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September 21, 1984
PY-CEI/NRR-0114 L

MURRAY R. EDELMAN
VICE PRESIDENT
NUCLEAR

Mr. B. J. Youngblood, Chief
Licensing Branch No. 1
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

Perry Nuclear Power Plant
Docket Nos. 50-440; 50-441
SER Confirmatory Issue (54)
Permanent Dewatering System Testing

Dear Mr. Youngblood:

This letter and its attachments are provided to address SER Confirmatory Issue (54), regarding preoperational and periodic testing plans for the porous concrete subsystem of the permanent dewatering system.

Preoperational testing for the porous concrete underdrain system consists of functionability and continuity tests. The functionability and continuity tests verify that the water will flow across the porous concrete and will build up and draw down at the monitoring point thus establishing that the system will reduce the hydrostatic pressure on building foundations to the desired level. Attachments 1 and 2 to this letter provide the details of these tests. These tests will be reflected in a future revision to FSAR Section 14.2.12.1.34.

Periodic testing will consist of groundwater inflow measurements and continuity tests. Attachment 3 describes the details of the periodic groundwater inflow testing, to be performed semiannually. The continuity test described in Attachment 2 will be performed semiannually for the first five years of operation, followed by annual testing.

The monitoring and inspection program for the permanent dewatering system includes piezometer measurements to monitor ground water level and hydrostatic pressures performed quarterly for the first five years of operation, followed by semiannual measurements. Inspection of the manhole components and gravity discharge piping will be performed quarterly to ensure all parts of the system are in operating condition. The description of system monitoring, inspection and periodic testing will be revised in a future amendment to FSAR, Section 2.4.13.5.4.

Finally, clarification of the permanent dewatering system design capabilities is provided in Attachment 4, to establish that testing of the gravity discharge piping subsystem is not required. The system design is such that the complete volume of water that must be handled under the postulated design basis accident is less than the available free volume within the system at elevation 590.0', without taking into account the manhole pumps or the gravity discharge subsystem. Thus testing of the gravity discharge piping is not planned.

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We believe this information should enable SER Confirmatory Issue (54) to be resolved. If you have any questions, please let me know.

Very truly yours,

[signature] for M. Edelman

Murray R. Edelman
Vice President
Nuclear Group

MRE:njc

Attachments

cc: Jay Silberg, Esq.
John Stefano
J. A. Grobe

FUNCTIONABILITY TEST

1.0 Objective

To verify that water will flow across the porous concrete mat and thereby establish that the underdrain system can, in fact, reduce the hydrostatic pressure on building foundations to the desired level.

2.0 Prerequisities

2.1 Set up the water intake and discharge systems as illustrated in Figure 1.

2.2 Saturate the pourous concrete and Class A fill up to Elevation 570'-0". The source of the water can be natural inflow of groundwater or service water (P41) from the pump house. This will permit up to a 4'-0" head loss across all portions of the drainage system during testing. Bottom of porous concrete in the Turbine Building is at Elev. 571'-0". By maintaining water level below 570', no water will be introduced into the Turbine Building mat. Saturation to this elevation allows determination of flow capacity of the entire system beneath the Nuclear Island since at that level the weepholes in the east and west manholes should be under water and the pourous concrete blanket under the Nuclear Island should be inundated.

2.3 Permit water to stabilize at Elevation 570'-0" for a period of 48 hours. Begin this stabilizing period as soon as water levels in the manholes and the piezometers are at Elevation 570'-0" or above. During this period, maintain a minimum water level at Elevation 570'-0".

3.0 Test Procedure

3.1 Immediately prior to the start of the test, record the building mat piezometer readings.

3.2 The west side regulating valves and the east side throttling valve should be in the closed position. The east side regulating valves should be fully open.

3.3 Start east side pumps. These will run continously during the test.

3.4 Open throttling valve on the east side to achieve a flow of about 50 gpm when the flow rate stabilizes.

3.5 Wait for a response on the west side. West side manhole observers should notify the test director when the water in his manhole has dropped 0.1 feet.

