SARGENT & LUNDY
ENGINEERS
CHICAGO

GROUND WATER MONITORING PROGRAM FOLLOWING

SEALING OF SETTLING BASINS AT

BAILLY GENERATING STATION

NORTHERN INDIANA PUBLIC SERVICE COMPANY

BAILLY GENERATING STATION, NUCLEAR 1

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Prepared by:

Sargent & Lundy
Chicago, Illinois

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I. INTRODUCTION

A dewatering system is required for the construction of Bailly Generating Station, Nuclear 1 (Bailly N-1) because the foundations are below the ground water level. A network of observation wells was installed to monitor ground water levels in the vicinity of the site during construction dewatering. The existing monitoring network is described in Reference 1. Drawdown limits for ground water levels in the unconfined aquifer at the site boundary caused by construction dewatering have been established with the Nuclear Regulatory Commission (NRC). Specific drawdown limits for implementing ground water recharge using a trickling filter recharge system are given in Reference 2. The recharge system is described in References 1 and 2.

The design of the present monitoring and recharge system was based in part on the assumption that seepage from the settling basins, located southeast of the Bailly N-1 excavation (Exhibit 1), would continue during the interval of construction dewatering for Bailly N-1. However, under the terms of an agreement between Northern Indiana Public Service Company (NIPSCo) and the U.S. Department of the Interior, NIPSCo is undertaking a program to seal the settling basins to eliminate seepage into the adjacent Indiana Dunes National Lakeshore (National Lakeshore). Sealing of the settling basins is

scheduled to begin in March 1980. After the settling basins are sealed, ground water levels will decline across the Bailly site and a portion of the adjoining National Lakeshore. The present method of evaluating drawdown in the National Lakeshore resulting from construction dewatering for Bailly N-1 cannot differentiate between declines in ground water levels resulting from construction dewatering and those caused by sealing the settling basins.

The purpose of this report is to present a method for evaluating the effects of Bailly N-1 construction dewatering on the unconfined aquifer in the adjoining National Lakeshore once the settling basins are sealed. This report also describes the method of sealing the settling basins, the existing and future site hydrogeologic conditions, and modifications to the monitoring program. The impact of sealing the settling basins on the mitigation criterion is also discussed.

II. SUMMARY

NIPSCo has implemented a program of ground water monitoring which includes, if necessary, recharge to protect ground water levels in the adjacent National Lakeshore from excessive drawdown caused by construction dewatering for Bailly N-1.

The existing monitoring program and trickling filter recharge system are described along with the present mitigation criterion in References 1 and 2.

Upon sealing the settling basins, ground water levels across the Bailly site and a portion of the adjoining National Lakeshore will decline to their natural state as desired by the National Park Service (NPS). These declines will be independent of construction dewatering activities. Ground water level declines resulting from Bailly N-1 construction dewatering may also occur during dissipation of the ground water mound following sealing of the settling basins. As a result, the method presently used to evaluate drawdown attributable to construction dewatering, as described in Reference 1, will no longer be valid because it cannot differentiate between drawdown caused by construction dewatering and simultaneous declines resulting from sealing of the settling basins. Thus, an alternate method of evaluating the effects of construction dewatering has been developed which incorporates the ground water level declines that will result from sealing the settling basins.

The U.S. Geological Survey (USGS) has constructed a three-dimensional digital model to simulate the ground water flow system in the vicinity of Bailly N-1 (Reference 4). Using this model, the USGS has generated reference ground water levels which represent the ground water levels that would

have occurred across the Bailly site and adjacent National Lakeshore on October 26, 1976, had there never been any seepage from the settling basirs (Reference 5). (Construction dewatering for Bailly N-1 had not begun on that date.) The USGS reference levels are listed in Table 1. It is these ground water levels that the NPS wants restored and preserved in the adjacent National Lakeshore (Reference 5). NIPSCo will use the USGS reference levels to evaluate the necessity for mitigation during dissipation of the ground water mound created by seepage from the settling basins.

The mitigation criterion previously established in Reference 2 has been modified to comply with the NPS position stated in Reference 5 that ground water levels in the National Lakeshore be maintained at their natural levels. The criterion should also reflect the ±2-foot accuracy of the reference levels (Reference 5). Therefore, NIPSCo will adopt a drawdown limit of two feet at the eastern property line as the basis for implementing mitigation. Except for the months during which the ground is frozen, specific drawdown limits at observation wells 54C, 16, and 67 will be 2.0, 2.5, and 3.0 feet below the seasonally adjusted reference levels, respectively. When the ground is frozen, the respective drawdown limits will be 3.0, 3.5, and 4.0 feet below the seasonally adjusted reference levels. These modified drawdown limits will be applied after sealing of the settling

basins begins. Mitigation will be accomplished using the trickling filter recharge system described in Reference 1 and 2. Mitigation will not be required if declines in ground water levels cannot be attributed to construction dewatering for Bailly N-1. This includes such instances as 1) smaller ground water level declines at NIPSCo's eastern property line than are measured farther east in the adjacent National Lakeshore or 2) ground water levels that have declined uniformly across the adjacent National Lakeshore.

If the ground water mound has substantially dissipated before Bailly N-1 construction resumes, the USGS reference levels may be verified using ground water levels measured in the observation wells. New baseline ground water levels will then be established from these measurements as the basis for implementing mitigation. In this event, NIPSCo will return to the mitigation criterion previously established in Reference 2.

NIPSCo will install two new observation wells in the unconfined aquifer north of Settling Basin 10, as shown on Exhibit 6. These new observation wells will be used in conjunction with the existing USGS and NIPSCo observation wells to verify the USGS reference levels following dissipation of the ground water mound. NIPSCo will also begin weekly monitoring of the USGS observation wells identified in Table 2 approximately one month before sealing of the settling basins

begins. Weekly monitoring shall continue until construction dewatering for Bailly N-1 is terminated.

III. METHOD OF SEALING THE SETTLING BASINS

The settling basins will be sealed by installing a double liner in the existing settling basins and bottom ash area. The double liner will consist of a compacted clay liner overlain by a membrane liner. The configuration of the sealed settling basins and typical liner construction detail are shown on Exhibit 2. One set of settling basins and a portion of the bottom ash area will remain in service at all times during installation of the liners to permit the continued operation of Bailly Generating Station, Units 7 and 8 (Bailly 7&8). Water that is not recycled for plant use presently leaves the system by seepage from the unlined settling basins. However, this seepage will no longer exist when construction begins in the second set of settling basins. Excess water which is not recycled will then be discharged to Lake Michigan following treatment to meet existing chemical discharge limitations.

Construction of the liners will require excavation to El. +30.* The water level in the unlined settling basins varies

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*Plant grade is El. +40. Elevations refer to NIPSCo datum, where El. 0.00 equals mean Lake Michigan Level, El. 576.80 feet (IGLD, 1955).

from El. +36 to +41. As shown by USGS observation wells G-1, G-3, and G-5, ground water levels around the settling basins are also high, usually above El. +35 (Exhibit 3). Thus, dewatering will be required around the settling basins to allow construction of the liners. Water removed by the dewatering system will be discharged to the operating set of settling basins.

A water budget analysis will be performed on each primary and secondary settling basin once every two years to evaluate the effectiveness of the liners in preventing leakage. For the analysis, precipitation, evaporation and changes in water levels will be monitored for one week while inflow is halted to the basin being tested.

IV. EXISTING HYDROGEOLOGIC CONDITIONS

As described in References 1 and 3, two aquifers are present in the Bailly N-1 excavation area, one unconfined and one confined. Available boring and observation well data indicate that both aquifers are also present in the vicinity of the settling basins and adjacent National Lakeshore. However, the stratigraphy beneath the settling basins and adjacent National Lakeshore differs from that in the excavation area, as described in this section.

The unconfined aquifer beneath the settling basins and adjacent National Lakeshore consists of fine to medium sand with some gravel and occasional thin layers of organic material. In contrast to the stiff silty clay confining layer present beneath the Bailly N-1 excavation, the unconfined and confined aquifers in the vicinity of the settling basins are separated by a soft, calcareous clayey silt containing numerous shell fragments and some organic material. The thickness of the confining layer ranges from less than five feet to 16 feet in the four borings that penetrated this layer. The top of the confining layer varies in elevation from approximately +4 at the west end of the settling basins to approximately +9 at the east end. The top elevation and thickness of the confining layer in the National Lakeshore area are not known because no USGS borings reached the necessary depth. Based upon two borings drilled to rock on NIPSCo property (NIPSCo 59 and USGS 102), the confined aquifer consists of fine to coarse sand and extends to approximately El. -72 to -75. Interbedded clay and silt layers in the confined aquifer are not as prevalent in the vicinity of the settling basins as beneath the Bailly N-1 excavation.

Ground water levels in the unconfined and confined aquifers are measured in the observation wells shown on Exhibit 1.

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Ground water levels at the Bailly site respond to changes in: 1) natural recharge to and discharge from the aquifers caused by variations in precipitation, evapotranspiration, and fluctuations in the level of Lake Michigan; 2) the rate of pumping by nearby industries; 3) the amount of water discharged to the unlined settling basins during operation of Bailly 7&8; and 4) the rate of construction dewatering for Bailly N-1. Potentiometric surface maps for the unconfined and confined aquifers, prepared using water levels measured on November 7, 1979, are included as Exhibits 3 and 4. Comparison of these maps with Exhibits 1 and 2 of Reference 3 indicates that ground water levels in both aquifers have declined since July 5, 1979. Since there has been minimal change in the rate of construction dewatering from July to November 1979, the observed decline must be caused by some combination of the first three factors. Seasonal declines have been observed in ground water levels measured across the Bailly site every year since monitoring began in 1975 (Exhibit 5).

Long-term seepage from the unlined settling basins has created a large ground water mound in the unconfined aquifer. In response to this seepage, ground water levels in the adjoining National Lakeshore have risen such that the present water table is above the ground surface in some topographically

low areas. This has resulted in the development of permanent interdunal ponds. Formerly, only the deeper portions of the interdunal ponds retained any water, and then only during the wetter times of the year.

