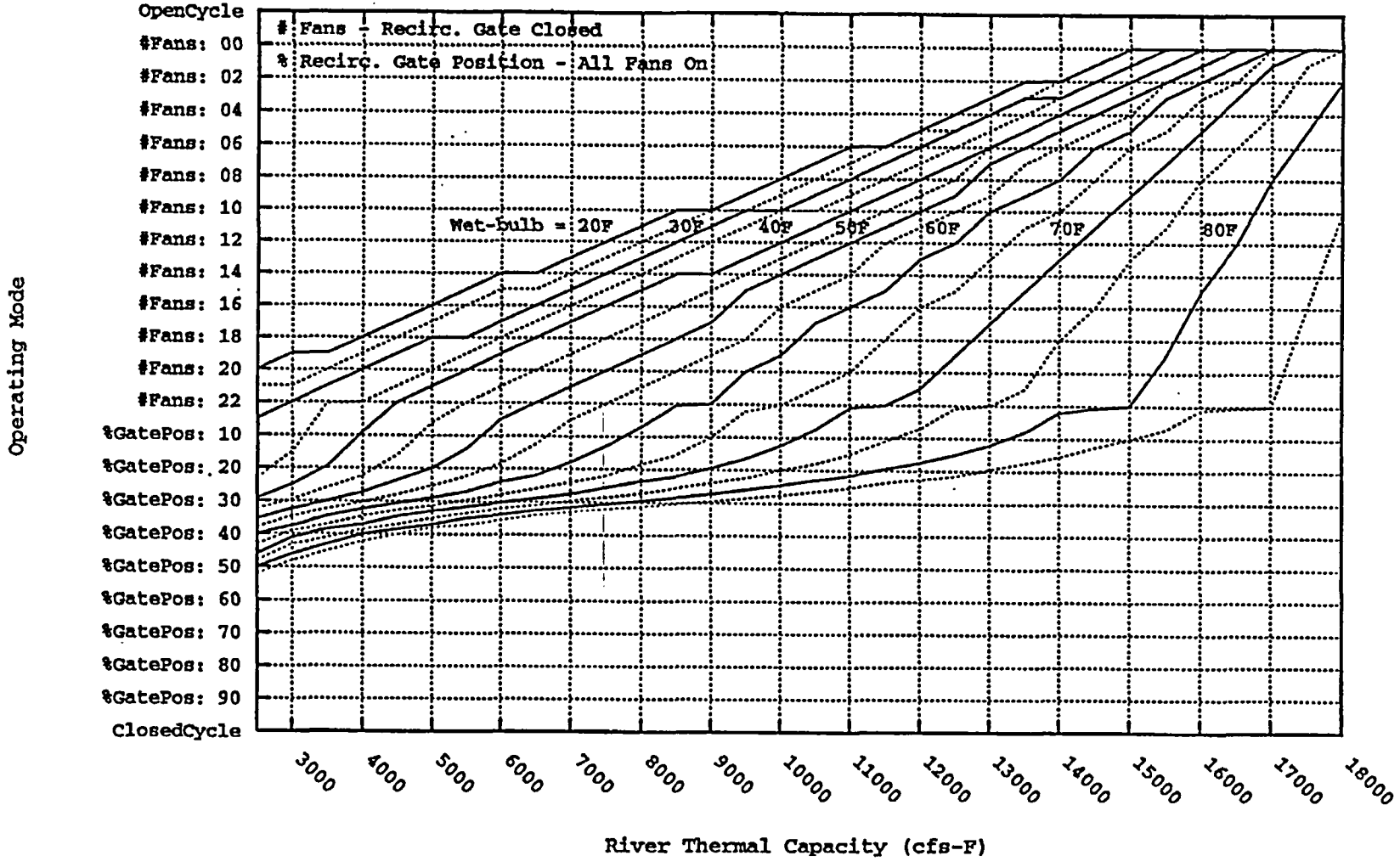

FIGURE 9 (Continued)

[EPU – Summer Derate Nomograph
River Temperature 66°F – 69.9 °F
(1912 MWth, 200 hp Fans)]