3.6 Open west side regulating valves to achieve a supply of 50 gpm, total.

3.7 Each east side manhole person will adjust his regulating valve setting as directed by the test director until a uniform water level (± 0.1 ft. between manholes) has stabilized in all east side manholes. The test director will adjust the east side throttling valve so that the east side water level will be at approximately Elevation 566'-0". During adjustments, the water level in east side manholes should not fall below Elevation 565'-0" to ensure mat saturation.

3.8 When a uniform water level at Elevation 566'-0: is achieved on the east side, the regulating valves on the west supply lines should be readjusted to provide a uniform water level in the west side manholes with a combined inflow of 50 gpm. The west side water level cannot be predicted in advance but it will be higher than Elevation 566'-0" maintained on east side.

3.9 Until an equilibrium condition is reached, modifications to regulating valve settings on either side will affect the water levels on both sides. Adjustments will have to be repeated as advised by the test director until the conditions of steps 3.7 and 3.8 are both met and maintained for a minimum of 15 minutes. A series of water level measurements should be made after each valve adjustment. A series of readings is necessary until the system reaches equilibrium or until the test director indicates the need for another valve adjustment in one or more of the manholes.

3.10 Open the west side regulating valves to give a total inflow of 100 gpm and repeat steps 3.7 through 3.9. The east side throttling valve should be used to maintain the Elevation 566'-0" water level on the east side. Minor readjustment of east side regulating valves may be required to achieve uniformity in east side water levels. Some minor readjustments of the west side valves may also be necessary as described in step 3.8.

3.11 Repeat steps 3.6 through 3.9 with combined inflow increments of 50 gpm (ie. 150, 200, etc.) until one of the following occurs:

a. West side regulating valves are fully open.
b. East side throttling valve is fully open.
c. Uniform water level on west side reaches Elevation 570'-0". The final condition should be adjusted as in steps 3.7 through 3.9, and then maintained for a minimum period of 30 minutes.

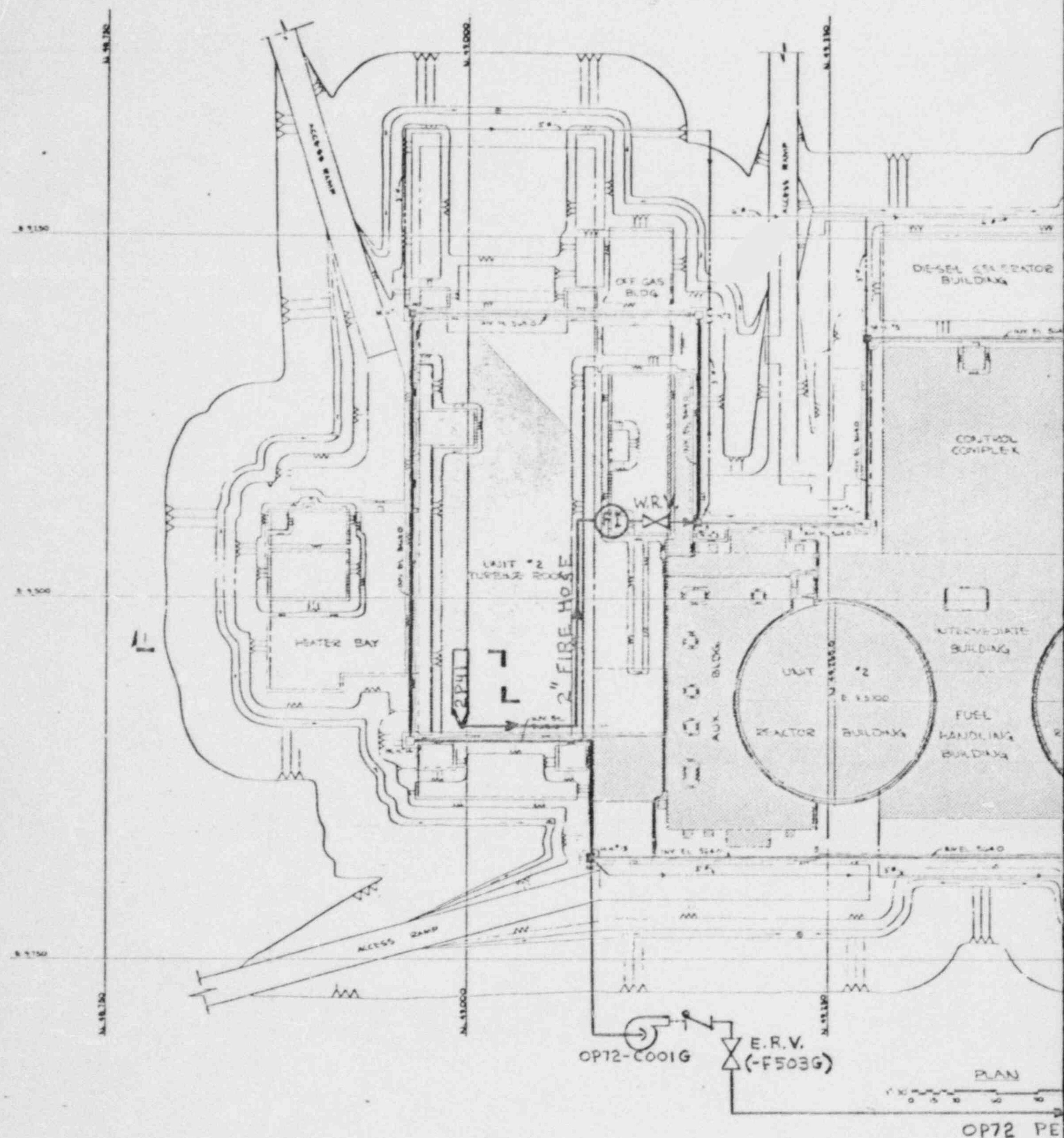
3.12 Record final water level measurements in the manholes and piezometers.