V. FUTURE HYDROGEOLOGIC CONDITIONS

As described in Section IV, seepage from the unlined settling basins has created a large ground water mound in the unconfined aquifer. The National Park Service, who administers the adjacent Indiana Dunes National Lakeshore, considered the elevated ground water levels to be unnatural and therefore undesirable, and requested that NIPSCo terminate seepage from the settling basins.

The unlined settling basins serve as an artificial, constant source of recharge to which the ground water flow system has adjusted. Sealing of the settling basins will cut off this source of recharge. Consequently, ground water levels will decline to the level that can be maintained by recharge from infiltrating precipitation.

Using a three-dimensional digital model, Meyer and Tucci of the USGS quantified the amount of water level decline that may be expected once the settling basins are sealed (Reference

4). The model predicts declines of about 15 feet in the unconfined aquifer under the settling basins and as much as 10 feet along NIPSCo's eastern property line with the National Lakeshore. Water levels in all the interdunal ponds will fall several feet below the bottom of the ponds, except that some water would remain in the deepest holes in Interdunal Pond 7 (Reference 4). At the Bailly N-1 excavation, the model predicts a decline of about five feet in the unconfined aquifer. These predicted declines are independent of any decline resulting from construction dewatering for Bailly N-1.

The USGS model also predicts a two- to seven-foot decline in potentiometric levels in the confined aquifer following sealing of the settling basins (Reference 4). The distance from the settling basins and the vertical hydraulic conductivity of the confining layer control the magnitude of the decline. The greatest declines will be in those areas where the vertical hydraulic conductivity of the confining layer is the highest. Based upon the model results, the greatest declines in the confined aquifer will occur at the west end of Interdunal Pond 1, where boring data indicate the confining layer is absent and the vertical hydraulic conductivity should be the highest.

Meyer and Tucci (Reference 4) also determined from model

experiments the time necessary for dissipation of the ground water mound created by seepage from the settling basins. Water levels will decline rapidly following sealing of the settling basins, but the rate of decline will decrease with time. Most of the ground water mound will have dissipated within two years after the basins are sealed (Reference 4). However, as indicated in Section III, dewatering around the settling basins is required for installation of the liners. The effect of this dewatering will be to accelerate the rate of dissipation of the ground water mound.

The USGS model also predicts declines of less than three feet in the unconfined aquifer and less than five feet in the confined aquifer at NIPSCo's eastern property line resulting from construction dewatering for Bailly N-1 (Reference 4). Thus, the water level decline in the unconfined aquifer at the property line attributable to construction dewatering for Bailly N-1 will amount to less than one-third of the decline expected to result from sealing the settling basins. Water level declines in the confined aquifer caused by construction dewatering will be about the same as declines predicted for sealing the settling basins.

VI. CONSEQUENCES OF SEALING THE SETTLING BASINS

According to the present construction schedule, installation

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of the liners in the second set of settling basins will begin by mid-summer 1980. Seepage from the settling basins will be terminated at that time. However, ground water levels across the Bailly site and adjoining National Lakeshore will begin to decline as soon as dewatering begins around the settling basins.

Ground water levels in the unconfined aquifer are presently higher than potentiometric levels in the confined aquifer across most of the area. This indicates that ground water is moving from the unconfined to the confined aquifer. However, projected declines across the Bailly site and a portion of the adjacent National Lakeshore following sealing of the settling basins are greater in the unconfined aquifer than in the confined aquifer and the direction of seepage will be reversed in some areas after the mound has dissipated. This phenomenon is most evident at the west end of Interdunal Pond 1 (Attachment 2 of Reference 5) where the closed contour at El. 596 (NGVD)* represents a mound in the unconfined aquifer caused by seepage from the underlying confined aquifer.

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*National Geodetic Vertical Datum (1929); El. 596.00 NGVD corresponds to El. +17.33 NIPSCo datum.

Sealing of the settling basins will also lower the ground water levels in the vicinity of Bailly N-1 excavation, thereby reducing the dewatering rate. Previous reports have established that much of the water pumped from the excavation is derived from the confined aquifer (References 1 and 3). How much the dewatering rate will be reduced following sealing of the settling basins will largely depend on the vertical hydraulic conductivity of the confining layer. The uncertain nature of the confining layer in that area precludes an accurate estimate of the reduction in the required dewatering rate.

Despite the reduction in ground water levels across the Bailly site following dissipation of the ground water mound, the dewatering rate must be increased from the present level for construction of the Bailly N-1 foundation as described in References 1, 2, and 3. The increased rate of construction dewatering will cause ground water levels to decline temporarily near the excavation whereas dissipation of the ground water mound will result in a permanent decline in ground water levels. Given the present construction schedule for sealing the settling basins, it is possible that both declines would occur simultaneously. Application of the mitigation criterion to water levels measured in the observation wells under these circumstances would require a means of separating the

decline resulting from construction dewatering from that caused by all of the other factors listed in Section IV, including sealing the settling basins.

The present method of evaluating drawdown in the unconfined aquifer resulting from construction dewatering for Bailly N-1 relies upon an assumed constant shape of pre-dewatering water table contours. Although this method takes into account seasonal fluctuations in ground water levels, it cannot be used to differentiate declines caused by sealing the settling basins from those caused by construction dewatering should these declines occur simultaneously. Therefore, a method for evaluating the effects of construction dewatering during and after dissipation of the mound has been developed and is described in Section VII.

VII. EVALUATION OF THE EFFECTS OF CONSTRUCTION DEWATERING

From the time ground water monitoring at the Bailly N-1 site began in 1974, it was obvious that ground water levels in the unconfined aquifer were influenced by seepage from the unlined settling basins. There is no record of pre-seepage ground water levels. However, using the digital model developed by Meyer and Tucci (Reference 5), the USGS has produced a map showing the ground water levels that would have occurred in the unconfined aquifer on October 26, 1976, had there never been any seepage from the settling

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basins (Attachment 2 in Reference 5). Because construction dewatering for Bailly N-1 did not begin until March 1977, the ground water levels shown on this map represent the response of the unconfined aquifer only to nearby industrial pumping and seasonal variations in recharge and discharge. The USGS estimates the accuracy of these ground water levels, hereafter called reference levels, to be about ±2 feet (Reference 5).

NIPSCo will use the USGS reference levels, which are presented in Table 1, to evaluate the necessity for mitigation during and after dissipation of the ground water mound. However, the reference levels are not static and adjustments must be made to reflect natural seasonal fluctuations in the unconfined aquifer before the reference levels can be compared to actual ground water levels measured in the observation wells. Since all of the NIPSCo observation wells are located within the large ground water mound created by seepage from the settling basins, these observation wells cannot be used to determine the seasonal fluctuation during dissipation of the mound. The response of the observation well used to make seasonal adjustments to the reference levels should not be affected by either sealing of the settling basins or construction dewatering for Bailly N-1. In addition, the ground water level should have been measured in that observation

well on October 26, 1976, the same date for which the USGS reference levels were identified. Only two observation wells in the unconfined aquifer appear to satisfy these criteria: USGS observation wells 24 and 25 (Exhibit 1).

Five-year hydrographs for NIPSCo observation wells 16, 18, 19, and USGS well 25 are plotted on Exhibit 5. The hydrograph for USGS observation well 24 (not plotted) is similar to that for USGS well 25. While the hydrographs show ground water levels fluctuate seasonally at each observation well, the average seasonal range in ground water levels is 3.9 feet in the NIPSCo observation wells and 2.1 feet in USGS well 25. In addition, the seasonal high and low ground water levels are observed in the USGS wells about three months before they occur in the NIPSCo observation wells. Differences in hydrogeologic setting probably account for these differences in seasonal fluctuations: the NIPSCo observation wells are located in an area of relatively high and varying topography (dunes) whereas USGS wells 24 and 25 are located in a large, low marsh characterized by standing water throughout much of the year.

Despite the observed differences in seasonal fluctuations, NIPSCo will use USGS well 25 as the base well for seasonal adjustments to the reference levels. Seasonal adjustments will be made in the following manner:

1) Determine the difference between the observed water level in USGS well 25 on any day in question and the base level of +23.23 measured on October 26, 1976. The difference will be positive if the observed level is higher than the base level, negative if it is lower.

2) Adjust the reference levels at each observation well by adding the difference between the base and observed water levels determined above for USGS well 25 to the levels given in Table 1.

3) Compare the measured ground water levels in the observation wells to the adjusted reference levels to determine whether ground water levels have declined below the natural levels the NPS wants to preserve in the adjacent National Lakeshore.

If USGS well 25 is out of service for any reason, NIPSCo will use data from USGS well 24 to make seasonal adjustments to the reference levels. The procedure for making seasonal adjustments will be the same as described above for USGS well 25 except that the base level for well 24 is +27.77.

The above procedure assumes that seasonal fluctuations in ground water levels at the NIPSCo site during and after

dissipation of the ground water mound will be identical to those observed offsite in USGS well 25. This assumption cannot be verified since ground water levels were not measured prior to the existence of the settling basins. As shown on Exhibit 5, the seasonal behavior of USGS well 25 since 1975 is comparable to that in the NIPSCo observation wells.

As stated earlier in this section, the accuracy of the USGS model-simulated reference levels is about ±2 feet. Furthermore, assumed values of average annual recharge, hydraulic conductivity and storage coefficient for the aquifers, and thickness of each aquifer and the confining layer are incorporated in the model. Limited information is available regarding the nature of the confining layer or the confined aquifer in the National Lakeshore near the settling basins (Section IV). Thus, even in those areas not affected by construction dewatering for Bailly N-1, ground water levels measured following dissipation of the ground water mound may not match the seasonally adjusted reference levels at all locations.

If the ground water mound completely dissipates before construction of Bailly N-1 resumes, the USGS reference levels can be verified using ground water levels measured in the NIPSCo and USGS observation wells. Assuming the rate of

construction dewatering does not change significantly during dissipation of the ground water mound, potentiometric surface maps prepared for the unconfined aquifer following dissipation of the mound will be modified to remove the drawdown caused by the present low rate of construction dewatering. The drawdown can be subtracted out using standard relationships between discharge rate, drawdown, and distance to obtain a new potentiometric surface map and, thus, new baseline reference levels based upon actual measurements of ground water levels in the observation wells.