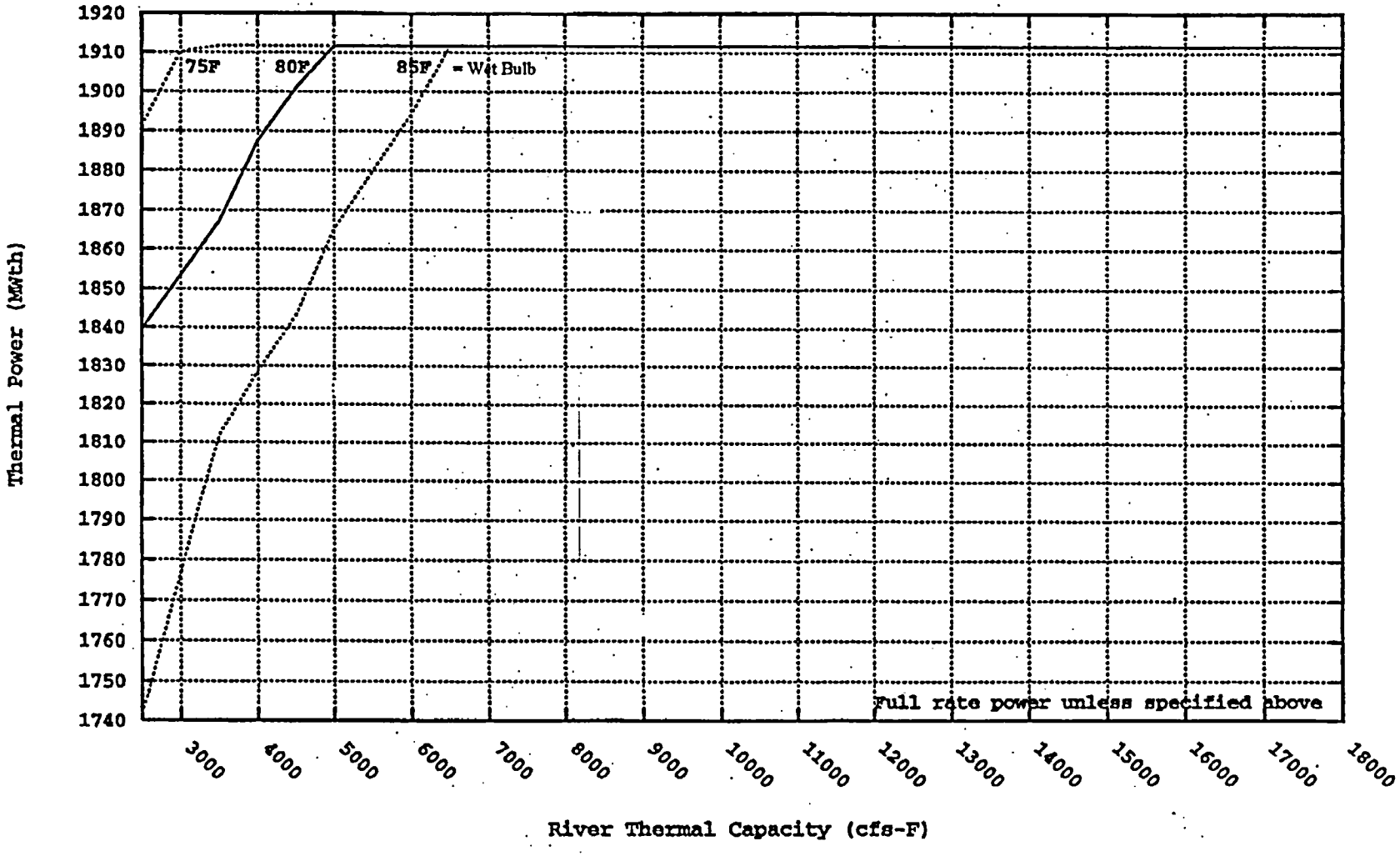

FIGURE 10

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 70.0-74.9°F

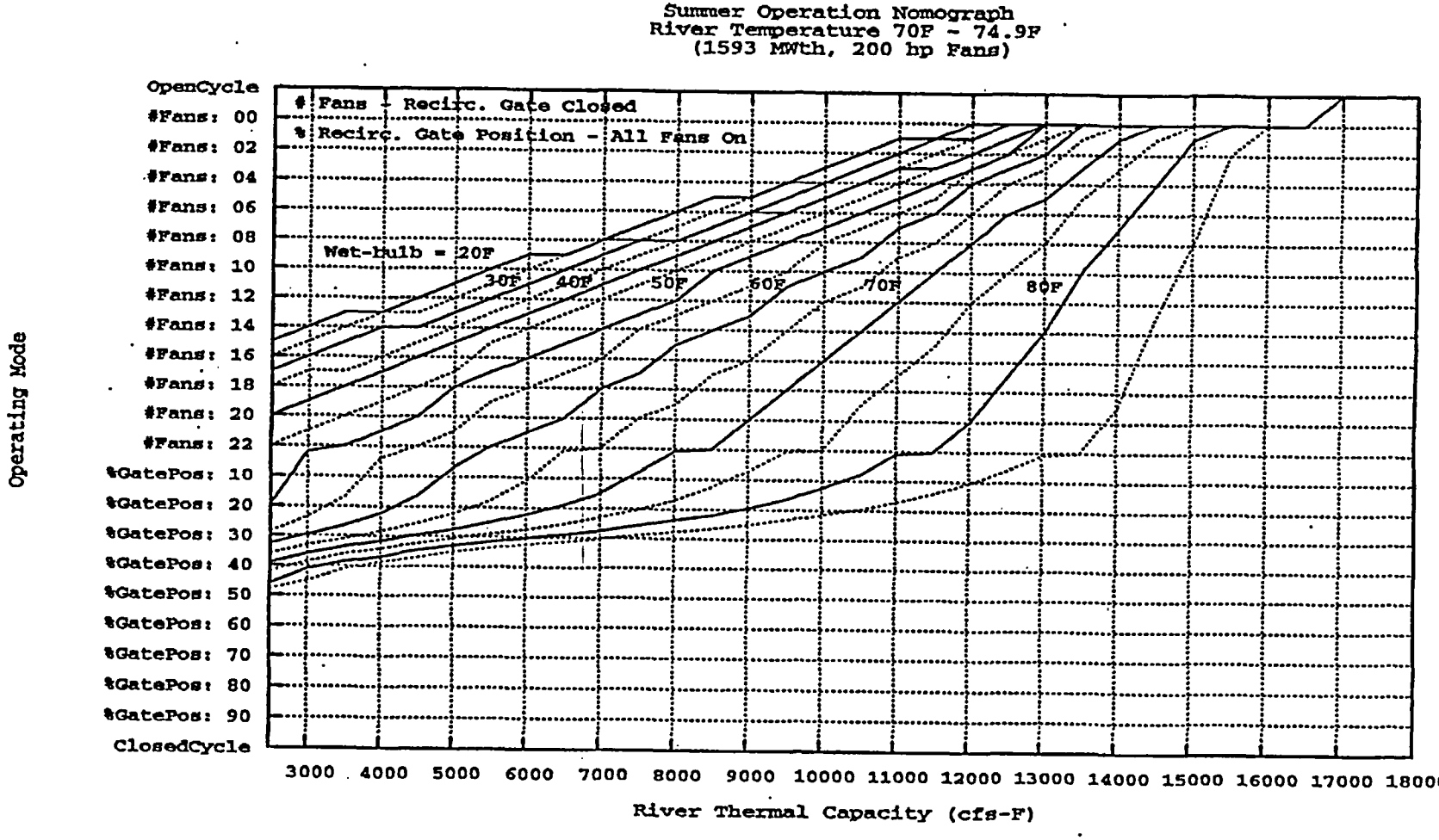

FIGURE 10 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 70°F – 74.9 °F
(1912 MWth, 200 hp Fans)]

