SUPPLEMENTARY INFORMATION,

HYDROGEOLOGIC EVALUATION OF CONSTRUCTION DEWATERING

BAILLY GENERATING STATION, NUCLEAR 1

Northern Indiana Public Service Company
August 27, 1979

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LIST OF EXHIBITS

I. INTRODUCTION

Construction of Bailly Generating Station Nuclear 1 (Bailly N-1) requires an excavation generally ranging from 32 to 46 feet below plant grade.* A dewatering system is required to allow excavation to these levels. The initial dewatering system consisted of a slurry wall, installed around the excavation to isolate the excavation area from the unconfined aquifer, and sump wells, installed within the excavation to remove water inside the slurry wall and to control water entering as precipitation and seepage. Operation of this system allowed excavation to proceed to El. +8, the level of excavation required for pile driving operations to commence.

Excavation below El. +8 requires further dewatering. A sheet pile wall was installed around the Reactor Building area to facilitate dewatering of that area. The initial dewatering system was supplemented by wellpoints and two free-flowing drains, installed in October and November 1978. This construction dewatering system is designed to satisfy the following objectives: (a) to lower the water table in the unconfined aquifer below the final excavation levels; (b) to reduce hydrostatic pressures in the confined aquifer beneath the excavation; and (c) to minimize the environmental effects of the required construction dewatering. The preliminary

*Plant grade is El. +40. Elevations refer to NIPSCO datum, where El. 0.0 equals mean Lake Michigan level, El. 576.80 feet (IGLD, 1955).

design for the construction dewatering system was submitted to the NRC in Reference 1, "Response to NRC Questions, Bailly Generating Station, Nuclear 1", July 20, 1978.

After installation, the wellpoint system was tested for three weeks and performed satisfactorily. Upon installation of the free-flowing drains, some pressure reduction in the confined aquifer was observed. However, the drains have not functioned as well as anticipated and more effective measures are required. Furthermore, it was recognized that the confined aquifer was more complex than originally anticipated. Thus, it was concluded that additional information about the characteristics of the confined aquifer was required prior to the design of additional dewatering systems. In March 1979, Northern Indiana Public Service Company (NIPSCO) undertook an extensive field testing program to verify the characteristics of the confined aquifer. This was required for the design of a dewatering system which would produce the necessary pressure relief in the confined aquifer.

This report describes the site hydrogeologic characteristics, site dewatering requirements, pumping tests performed to determine the capacity of the existing free-flowing drains, and the installation and testing of a deep test well to refine the aquifer parameters upon which the design of a

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pressure relief system is based. Three alternate pressure relief systems were considered to achieve pressure reduction. Wellpoints installed in the confined aquifer are considered the best engineering solution for pressure relief. The projected environmental effects at the property line resulting from operation of this system are also examined.

Ground/Water Technology, Inc., a consulting firm specializing in the design of construction dewatering systems, was retained to provide technical assistance in evaluating the characteristics of the confined aquifer and alternative methods for pressure relief. Results of their evaluation are incorporated in this report. Their report, which summarizes the testing, analyses, and evaluation of the confined aquifer characteristics, is presented as Attachment A.

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II. SITE HYDROGEOLOGIC CHARACTERISTICS

Hydrogeologic characteristics of the area surrounding the Bailly site have been established by numerous borings and observation wells. Hydrogeologic descriptions are included in Reference 2, "Hydrogeologic Evaluation of Construction Dewatering, Bailly Generating Station, Nuclear 1", March 30, 1978, and in Reference 3, "Effects of Seepage from Fly-Ash Settling Ponds and Construction Dewatering on Ground-Water Levels in the Cowles Unit, Indiana Dunes National Lakeshore, Indiana". The following summary of hydrogeologic characteristics is drawn from these two reports.

Two aquifers, one unconfined and one confined, are present in the glacial-lacustrine deposits in the excavation area. The unconfined aquifer consists of fine to medium sand and some fine gravel. The confined aquifer consists of fine to medium sand with discontinuous layers of silt and clay. A confining layer, consisting predominantly of clay with minor amounts of silt and sand, separates the unconfined and confined aquifers. The confining layer is wedge-shaped in profile, increasing from approximately 5 feet thick at the south end of the excavation to approximately 80 feet thick at the north end of the excavation. The top of the confining layer is generally at El. -10. At the south end of the excavation,

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the confined aquifer is 60 to 80 feet thick. However, it is effectively pinched out beneath the Turbine Building by the confining layer. The confined aquifer is underlain by a hard glacial-lacustrine clay.

Groundwater levels at the Bailly N-1 site have been monitored in accordance with the program described in Reference 2. Potentiometric surface maps for the unconfined and confined aquifers have been prepared using groundwater levels recorded on July 5, 1979, and are presented as Exhibits 1 and 2. Maps showing potentiometric levels in the unconfined and confined aquifers prior to construction dewatering are presented in Reference 3. Groundwater levels measured in United States Geologic Survey (USGS) observation well 101 indicate that potentiometric levels in the confined aquifer could have been as high as El. +25 in the excavation area before construction dewatering began.

Groundwater in the unconfined and confined aquifers flows from southeast to northwest across the site. Reference 3 indicates that groundwater from the confined aquifer also discharges up into the unconfined aquifer in the excavation area. This hydrologic behavior is possible because the materials comprising the confining layer are not completely impermeable and the confining layer is discontinuous at the south end of the excavation, as determined from borings and observations made during installation of the slurry wall.

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The results of the pumping tests suggest that discontinuities may also exist within the Bailly site limits south of the excavation. Reference 3 shows the confining layer to be absent over a large area about 2000 feet south of the excavation.

Within limited areas of the excavation, there are additional discontinuities in the confining layer through which discharge occurs from the confined aquifer. These discontinuities resulted from preconstruction pile testing activities, including preaugering, jetting, and pile extraction. The preconstruction areas have been described in Reference 4, "Supplementary Information on Driven H-Pile Foundations, Bailly Generating Station, Nuclear 1", December 4, 1978.