In the event that new baseline ground water levels can be established for the unconfined aquifer before construction of Bailly N-1 resumes, NIPSCo will use these baseline levels to evaluate the effect on the adjacent National Lakeshore of any subsequent construction dewatering. The baseline levels must also be adjusted seasonally in the same manner as the USGS reference levels. Hydrographs of the ground water levels measured in NIPSCo and USGS observation wells will be plotted to identify which observation wells reflect only seasonal fluctuations. One of the observation wells so identified will be used to make seasonal adjustments to the new baseline levels.

VIII. MODIFICATION OF THE MITIGATION CRITERION

The ground water levels the NPS wants restored and preserved in the National Lakeshore adjacent to the Bailly site are the natural levels that would occur had there never been any seepage from the settling basins. To this end, the NPS has taken the position that NIPSCo need not mitigate the water level decline due to construction dewatering as long as ground water levels in the National Lakeshore remain above the USGS reference levels (Reference 5). Thus, the mitigation criterion previously established in Reference 2 should be modified to reflect the expressed desire of the NPS to restore ground water levels in the National Lakeshore to natural conditions.

Accordingly, NIPSCo will use the reference levels identified in the USGS/NPS monitoring plan (Reference 5) to evaluate the necessity for mitigation during dissipation of the ground water mound. Specific drawdown limits will be applied at the same three NIPSCo observation wells identified in Reference 2: 54C, 16, and 67. However, because the USGS estimates the accuracy of the reference levels to be about ±2 feet (Reference 5), NIPSCo will establish a limit of two feet of drawdown at the eastern property line attributable to construction dewatering as the basis for implementing mitigation measures. Thus, the specific drawdown limits for

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initiation of ground water recharge during the months the ground is not frozen will be 2.0 feet below the seasonally adjusted reference level at well 54C, 2.5 feet at well 16, and 3.0 feet at well 67. For the months during which the ground is frozen, NIPSCo will use a drawdown criterion of 3.0 feet. The drawdown limits then become 3.0 feet, 3.5 feet, and 4.0 feet at observation wells 54C, 16, and 67, respectively. This minimal increase in allowable drawdown during the winter months will have a negligible effect because vegetation is dormant during these months.

If construction of Bailly N-1 resumes before the ground water mound has completely dissipated, the USGS reference levels will be used throughout the interval of Bailly N-1 construction dewatering to evaluate whether any undesired dewatering of the adjacent National Lakeshore has occurred. Since drawdown caused by construction dewatering will decrease as the distance from the Bailly N-1 excavation increases, the effect on ground water levels in the adjacent National Lakeshore will be greatest at NIPSCo's eastern property line. Evidence of any dewatering effects will also appear first at the property line. If ground water levels decline less than two feet below the reference levels at the property line but more than two feet below the reference levels farther east, the decline in the National Lakeshore cannot be attributed to construction dewatering. Similarly, uniform

declines in ground water levels below the reference levels across the National Lakeshore cannot be caused by Bailly N-1 construction dewatering. Mitigation is not required under these circumstances. NIPSCo will initiate ground water recharge if the ground water levels measured in observation wells 54C, 16, and 67 fall below the modified drawdown limits given above.

If the ground water mound has substantially dissipated before construction resumes, the new baseline levels identified from actual measurements of ground water levels in the observation wells will be used to evaluate the drawdown at the property line attributable to construction dewatering (Section VII). In this case, NIPSCo will return to the mitigation criterion established in Reference 2 which permits one foot of drawdown at the property line (two feet during the winter months).

IX. MONITORING

The existing network of observation wells installed and monitored by NIPSCo is shown on Exhibit 1. Installation details for these observation wells are given in Reference 1. The charts on observation wells having continuous recording equipment are changed once a week. Water levels in the interdunal ponds, settling basins, and observation wells without recorders are measured the same day the recorder

charts are changed. NIPSCo also measures the water levels once a month in the USGS observation wells listed in Table 2.

In June 1979 the USGS installed observation well 26 in the National Lakeshore 10 feet east of NIPSCo's eastern property line. The observation well is 19 feet deep and measures the water level in the unconfined aquifer. NIPSCo began monitoring USGS well 26 on a monthly basis in November 1979. At the same time, NIPSCo dropped USGS observation wells 19 and 20 from the list of USGS wells to be measured monthly because the measured water levels were not representative of either the unconfined or confined aquifer (Reference 5).

In addition to these changes in the monitoring network, NIPSCo will install two observation wells in the unconfined aquifer north of Settling Basin 10 at the locations shown on Exhibit 6. The observation wells will consist of standard wellpoints installed in the same manner as USGS well 26 to approximately El. +10. The new observation wells will be used in conjunction with the existing USGS wells to periodically prepare water table profiles as the dissipation of the ground water mound progresses and to verify the reference levels predicted by the USGS model after the mound has dissipated.

During the dissipation of the ground water mound, the USGS plans to collect the data tapes from their observation wells having continuous recorders, including control well 25, every two weeks. NIPSCo receives the USGS water level summary approximately two weeks after it is collected. Thus, up to four weeks may elapse before it is known whether dewatering below the reference levels has occurred or is likely to occur in the National Lakeshore.

To eliminate some of this delay, NIPSCo will monitor USGS observation wells 24 and 25, and those listed in Table 2 on the same schedule as NIPSCo's wells during and after the sealing of the settling basins. Determination of the water level in USGS wells 24 and 25 will permit the immediate seasonal adjustment of water levels measured in the other USGS and NIPSCo observation wells. NIPSCo will begin weekly monitoring of the USGS observation wells approximately one month before sealing of the settling basins begins. Weekly monitoring of the NIPSCo and USGS observation wells will continue until construction dewatering for Bailly N-1 is terminated.

X. CONCLUSIONS

This report describes the anticipated decline in ground water levels in a portion of the Indiana Dunes National

Lakeshore following sealing of the settling basins and the modifications in the method of evaluating the effects of construction dewatering for Bailly N-1 necessitated by this decline. The modifications to the evaluation method, including specific changes to the mitigation criterion, monitoring network, and monitoring frequency are summarized below:

1. During dissipation of the ground water mound, NIPSCo will use the USGS reference levels given in Table 1 as the basis for determining whether any dewatering of the adjacent National Lakeshore has occurred as a consequence of construction dewatering for Bailly N-1. If construction of Bailly N-1 resumes after the ground water mound has dissipated, new baseline levels will be established from potentiometric levels measured in the observation wells.

2. The mitigation criterion during the period the ground water mound is dissipating shall be changed to reflect the ±2-foot accuracy of the reference levels. Specifically, ground water recharge will be initiated throughout most of the year when drawdown attributable to construction dewatering for Bailly N-1 exceeds 2.0 feet at NIPSCo's eastern property line. As applied to individual observation wells, the drawdown limits will be 2.0, 2.5, and 3.0 feet below the seasonally adjusted

reference levels at NIPSCo wells 54C, 16, and 67, respectively. During the winter months, the respective drawdown limits will be increased to 3.0, 3.5 and 4.0 feet below the seasonally adjusted reference levels.

3. The drawdown criteria for mitigation will remain as established in Reference 2 if the ground water mound dissipates before construction resumes on Bailly N-1.

4. NIPSCo will install two new observation wells in the unconfined aquifer north of Settling Basin 10 to monitor the dissipation of the ground water mound and to verify the reference levels after dissipation is complete.

5. NIPSCo will begin monitoring the USGS observation wells listed in Table 2 weekly approximately one month before sealing of the settling basins begins. Weekly monitoring of the USGS and NIPSCo observation wells shall be continued until construction dewatering for Bailly N-1 is terminated.

XI. REFERENCES

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

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

3. Sargent & Lundy, "Supplementary Information, Hydrogeologic Evaluation of Construction Dewatering, Bailly Generating Station, Nuclear 1", August 27, 1979.

4. William Meyer and Patrick Tucci, "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, 1979.

5. National Park Service, letter to Nuclear Regulatory Commission, October 1, 1979: "USGS/NPS Plan for Determining Dewatering of the Indiana Dunes National Lakeshore Adjacent to NIPSCo Bailly Generating Station."

TABLE 1

REFERENCE GROUND WATER LEVELS
FOR THE UNCONFINED AQUIFER

USGS Well Number	Reference Level (ft)	NIPSCo Well Number	Reference Level (ft)
21	+17.0	14	+15.1
22	+17.0	15	+10.3
23	+17.1	16	+17.6
24	+27.8	17	+15.1
25	+23.2	18	+17.1
26	+15.7	19	+15.0
104	+30.3	20	+14.5
D-1	+15.3	51C	+12.9
D-2	+17.1	52C	+14.3
D-3	+19.8	53C	+14.1
D-4	+17.7	54C	+15.7
D-5	+23.0	55C	+13.3
D-6	+20.7	56C	+17.6
D-7	+25.7	57C	+14.4
D-8	+30.3	58	+15.9
G-1	+17.7	59C	+17.1
G-2	+19.0	62	+16.1
G-3	+19.0	65	+15.2
G-4	+19.8	67	+15.0
G-5	+19.8	72	+9.2
G-6	+23.6	73	+8.5
G-7	+25.9	74	+9.0
G-8	+25.9		
G-9	+27.1		
G-10	+27.1		

NOTES:

1. Ground water levels are referenced to NIPSCo datum. To convert these levels to NGVD (1929), add 578.67 feet.

2. The levels listed here are the USGS reference water levels identified in Reference 5 for October 26, 1976.

3. The reference ground water levels were generated from the USGS digital model described in Reference 5 and represent the ground water levels that would have been measured had seepage from the settling basins never occurred. The USGS considers these levels to be accurate to $\pm$2 feet (Reference 5).

4. Reference levels given for USGS observation wells 24 and 25 are actual ground water levels measured on October 26, 1976.