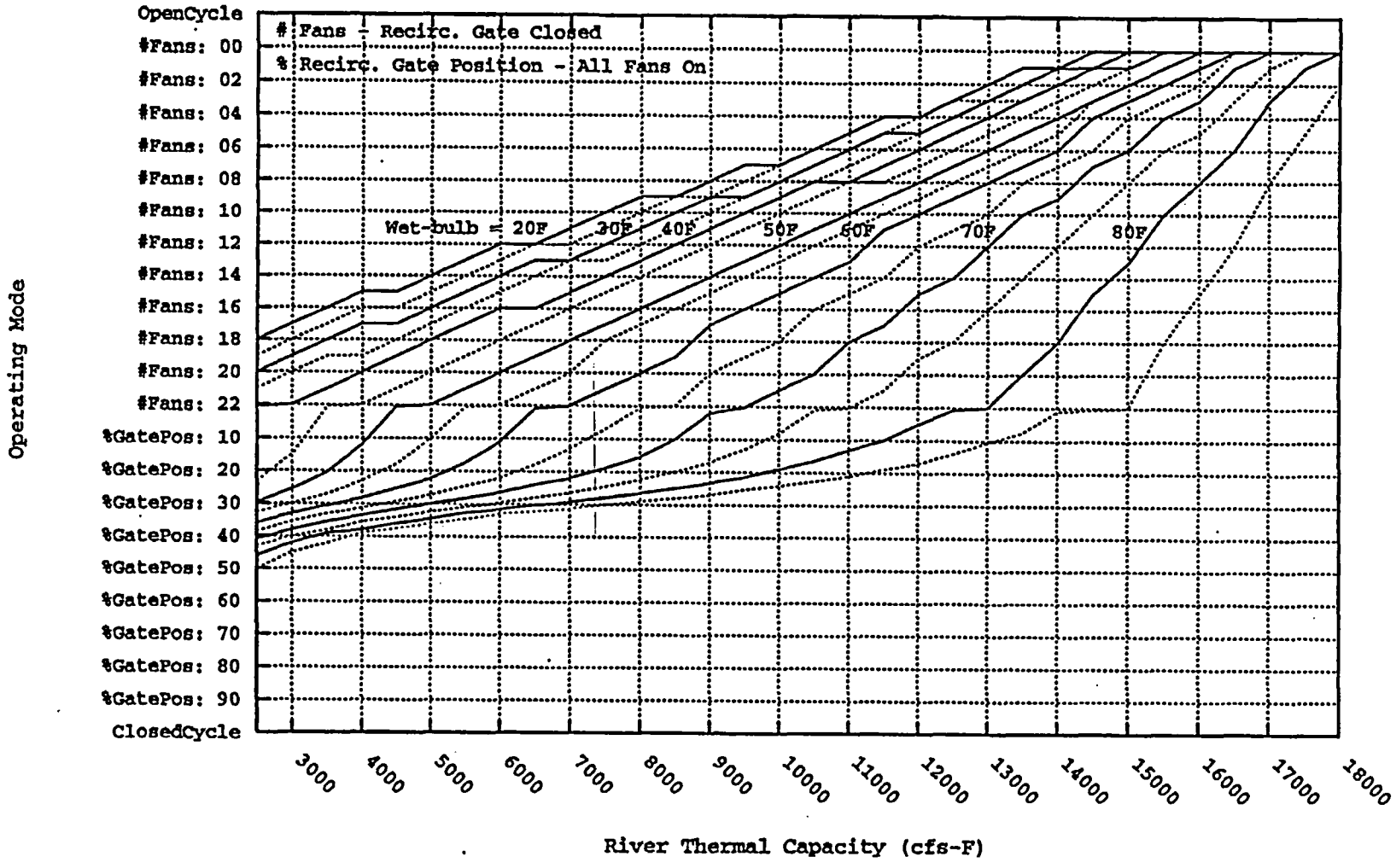

Figure 10
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FIGURE 10 (Continued)

[EPU – Summer Derate Nomograph
River Temperature 70°F – 74.9 °F
(1912 MWth, 200 hp Fans)]