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III. SITE DEWATERING REQUIREMENTS

To establish the dewatering requirements for the construction site, consideration has been given to: (a) the unconfined aquifer, (b) the confined aquifer, and (c) environmental effects at the site boundary.

For the unconfined aquifer, the dewatering system must maintain the water levels a few feet below the excavation to allow pile driving and other construction activities to proceed. A sheet pile wall was installed around the Reactor Building to reduce seepage from adjacent shallower excavations.

With respect to the confined aquifer, hydrostatic pressures must be reduced such that the uplift pressure is less than the total overburden pressure (weight of soil overlying the confined aquifer). The degree of pressure relief required varies across the excavation because the final excavation level and the thickness of the confining layer differ across the excavation. The objective of the dewatering system for the confined aquifer is to maintain a ratio of overburden pressure to hydrostatic pressure in excess of 1.3 at the general excavation levels. For example, this criterion is satisfied at a point 60 feet south of the Reactor centerline if the potentiometric level is reduced to El. +5.

The final requirement for the design of the dewatering system relates to drawdown in the unconfined aquifer at the eastern property line caused by construction dewatering. The drawdown criteria for implementing mitigation measures are set forth in Reference 1.

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IV. EXISTING DEWATERING SYSTEM

The existing dewatering system is shown in Exhibit 3 and consists of five sump wells, two free-flowing drains, and a shallow wellpoint system. Except for sump well E, the sump wells, drains, and wellpoints are located outside the buildings.

At the time construction was halted in September 1977, the dewatering system consisted of four sump wells (A through D) (Exhibit 3) in conjunction with a slurry wall around the excavation. A sheet pile wall was installed around the Reactor Building in October 1977. A fifth sump well (E) was installed in June 1978. Groundwater levels have been maintained at approximately El. +7 inside the slurry wall by continuous operation of the sump wells which have a combined discharge rate of 250 to 300 gpm. Approximately two-thirds of the water pumped by the sump wells is derived from the confined aquifer (Reference 2).

The shallow wellpoint system was tested from October 17 to November 13, 1978. During the interval of continuous wellpoint operation (October 23 to November 10, 1978), the shallow wellpoint system performed satisfactorily and demonstrated the ability to hold the water table below El. 0, the general excavation level for the Radwaste Building. This level was maintained with an average discharge of 450 gpm from the shallow wellpoints and sump wells A, B and C. Of the total 450 gpm discharge, the shallow wellpoint system contributed approximately 200 gpm.

The two free-flowing drains operated continuously at a discharge level of El. +3 throughout the winter of 1978-1979. Potentiometric levels in the confined aquifer beneath the excavation were measured using six pneumatic piezometers (P-series) installed in June 1978, (Exhibit 3). The combined discharge from Drains 1 and 2, about 55 gpm in March 1979, did not produce the necessary pressure relief. Discharge from the confined aquifer must be increased to achieve the required pressure relief. Pumping tests were performed on the free-flowing drains to determine their capacity. The results of these tests and subsequent evaluations are described in Section V.

V. PUMPING TESTS

During the spring of 1979, NIPSCO undertook an extensive field testing program to investigate the characteristics of the confined aquifer. The pumping test results described in this section are summarized from Attachment A.

Existing Drains

Drains 1 and 2 were developed to assure that each drain would be tested at its full capacity. Development was successful on Drain 1. The filter surrounding Drain 2 failed during development; that is, the filter did not prevent movement of the aquifer sands into the drain. As a result, Drain 2 was abandoned. The development procedure is described in Attachment A.

A 25-hour pumping test was conducted on Drain 1 on March 15-16, 1979. Discharge from the drain averaged 68 gpm during the test. Groundwater levels were closely monitored using the P-series piezometers and the observation wells surrounding the excavation. Test data are presented in Attachment A.

The observational data gathered during the testing of Drain 1 was insufficient, primarily because the maximum sustained

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pumping rate which could be achieved was too low. The response of the piezometers indicated that the aquifer was not stressed sufficiently to provide meaningful data for reliable interpretation of the aquifer characteristics.

Test Well

Since the above tests failed to provide sufficient meaningful data, a larger, more productive well, fully penetrating the confined aquifer, was installed and tested. The purpose of the pump test was to sufficiently stress the confined aquifer to provide the information needed to determine the aquifer characteristics to be used for the design of a pressure relief system and to assess the effects of construction dewatering at the eastern property line.

Installation and development of the test well, located in the southeastern corner of the excavation, were completed on April 18, 1979. Two fully penetrating observation wells, AP-1 and AP-2, were also installed at this time. Locations of AP-1, AP-2 and the test well are shown on Exhibit 3. Boring logs and installation diagrams for the test well and observation wells are included in Attachment A.

Beginning April 21, 1979, the test well was pumped at a sustained rate of 174 gpm for 96 hours, which stressed the aquifer sufficiently. Results of this test, including recovery data, are presented in Attachment A. These results were evaluated using a model developed by Hantush and Jacob which assumes a leaky confined aquifer with no change in water levels in the unconfined aquifer and no storage in the confining layer. In those cases where storage in the test well was a significant factor in the response of an observation well, the methods of Papadopoulos and Papadopoulos-Cooper were applied. These methods are summarized in Reference 5 "Review of Leaky Artesian Aquifer Test Evaluation Methods".

Based upon the analyses performed in conjunction with the testing program, the following is concluded:

1. The transmissivity of the confined aquifer is in the range of 10,000 to 14,000 gpd/ft in the excavation area.

2. The storativity of the confined aquifer is on the order of 10^{-4}.

3. A source of recharge to the confined aquifer is apparent about 600 feet south-southeast of the test well.

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4. A barrier boundary is apparent across the northern portion of the excavation.

The effects of the pumping test at the eastern property line are demonstrated in the potentiometric maps included as Figures 9 through 12 of Attachment A. From these figures, it is concluded that pumping of the test well resulted in negligible drawdown in the unconfined aquifer and less than one-half foot of drawdown in the confined aquifer at the eastern property line.

These conclusions are the basis for development of the alternative pressure relief systems described in Section VI.