5. Construction dewatering for Bailly N-1 did not begin until March 1977.

1735 177

TABLE 2

USGS OBSERVATION WELLS
MONITORED BY NIPSCO

19	D-3
20	G-1
21	G-2
22	G-3
23	G-4
26	G-5
D-1	G-6
D-2	

NOTES:

1. USGS observation wells listed above are monitored monthly by NIPSCo.

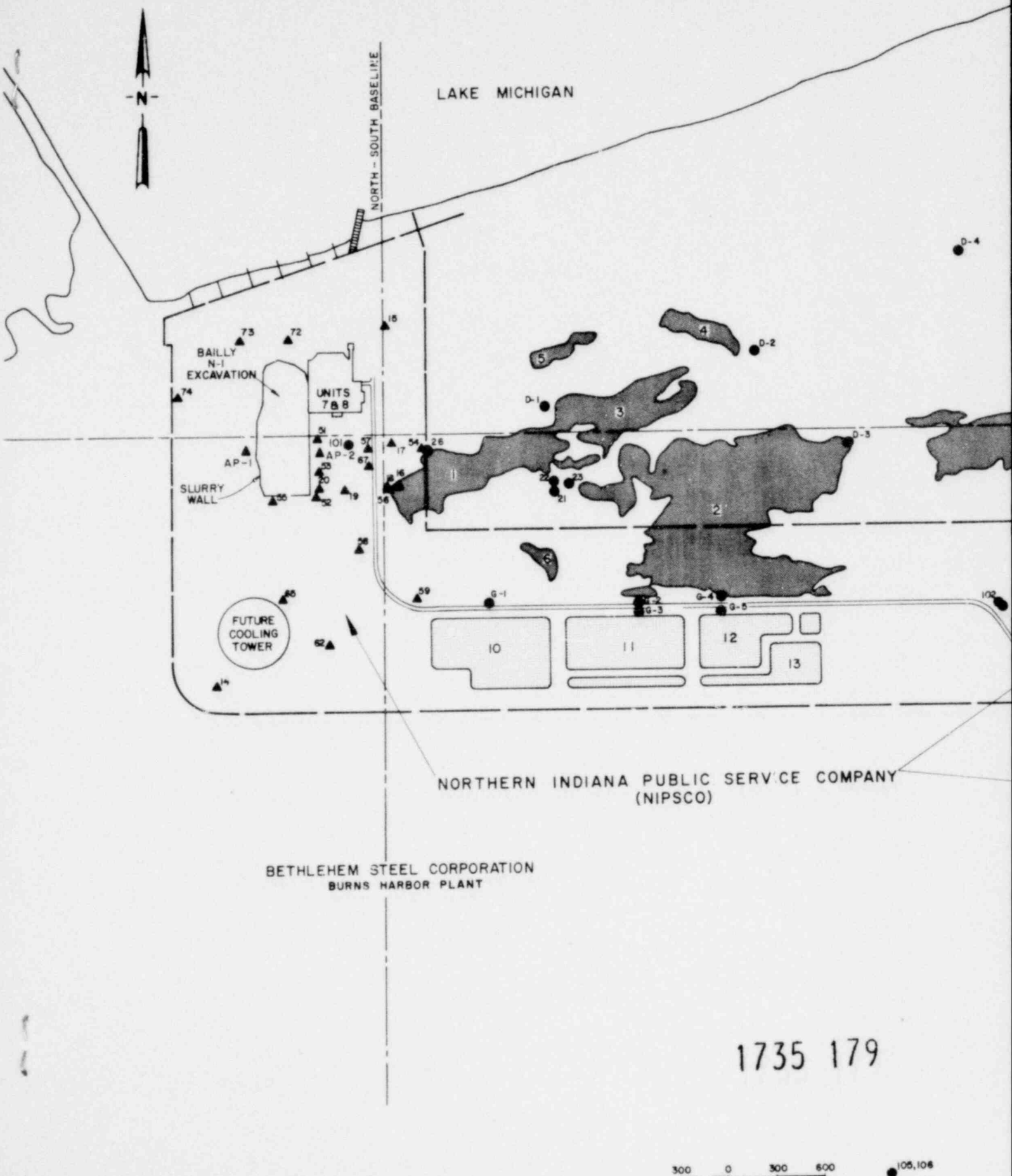
2. USGS wells 19 and 20 were dropped from the list of wells monitored by NIPSCo in November 1979.

3. NIPSCo added USGS well 26 to this list in November 1979.

4. NIPSCo will begin weekly monitoring of USGS wells 24 and 25, and all other USGS wells listed above approximately one month before sealing of the settling basins begins.

5. Monitoring of USGS observation wells shall continue until construction dewatering for Bailly N-1 is terminated.

1735 178


N
LAKE MICHIGAN
NORTH - SOUTH BASELINE
BAILLY N-1 EXCAVATION
UNITS 7 & 8
AP-1
AP-2
SLURRY WALL
FUTURE COOLING TOWER
D-1
D-2
D-3
D-4
G-1
G-2
G-3
G-4
G-5
1
2
3
4
5
6
10
11
12
13
NORTHERN INDIANA PUBLIC SERVICE COMPANY
(NIPSCO)
BETHLEHEM STEEL CORPORATION
BURNS HARBOR PLANT
300 0 300 600
Scale in feet
105,106

1735 179

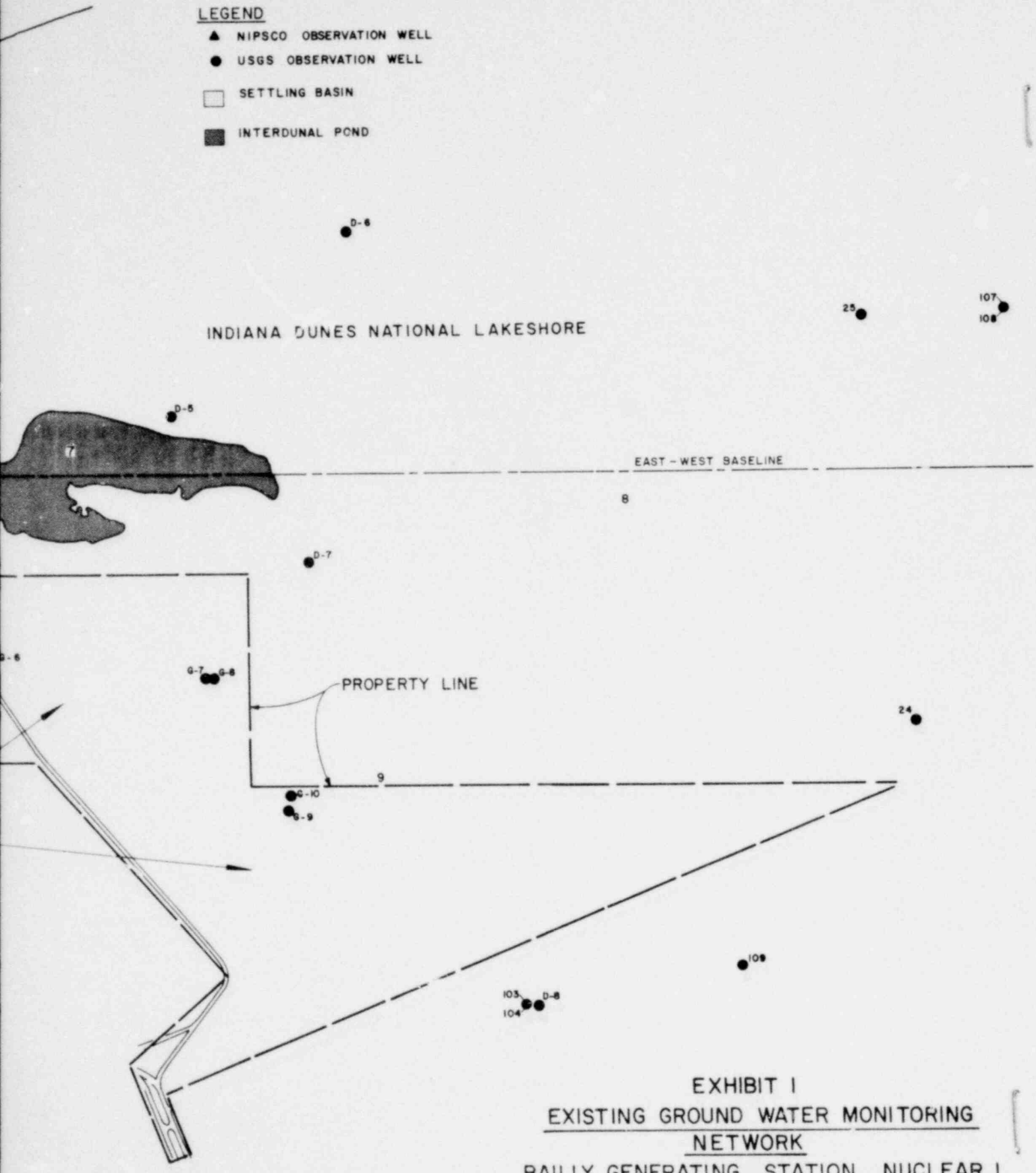
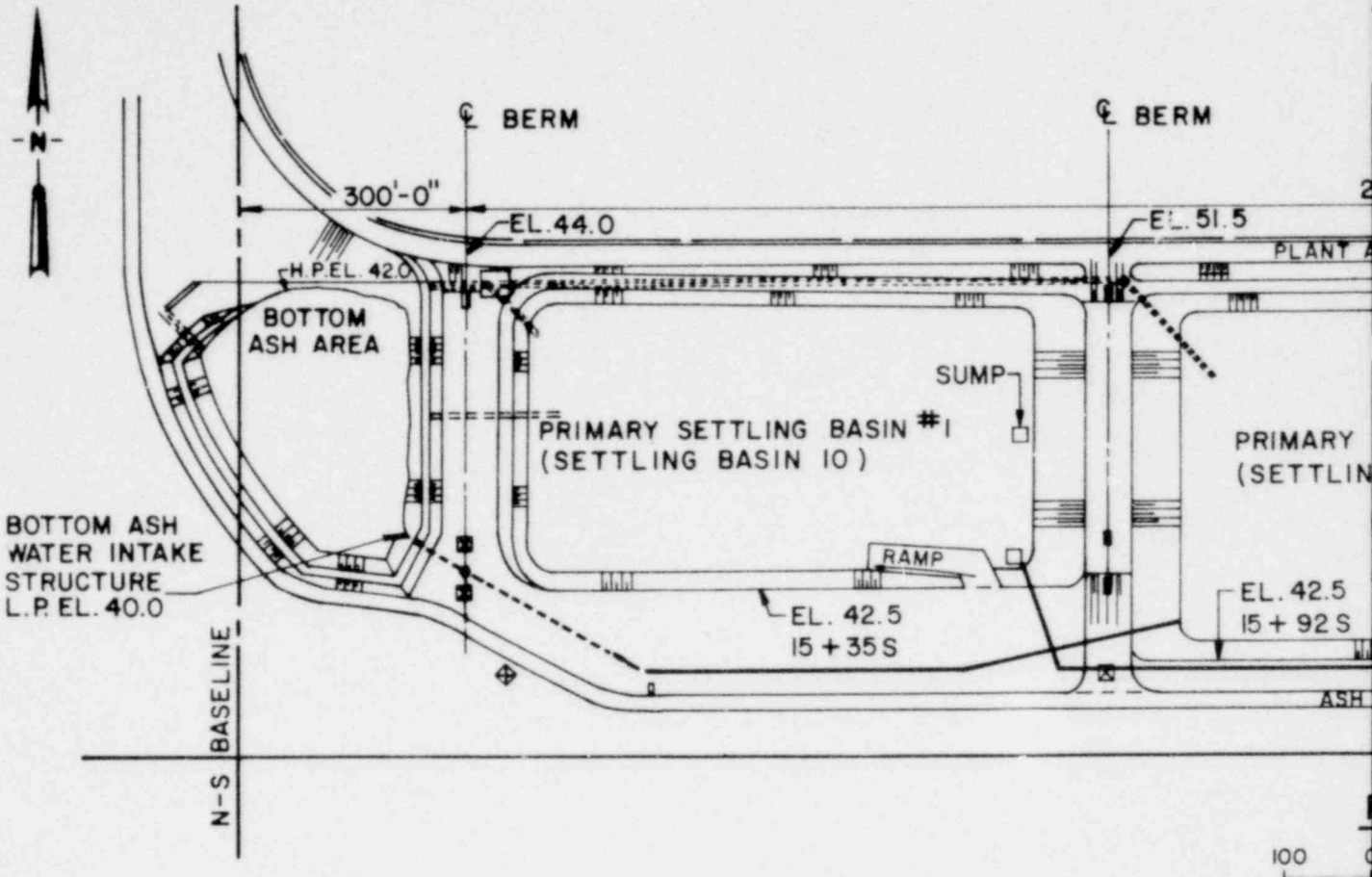