3.13 Record final supply and discharge flow rates.

3.14 Repeat steps 2.1 through 3.13 for a test with flow in the opposite direction. The water supply and discharge systems should be set up as shown in Figure 2 with outflow measured in manhole 20. Procedural steps will be the same as in the first test except that references to "east" and "west" should be reversed.

4.0 <u>References</u>

Plot Plan - Porous Concrete Underdrain System Figures 1 and 2



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CONTROL COMPLEX
W.R.V.
UNIT #2 TURBINE ROOM
2" FIRE HOSE
2P41
HEATER BAY
AUX. BLDG
UNIT #2 REACTOR BUILDING
INTERMEDIATE BUILDING
FUEL HANDLING BUILDING
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OP72-C001G
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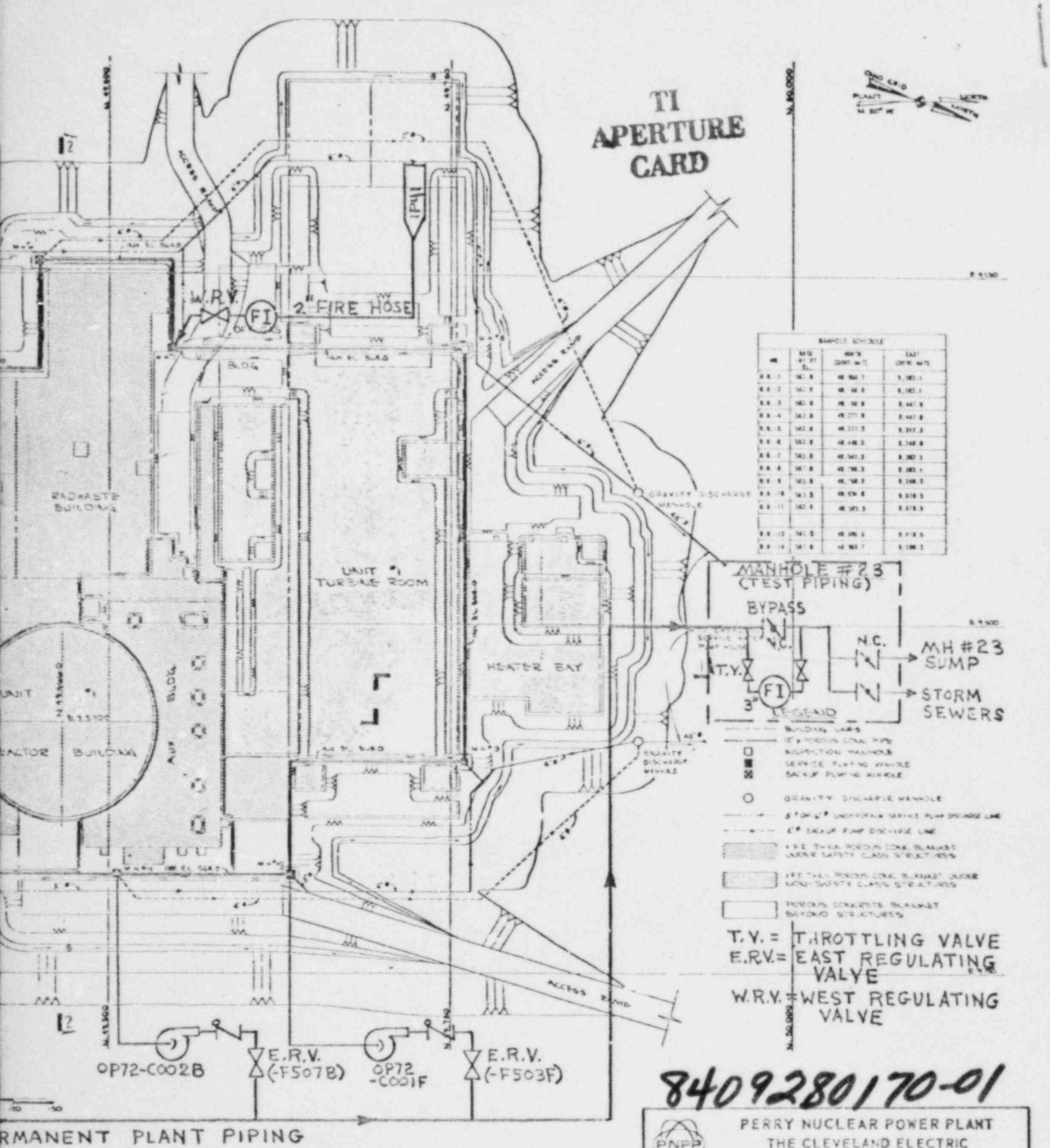

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PERRY NUCLEAR POWER PLANT
THE CLEVELAND ELECTRIC
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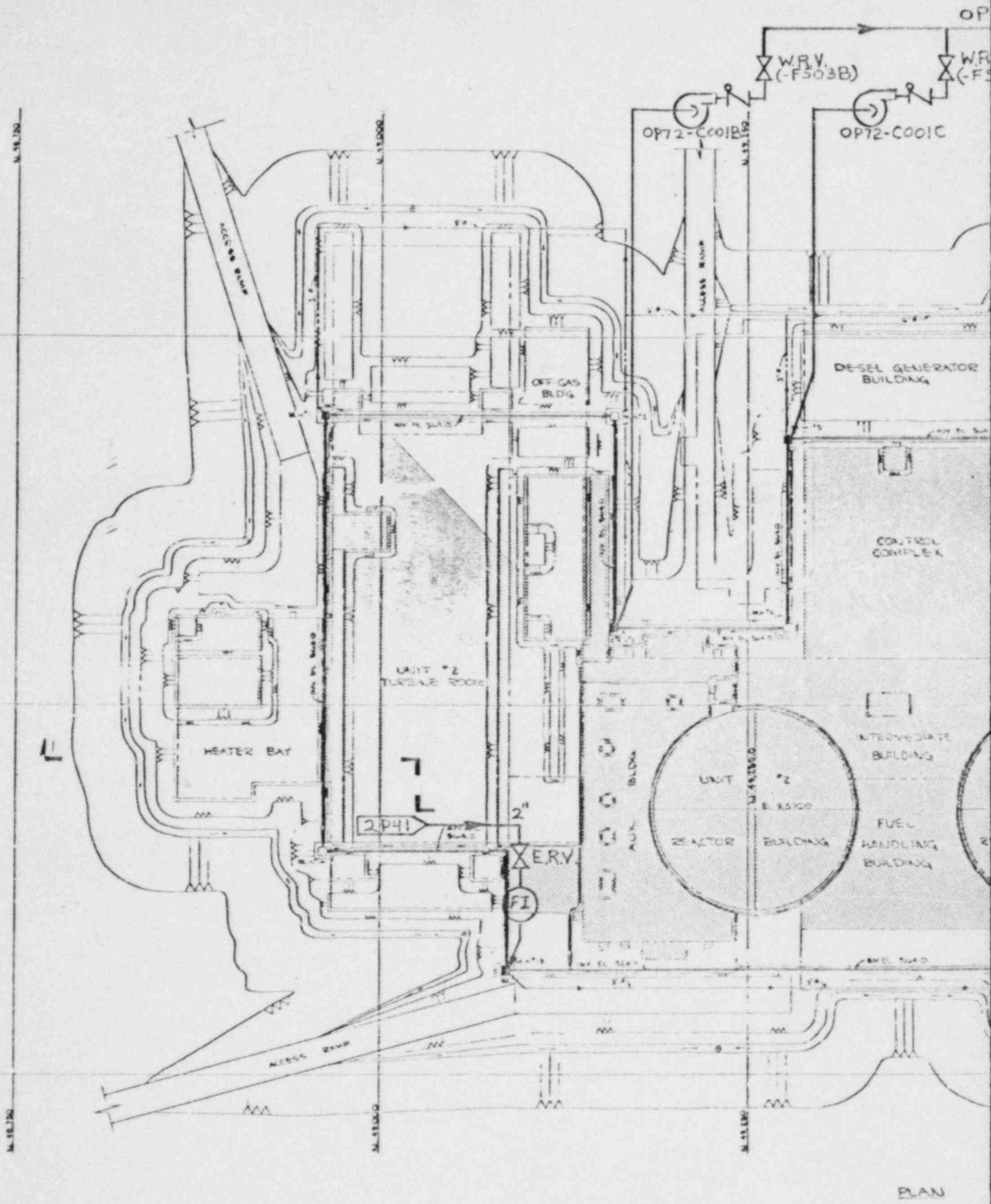
Plot Plan-Porous Concrete
Underdrain System