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VI. RECOMMENDED METHOD OF PRESSURE RELIEF

Evaluation of Alternative Systems

Analyses of alternate designs for pressure relief systems are based upon an analytical model where transmissivity is assumed to be 12,000 gpd/ft and an east-west barrier to flow is located at the south end of the Turbine Building. As a consequence of the close source of recharge which was apparent during the pumping test, a radius of influence of 600 feet was used in the model, rather than the usual 10,000 to 20,000 feet expected in a confined aquifer. A "static" water level of El. +25 was assumed for the confined aquifer in the model. This elevation is consistent with levels reported in Reference 3.

The analytical model does not account for uncontrolled drainage through discontinuities in the confining layer since the nature and amount of leakage cannot be separately quantified. As a result, the design of the alternate pressure relief systems conservatively assumes that all upward seepage from the confined aquifer to the unconfined aquifer is intercepted.

The three design alternatives analyzed for a pressure relief system are: (a) an array of free-flowing drains discharging at El. +3; (b) deep pumped wells; and (c) deep wellpoints. These alternatives are discussed below.

It should be noted that the number of drains, wells, or wellpoints given belcw includes only those necessary to achieve the required pressure relief. Additional drains, wells, or wellpoints will be installed for system reliability, for example, to accomodate equipment damage and routine maintenance.

Free-Flowing Drains Discharging at El. +3

Analyses indicate that free-flowing drains are technically and economically infeasible because of the large number of drains required (in excess of 26) and the inflexibility inherent in a free-flowing system. Therefore, they are not considered further.

Deep Pumped Wells

Three to six deep pumped wells would be necessary to achieve the required pressure relief. The final number and locations of wells would be determined using an observational approach. That is, the location and number of wells would be re-evaluated after each well is installed. Each well would be approximately 80 feet deep and 30 inches in diameter, with a 12-inch diameter well screen surrounded by filter material.

Deep Wellpoints

Analyses indicate that approximately 18 deep wellpoints located as shown in Exhibit 4 would be necessary to achieve the required pressure relief. The final location, depth, and number of wellpoints would be determined using the observational approach as described for deep pumped wells. Each 2-1/2 inch diameter wellpoint surrounded by filter materal would be installed in a 12-inch diameter borehole. Due to the decreasing elevation of the confined aquifer to the north, wellpoint depths will range from 50 to 70 feet below a surface elevation of +8.

Selection of a Pressure Relief System

Final comparisons were made between systems of deep pumped wells and deep wellpoints. Based upon the following comparasions, deep wellpoints were selected because they are the best engineering solution for pressure relief and most environmentally acceptable.

Discharge Requirements

A system of deep wellpoints can achieve the required pressure relief with less total pumping from the confined aquifer than a system of deep wells. Because the

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individual wellpoints can be controlled, pumping can be concentrated in those areas where pressure relief requirements are greatest, resulting in the least effect on the hydrogeologic environment.

Flexibility

Because a wellpoint system consists of numerous low-yield wells, their spacing and depth can be varied during installation so as to:

A. Detect subsurface variability, i.e., each installation is, in effect, an exploratory boring.

B. Concentrate the system capacity in the most pervious zones of the aquifer.

C. Increase assurance that the pumping system will intercept all significant lateral flow in the confined aquifer.

Installation

The smaller diameter drill hole required for wellpoints greatly reduces the difficulty of installation. The wellpoint system is much more adaptable than deep wells

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to the necessary procedures of staged installation, whereby the initial wellpoints of the system must be located and must be operated so as to produce enough pressure relief to permit drilling from El. +8 (present excavation grade) to install the balance of the system.

It is anticipated that the drawdown in the unconfined aquifer at the eastern property line resulting from construction dewatering will be the same as that described in Reference 1. Any drawdown effects can be readily detected by the existing groundwater monitoring network and controlled by the trickling filter recharge system described in References 1 and 2.

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VII. CONCEPTUAL DESIGN OF DEEP WELLPOINT SYSTEM

A system of deep wellpoints has been selected as the method to provide pressure relief in the Bailly N-1 excavation. In addition to providing the necessary pressure relief, the conceptual design incorporates features (a) to assure that natural soil fines will not be removed from the confined aquifer during operation, (b) to provide system reliability, and (c) to prevent buildup of excessive pressure in the confined aquifer in the unlikely event that all power (primary and backup) is lost. The design approach to accommodate each of these items is described below.

The required degree of pressure relief varies across the excavation because of the different excavation levels and non-uniform thickness of the confining layer. The pressure relief effort will be concentrated in those areas requiring the greatest pressure reduction. In addition, the system will have sufficient capacity to further reduce excessive pressures in the confined aquifer beneath the sumps extending below the general excavation levels, if required.

The installation and successful operation of the test well provided valuable experience in the design and construction of efficient wells in the confined aquifer beneath the Bailly

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N-1 excavation. This knowledge forms the basis for the design of an effective and reliable deep wellpoint system to provide pressure relief.

The installation specifications and the operating instructions for the deep wellpoint system will include specific provisions to prevent the removal of natural soil from the confined aquifer during pumping. A detailed specification of the filter material and the method of its placement around the wellpoint screens will be prepared. The installation specifications will also require that each wellpoint be test pumped before it is connected to the system to demonstrate that it produces a clear, sand-free discharge.

The header piping system will include a settling trap to collect solid material transported in the header. The wellpoint system maintenance procedures will require frequent cleaning of this trap and examination of any collected solid particles. If natural soil particles are observed in these inspections, individual wellpoints will be test pumped to detect which, if any, wellpoints may have started to pump fines from the aquifer. Defective wellpoints will be deactivated and, if required for system reliability, replaced.

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The design of the piping and pumping details of the deep wellpoint system will include redundant features with automatic controls. These redundant features will be similar to those frequently used to provide operational reliability in construction dewatering, e.g., alternative power sources with automatic switchover. The number and location of the pumps and details of piping and valves will enable continued system operation despite disturbances due to routine maintenance of individual wellpoints and pumps or resulting from damage by construction activities. These design features will mean that foundation construction activities may proceed without significant interruption.