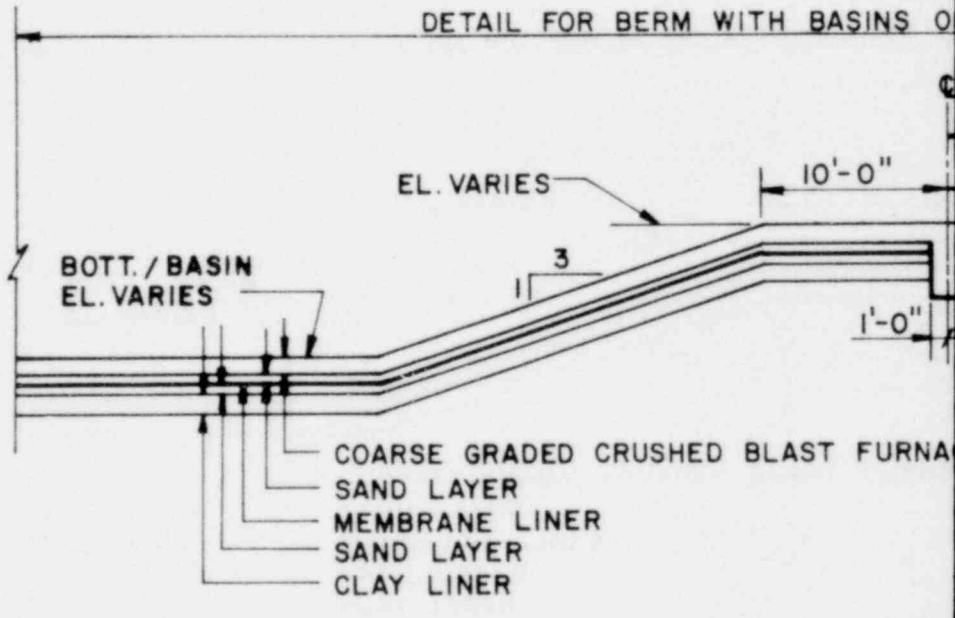
EXHIBIT I

EXISTING GROUND WATER MONITORING NETWORK

BAILLY GENERATING STATION, NUCLEAR I
NORTHERN INDIANA PUBLIC SERVICE COMPANY

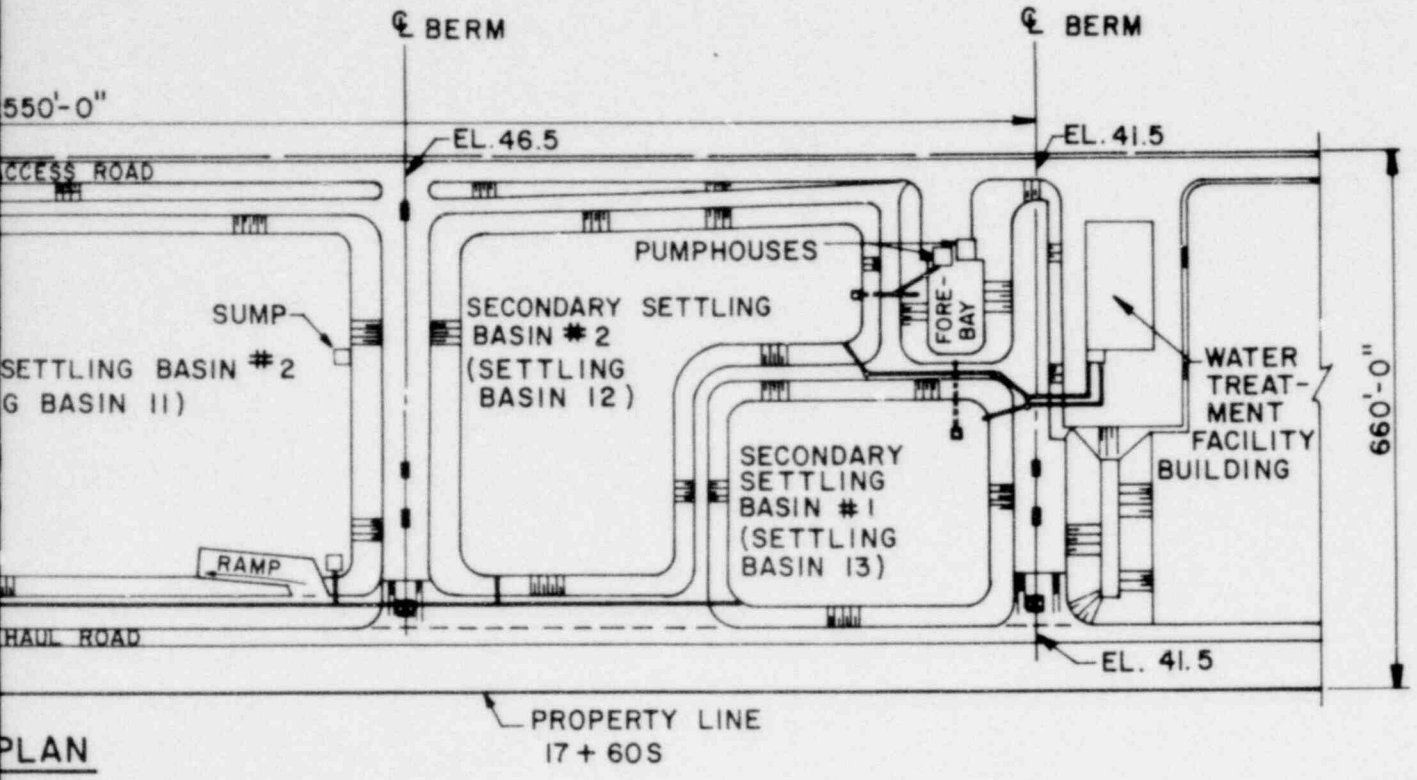
SARGENT & LUNDY ENGINEERS





TYPICAL LINING M

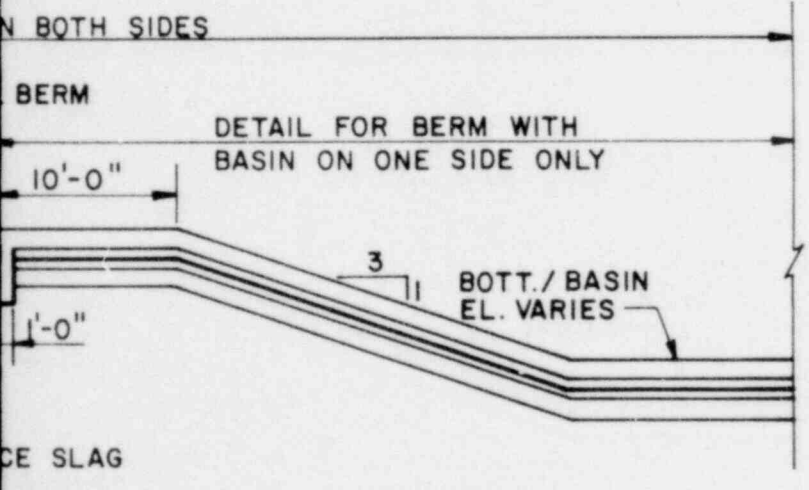
NOT TO



PLAN

0 100 200

LE IN FEET



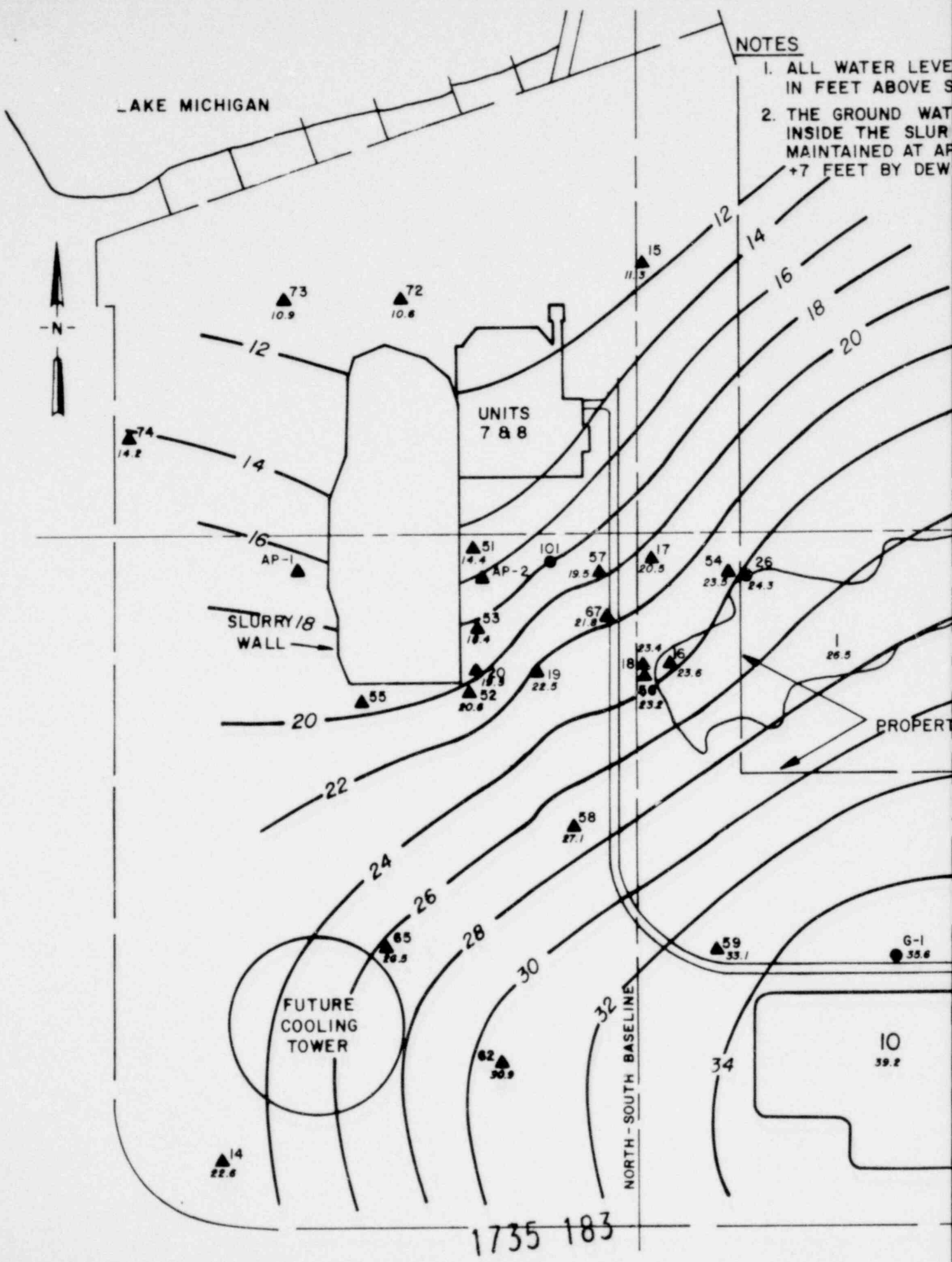
CE SLAG

IATERIALS DETAIL

SCALE

EXHIBIT 2
PRELIMINARY SETTLING BASIN
LINER PLAN AND DETAIL
BAILLY GENERATING STATION, NUCLEAR 1
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS


NOTES
1. ALL WATER LEVE
IN FEET ABOVE S
2. THE GROUND WAT
INSIDE THE SLUR
MAINTAINED AT AP
+7 FEET BY DEW
LAKE MICHIGAN
-N-
UNITS 7 & 8
SLURRY WALL
AP-1
AP-2
FUTURE COOLING TOWER
NORTH-SOUTH BASELINE
PROPERT
10
39.2
G-1
35.6
12
14
16
18
20
22
24
26
28
30
32
34
73
10.9
72
10.6
74
14.2
15
11.3
51
14.4
101
57
19.5
17
20.5
54
23.5
26
24.3
53
67
21.8
23.4
18
16
23.6
23.2
1
26.5
55
52
20.6
19
22.5
58
27.1
65
59
33.1
62
30.9
14
22.6

1735 183

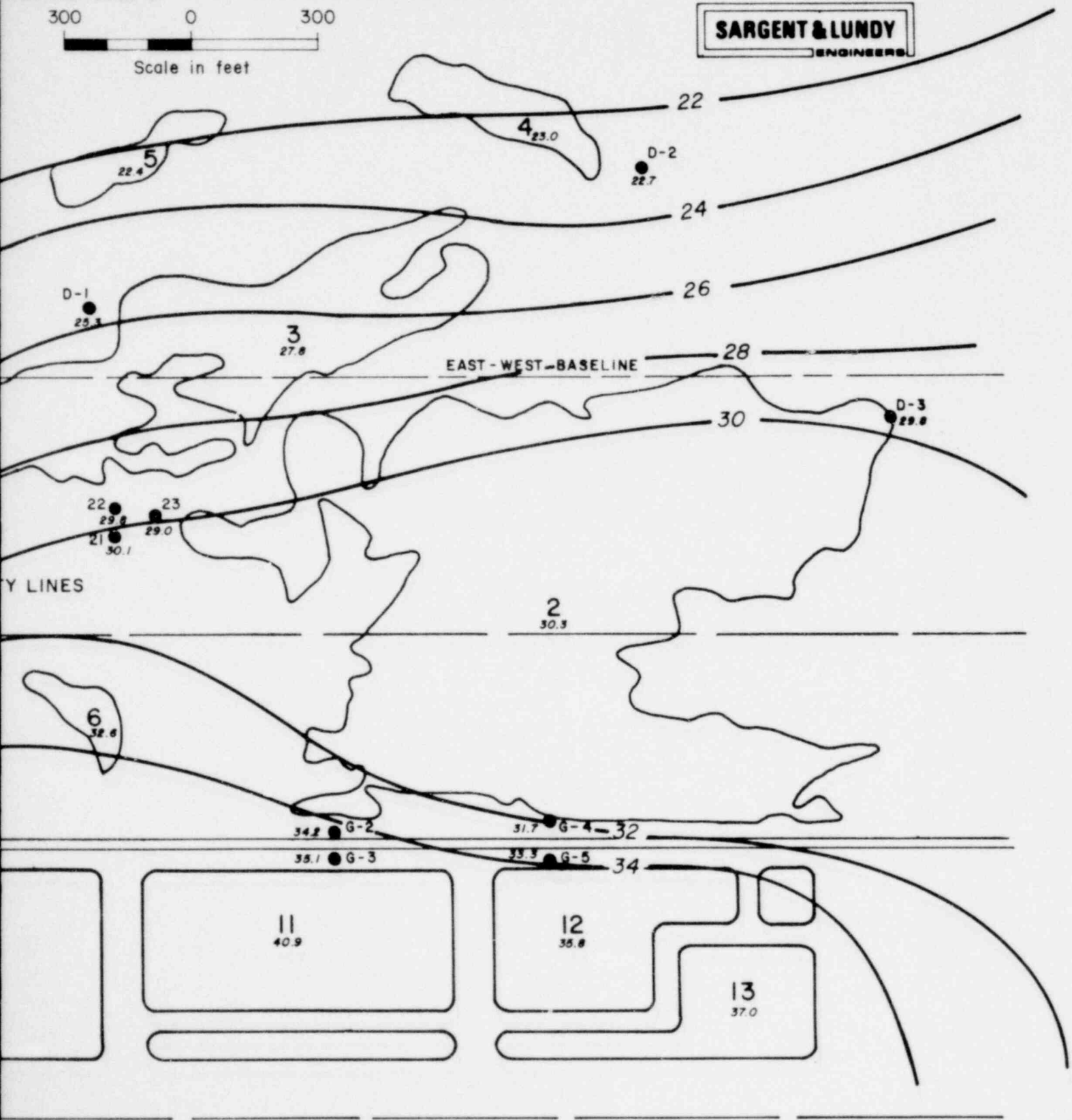
LS ARE GIVEN
TATION DATUM.
ER LEVEL
RY WALL IS
PPROXIMATELY
ATERING SUMPS.