Figure 1



W.R.V.
(-F503B)
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OP72-C001C
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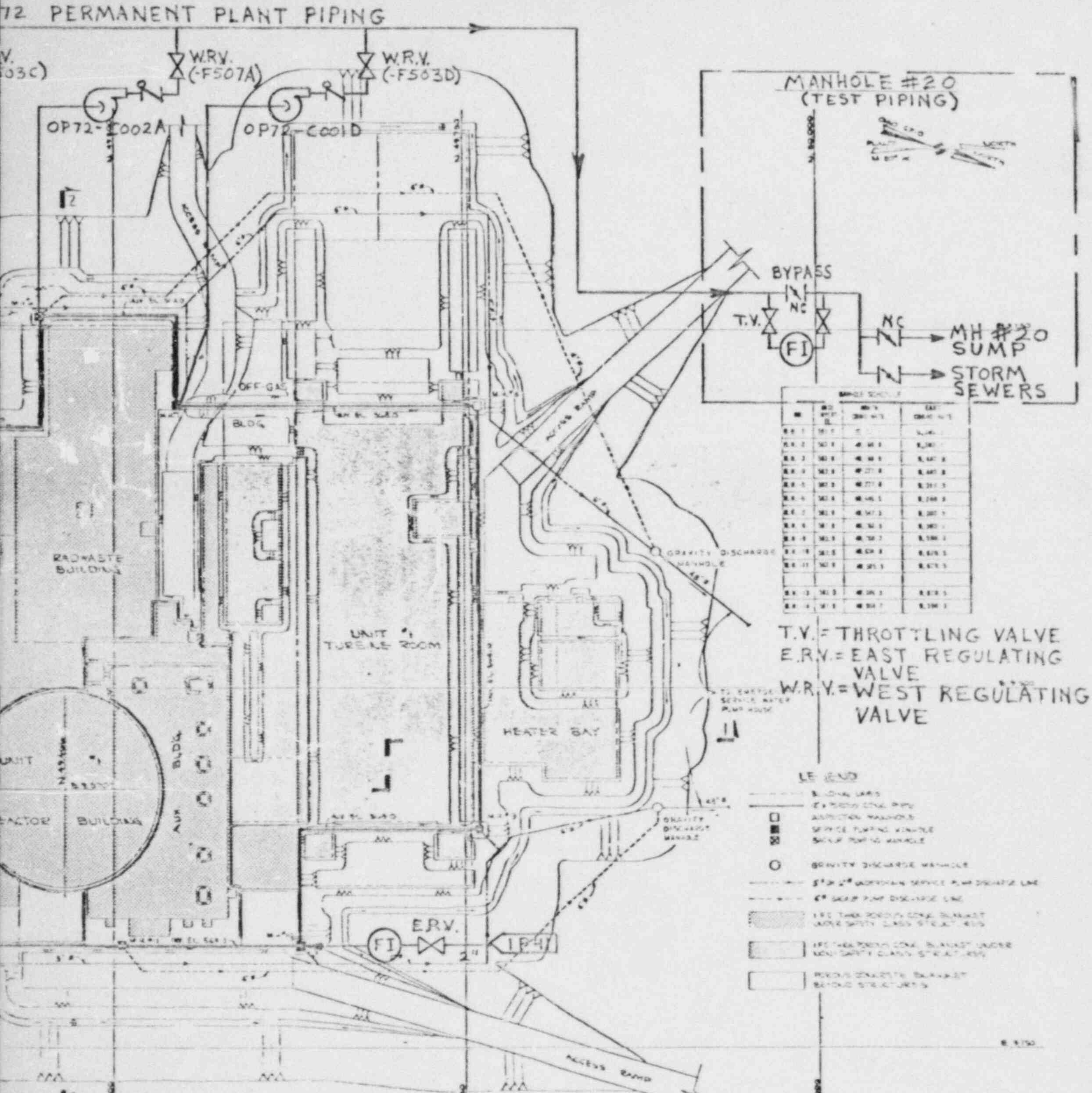