Despite the fact that numerous precautions will be incorporated in the design to minimize the possibility of malfunction, the hypothetical case of a temporary loss of both primary and backup power systems has been considered. Therefore, the system will be designed to: (a) provide stability against excavation uplift, and (b) minimize the potential for sand boil development. In the unlikely event of a total power failure, the deep wellpoint system will be designed to automatically discharge as free-flowing drains. Analytical evaluation of a system of free-flowing drains discharging at El. 0 leads to the conclusion that temporarily, during the period of total power loss (less than

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8 hours), the potentiometric levels in the confined aquifer might range in elevation from +5 at the south end of the Radwaste Building to +9 at the south end of the Reactor Building. Under these conditions, the total overburden pressure at the base of the confining layer will still be greater than the uplift pressures.

Where the confining layer is continuous, the magnitude of the hydraulic gradient is of little practical significance as long as the total overburden pressure is greater than the uplift pressure at the base of the confining layer. However, where the confining layer is discontinuous, water may flow upward through a continuous column of sand. Discontinuities in the confining layer may exist at the locations of preconstruction activities. Because of these activities, the soils in these areas are less dense than their undisturbed state. Under these conditions, the hydraulic gradient must be maintained below the critical hydraulic gradient (Reference 6: Soil Mechanics).

It should be noted that in the preconstruction areas where these discontinuities are known to exist, the soils will be densified by driving displacement densification piles early in the construction schedule (Reference 7: "Response to NRC Requests for Information of June 28, 1979"). This densification will increase the critical hydraulic gradient and eliminate the potential for the development of sand boils. In the unlikely event that the postulated total loss of power occurs prior to densification of the preconstruction areas, the hydraulic gradient in these areas would be close to the critical hydraulic gradient. The probability of this occurrence is remote and as such should not be considered as a design criterion; however, gravel material will be available in the excavation for placement as a surcharge filter above a sand boil in the unlikely event that one occurs. Such use of gravel as a surcharge filter will prevent the migration of soil fines, yet allow pressure relief to continue in a controlled manner. This condition would only exist for the short duration of time required to restore construction power.

In summary, the deep wellpoint system will be designed to: (a) eliminate the potential removal of fines from the confined aquifer during operation, (b) provide system reliability in case of an equipment malfunction, and (c) incorporate features to assure that the stability of the excavation and the underlying aquifer will not be jeopardized in the remote possibility that all power is lost.

VIII. EFFECTS OF PRESSURE RELIEF AT THE PROPERTY LINE

The discharge rate from the deep wellpoint system will depend upon the final number and locations of wellpoints within the excavation. Although the discharge rate cannot be predicted with certainty, it is not expected to be greater than 750 gpm. Operation of the shallow wellpoint system has shown that the water table can be maintained below the general excavation level with less discharge than previously estimated. Thus, installation of deep wellpoints for pressure relief is not expected to increase the total discharge rate beyond 1300 gpm, as estimated for the previously approved dewatering system described in Reference 1.

With no change in the total discharge rate from the construction dewatering system, the environmental effects due to construction dewatering are not expected to differ from those previously described. Any changes in drawdown in the unconfined aquifer at the eastern property line will be detected using the existing groundwater monitoring network. Increases in drawdown in the unconfined aquifer beyond those identified in Reference 1 can be readily avoided using the existing trickling filter recharge system. The mitigation criteria committed to in Reference 1 will still be applied.

IX. CONCLUSIONS

This report has described the site hydrogeologic characteristics, site dewatering requirements, pumping tests performed to determine the capacity of the existing free-flowing drains, and the installation and testing of a deep test well to refine the aquifer parameters. These investigations have been used to determine the best method to relieve pressures in the confined aquifer beneath the Bailly N-1 excavation. The following conclusions are drawn from these investigations:

1. Deep wellpoints are the best engineering method for pressure relief in the confined aquifer from the standpoint of ease of installation, greater flexibility in operation, and minimizing the effect of construction dewatering at the eastern property line.

2. The estimated combined discharge from all components of the construction dewatering system will not increase as a result of installing deep wellpoints for pressure relief. Therefore, the offsite environmental effects are expected to be the same as previously described in References 1 and 2.

3. The existing groundwater monitoring network will be used to detect any changes in groundwater levels in the unconfined aquifer at the eastern property line due to construction dewatering. The mitigation criteria committed to in Reference 1 will continue to be applied.

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X. REFERENCES

1. Sargent & Lundy, "Response to NRC Questions, Bailly Generating Station, Nuclear 1", July 20, 1978.

2. Sargent & Lundy, "Hydrogeologic Evaluation of Construction Dewatering, Bailly Generating Station, Nuclear 1", March 30, 1978.

3. Meyer, William and Patrick Tucci, 1979, "Effects of Seepage from Fly-Ash Settling Ponds and Construction Dewatering on Ground-Water Levels in the Cowles Unit, Indiana Dunes National Lakeshore, Indiana" U.S. Geological Survey, Water-Resources Investigations 78-138, p. 95.

4. Sargent & Lundy, "Supplementary Information on Driven H-Pile Foundations, Bailly Generating Station, Nuclear 1", December 4, 1978, Chapter 2, p. 2-1 to 2-27.

5. Walton, William C., 1979, "Review of Leaky Artesian Aquifer Test Evaluation Methods" Ground Water, Vol. 17, No. 3, pp. 270-283.

6. Lambe, T. William and Whitman, Robert V., 1969, Soil Mechanics, John Wiley & Sons, Inc., New York.

7. Northern Indiana Public Service Company, "Response to NRC Requests for Information of June 28, 1979, Bailly Generating Station, Nuclear 1", August 14, 1979.