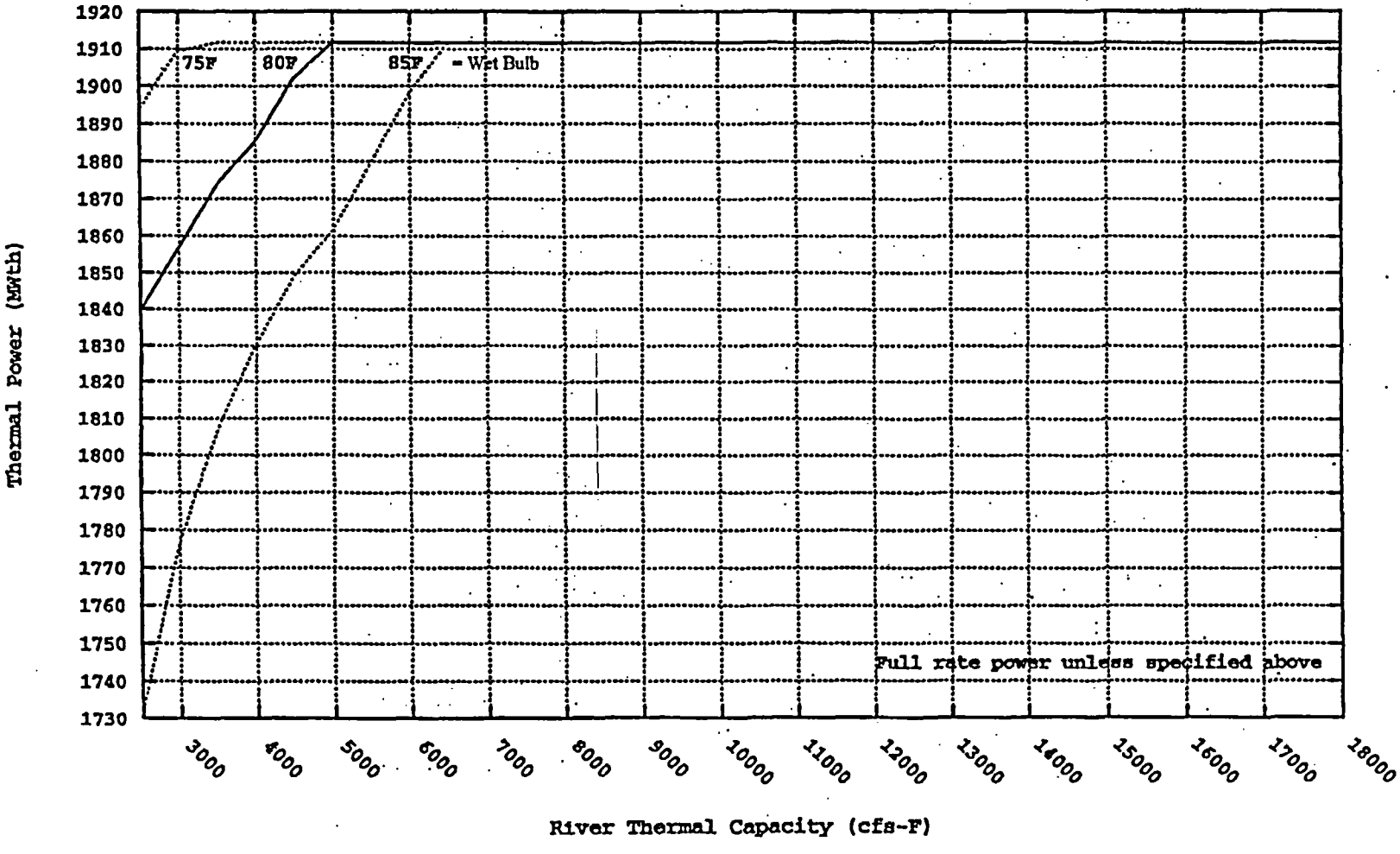

FIGURE 11

PLANT SETTING NOMOGRAPH FOR RIVER TEMPERATURES 75.0-79.9°F

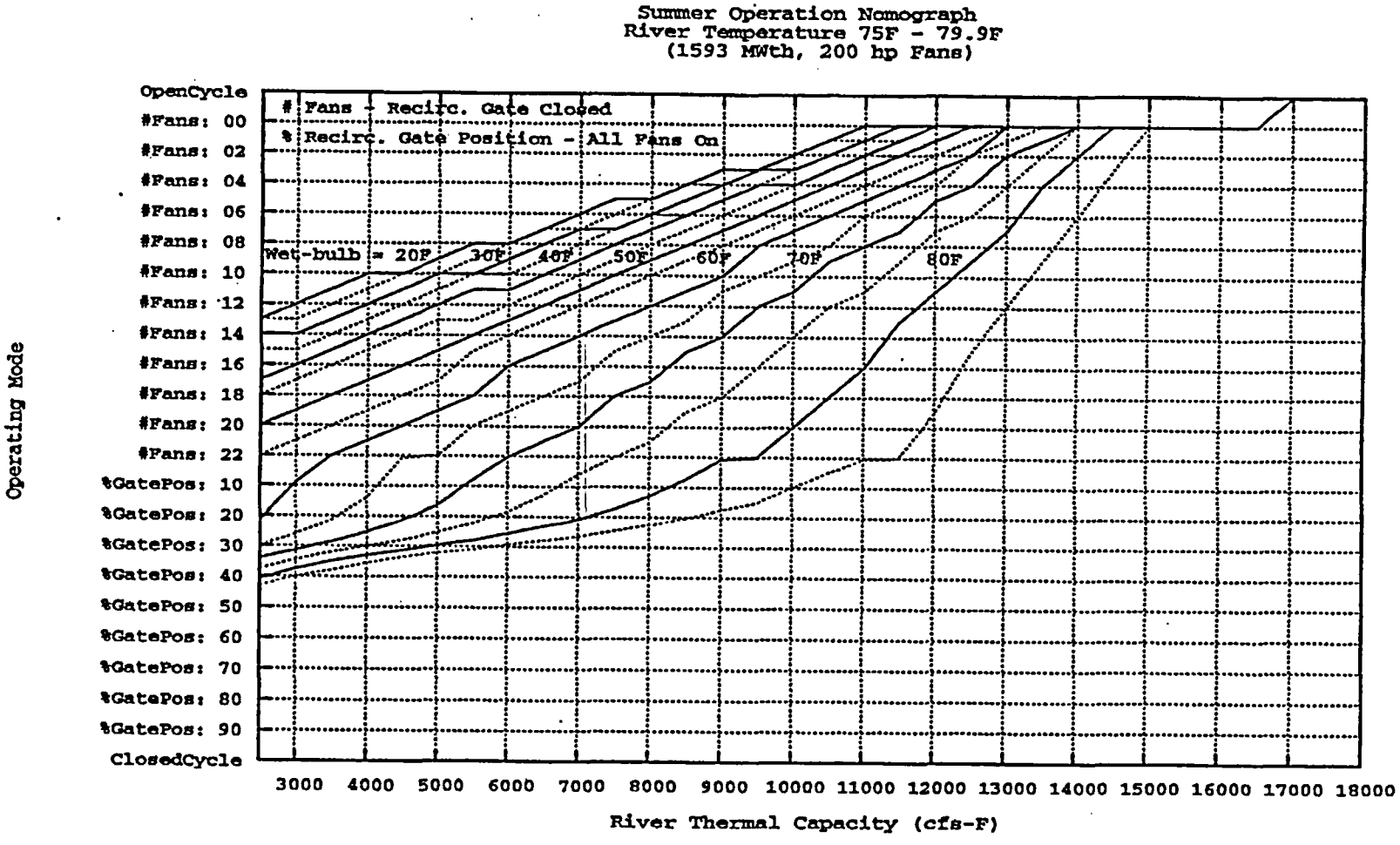

FIGURE 11 (Continued)