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PERRY NUCLEAR POWER PLANT
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Plot Plan-Porous Concrete
Underdrain System

Figure 2

CONTINUITY TEST

1.0 Objective

To verify that water will build-up and drawdown at the monitoring points and thereby establish that the underdrain system can, in fact, reduce the hydrostatic pressure on building foundations to the desired level.

2.0 Pre-requisites

2.1 Pump start/stop float switches are calibrated and functioning properly.

2.1.1 Set level float switches to elevation 563 ft. & 564 ft., respectively.

2.2 Flowmeters are calibrated and functioning properly.

2.3 Provide piezometer tube extensions to at least elevation 571 ft.

3.0 Test Procedure

3.1 Immediately prior to the start of the test record the building mat peizometers readings.

3.2 Allow water to rise in system to approximate elevation 570 ft. Water may be added into system via the manholes to promote water build-up

3.3 Record building mat piezometer readings during water build-up phase on a regularly scheduled basis.

3.4 Upon assurance that water elevation has reached elevation 570 ft., energize pumps.

3.5 Record building mat piezometer readings during water drawdown phase on a regularly scheduled basis.

3.6 Upon assurance that water elevation has reached elevation 564 ft., de-energize pumps.

4.0 Post Test Details

4.1 Reset pump switch floats per P72 System Design.

4.2 Testing to be performed bi-annually, in the spring and fall.

GROUNDWATER INFLOW TESTING

1.0 Objective

To verify that total inflow of groundwater into the porous concrete underdrain system does not exceed a rate of 80 gpm.

2.0 Pre-requisites

2.1 Pump start/stop switches are calibrated to elevations 566 ft. & 567 ft, and functioning properly.

2.2 Groundwater inflow rates to be determined by flow through flowmeters located at manholes 20 & 23 per P72 system design description.

2.3 Flowmeters are calibrated and functioning properly.

3.0 Test Procedure

3.1 Immediately prior to start of test, record the flowmeter readings.

3.2 Continue flowmeter readings on a daily basis for a period not less than one month.

4.0 Post Test Details

4.1 Reset pump switch floats per P72 system design criteria.

4.2 Testing to be performed bi-annually, in the spring and fall.

PERMANENT DEWATERING SYSTEM

BACKGROUND DETAILS

The gravity discharge subsystem is designed as a backup system to the pump discharge system to keep the ground water below Elevation 590.0'. It was originally designed to handle flow resulting from two postulated breaks in the circulating water piping (15,000 gpm from each unit resulting in a combined flow of 30,000 gpm).