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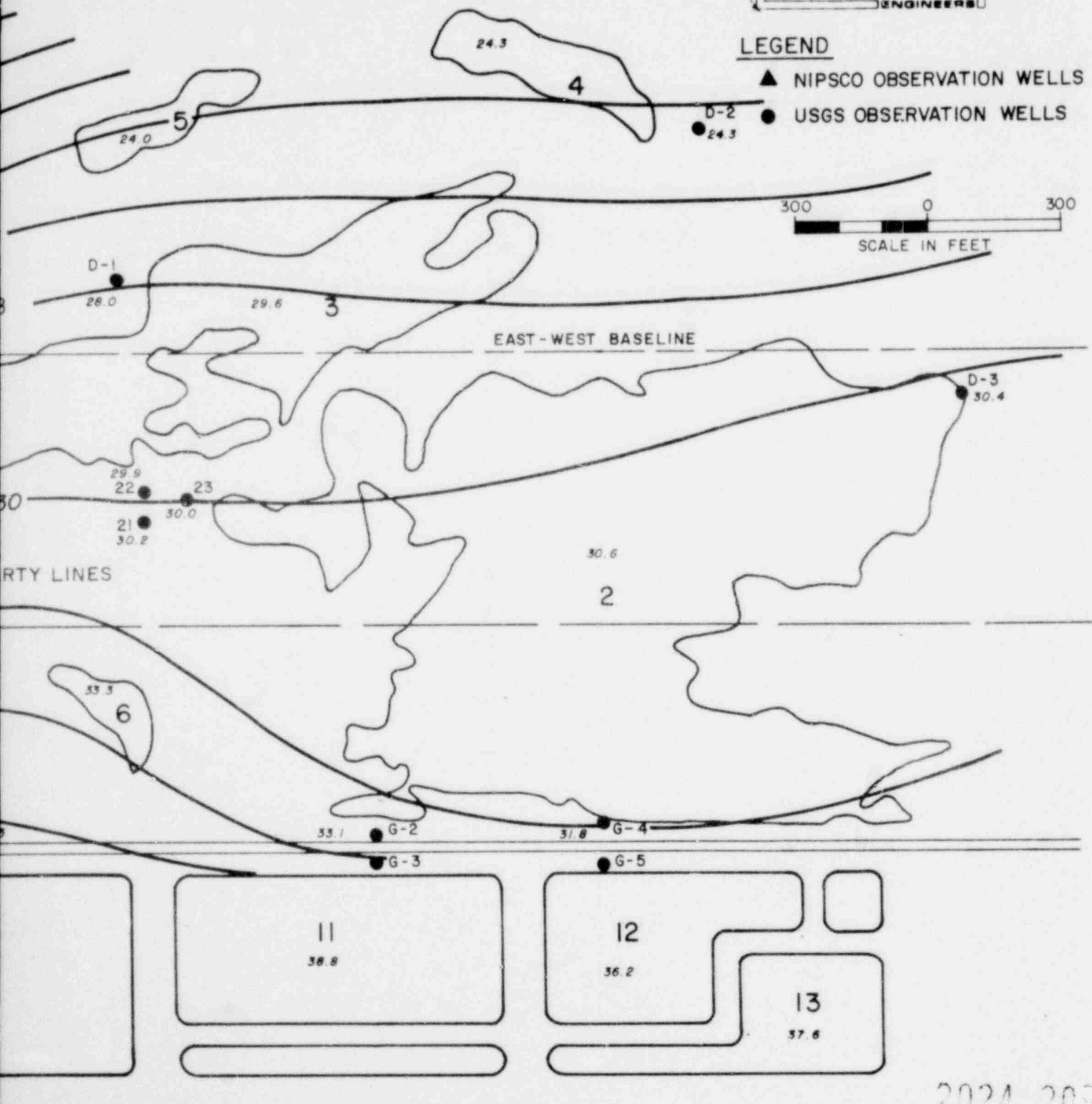
EXHIBIT I
POTENTIOMETRIC SURFACE FOR THE UNCONFINED
AQUIFER ON JULY 5, 1979
BAILLY GENERATING STATION, NUCLEAR I
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY
ENGINEERS



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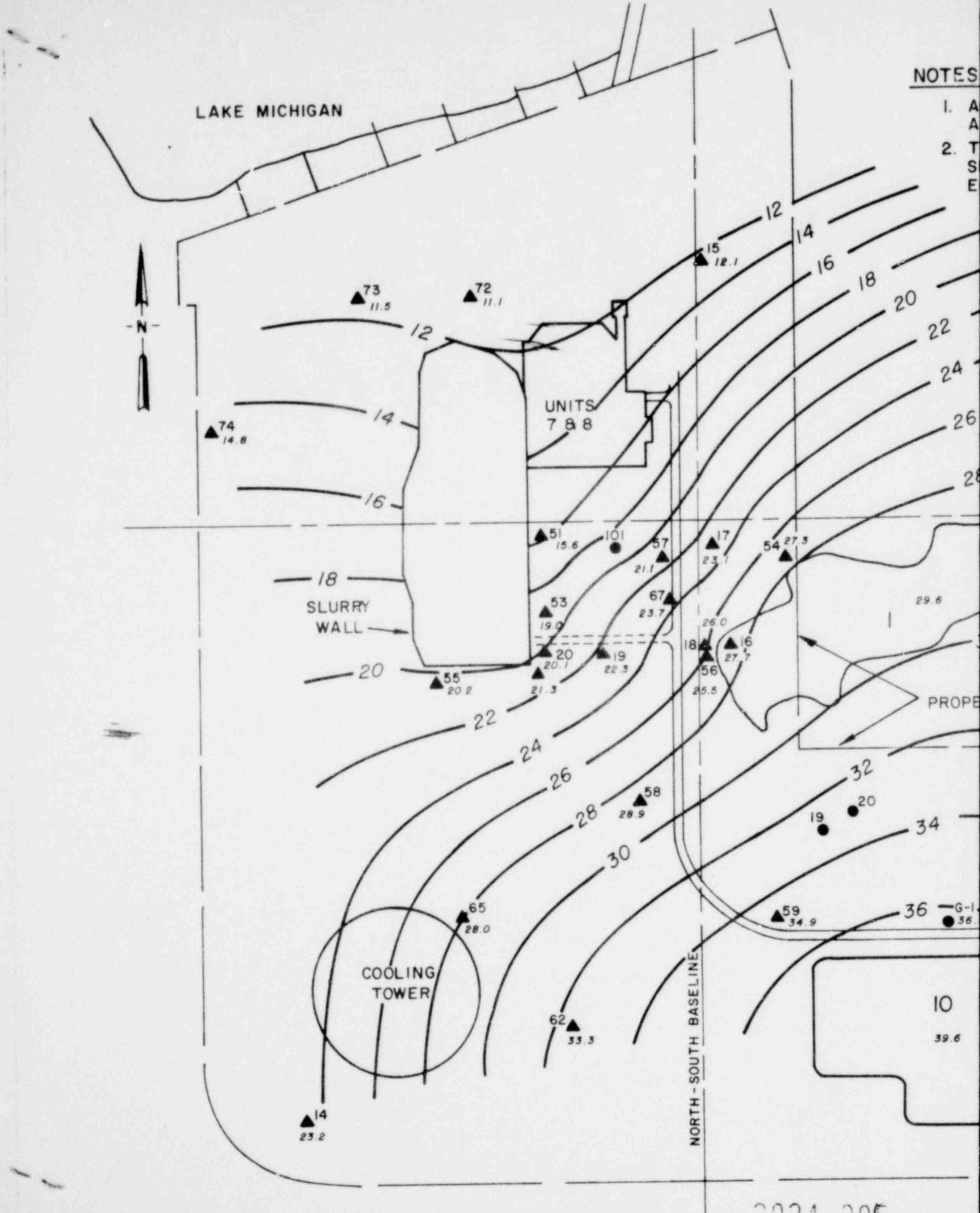
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EXHIBIT 2