[EPU – Summer Operation Nomograph
River Temperature 75°F – 79.9 °F
(1912 MWth, 200 hp Fans)]

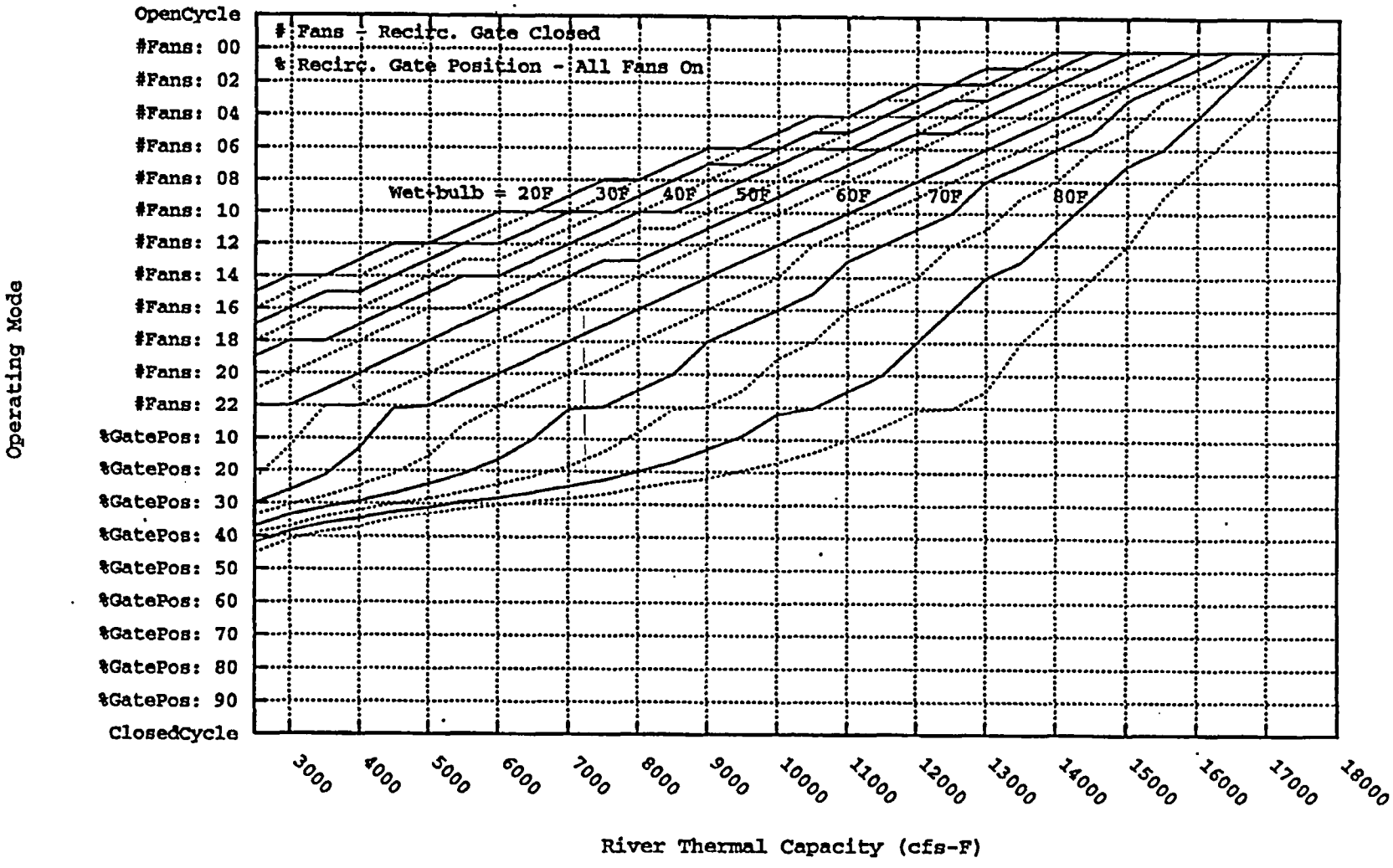

Figure 11
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FIGURE 11 (Continued)

[EPU – Summer Derate Nomograph
River Temperature 75°F – 79.9 °F
(1912 MWth, 200 hp Fans)]