The postulated design basis accident and worst case analysis for the permanent dewatering system is the rupture of two circulating water pipes within the Turbine Buildings.

During the initial investigation of this accident (early 1975), it was determined that water from the ruptured circulating water pipe in each turbine building would flood the turbine buildings to above elevation 590'. Following the postulated cracking of the turbine building floors, water would enter the porous concrete mat and flow to the perimeter of the underdrain system where it would enter the manholes and start raising the water levels in the manholes, and in the porous concrete and Class A fill outside the buildings.

Assuming no manhole pumps, the water levels would rise to the gravity discharge pipes which would begin to drain the water away. In preliminary hydraulic analyses, assuming a water level of 619.5' in both turbine buildings, it was determined that the gravity discharge pipes could keep the groundwater levels outside safety related buildings below elevation 590'. Using the permeability of the porous concrete mat (K=3 fpm) and the porous concrete pipes, the maximum flow in the gravity discharge pipe was calculated to be about 30,000 gpm.

Shortly thereafter (April 1975), structural modifications to increase volume capacity were made in the circulating water system and turbine buildings which reduced the maximum water level in both turbine buildings to elevation 595'. Using this level, very conservative hydraulic analyses were made assuming that the 12" diameter holes for connecting the porous pipes to the manholes provided the only resistance for inflows to the manholes (i.e., it was assumed that the porous concrete mat and porous pipe was fractured and offered no frictional resistance to flow). These calculations also showed the maximum groundwater level would not exceed elevation 590' outside the nuclear island. Subsequent allowances for storage within the various components of the underdrain system reduced the turbine building water levels to 594'.

Finally, additional design changes were made (including the addition of safety related service water isolation valves and associated controlling instrumentation to limit the service water make up to the cooling tower basin) which lowered the maximum turbine building flood level to elevation 591.1', if the turbine building floors do not fracture, and to elevation 590.0' if they do fracture. The reduction from 591.1 to 590.0 with floor fracturing is due to water flowing into and throughout the porous concrete mat, filling the manholes and air voids in the porous concrete and Class A fill above the maximum normal groundwater level of 568.0'. Without taking into account any drainage by the manhole pumps or the gravity discharge pipes, the groundwater level would not exceed the allowable limit of elevation 590.0'.

The attached FSAR Table 2.4-9 shows the potential flooding volumes for each unit under this DBA and the attached FSAR Table 2.4-10 shows the available water storage volumes in each unit with the turbine building water level at 590'. The "Gravity Drain Subsystem" mentioned in Table 2.4-10 refers to the manhole storage volume between elevations 568.0' and 590.0'.

In summary, the FSAR states that with the final design changes, a complete rupture of a circulating water pipe in each turbine building could be handled simultaneously with fracturing of the turbine building floors without the water levels inside the turbine buildings and outside all buildings exceeding elevation 590', even if the manhole pumps and gravity drain pipes did not exist. Therefore, there is no need to test the gravity discharge system (drain pipes) for this DBA. If the floors did not fracture, the groundwater elevation around the plant would not rise above its normal operating range (566' - 568'); and within the turbine buildings the water would rise to elevation 591.1' for which safety-related equipment is protected.

TABLE 2.4-9

POTENTIALLY FLOODING VOLUME

Source	(Gallons)
Cooling tower basin	2,700,000
Cooling tower distribution system and fill	425,000
Circulating water piping and pumphouse forebay	2,165,000
Condenser tubes an' water boxes	422,000
Service water inflow	40,000
Total	5,752,000

TABLE 2.4-10

FREE STORAGE VOLUMES

Buildings	(Gallons)
Turbine building	2,375,000
Condensate demineralizer area	1,834,000
Heater bay	1,200,000
Total Building Volume	5,409,000
Underdrain System	
Porous concrete blanket and Class A fill	311,500
Gravity drain subsystem	23,400
"Rattle" space	25,000
Total Underdrain	359,900
Total System	5,768,900