POTENTIOMETRIC SURFACE FOR THE CONFINED AQUIFER ON JULY 5, 1979

BAILLY GENERATING STATION, NUCLEAR 1

NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS

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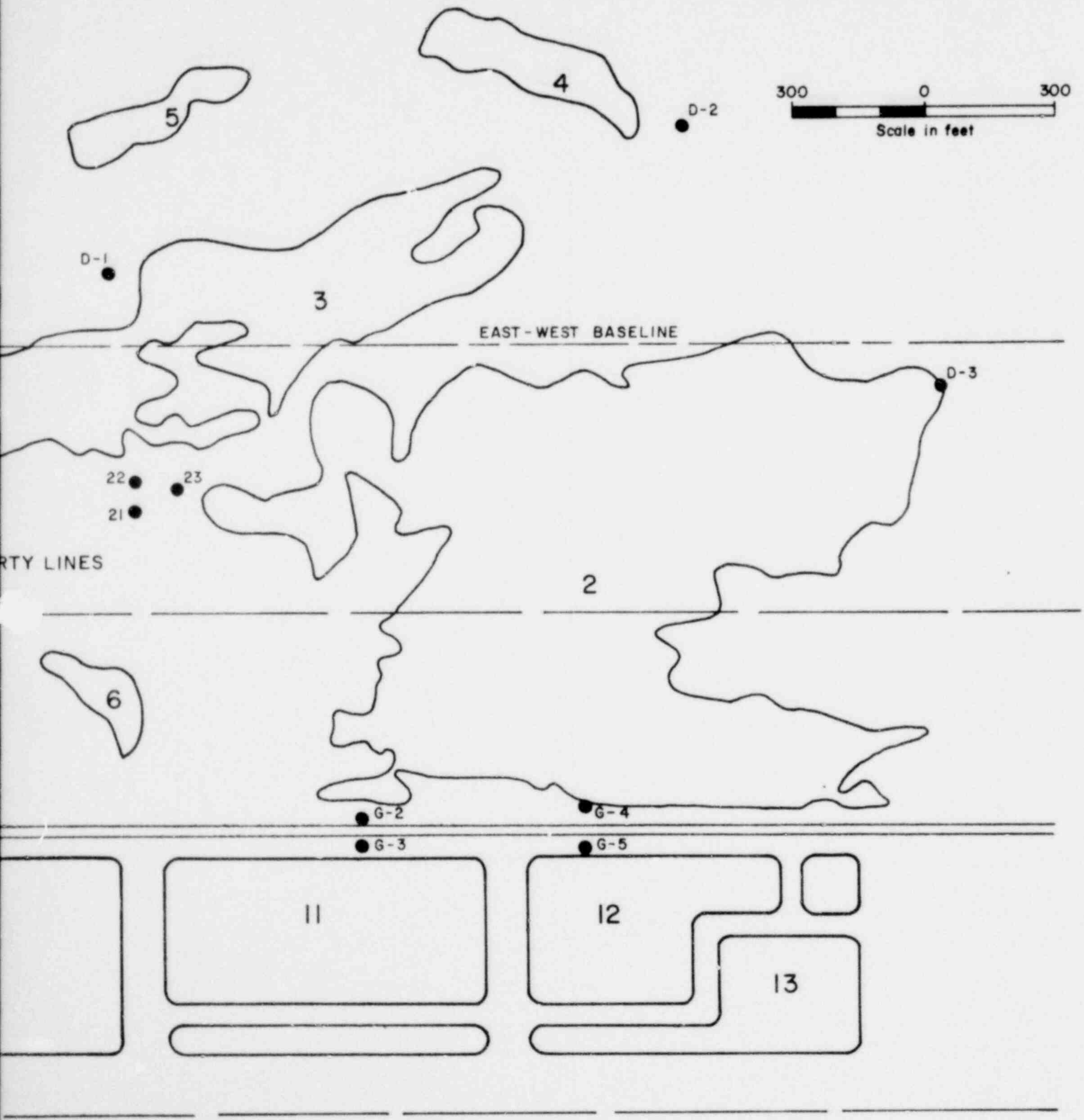