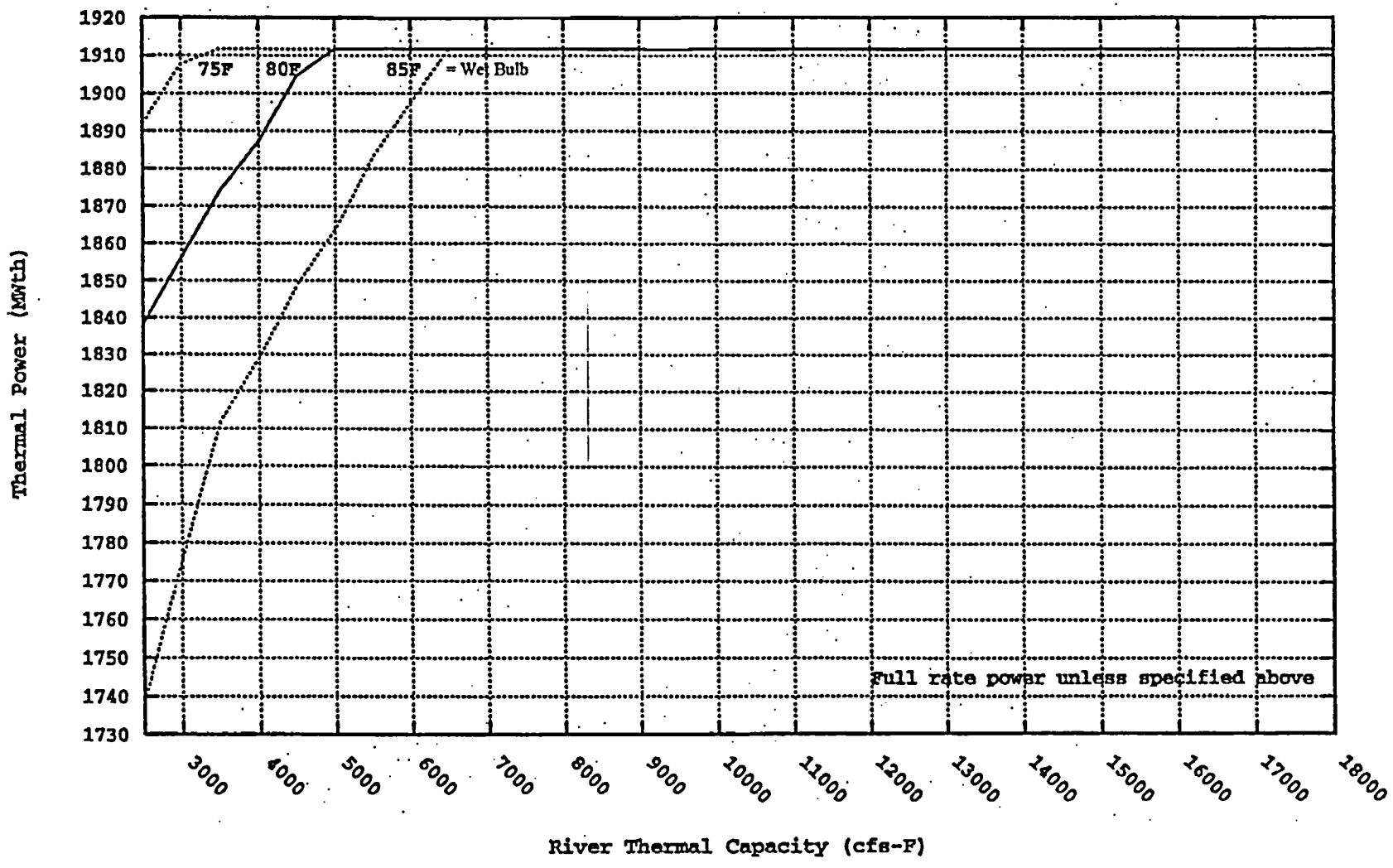
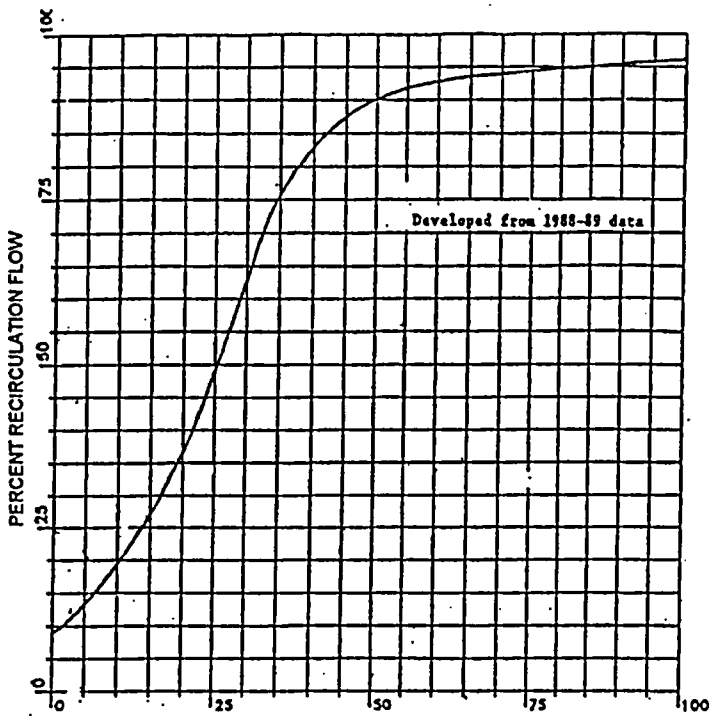


FIGURE 12

RECIRCULATION GATE POSITION INTAKE A FULLY OPEN

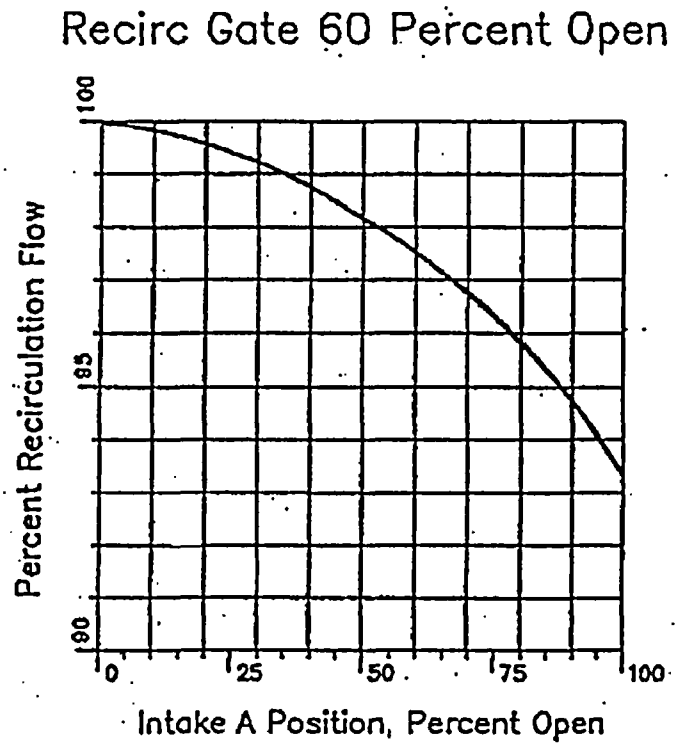


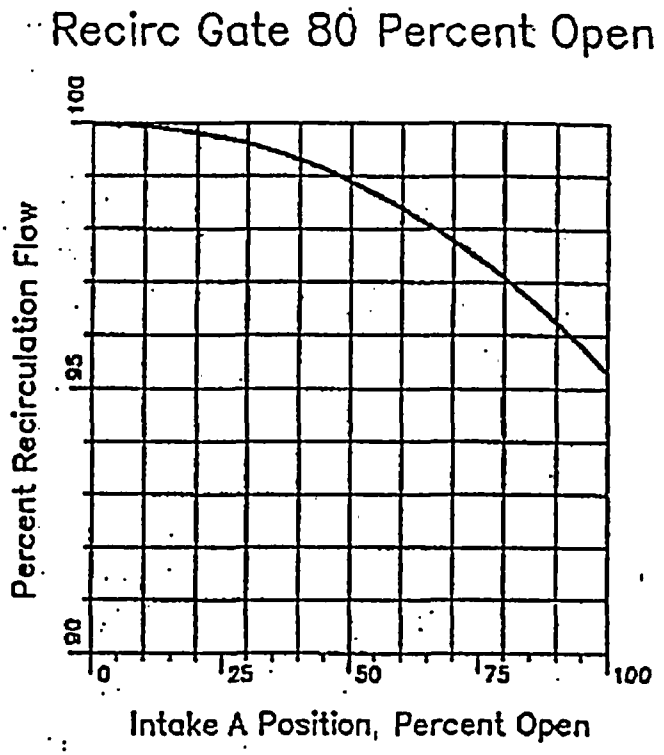
Tabulation of above figure

Recirc Flow, %	Gate Pos., %	Recirc Flow, %	Gate Pos., %	Recirc Flow, %	Gate Pos., %	Recirc Flow, %	Gate Pos., %
9	0	31	17	53	27	75	35
10	1	32	18	54	27	76	35
11	2	33	18	55	27	77	36
12	4	34	19	56	28	78	37
13	5	35	19	57	28	79	37
14	6	36	20	58	28	80	38
15	7	37	20	59	29	81	38
16	7	38	21	60	29	82	39
17	8	39	21	61	29	83	40
18	9	40	22	62	30	84	41
19	10	41	22	63	30	85	42
20	10	42	22	64	30	86	43
21	11	43	23	65	31	87	45
22	12	44	23	66	31	88	46
23	12	45	23	67	31	89	48
24	13	46	24	68	32	90	50
25	14	47	24	69	32	91	52
26	15	48	25	70	32	92	55
27	15	49	25	71	33	93	61
28	16	50	25	72	33	94	70
29	16	51	26	73	34	95	85
30	17	52	26	74	34	96	100

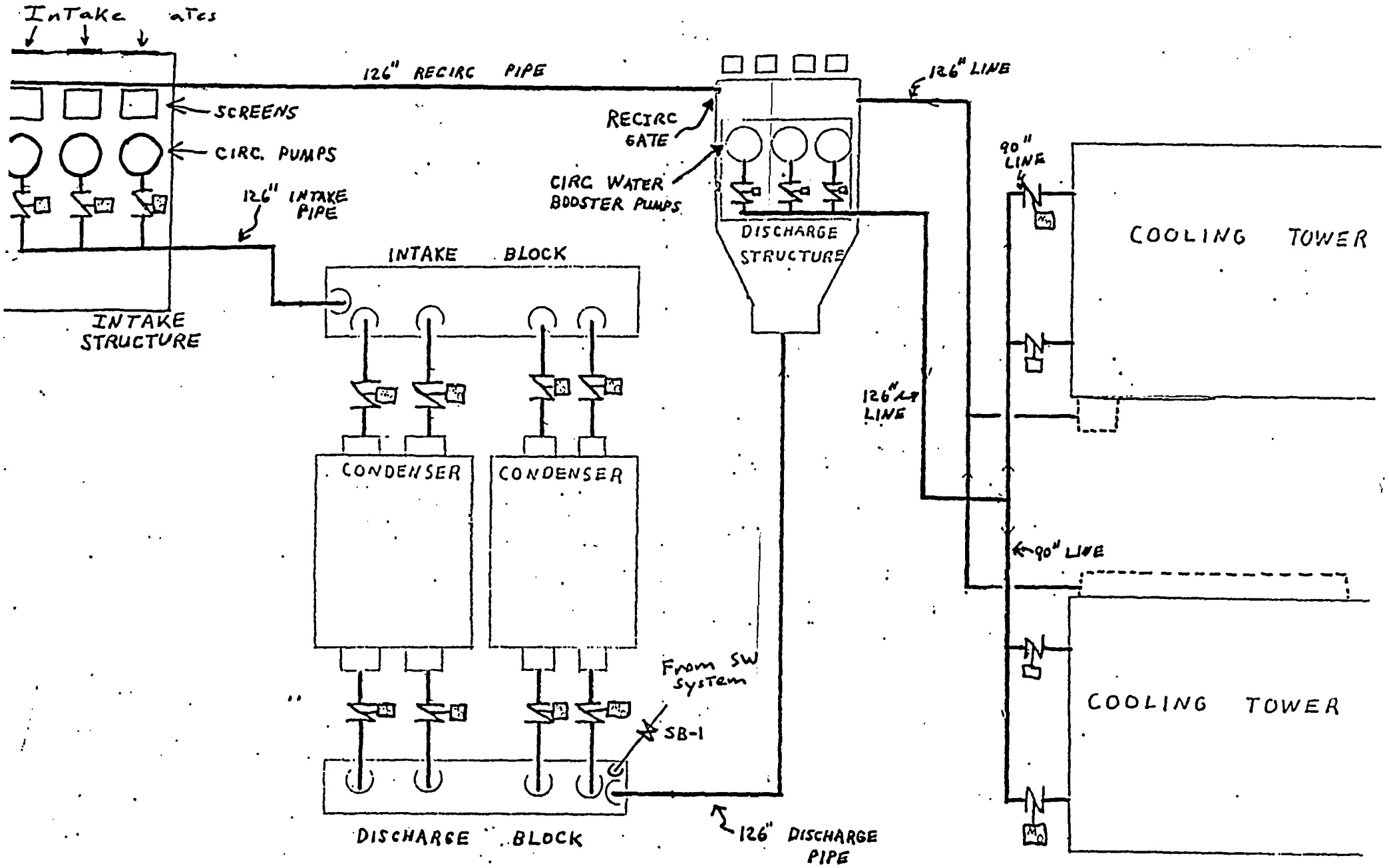
FIGURE 13

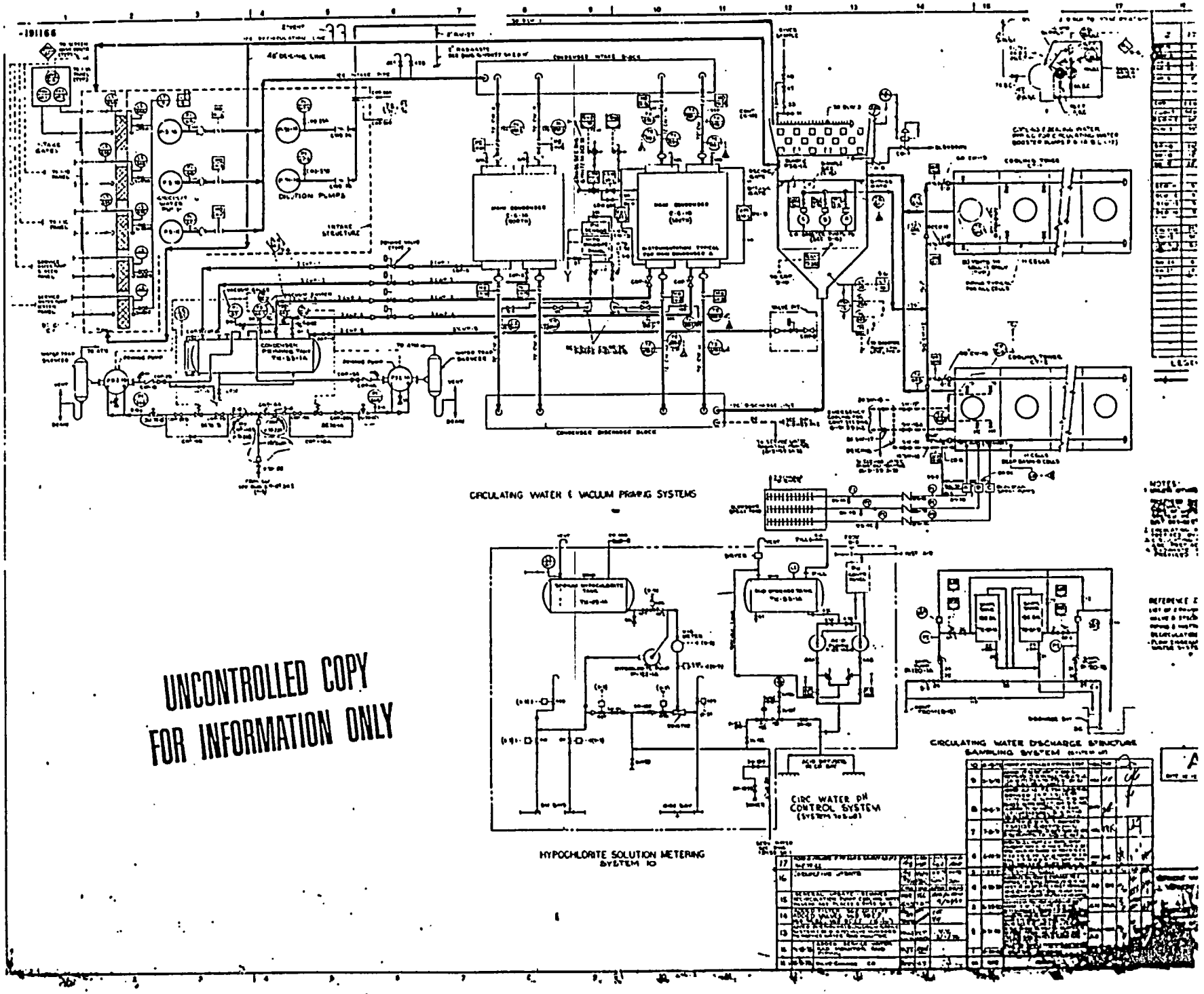
RECIRC GATE 60% OPEN/RECIRC GATE 80% OPEN





Developed From 1988-89 Data


Intake Gates
126" RECIRC PIPE
SCREENS
CIRC. PUMPS
126" INTAKE PIPE
INTAKE STRUCTURE
RECIRC GATE
CIRC WATER BOOSTER PUMPS
DISCHARGE STRUCTURE
126" LINE
90" LINE
COOLING TOWER
INTAKE BLOCK
CONDENSER
CONDENSER
126" LINE
90" LINE
COOLING TOWER
From SW System
SB-1
DISCHARGE BLOCK
126" DISCHARGE PIPE


CIRCULATING WATER & VACUUM PRIMING SYSTEMS
HYPOCHLORITE SOLUTION METERING SYSTEM 10
CIRC WATER PH CONTROL SYSTEM
CIRCULATING WATER DISCHARGE STRUCTURE SAMPLING SYSTEM
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