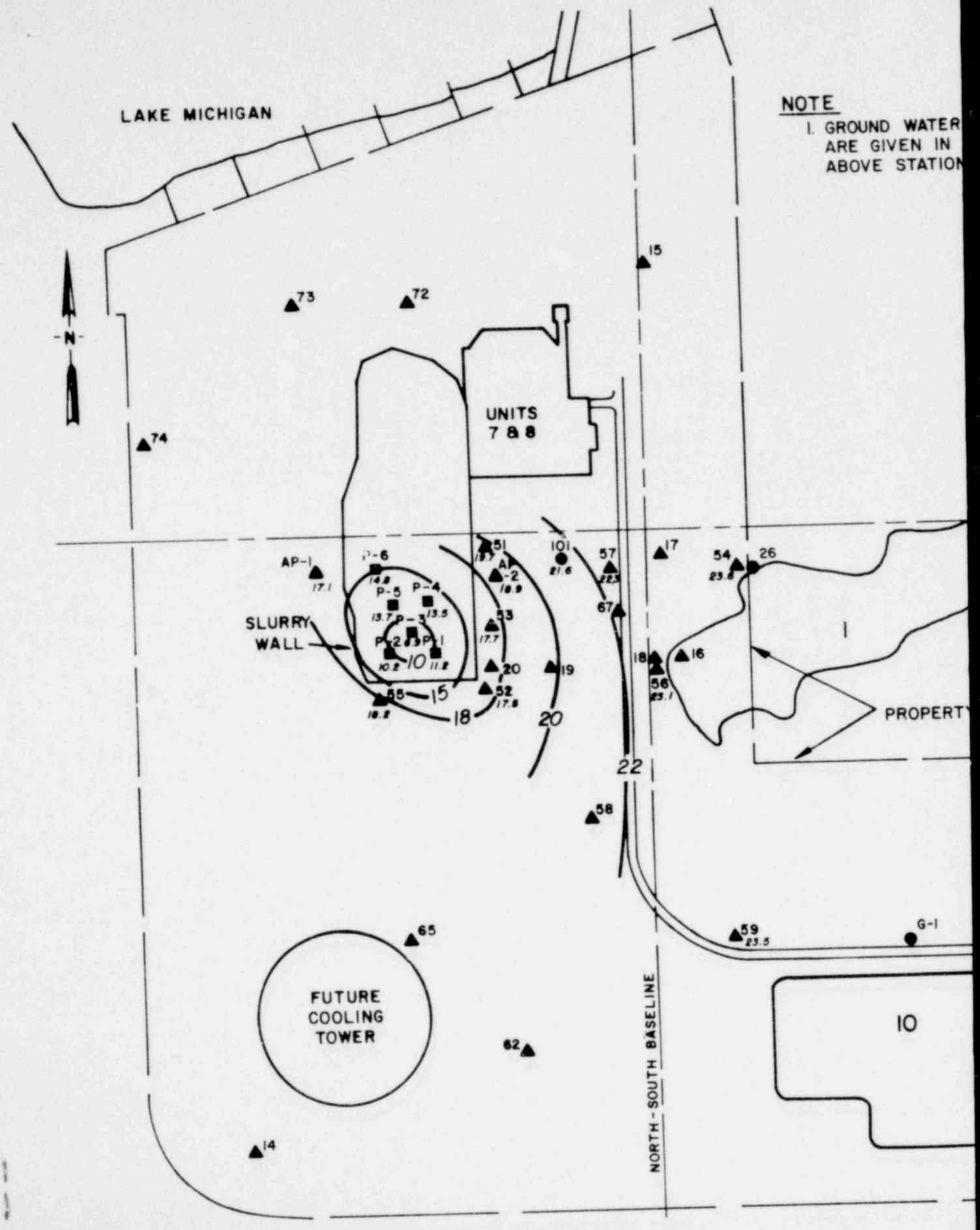
EXHIBIT 3
POTENTIOMETRIC SURFACE MAP FOR THE UNCONFINED AQUIFER ON NOVEMBER 7, 1979
BAILLY GENERATING STATION, NUCLEAR I
NORTHERN INDIANA PUBLIC SERVICE COMPANY

LEGEND
- ▲ NIPSCO OBSERVATION WELLS
- ● USGS OBSERVATION WELLS

300 0 300
Scale in feet

SARGENT & LUNDY ENGINEERS




LAKE MICHIGAN
NOTE
1. GROUND WATER
ARE GIVEN IN
ABOVE STATION
-N-
UNITS
7 & 8
AP-1
17.1
P-6
14.8
P-5
13.7
P-4
13.5
P-3
P-2
P-1
10.2
11.2
AP-2
18.9
SLURRY
WALL
10
15
18
20
22
51
101
21.6
57
22.5
17
54
23.6
26
67
53
17.7
18
16
56
23.1
20
19
55
18.2
52
17.5
58
PROPERTY
1
65
FUTURE
COOLING
TOWER
62
59
23.5
G-1
NORTH-SOUTH BASELINE
10
14
73
72
74
15

LEVELS
FEET
DATUM.

LEGEND

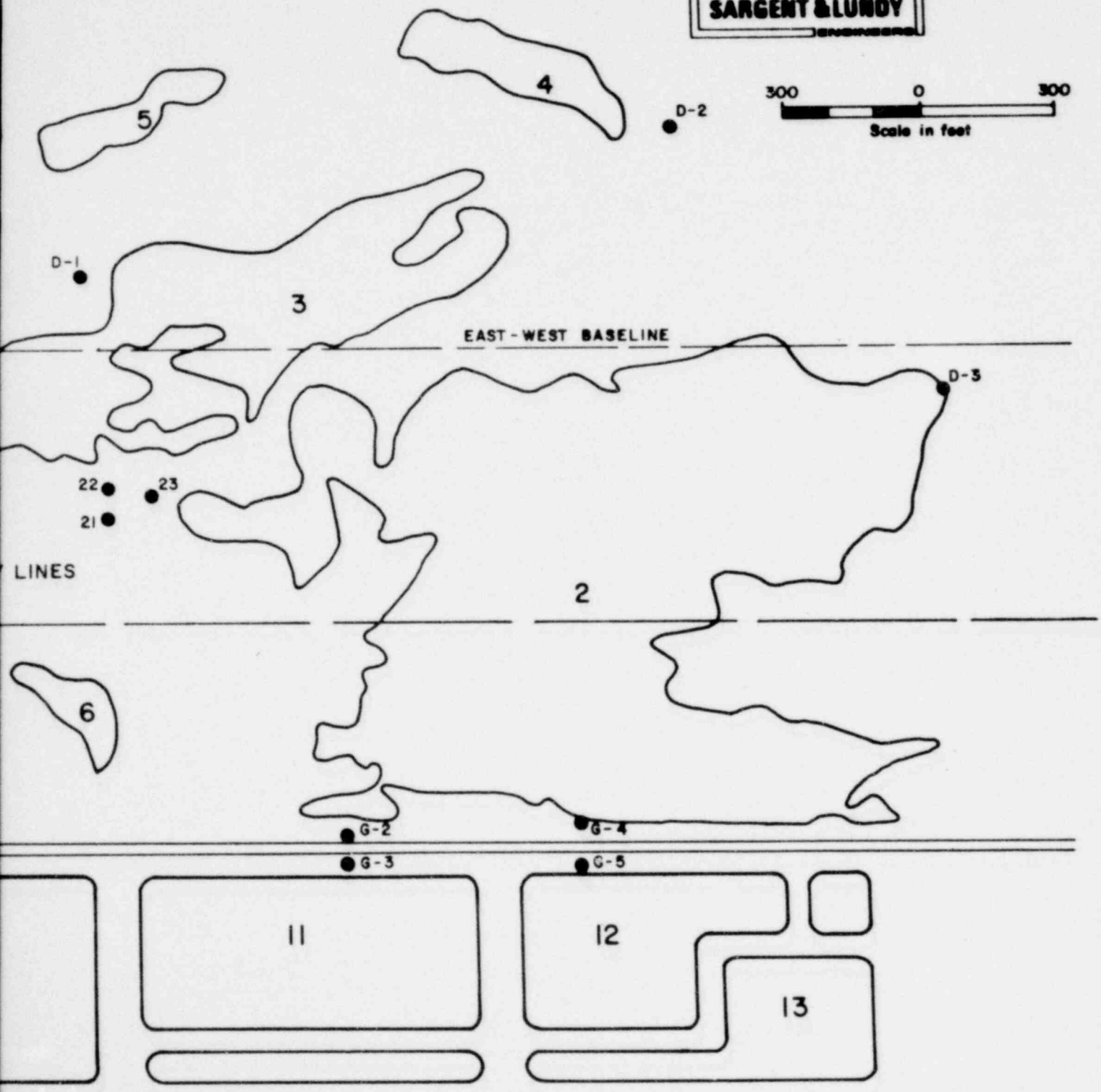
- ▲ NIPSCO OBSERVATION WELLS
- ● USGS OBSERVATION WELLS
- ■ NIPSCO PNEUMATIC PIEZOMETER

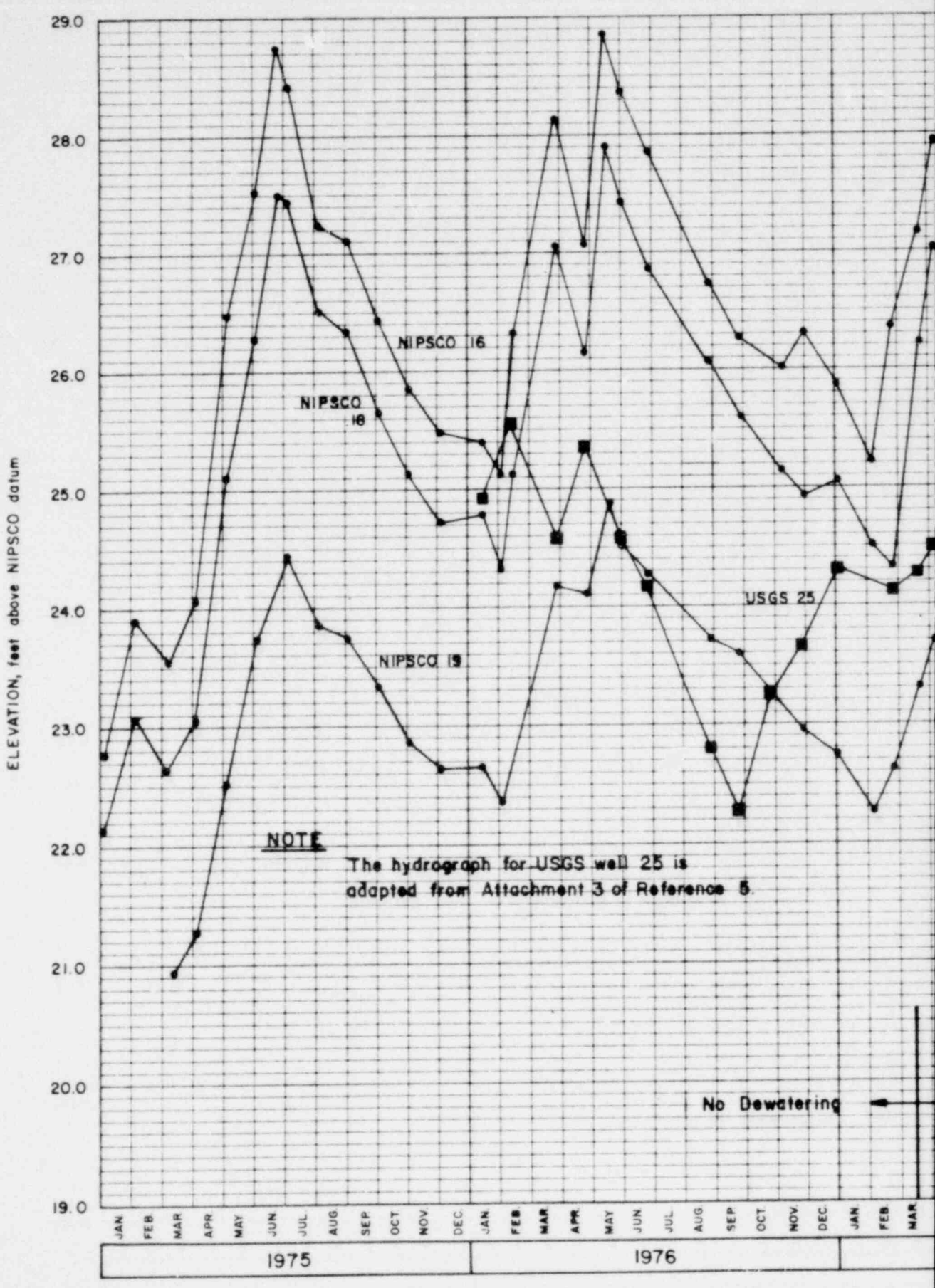
EXHIBIT 4

POTENTIOMETRIC SURFACE MAP FOR THE CONFINED AQUIFER ON NOVEMBER 7, 1979

BAILLY GENERATING STATION, NUCLEAR 1
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS





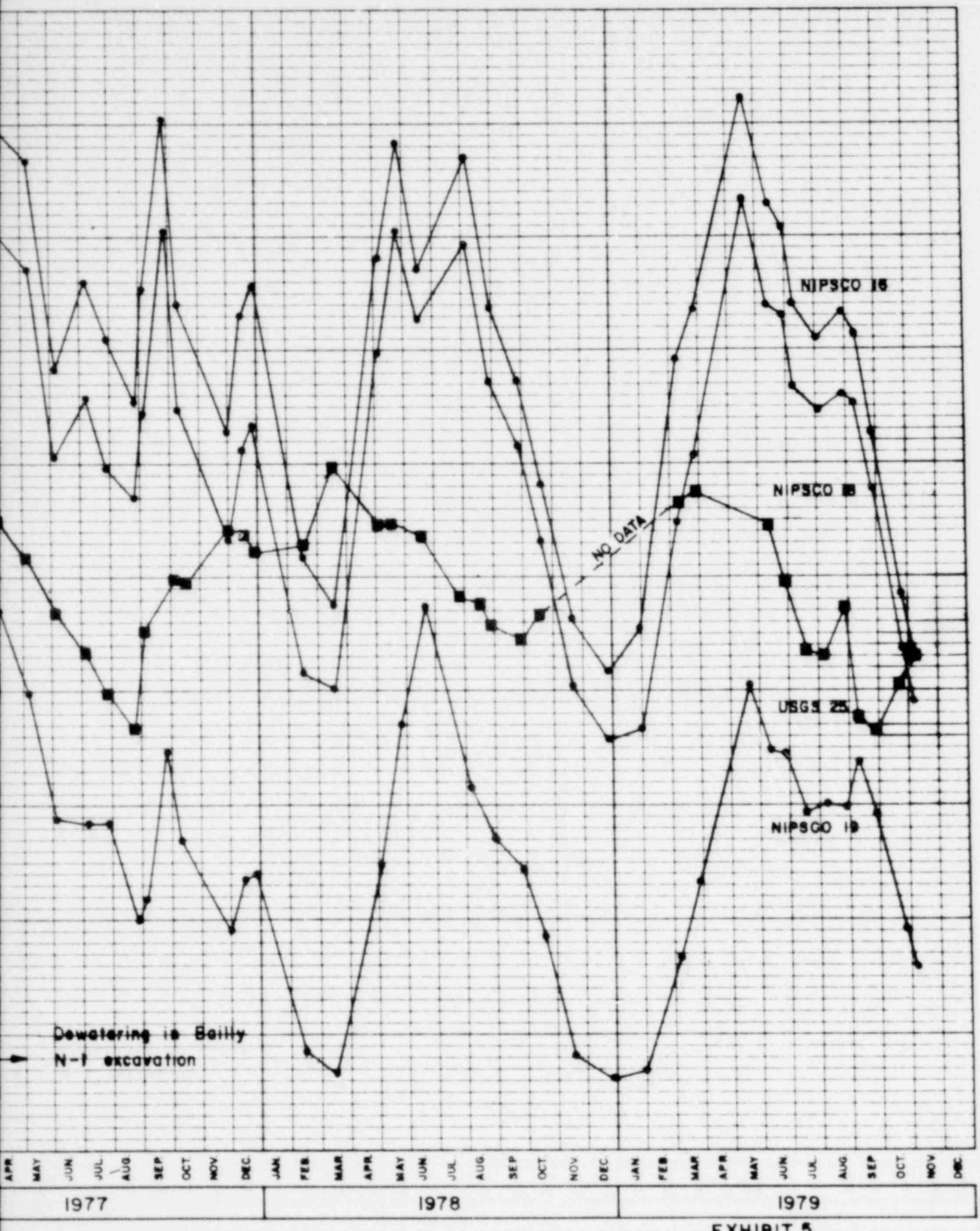


EXHIBIT 5
SEASONAL FLUCTUATIONS IN NIPSCO
WELLS 16, 18, 19, AND USGS WELL 25
BAILLY GENERATING STATION, NUCLEAR 1
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS

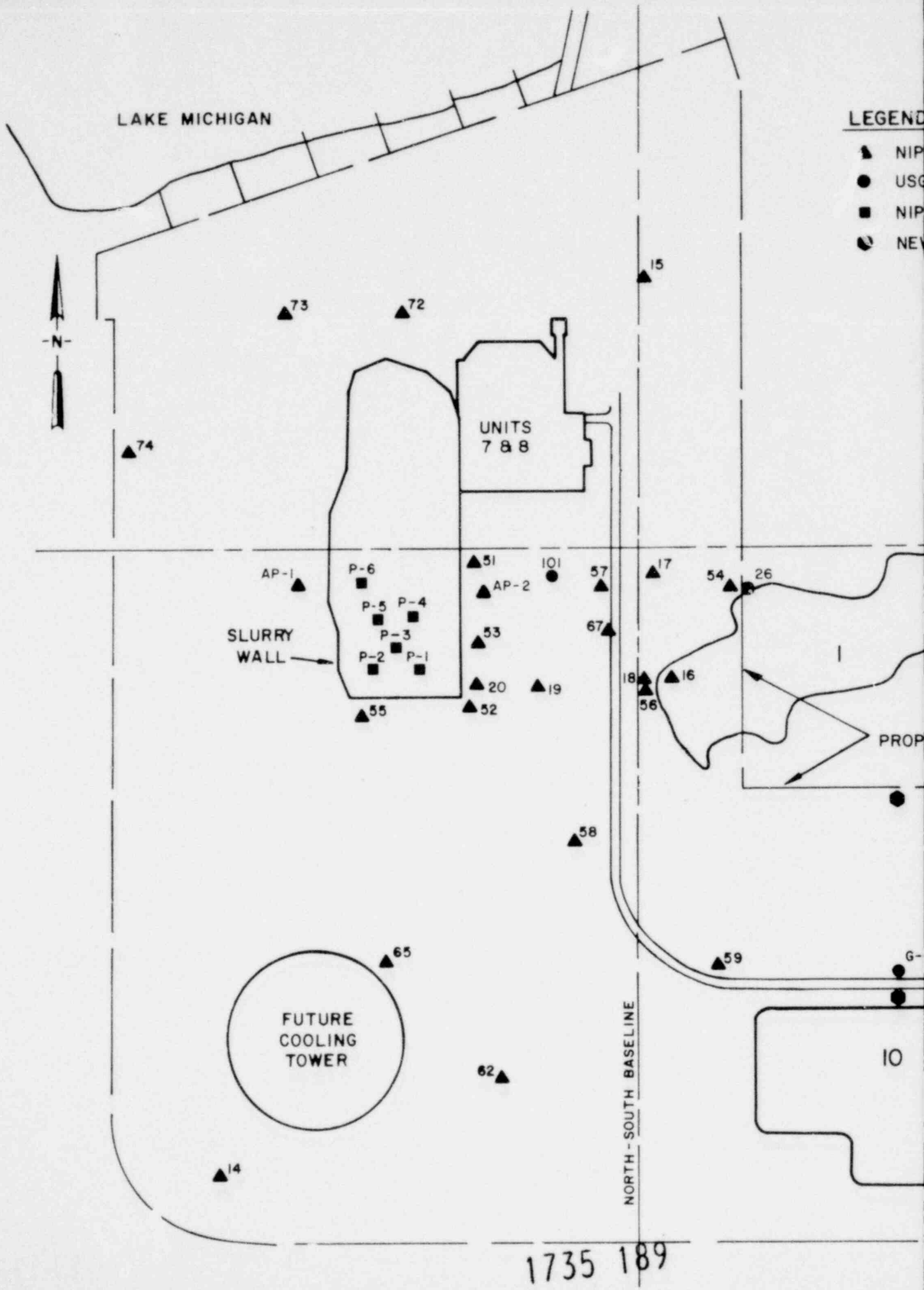

LAKE MICHIGAN
LEGEND
NIP
USG
NIP
NEW
-N-
UNITS
7 & 8
SLURRY
WALL
AP-1
P-6
P-5
P-4
P-3
P-2
P-1
AP-2
PROP
FUTURE
COOLING
TOWER
NORTH-SOUTH BASELINE
10
I
15
73
72
74
51
101
57
17
54
26
53
67
18
16
56
20
19
55
52
58
65
59
62
14

EXHIBIT 6

CHANGES IN THE MONITORING NETWORK

BAILLY GENERATING STATION, NUCLEAR I
NORTHERN INDIANA PUBLIC SERVICE COMPANY

SARGENT & LUNDY ENGINEERS

SCO OBSERVATION WELLS
S OBSERVATION WELLS
SCO PNEUMATIC PIEZOMETER
V NIPSCO OBSERVATION WELLS