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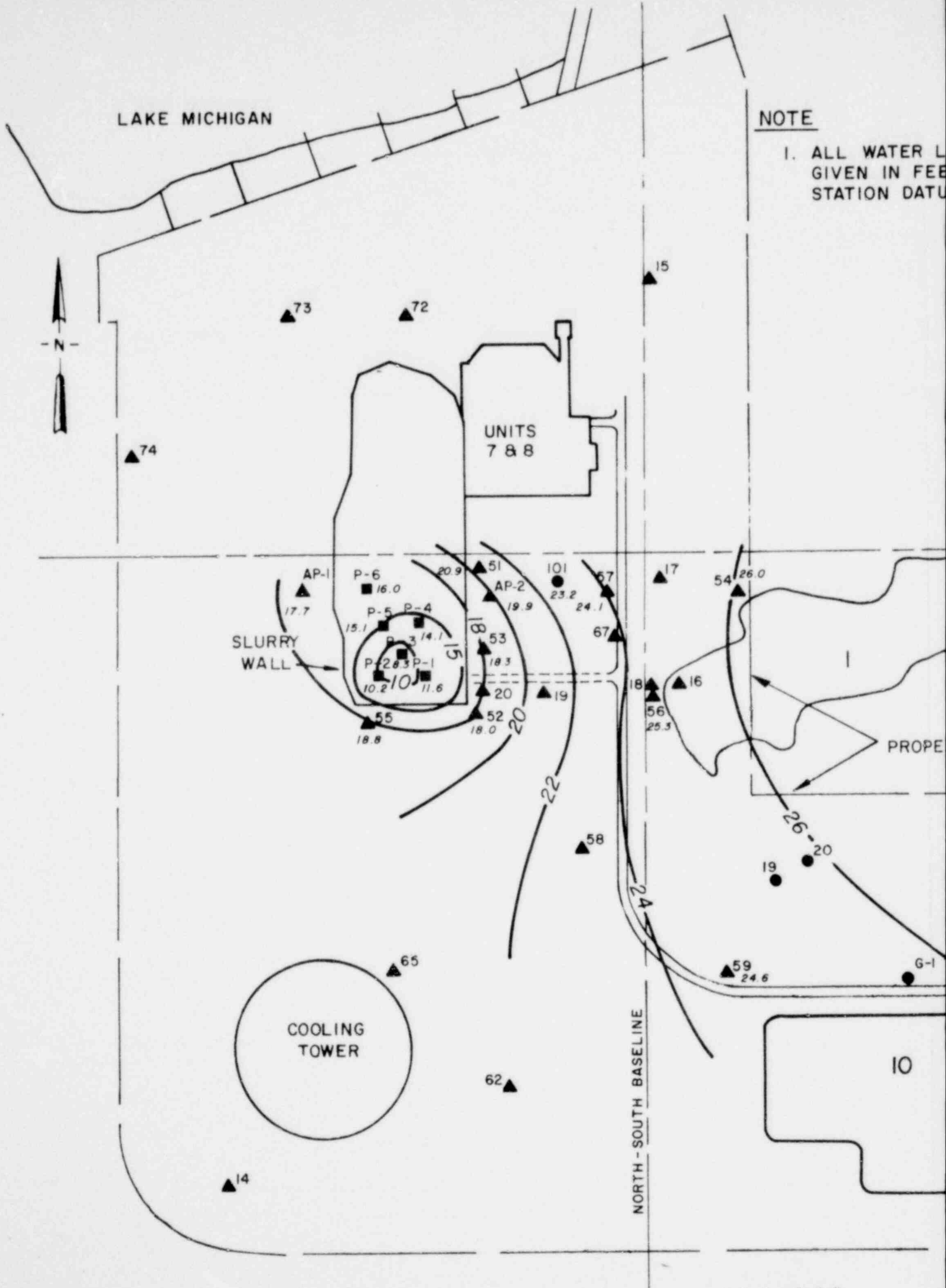
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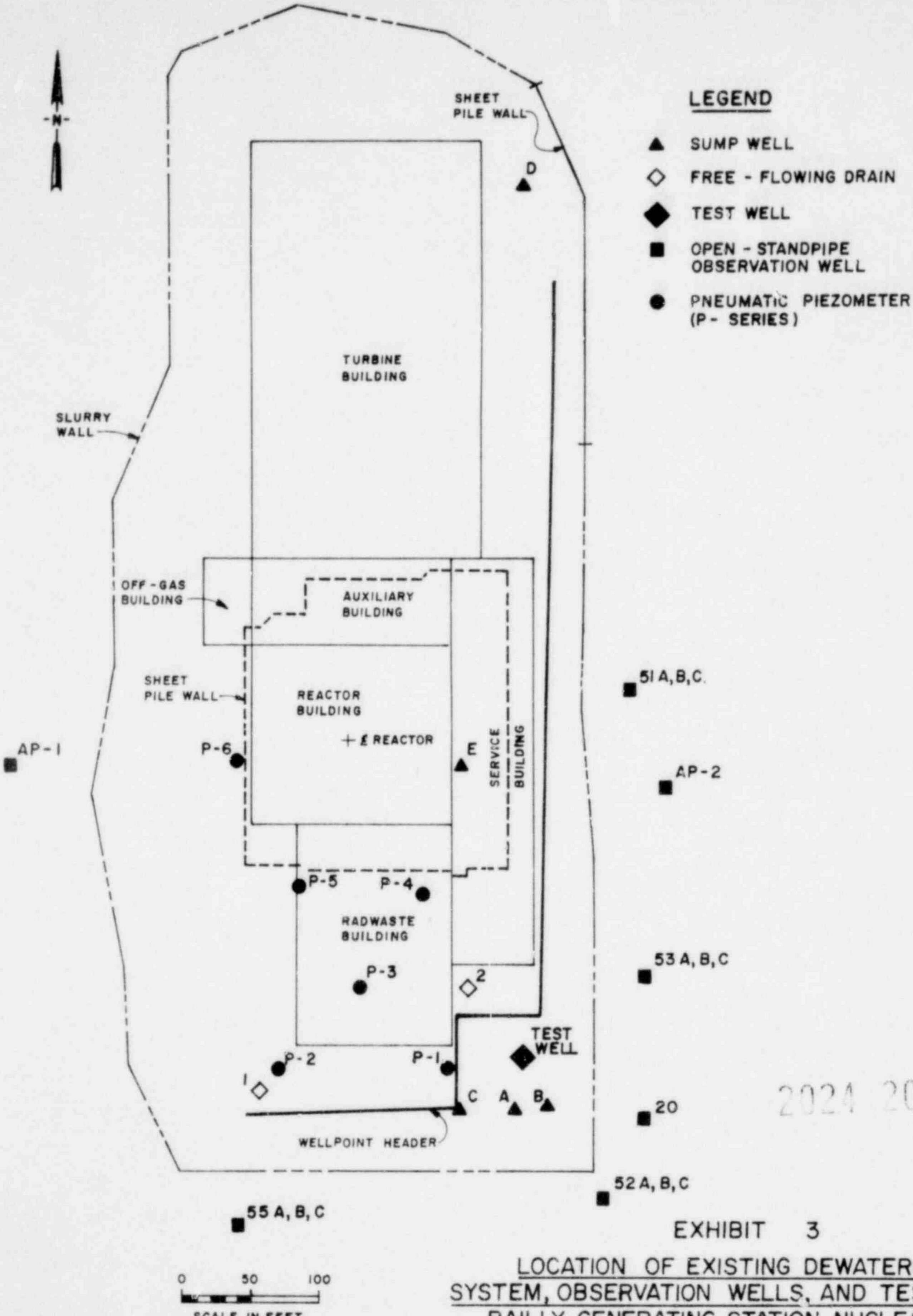

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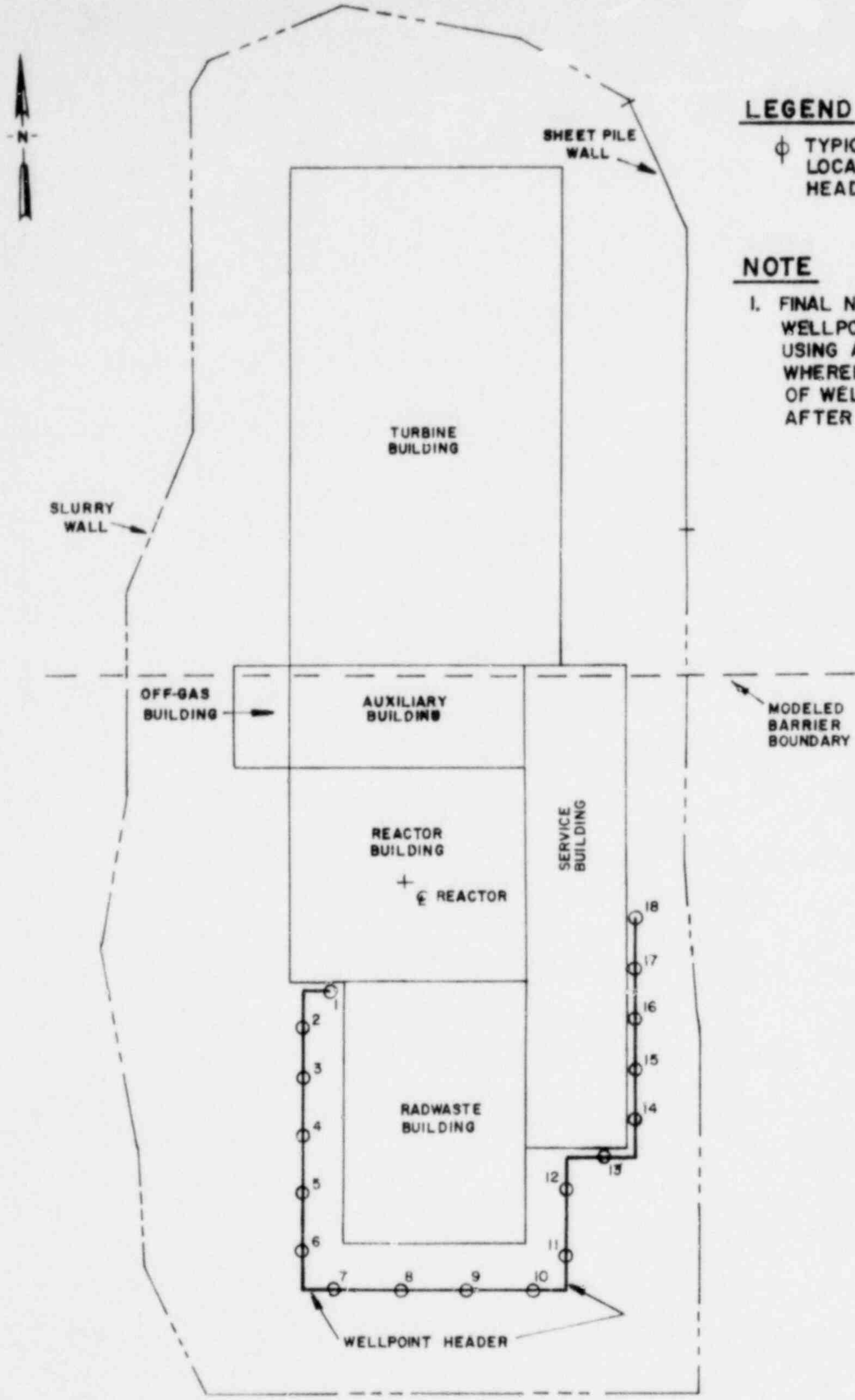
EXHIBIT 3

LOCATION OF EXISTING DEWATERING SYSTEM, OBSERVATION WELLS, AND TEST WELL
BAILLY GENERATING STATION, NUCLEAR 1
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS



LEGEND

ϕ TYPICAL DEEP WELLPOINT LOCATION ALONG WELLPOINT HEADER.

NOTE

1. FINAL NUMBER AND LOCATIONS OF WELLPOINTS WILL BE DETERMINED USING AN OBSERVATIONAL APPROACH WHEREIN THE NUMBER AND LOCATION OF WELLPOINTS IS REEVALUATED AFTER EACH INSTALLATION.

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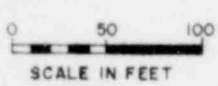

EXHIBIT 4

TYPICAL CONFIGURATION OF DEEP WELLPOINTS FOR PRESSURE RELIEF

BAILLY GENERATING STATION, NUCLEAR 1
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS