HISTORY OF CONSTRUCTION

CFR 257.73(c)(1)

Bottom Ash Complex

Rockport Plant
Rockport, Indiana

October, 2016

Prepared for : Indiana Michigan Power - Rockport Plant

2791 North US 231

Rockport, Indiana 47635

Prepared by: American Electric Power Service Corporation

1 Riverside Plaza

Columbus, OH 43215

Document ID: GERS-16-071

Table of CONTENTS

Attachments

1.0 OBJECTIVE

This report was prepared by AEP- Geotechnical Engineering Services (GES) section to fulfill requirements of CCR 257.73(c)(1) with an evaluation of the facility.

2.0 DESCRIPTION OF CCR THE IMPOUNDMENT

The Rockport plant is located near the City of Rockport, Spencer County, Indiana.
It is owned by Indian Michigan Power Co. (I&M), a unit of American Electric Power. The facility operates two surface impoundments for storing CCR within the Bottom Ash Complex.

The bottom ash pond complex is formed by excavation into the existing ground with a diked embankment along the west bottom ash pond. The bottom ash ponds and wastewater ponds were designed in tandem; one bottom ash pond and one wastewater pond are in service at any given time.

There are six main ponds within the bottom ash pond complex as listed below.

List of Main Ponds within the Bottom Ash Complex
West Bottom Ash Pond
East Bottom Ash Pond
West Waste Water Pond
East Waste Water Pond
Reclaim Pond
Clear Water Pond

The west bottom ash pond dike is approximately 2000 feet long and is 13 feet high with a design crest width of 30 feet. The dike is a compacted soil earthen embankment. The top of the dike is at elevation 399.0 feet with the natural ground surface beneath the dikes is at about elevation 390 feet. The exterior side slope of the embankment fill is designed to be 2.5:H to 1:V that transitions to 3:H to 1:V. The interior design side slopes are 2:H to 1:V. The bottom elevation of the west pond is at elevation 386 ft msl with a minimum operating pool elevation of 394 ft msl providing a CCR storage capacity of 211 ac-ft.

The east bottom ash pond is an incised pond with the surrounding ground at elevations above 399 ft msl. The east bottom ash pond also has interior design slopes of 2:H to 1:V. The bottom elevation of the east pond is at elevation 377 ft msl with a minimum operating pool elevation of 391 ft msl providing a CCR storage capacity of 337 ac-ft.

3.0 SUMMARY OF OWNERSHIP 275.73(c)(1)(ı)

[The name and address of the person(s) owning or operating the CCR unit: the name associated with the CCR unit: and the identification number of the CCR unit if one has been assigned by the state.]

The Rockport Power Plant is located at 2791 North U.S. Hwy 231, Rockport, IN, 47635 near the City of Rockport, Indiana. It is owned and operated by I&M. The facility operates two surface impoundments for storing CCR called the east and west bottom ash ponds. The State of Indiana does not require a dam permit for this facility.

<u>4.0</u> LOCATION OF THE CCR UNIT 275.73 (c)(1)(ii)

[The location of the CCR unit identified on the most recent U.S. Geological Survey (USGS) 7 ½ minute or 15 minute topographic quadrangle map, or a topographic map of equivalent scale if a USGS map is not available.]

A location map is included in Attachment A.

<u>5.0</u> STATEMENT OF PURPOSE 275.73 (c)(1)(III)

[A statement of the purpose for which the CCR unit is being used.]

The east and west bottom ash ponds are used for primary settling and storage of bottom ash.

<u>6.0</u> NAME AND SIZE OF WATERSHED THE CCR UNIT IS LOCATED 275.73 (c)(1)(IV)

[The name and size in acres of the watershed within which the CCR unit is located.]

The bottom ash ponds are located within the Ohio River Water Shed (HUC 05140201) which is approximately 1,396.96 square miles (894,054 acres) (USGS).

The west bottom ash pond is comprised of diked embankments along the west side of the pond and a splitter dike with the east bottom ash pond and waste water pond. Storm water is directed away from the west pond and limits runoff to that which falls directly on the pond's water surface.

A small watershed area, 13 acres, drains into the east bottom ash pond.

<u>7.0</u> DESCRIPTION OF THE FOUNDATION AND ABUTMENT MATERIALS 275.73(c)(1)(v)

[A description of the physical and engineering properties of the foundation and abutment materials on which the CCR unit is located.]

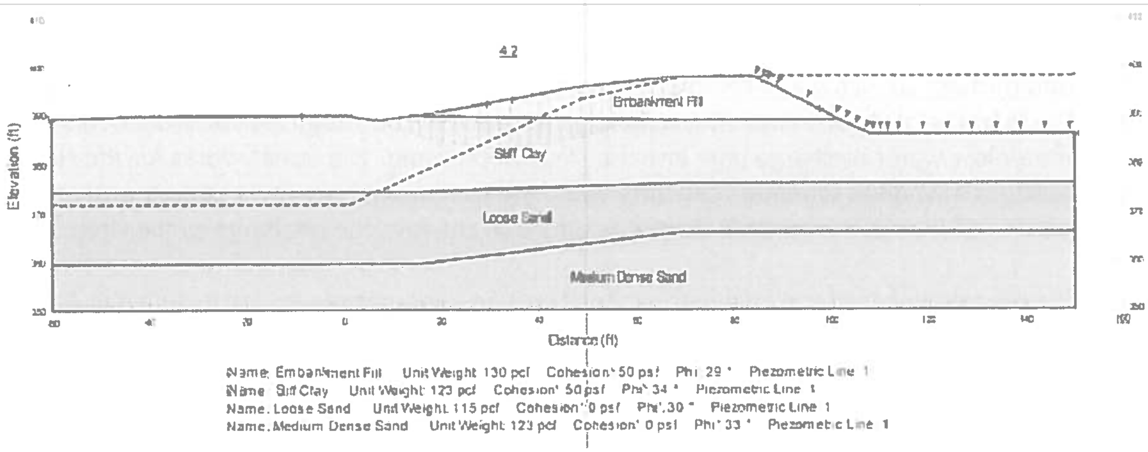
The embankment fill consists of lean clay that overlies stiff lean clay. These clay soils overlie a layer of loose sand to sandy silt that grades into medium dense sand. Two borings were drilled in 2015 along the embankment with Boring B-2, (located along the crest of the embankment) penetrating approximately 12 feet of embankment fill consisting of lean clay with varying amounts of sand, and sandy silt, to about elevation 389.5. Beneath the embankment fill, and within Boring B-1 (located along the outboard toe of the embankment), a layer of stiff fat and lean clay was encountered to elevations of approximately 372 to 376 feet. Below the clay, the soils contained a 1 to 2 foot thick transitional layer of loose clayey sand and sandy silt deposits, grading to deposits of loose to medium dense poorly graded sand and silty sand containing varying amounts of gravel to the termination depths of the borings.

See figure and material properties below:

Material	Unit Weight (pcf)	Cohesion (psf)	Friction Angle (deg)
Embankment Fill	130	50	29
Stiff Clay	123	50	34
Loose sand	115	0	30
Medium dense sand	123	0	33

West Bottom Ash Pond Embankment

MAXIMUM SURCHARGE POOL WATER LEVEL: EXTERIOR



REFERENCE: TERRACON CONSULTANTS INC., 2016, GEOTECHNICAL ENGINEERING REPORT AEP ROCKPORT BOTTOM ASH COMPLEX

<u>8.0</u> DESCRIPTION OF EACH CONSTRUCTED ZONE OR STAGE OF THE CCR UNIT 275.73 (c)(1)(vi)

[A statement of the type, size, range, and physical and engineering properties of the materials used in constructing each zone or stage of the CCR unit; and the approximate dates of construction of each successive stage of construction of the CCR unit.]

The original dike is a homogeneous embankment fill constructed of soil borrowed from the site. Geotechnical details of the original dike system are included in Attachment B. See previous table for soil properties.

<u>9.0</u> ENGINEERING STRUCTURES AND APPURTENANCES, 275.73 (c)(1)(vii)

[At a scale that details engineering structures and appurtenances relevant to the design, construction, operation, and maintenance of the CCR unit, detailed dimensional drawings of the CCR unit, including a plan view and cross sections of the length and width of the CCR unit, showing all zones, foundation improvements, drainage provisions, spillways, diversion ditches, outlets, instrument locations, and slope protection...]

The outlet works for the bottom ash ponds consists of a wooded surface skimming structure constructed around a weir box that discharges through a 48 inch diameter fiberglass pipe. In 1992, Structure No 4 fiberglass pipe was replaced with a 48 in diameter polyethylene pipe. In addition to the primary discharge structure, there is a low water discharge structure with stop logs connected to 30 inch diameter fiberglass pipe. The outlet works of the Wastewater Pond cells consist of a concrete weir. The weir discharges into a concrete chute which transitions into a box structure leading to a junction chamber. The chamber controls flows from the wastewater ponds into the reclaim pond and/or clear water pond through 30 inch diameter fiberglass pipes. A portion of the flow into the reclaim pond is pumped back to the plant for reuse. The remaining portion flows through a 42 inch diameter pipe or 30 inch diameter low water discharge pipe into the clear water pond. The outlet works for the clear water pond consists of a wooden skimmer /concrete weir. The weir discharges into a concrete structure connected to a 66 inch diameter CMP discharge pipe that conveys the discharge to the Ohio River.

The engineering drawings of the engineering structures and appurtenances are included in Attachment C.

Drainage is diverted around the Bottom Ash Pond Complex by natural drainage channels and grass lined ditches. A small catchment area (13 acres) exists along the east bottom ash pond complex.

Slope protection along the outboard slope consists primarily of grass vegetation. All inboard slopes are protected by rip rap.

No instrumentation exists for this facility.

<u>10.0</u> SUMMARY OF POOL SURFACE ELEVATIONS, AND MAXIMUM DEPTH OF CCR, 275.73 (c)(1)(vii)

[...in addition to the normal operating pool surface elevation and the maximum pool elevation following peak discharge from the inflow design flood, the expected maximum depth of CCR within the CCR surface impoundment.]

The table below describes the normal pool elevations and maximum pool elevations as well as maximum depth of CCR within the impoundment.

	West Bottom Ash Pond	East Bottom Ash Pond
Minimum Operating Pool Stage	394 ft msl	391 ft msl
Maximum Pool Stage following peak discharge from inflow design flood	395.2 ft msl	392.6 ft msl*
Expected maximum depth of CCR within the impoundment	10 ft	19 ft

*As previously noted, a small watershed catchment area (13 acres) would contribute a minor amount of flow to the east bottom ash pond. If it is assumed that all of the storm water runs into the east pond (i.e. no infiltration), then the resulting volume would increase the pond stage by 0.38 ft.

13 acres x 43560 ft/ac x (10.3 in/(12in/ft)) = 486057 cubic ft.

486057 cf / 1280930 sf (pond surface area) = 0.38 ft.

The east bottom ash pond elevation would therefore increase from 391 to 392.6 ft. (i.e.1.2 ft attributed to the storm event plus the drainage acreage 0.38 ft).

<u>11.0</u> FEATURES THAT COULD ADVERSELY AFFECT OPERATION DUE TO MALFUNCTION OR MIS-OPERATION (275.73 (c)(1)(vii))

[...and any identificable natural or manmade features that could adversely affect operations of the CCR runit due to malfunction or mis-operation]

The east or west pond operations could be adversely affected due to a malfunction or mis-operation of any of the pond's appurtenances. These structures include weir structures and piping between pond cells, low water discharge structures, weir structures, effluent return piping and pump structures and influent sluicing piping and structures. See design drawings in Attachment C for location and details of all appurtenances.

<u>12.0</u> DESCRIPTION OF THE TYPE, PURPOSE AND LOCATION OF EXISTING INSTRUMENTATION 275.73 (c)(1)(viii)

[A description of the type, purpose, and location of existing instrumentation.]

The bottom ash ponds do not have instrumentation.

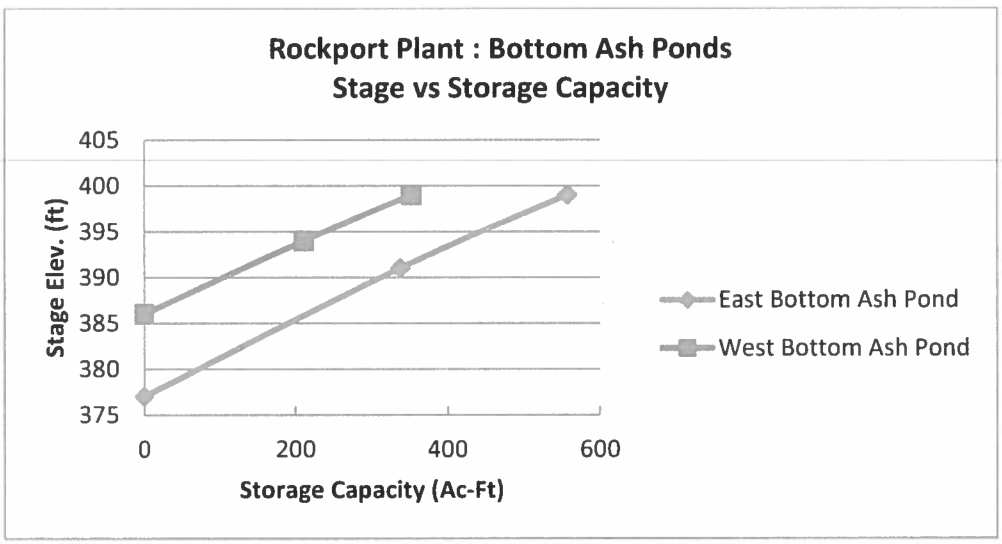
13.0 AREA – CAPACITY CURVES FOR THE CCR UNIT 275.73 (c)(1)(ix)

[Area-capacity curves for the CCR unit.]

The area capacity curves for the east and west bottom ash ponds are

listed in the following table and are illustrated below.

Bottom Ash Ponds			
East Pond		West Pond	
storage ac-ft	stage ft	storage ac-ft	stage ft
557	399	352	399
337	391	211	394
0	377	0	386



14.0 275.73 (c)(1)(x) DESCRIPTION OF EACH SPILLWAY AND DIVERSION

[A description of each spillway and diversion design features and capacities and calculations used in their determination.]

The outlet works for the bottom ash ponds consists of a wooded surface skimming structure constructed around a weir box that discharges through a 48 inch diameter fiberglass pipe. In 1992, Structure No 4 fiberglass pipe was replaced with a 48 in diameter polyethylene pipe. In addition to the primary discharge structure, there is a low water discharge structure with stop logs connected to 30 inch diameter fiberglass pipe. The outlet works of the Wastewater Pond cells consist of a concrete weir. The weir discharges into a concrete chute which transitions into a box structure leading to a junction chamber. The chamber controls flows from the wastewater ponds into the reclaim pond and/or clear water pond through 30 inch diameter fiberglass pipes. A portion of the flow into the reclaim pond is pumped back to the plant for reuse. The remaining portion flows through a 42 inch diameter pipe or 30 inch diameter low water discharge pipe into the clear water pond. The outlet works for the clear water pond consists of a wooden skimmer /concrete weir. The weir discharges into a concrete structure connected to a 66 inch diameter CMP discharge pipe that conveys the discharge to the Ohio River.

Hydrology and Hydraulic Analysis which include calculations for each spillway structure are included in Attachment D.

15.0 SUMMARY CONSTRUCTION SPECIFICATIONS AND PROVISIONS FOR SURVEILLANCE, MAINTENANCE AND REPAIR 275.73 (c)(1)(xi)

[The construction specifications and provisions for surveillance, maintenance, and repair of the CCR unit.]

Construction of the Bottom Ash Complex was completed in around 1982. A Geotechnical Report by Casagrande Consultants completed in 1977 provided recommendations for construction of the Bottom Ash Pond. This report has been provided in Appendix B.

As required by the CCR rules the bottom ash pond complex is inspected at least every 7 days by a qualified person. Also as a requirement of the CCR rules the impoundment is also inspected annually by a professional engineer.

If repairs are found to be necessary during any inspection they will be completed as needed.

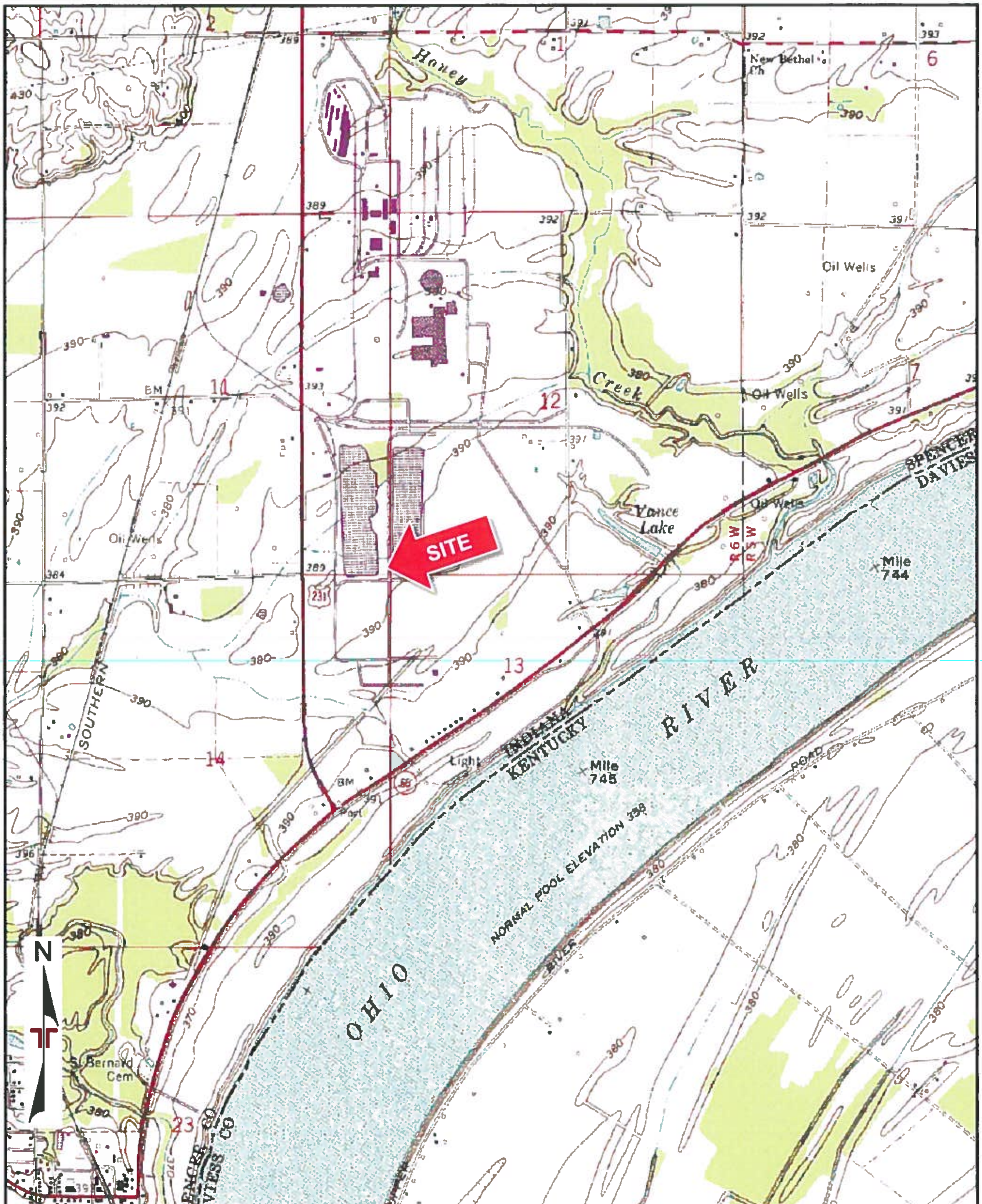
16.0 RECORD OR KNOWLEDGE OF STRUCTURAL INSTABILITY 275.73 (c)(1)(xii)

[Any record or knowledge of the structural instability of the CCR unit.]

To date there has been no record of knowledge of structural instability of the CCR unit.

ATTACHMENT A

LOCATION MAP



TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: ROCKPORT, IN (1/1/1982).

Project Manager: MSF	Project No. N4155126	Terracon	SITE LOCATION MAP	Exhibit
Drawn by: AKB	Scale: 1:24,000	800 Morrison Rd.	AEP Rockport Bottom Ash PE Certification	A-2
Checked by: KME	File Name: N4155126	Columbus, OH 43230	US Highway 231	
Approved by: KME	Date: Dec. 2015		Rockport, IN	

ATTACHMENT B

DESIGN REPORTS

Casagrande file

Arthur Casagrande
Leo Casagrande
Dirk R. Casagrande

CASAGRANDE CONSULTANTS FOUNDATIONS & EARTHWORKS

Report to

American Electric Power Service Corporation

on

FOUNDATION INVESTIGATIONS FOR ROCKPORT SITE

April 25, 1977

40 Massachusetts Avenue, Arlington, Massachusetts 02174 Tel. (617) 648-3630
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TABLE OF CONTENTS

LIST OF FIGURES

I. INTRODUCTION

The 300- and 400-series borings, carried out during the latter part of 1976 and early 1977, were made in response to the following recommendation in our report dated January 14, 1976:

> "It is possible that on the basis of additional borings which are made with special care, and also undisturbed sample borings, we may conclude that the low blowcount sands are actually much better than indicated by the available borings. We recommend such additional investigations."

It was later agreed that due to (1) the difficulty, (2) length of time and (3) expense of taking reliable undisturbed samples of sand, we would base our recommendations on the results of numerous, carefully executed split-spoon borings.

The 300-series borings were made by Law Engineering Testing Company, using three drill rigs. After a number of the 300-series borings had been completed, the location of the Plant was shifted 220 ft to the east. This meant that some of the completed borings were no longer within the Plant area. A new boring layout eliminated some of the 300-series borings that had not yet been made, shifted the locations of several others, and included the 400-series borings. The locations of all borings, including (1) several of the initial borings made in 1973, (2) the 200-series borings made in 1975, (3) the 300- and 400-series borings made in 1976 and 1977 and (4) eight undisturbed sample borings (designated ST-) made in 1977, are shown in Fig. 1. The logs of the 300- and 400-series borings and of the undisturbed sample borings are contained in Appendix II (in a separate volume).

During the period December 24, 1976, to March 24, 1977, we received (1) split-spoon samples from sixty-seven 300-series borings, (2) split-spoon samples from thirty-five 400-series borings, and (3) thirty-two undisturbed tube samples from the eight ST-series borings. Our description of the split-spoon samples and the results of classification tests are included in Tables 1 to 102 of Appendix I (in a separate volume).

The subsurface conditions are generally as described in our report dated January 14, 1976. However, the new borings give a more comprehensive picture of the conditions. All these borings, in combination with information on the design of the structures, including grade elevations for the base of the structures, permitted us to make specific recommendations for the design of the foundations as presented under the following headings.

II. STUCTURES ON MAT FOUNDATIONS

1. Turbine Room

The base of the turbine room mat is at El. 367. This is about 27 ft below existing ground surface, which ranges from El. 392 to 396. The groundwater level in piezometer P-1 in mid-March, 1977, was at El. 368, i.e. about the same as the river level.

Figure 2 is a plot of the standard penetration resistance vs elevation and depth below El. 395, for the 400-series borings in the turbine room area; and Fig. 3 is a similar plot for the 200-series borings. These plots show a zone of low blowcounts between about El. 350 and 365; i.e., between about 2 and 17 ft below the base of the turbine room slab. The proximity of this low blowcount zone to the base of the turbine room would result in significant settlements. Therefore, we recommend that the area of the turbine room be overexcavated to El. 355 and backfilled with suitable granular material. Before backfilling, the surface of the excavation must be compacted by not less than 10 passes with a heavy smooth-drum vibratory roller.

On the basis of the split-spoon samples, the sand and gravel excavated from below the base of the turbine room would be suitable for use as structural backfill. If it is desired to use also fine sand and silty fine sand for structural backfill, the suitability of such materials for structural backfill would have to be investigated by means of a comprehensive test fill program.

The excavation slopes should not be steeper than 1 on 2. They must be protected against erosion without delay as excavation progresses. Effective protection could be provided by a layer of topsoil, not less than 8 in. thick, and seeding, or by a 6 in.

layer of topsoil and sodding. We recommend that the State Highway Department be consulted concerning the most effective protection of cut slopes in fine sand against erosion. Any erosion protection will require prompt maintenance whenever erosion channels develop.

For overexcavation to El. 355, a dewatering system will be required. The split-spoon samples of the granular stratum, which is about 90 ft thick, indicate that dewatering may be difficult, especially during high river stages. A pumping test should be carried out, as outlined in our letter of March 13, 1977.

2. Boiler Rooms

The existing ground surface in this area ranges between about El. 392 and El. 395. The base of the concrete mat for the boiler rooms is at El. 388, i.e. about 4 to 7 ft below existing ground surface. According to the 19 borings in this area, the thickness of the clay stratum varies from less than 3 ft (Boring 343) to about 20 ft (Boring 330). The bottom of the clay ranges from about El. 372 to El. 392. At 16 of the borings, the consistency of the samples of clay varied between stiff and hard. However, at Borings 338 and 339, the clay was firm, and at Borings 330 and 215 it was soft to firm.

Due to the large variation in thickness and character of the clay stratum, all clay should be excavated from under the boiler rooms. In addition, the plots of standard penetration resistance, N, vs elevation and depth below El. 395 in Figs. 4 to 7, indicate that some of the fine sand and silty fine sand directly beneath the clay may be in relatively loose condition. Therefore, we recommend a general overexcavation to El. 376, with local additional excavation where required to remove all clay which extends below El. 376. The excavated surface should be compacted by not less than 10 passes with a smooth-drum vibratory roller. Suitable granular fill should then be placed and compacted in 9 in. thick (loose) layers to grade elevation. This will provide a stiff, at least 20-ft thick granular mat between the base of the concrete mat and the relatively loose granular zone below about El. 365.

In soft to firm clay, the excavation slopes may have to be as flat as 1 on 3. All slopes should be protected against erosion as recommended under the preceding heading.

3. Precipitators

For precipitators designed on spread footings, the bottom of the mat is at El. 388.5. The existing ground surface in this area ranges from El. 392 to 397. Therefore, the required depth of excavation would be only 4 to 9 ft. However, as in the area for the boiler rooms, the elevation of the bottom of the clay stratum varies considerably. Also, the consistency of the clay samples from 24 of the 30 borings within this area was stiff to hard, but very soft to firm clay was encountered in the other 6 borings. The worst conditions appear to be at Borings 207, 326, 330 and 417, which form a line approximately in the center between the two precipitators for the South Unit. This suggests the presence of an old "oxbow" channel. The bottom of this channel is at about El. 373, and in Boring 326 a lens of soft clay was also sampled at about El. 362. Because the spacing of the borings varies from about 100 to 300 ft, the extent of this channel is not well-defined, and it is not known whether it extends also through the area of the south boiler room and turbine room. Also, there may be other channels located between borings.

The standard penetration resistances for the 24 split-spoon borings made in the area of the precipitators are plotted as a function of elevation and depth below El. 395 in Figs. 8 to 12. Most of these borings were made by the same boring crew using the same drill rig (Boyette crew using a Mayhew Jr. drill rig); and the blowcounts obtained by this crew were consistently higher than the blowcounts obtained by the other two crews. These other two crews used CME drill rigs. The magnitude of the difference in the blowcounts between the Mayhew rig and one of the CME rigs can be seen in Fig. 13, which is a plot of penetration resistance vs depth for two borings (323 and 323-A) made 5 ft apart.

On the basis of the split-spoon samples and the plots in Figs. 8 to 13, we recommend that the area of the precipitators be overexcavated to El. 379, and deeper where required to remove all clay. Fortunately, the "oxbow" channel in the area of the south precipitators is apparently confined to only the chevron area between the two precipitators, which is only lightly loaded by ductwork. Therefore, if locally pockets or lenses of clay within the granular stratum are overlooked and not excavated, they should not cause damage in this area.

The excavated surface should be compacted with at least 10 passes with a smooth-drum vibratory roller. Any areas which cannot be properly compacted will require investigation and excavation of unsuitable material.

The excavation slopes can be 1 on 2, except in soft clay, where slopes of 1 on 3 will be required for stability. The excavation slopes must be protected against erosion as recommended under a previous heading.

4. Stack

The bottom of the concrete mat for the stack is at El. 384, which is about 11 ft below existing ground surface. The thickness of the clay stratum in this area varies from less than 5 ft to about 20 ft.

In Figs. 14 and 15 we have plotted the standard penetration resistances, N, for the 8 borings in this area. These plots show that a relatively loose zone of granular material exists between about El. 355 and El. 365. Because of high edge pressures at the base of the concrete mat and because of rocking caused by wind loads, the relatively loose zone would have to be removed by excavation to El. 355. The bottom of the excavation would then have to be thoroughly compacted using a heavy, smooth-drum vibratory roller. Backfill would have to consist of suitable granular material. The excavated sand and gravel below a depth of about 30 ft (El.365) would be suitable for backfill.

The excavation slopes should not be steeper than 1 on 2, and they must be properly protected against erosion, as recommended for the turbine room excavation. Excavation to El. 355 will require dewatering of this area.

5. Cooling Towers

The base of the circumferential mat of the cooling towers is at El. 388, and the bottom of the basin slab is at El. 391 (assuming a 6 in. thick slab). Because of a considerable difference in the foundation conditions at the two cooling towers, their foundation design will be discussed separately.

a. South Cooling Tower: The existing ground surface ranges between about El. 390 and El. 393. The thickness of the clay stratum appears to be quite uniformly about 10 ft. The elevation of the bottom of the clay ranges from about El. 380 to 384. The consistency of the clay appears to be fairly uniform, ranging from stiff to hard, with only one sample of firm clay at a depth of 6 ft in Boring 344. For these reasons, we considered the possibility of excavating only to grade, El. 388, and placing the entire structure on spread foundation on the clay. Therefore, we requested that four undisturbed sample borings be made along the circumference of the tower to permit us to make a settlement analysis. However, after discovering in other areas of the Plant the existence of "oxbow" channels filled with soft clay, we concluded that only 6 split-spoon and 4 undisturbed sample borings made for this cooling tower are too few to eliminate the possibility that such a channel exists under this structure.

On the basis of the foregoing information and the plots of standard penetration resistance vs elevation and depth below El. 395 in Figs. 16 and 17, we recommend that the area for the circumferential mat be overexcavated to El. 380 and backfilled with suitable granular material. Locally, the required excavation may have to be deeper to remove all clay material. The excavation slopes should be not steeper than 1 on 2. The bottom of the excavation should be thoroughly compacted by not less than 10 passes with a smooth-drum vibratory roller.

These cooling towers will have no interior columns, and the load on the basin slab will be due to the depth of water in the basin, which will be a maximum of 750 lb/sq ft. Because of this small load and because the basin slab is not very sensitive to differential settlements, the clay under the slab need not be excavated.

b. <u>North Cooling Tower</u>: The existing ground surface ranges between El. 385 and El. 394, with the northern two-thirds of the area ranging between 385 and 388. Thus, a major portion of the structure will be founded above existing ground surface.

The thickness of the clay stratum varies from about 10 ft to 20 ft, with the bottom of this stratum between El. 368 to 385.

The consistency of the clay in the southern one-third of the area is stiff to hard; but in the northern two-thirds, the consistency decreases from stiff to hard near the surface to soft to firm in the lower portion of the stratum.

In Figs. 18 and 19 are plotted the standard penetration resistances vs elevation and depth below El. 395, for the 7 borings made in this area. On the basis of these plots, and the soft consistency of some of the clay, we recommend that the area of the circumferential mat be excavated to El. 372, and locally deeper where required to remove all clay. The side slopes should be not steeper than 1 on 2 within the southern one-third of the area, and not steeper than 1 on 3 in the northern two thirds. The total width of the bottom of the excavation should be not less than the width of the circumferential mat plus the depth of over-excavation. The surface at the bottom of the excavation must be compacted with at least 10 passes of a smooth-drum vibratory roller. Backfill should consist of suitable granular material placed and compacted in layers not exceeding 9 in. before compaction.

The interior basin slab will undergo significant total and differential settlement if the clay is not excavated. However, such settlements could be counteracted by mud-jacking, if necessary.

The drawings for the Marley cooling towers sent to us by Dennis Rubin with his letter of February 28, 1977, show a ribbed design for the base of the circumferential mat. For more uniform load distribution, a uniform thickness would be preferable.

6. Miscellaneous Lightly-Loaded Structures

Structures which are not sensitive to settlements may be founded on spread footings on the clay. Borings should be made in the areas of structures that could be somewhat sensitive to differential settlements, such as fuel oil tanks, to determine whether clay should be excavated beneath such structures.

7. Granular Material for Structural Backfill

When overexcavation and backfilling was considered in 1976, we were informed that (1) borrow pits cannot be excavated on the property for obtaining suitable granular material for backfill, and (2) the cost of importing granular material for backfill would be prohibitive. Therefore, we had agreed that all granular materials from the required excavations, including fine sand and silty fine sand, could be used as structural backfill if properly compacted. In order to determine the best method for placement and compaction, we had recommended that a comprehensive test fill program be carried out.

Since then, AEP has learned that a well-graded sand called "Grits" is readily available from a supplier at a reasonable cost. The gradation of a sample of this material, as determined by the AEP Civil Engineering Laboratory, is shown in Fig. 23 by the full-drawn curve. This material would be well-suited for structural backfill.

George Camporini informed us that it will be the contractor's responsibility to supply granular material for structural backfill. Therefore, he requested that we recommend limits for the gradation of granular material suitable for structural backfill, to be included in the specifications. The finer limit of the gradation should be approximately as shown by the dashed curve in Fig. 23. However, the granular material from below about El. 367 in the turbine room excavation consists generally of fine to medium sand or coarser material, and may be used as structural backfill with the exception of any clean fine sand or silty fine sand.

The upper limit of the gradation for structural backfill should not be specified, except that the material should have a maximum size of 4 in. The material should be durable and reasonably well-graded and it should be approved by the engineer.

The excavated fine sand could be used as fill under lightly-loaded structures, or as general fill to bring the area around the Plant to grade El. 399. If used for backfill under structures, the best method of placement and compaction should be investigated by means of a test fill.

The area between the west slope of the turbine room excavation and the turbine room wall, which will be overlain by a portion of the boiler rooms, may be backfilled using the same vibratory roller as used for the general structural backfill. Because the turbine room wall is 12 ft thick and only 11 ft high above the turbine room floor, it cannot be displaced even by a heavy vibratory roller when operating immediately adjacent to the wall.

Granular structural fill should be placed in lifts not exceeding 9 in., measured after spreading, and should be compacted with at least 6 passes of a self-propelled smooth-drum vibratory roller with a static weight not less than 10 tons. It may be necessary to apply water to the fill during compaction to achieve optimum results. This should be investigated by means of a test fill, preferably before filling operations commence. The relative density of the compacted fill should be checked by means of field density tests and laboratory maximum-minimum density tests.

To ensure satisfactory compaction of all structural backfill, we emphasize the great importance of rigorous enforcement of the placement and compaction specifications. The bidding contractors must be told in no uncertain terms that these specifications will be strictly enforeced and AEP must accept the responsibility of providing competent inspectors.

III. STRUCTURES ON PILE FOUNDATIONS

It may be more economical to use pile foundations for some structures, rather than overexcavating unsuitable material. According to George Camporini, one such structure would be the stack, where the excavation would have to extend to El. 355. Bedrock at the stack is at about El. 285. Therefore, piles to bedrock would have to be at least 100 ft long. Because the surface of bedrock consists of soft shale, H-piles may penetrate several feet into bedrock before attaining the required driving resistance.

For friction piles, AEP proposed a design load of 100 tons. This is about 25 tons more than we have used so far for friction piles. Such a design load would require a 16 in. diameter shell, if cast-in-place concrete piles are used. Because of the erratic nature of the granular stratum at this site, we have serious doubts that 100 ton design load can be achieved consistently with cast-in-place friction piles. For such loads, the length of pile embedment in the compact bearing stratum would have to be at least 25 ft. The standard penetration resistances for the borings at the stack, plotted in Figs. 14 and 15, indicate that with a 25 ft embedment in the compact granular stratum, the tips of the piles may again be penetrating into a looser zone, but locally may meet refusal. Such differences will affect the load bearing capacity of each pile. Therefore, a number of load tests will have to be performed.

If cast-in-place concrete piles are to be used also for tensile loads, the steel reinforement will have to extend to the bottom of the piles, and the shells will have to be filled by tremie.

All cast-in-place shells must be inspected just before the reinforcing steel and concrete are placed. They must be free from excessive deformation and water or debris.

IV. DEWATERING

For excavation to El. 355, the groundwater level at the center of the excavation should probably be lowered to about El. 350. Data in our files indicate that the normal groundwater level in the Plant area is at about El. 368. Therefore, the groundwater level at the edge of the excavation would have to be lowered at least 20 ft during normal pool stages of the river. However, AEP has informed us that the dewatering system will be designed for dewatering to river El. 396. For higher river levels the excavation will be permitted to be flooded.

At the time when AEP was comparing the cost of dewatering and overexcavation with the cost of using pile foundations, Wally Howard requested that we perform sieve analyses of the granular samples from Boring 209, so that a dewatering contractor could estimate the cost of dewatering. The grain size curves of the granular samples from Boring 209 were transmitted with our letter of January 25, 1977, and are reproduced in Figs. 20 to 22. These curves, together with the curve of standard penetration resistance vs depth in Fig. 12, illustrate the variable character of the granular stratum.

Due to the great thickness of the granular stratum at this site, we have recommended that a pumping test be carried out. The details of such a test were outlined in our letter of March 13, 1977, and during several telephone conversations with George Camporini.

If the pumping test indicates that some local water supply wells may be affected by the dewatering operation, then provision must be made to assure a continued water supply for those homes.

V. BOTTOM ASH PONDS

During the meeting at your offices on April 4, 1977, we were informed that the design elevation of the crest of the dikes is limited to El. 399 because of river "backwater" restrictions. The existing ground surface at the 13 borings made in this area ranges between El. 388 and 394. Therefore, the height of the dikes will range between about 5 and 11 ft above existing ground surface.

The borings, which were made at 650 to 1000 ft spacing, show that the thickness of the clay stratum generally ranges from less than 5 ft (Boring 367) to about 15 ft. The consistency of the clay is generally stiff to hard. At Boring 365, the clay stratum extends to a depth of about 30 ft, and contains a layer or lens of fine sand between depths of about 10 ft and 20 ft. The clay above the sand is very stiff, and below the sand it is soft to firm, indicating that this may be an "oxbow" channel. However, because the required excavation will probably not extend into this soft clay, it should not cause problems.

After stripping and removal of any soft clay from the surface, all remaining clay should be suitable for support of such low dikes. Also, all excavated stiff to hard clay would be suitable for lining of the ponds. For this purpose, the clay should be stockpiled in a manner that will prevent rainwater from entering the fill and increasing its water content. A clay lining should be not less than 3 ft thick, and should be compacted in lifts not exceeding 9 in. before compaction, at water contents within $\pm$ 2% of standard optimum, using a heavy sheepsfoot roller (not a tamping roller!).

The slopes of the dikes should be not steeper than 1 on 2.5. The outside slope should be covered with topsoil and seeded.

VI. COAL STORAGE AREA

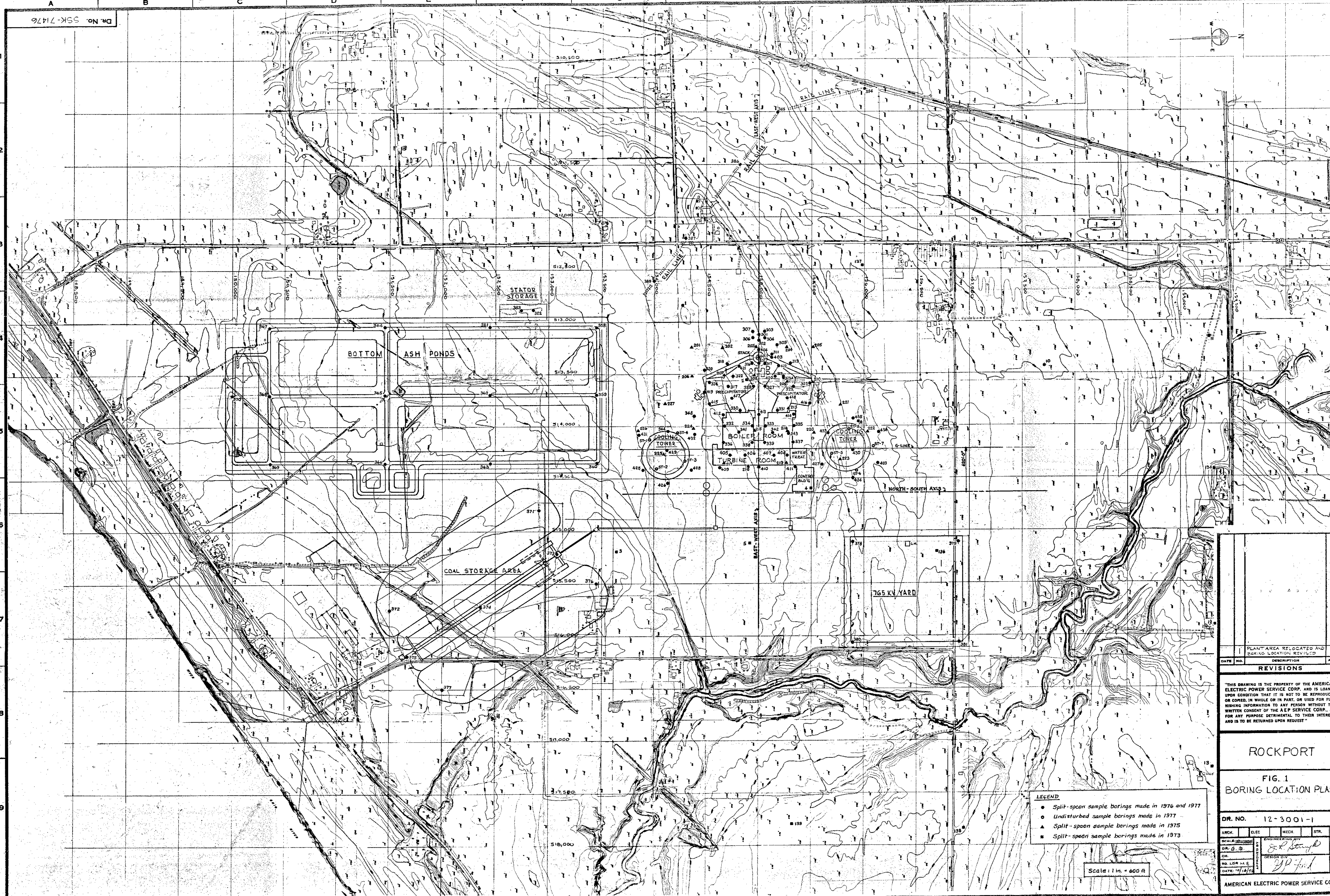
The existing ground surface at the seven borings in this area ranges between El. 391 and 397. The thickness of the clay stratum at the borings varies from less than 5 ft (Boring 376) to about 15 ft (Boring 372). The consistency of the clay ranges from stiff to hard. The groundwater level at piezometer P2, which is located just west of this area, was at about at El. 365 in March 1977.

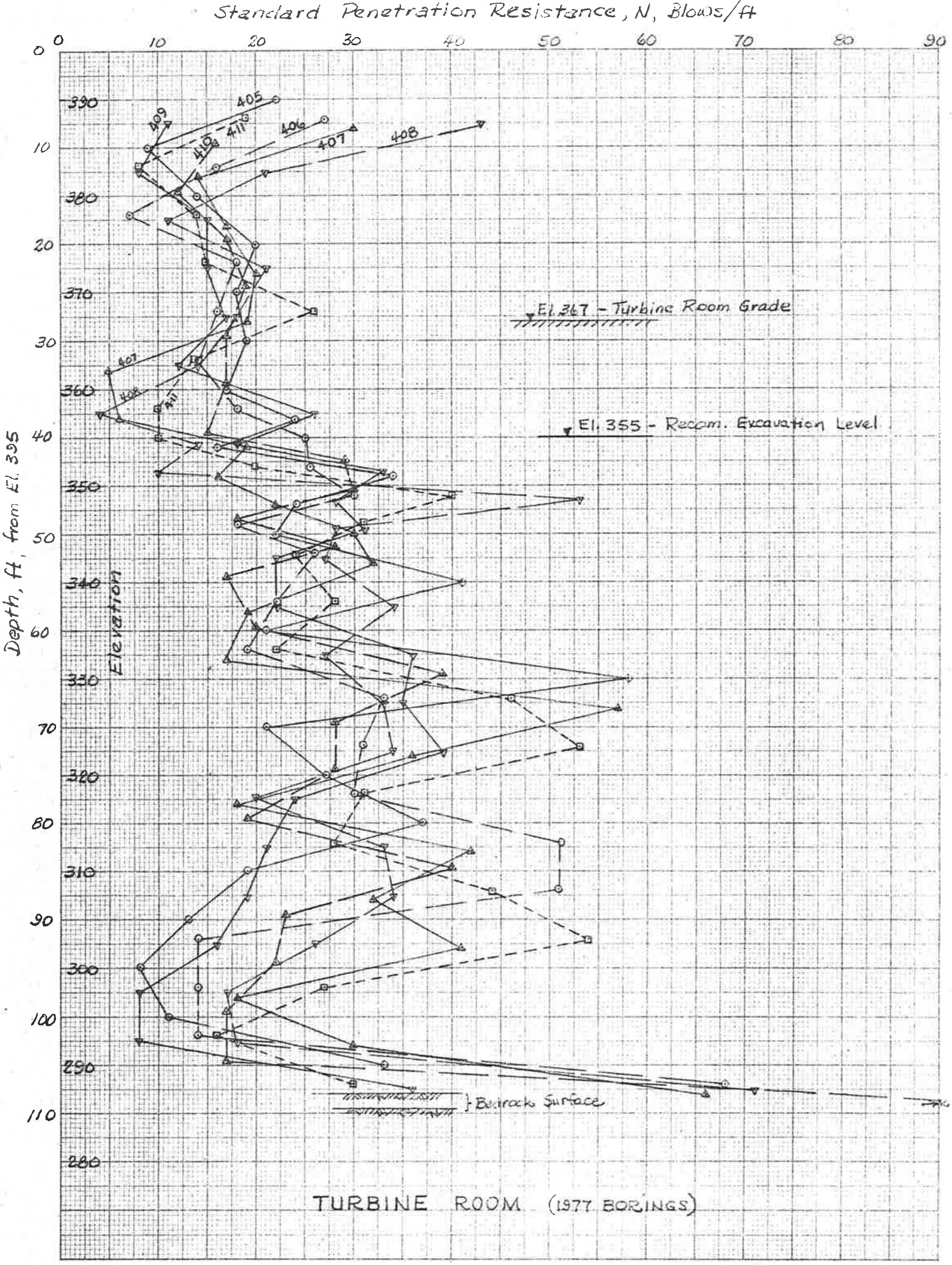
To permit us to make recommendations concerning the foundations of the coal stacker, reclaim tunnels and conveyor stations, we would need the following information:

1. Borings at the locations of any structures where borings have not yet been made, and additional borings along the stacker. Split-spoon samples of the clay should be taken at 3 ft intervals.

2. The size, design, and grade elevations for all structures.

3. The sensitivity of each structure to total and differential settlement.


Dr. No. SSK-71476
BOTTOM ASH PONDS
STATOR STORAGE
COAL STORAGE AREA
765 KV YARD
BOILER ROOM
TURBINE ROOM
COOLING TOWER
COOLING TOWER
STACK
PRECIPITATOR
PRECIPITATOR
WATER TREAT.
CONTROL BLDG.
RAIL LINE
RAIL LINE
EAST-WEST AXIS
NORTH-SOUTH AXIS
PLANT AREA RELOCATED AND BORING LOCATION REVISED
REVISIONS
"THIS DRAWING IS THE PROPERTY OF THE AMERICAN ELECTRIC POWER SERVICE CORP. AND IS LOANED UPON CONDITION THAT IT IS NOT TO BE REPRODUCED OR COPIED, IN WHOLE OR IN PART, OR USED FOR FURNISHING INFORMATION TO ANY PERSON WITHOUT THE WRITTEN CONSENT OF THE A.E.P. SERVICE CORP., OR FOR ANY PURPOSE DETRIMENTAL TO THEIR INTEREST, AND IS TO BE RETURNED UPON REQUEST"
ROCKPORT
FIG. 1
BORING LOCATION PLAN
LEGEND
Split-spoon sample borings made in 1976 and 1977
Undisturbed sample borings made in 1977
Split-spoon sample borings made in 1975
Split-spoon sample borings made in 1973
Scale: 1 in. = 600 ft
DR. NO. 12-3001-1
AMERICAN ELECTRIC POWER SERVICE CORP.



Standard Penetration Resistance, N, Blows/ft
Depth, ft, from El. 395
Elevation
El. 367 - Turbine Room Grade
El. 355 - Recom. Excavation Level
Bedrock Surface
405
406
407
408
409
410
411
TURBINE ROOM (1977 BORINGS)

FIG. 2

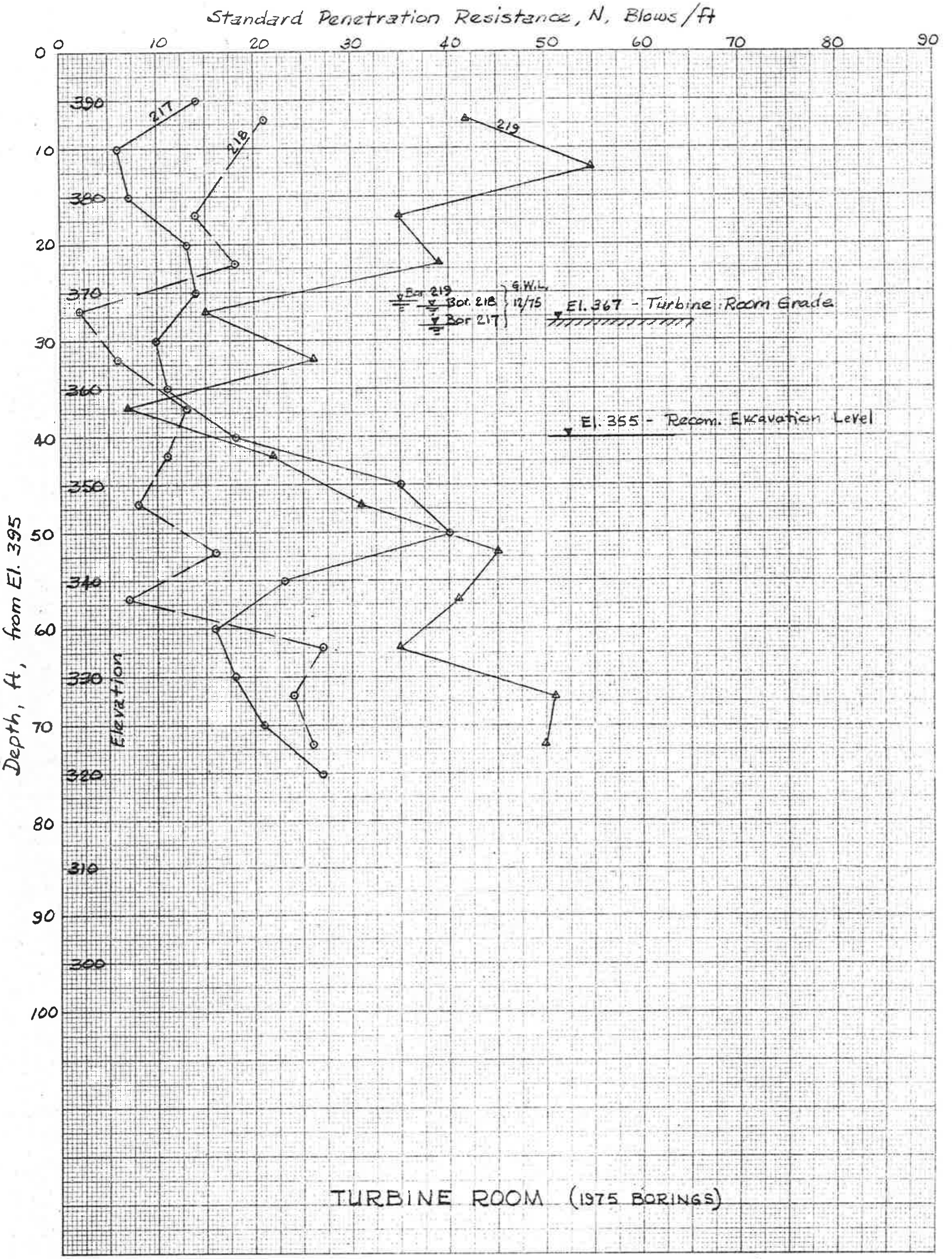
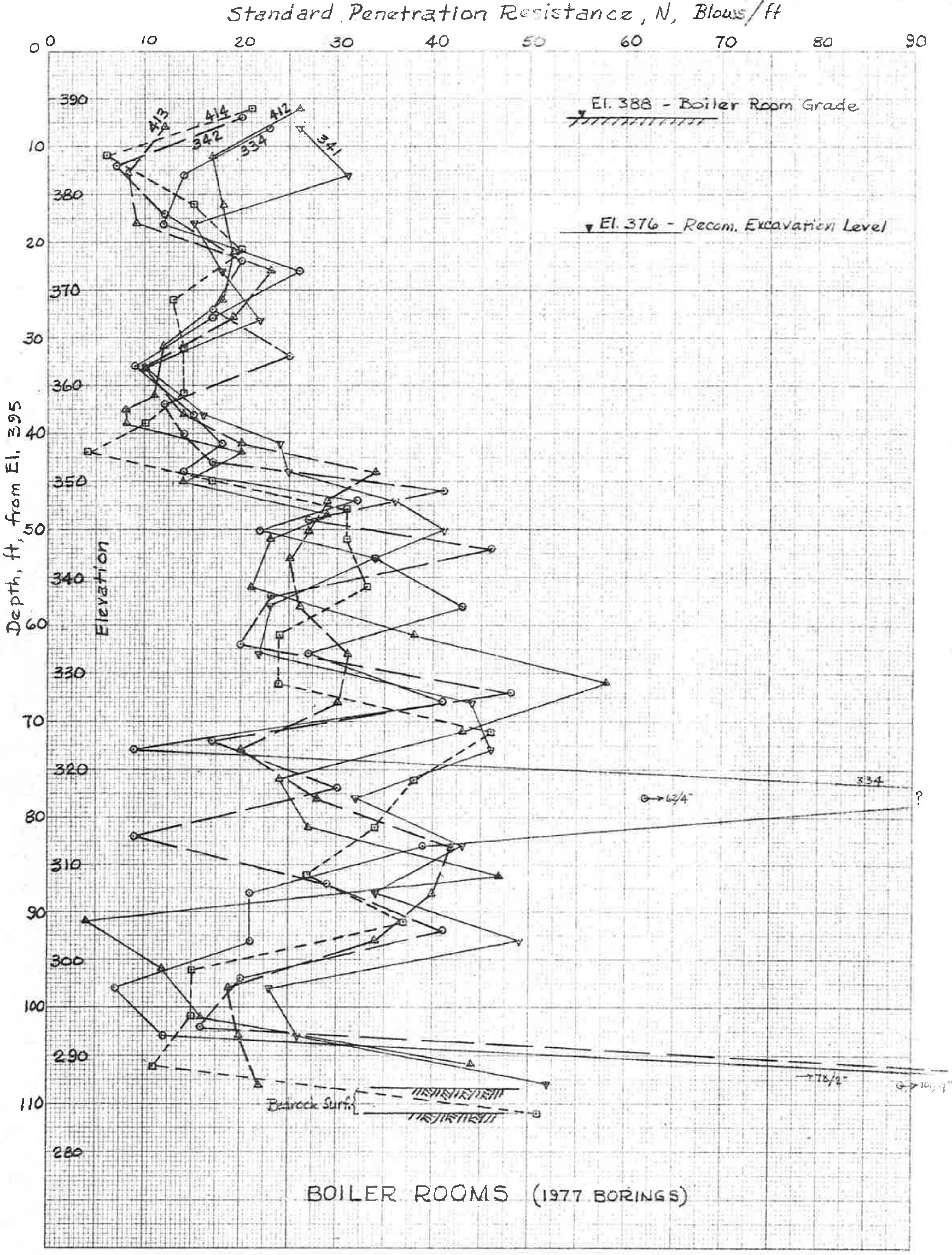

Standard Penetration Resistance, N, Blows/ft
0
10
20
30
40
50
60
70
80
90
Depth, ft, from El. 395
100
Elevation
390
380
370
360
350
340
330
320
310
300
217
218
219
Bor 219
Bor. 218
Bor 217
G.W.L.
12/75
El. 367 - Turbine Room Grade
El. 355 - Recom. Excavation Level
TURBINE ROOM (1975 BORINGS)

FIG. 3



Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
Elevation
0 10 20 30 40 50 60 70 80 90 100 110
390 380 370 360 350 340 330 320 310 300 290 280
413
414
342
412
334
341
El. 388 - Boiler Room Grade
El. 376 - Recom. Excavation Level
334
?
Bedrock Surf.
BOILER ROOMS (1977 BORINGS)

FIG. 4

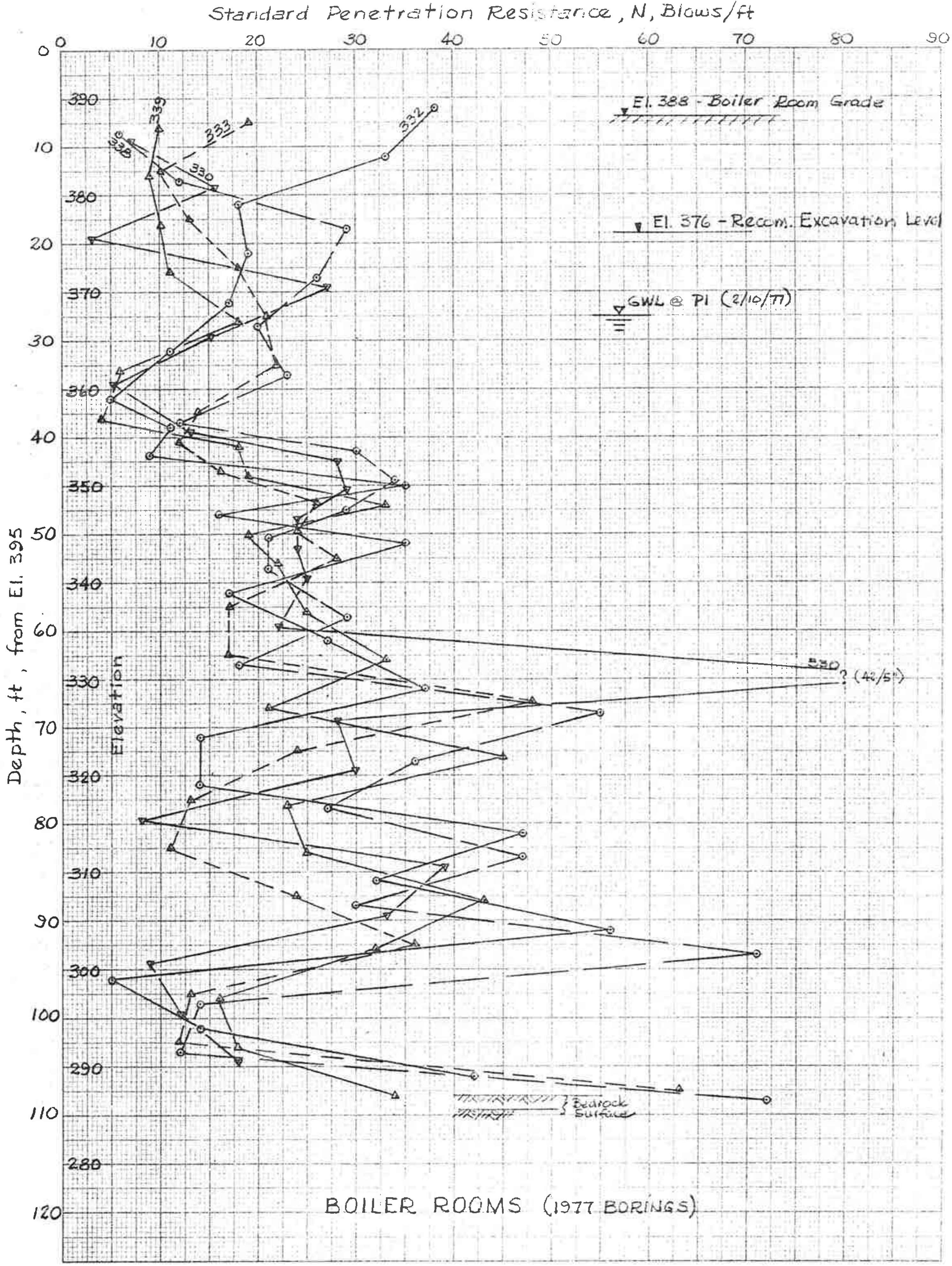
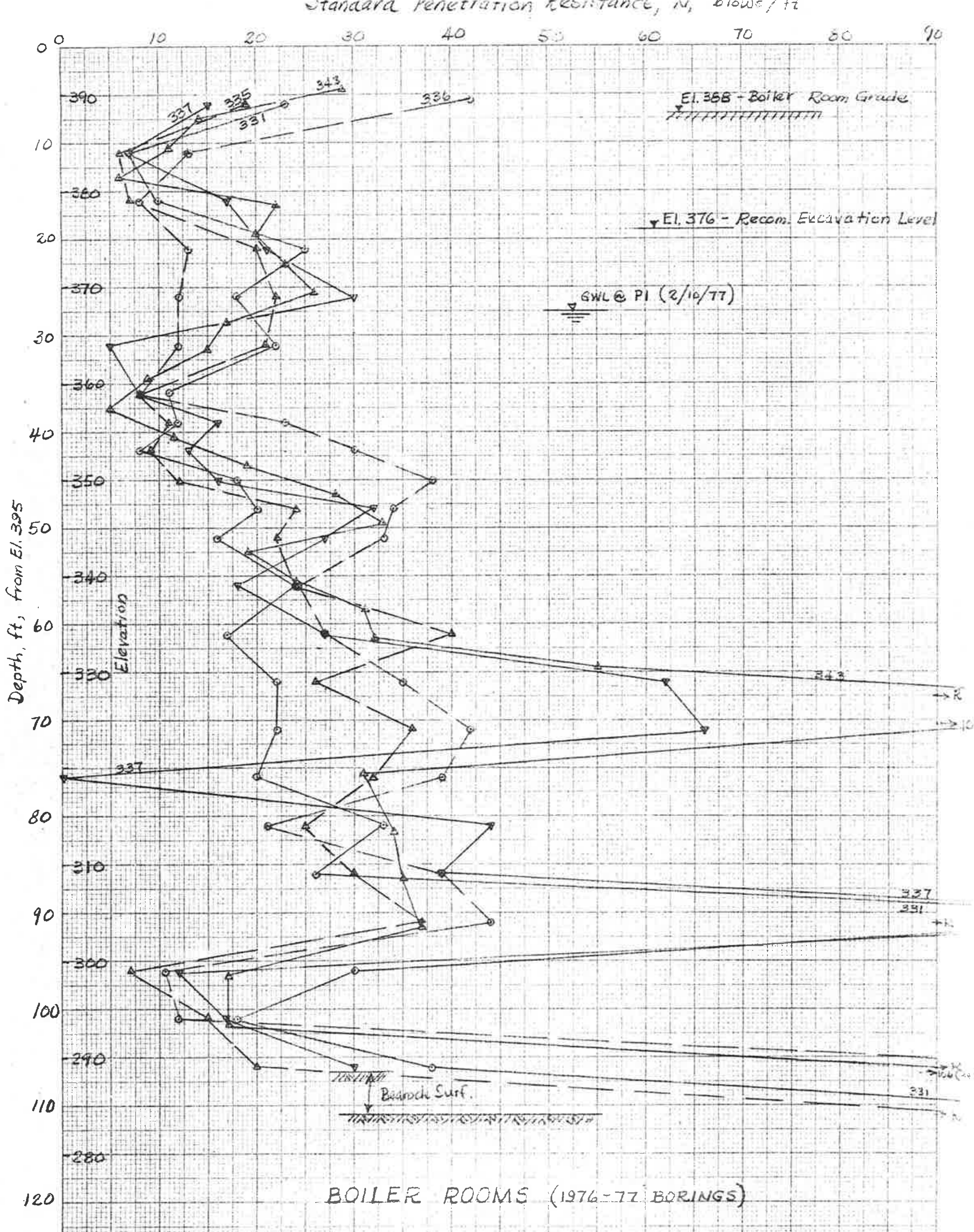
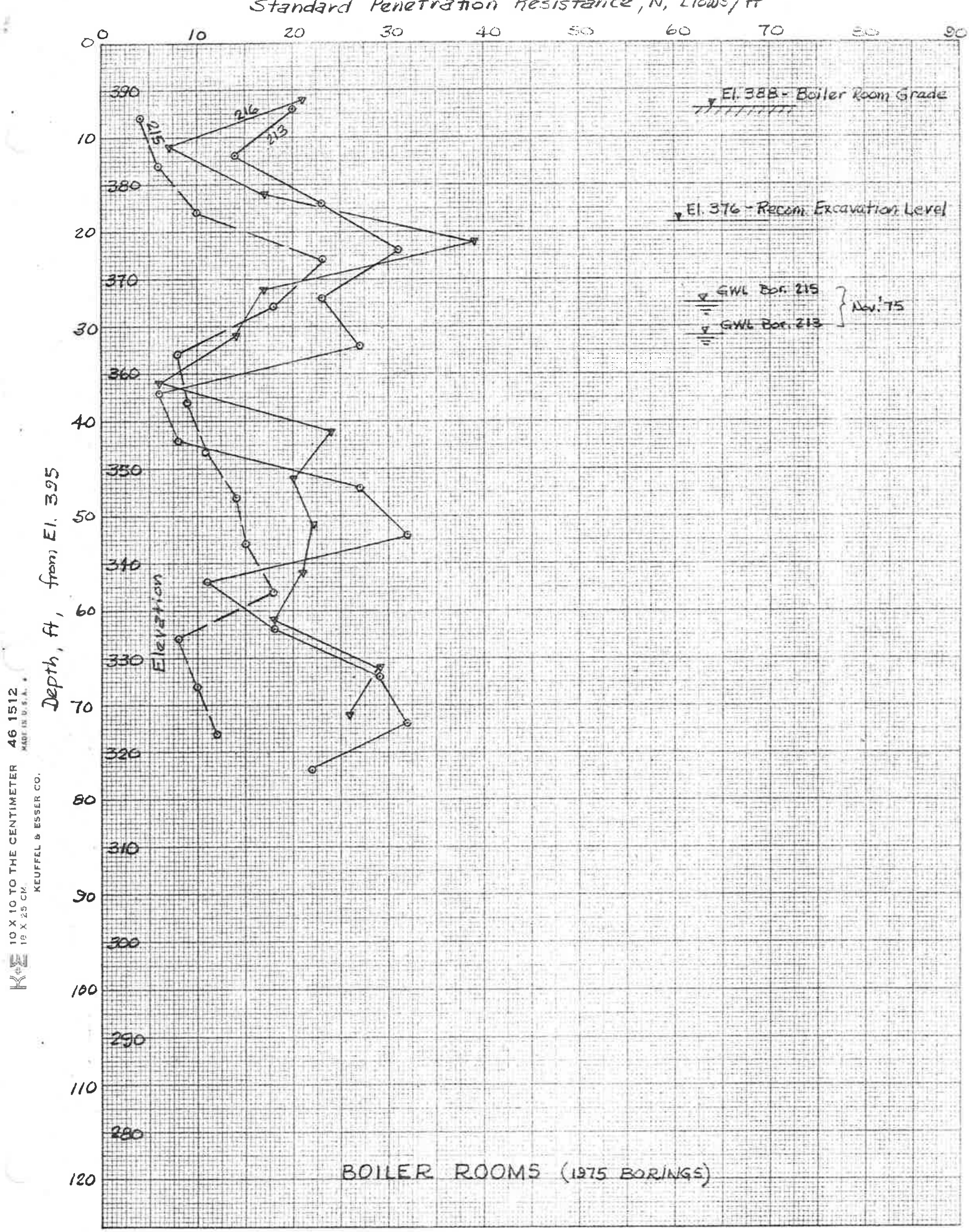

Standard Penetration Resistance, N, Blows/ft
0
10
20
30
40
50
60
70
80
90
Depth, ft, from El. 395
Elevation
0
10
20
30
40
50
60
70
80
90
100
110
120
390
380
370
360
350
340
330
320
310
300
290
280
339
333
332
338
330
El. 388 - Boiler Room Grade
El. 376 - Recom. Excavation Level
GWL @ P1 (2/10/77)
? (42/5")
Bedrock Surface
BOILER ROOMS (1977 BORINGS)

FIG. 5



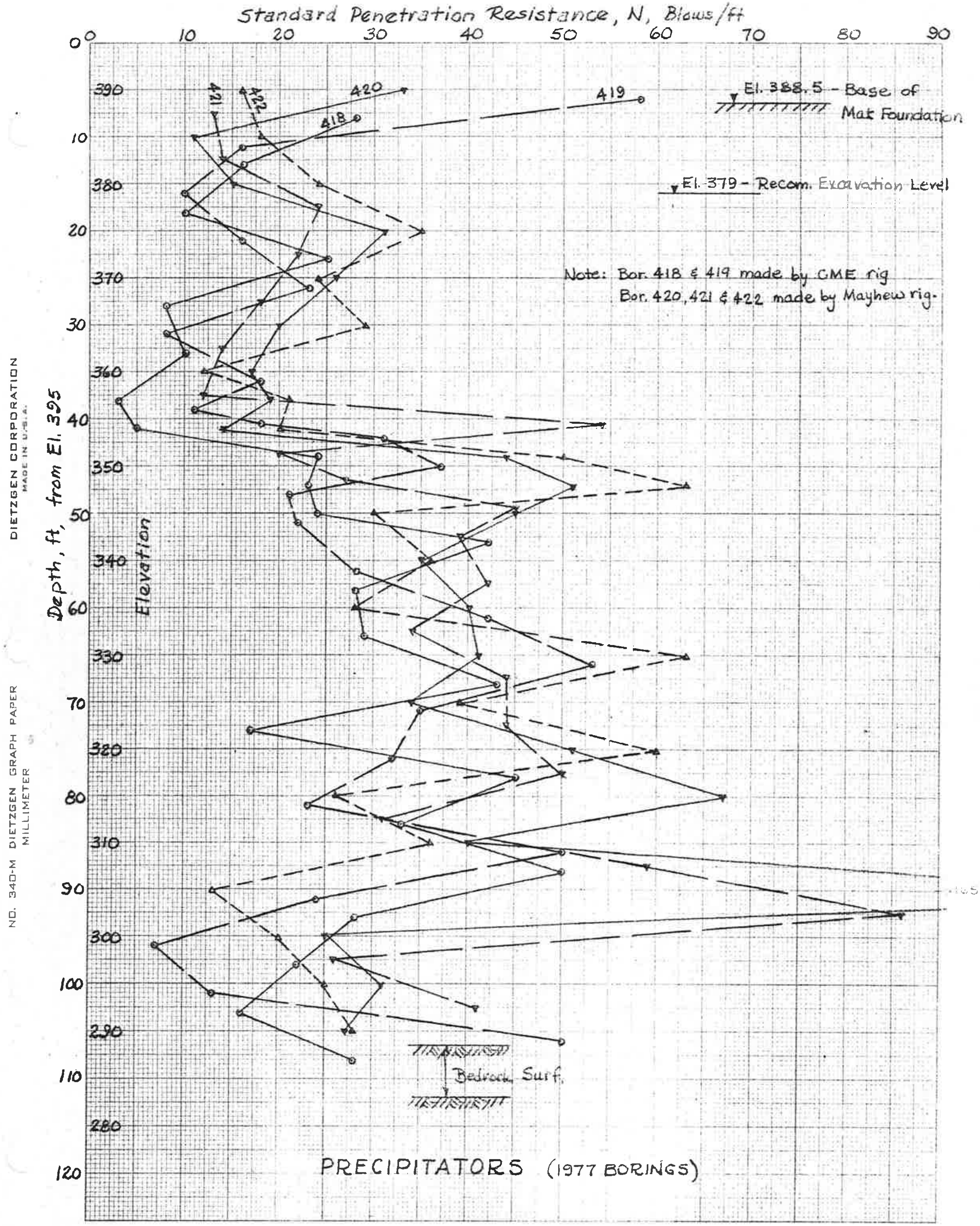
Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
Elevation
El. 388 - Boiler Room Grade
El. 376 - Recom. Excavation Level
GWL @ P1 (2/16/77)
Bedrock Surf.
343
336
337
335
331
BOILER ROOMS (1976-77 BORINGS)

FIG. 6



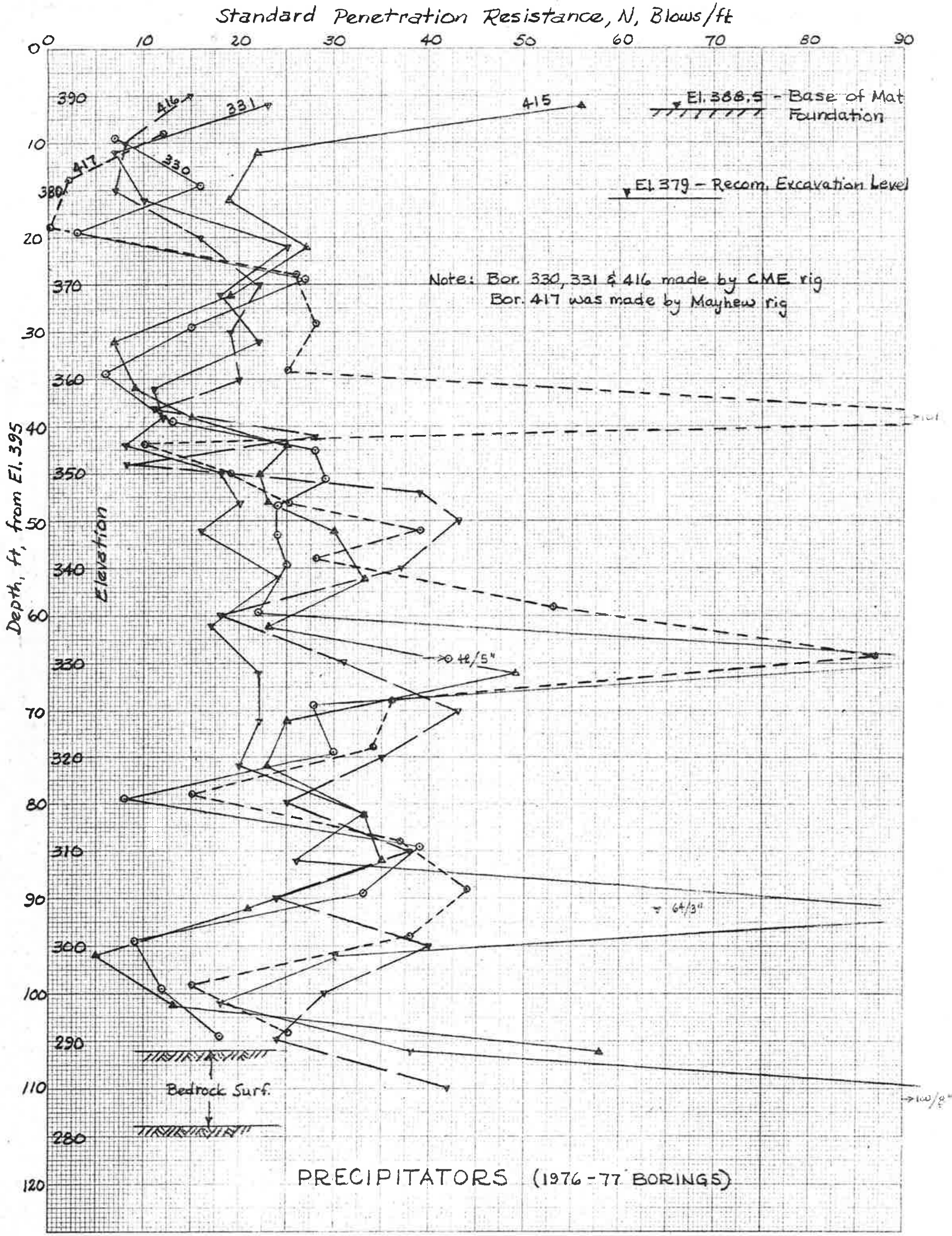
Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
Elevation
El. 388 - Boiler Room Grade
El. 376 - Recom. Excavation Level
GWL Bor. 215
GWL Bor. 213
Nov. '75
216
213
215
BOILER ROOMS (1975 BORINGS)
10 X 10 TO THE CENTIMETER 18 X 25 CM. 46 1512
KEUFFEL & ESSER CO. MADE IN U.S.A.

FIG. 7



Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
0 10 20 30 40 50 60 70 80 90 100 110 120
Elevation
390 380 370 360 350 340 330 320 310 300 290 280
421
422
420
419
418
El. 388.5 - Base of Mat Foundation
El. 379 - Recom. Excavation Level
Note: Bor. 418 & 419 made by CME rig
Bor. 420, 421 & 422 made by Mayhew rig.
105
Bedrock Surf.
PRECIPITATORS (1977 BORINGS)
DIETZGEN CORPORATION
MADE IN U.S.A.
NO. 340-M DIETZGEN GRAPH PAPER
MILLIMETER

FIG. 8

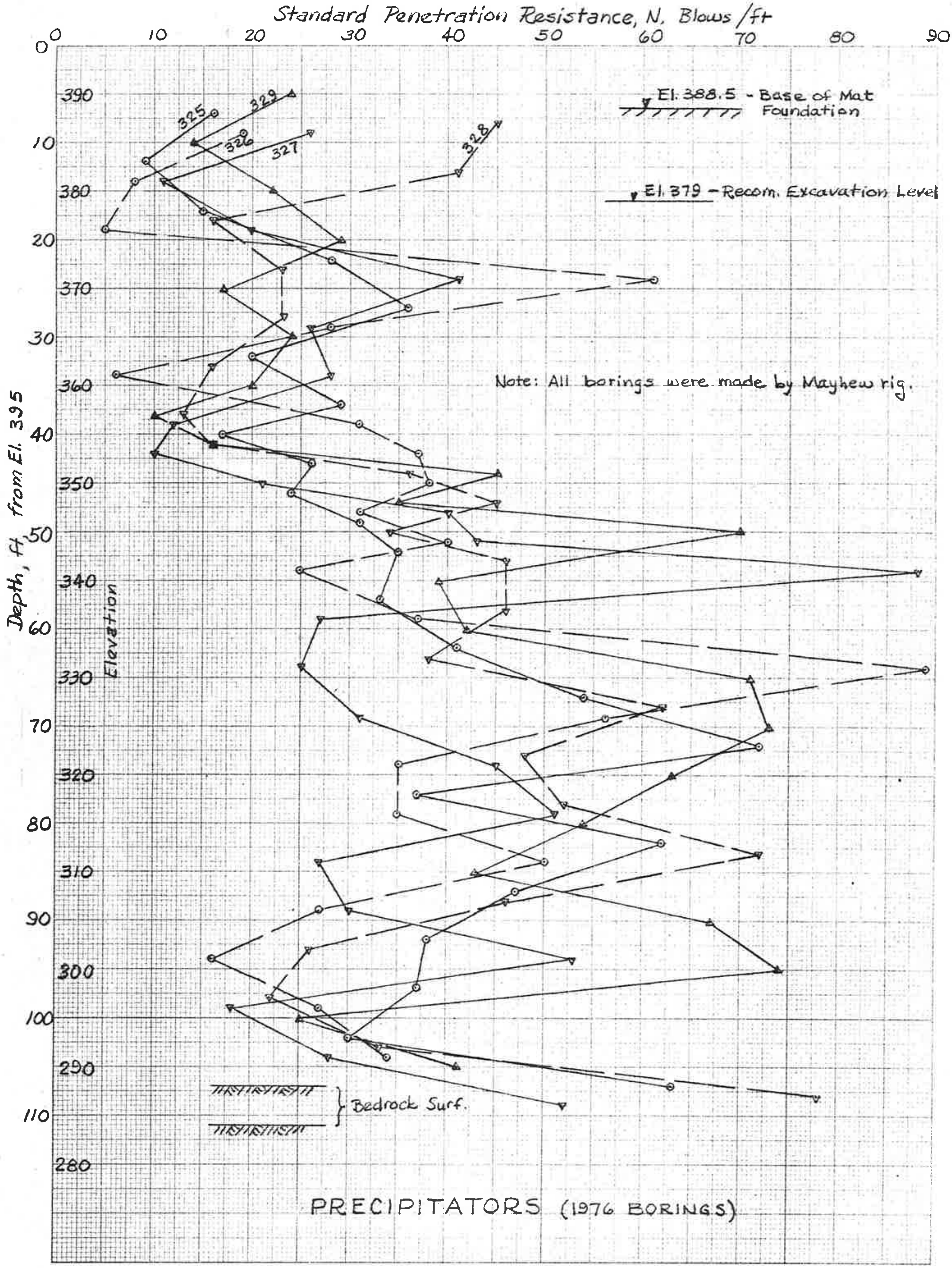


PRECIPITATORS (1976-77 BORINGS)

FIG. 9

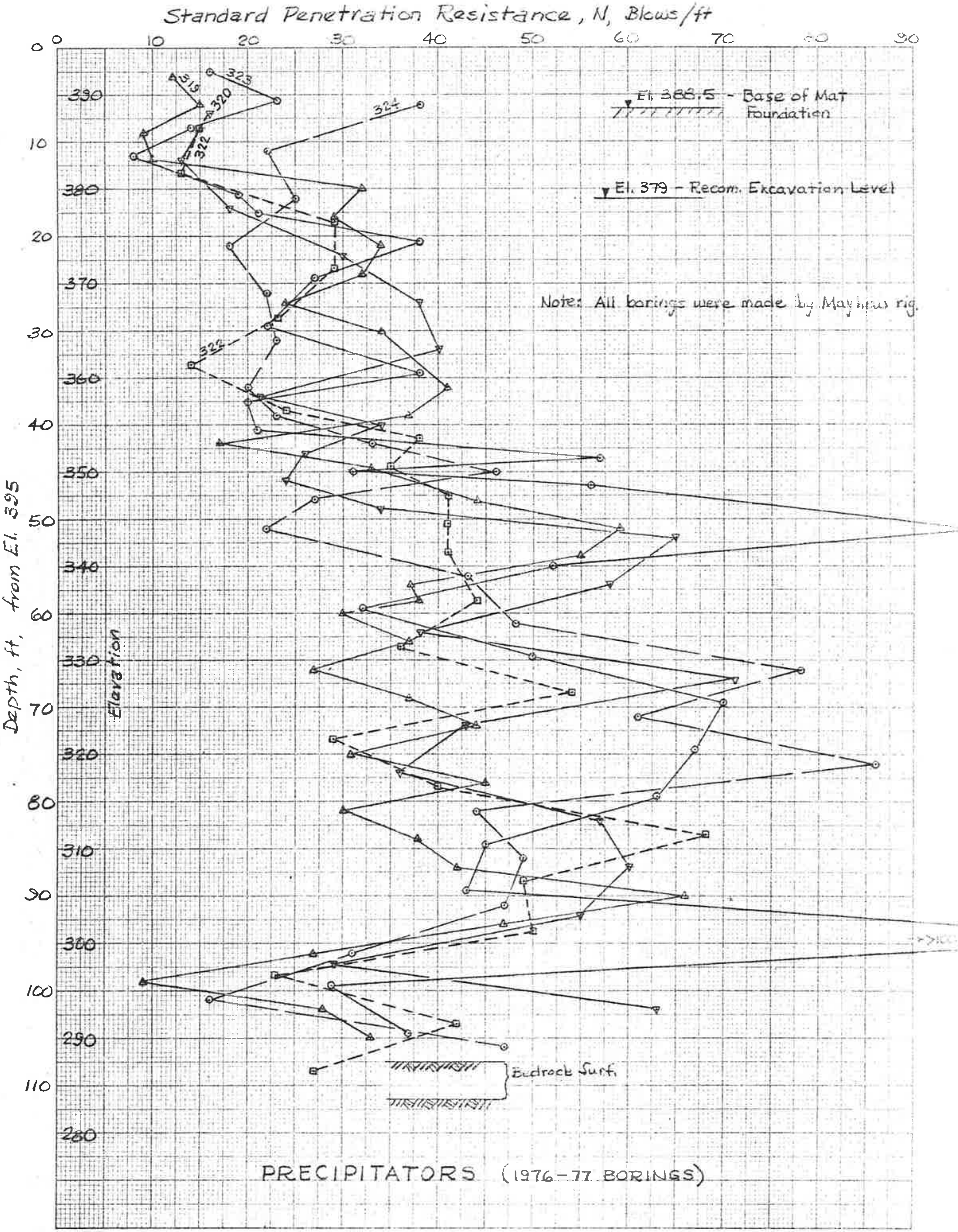
DIETZGEN CORPORATION MADE IN U.S.A.

NO. 340-M DIETZGEN GRAPH PAPER MILLIMETER



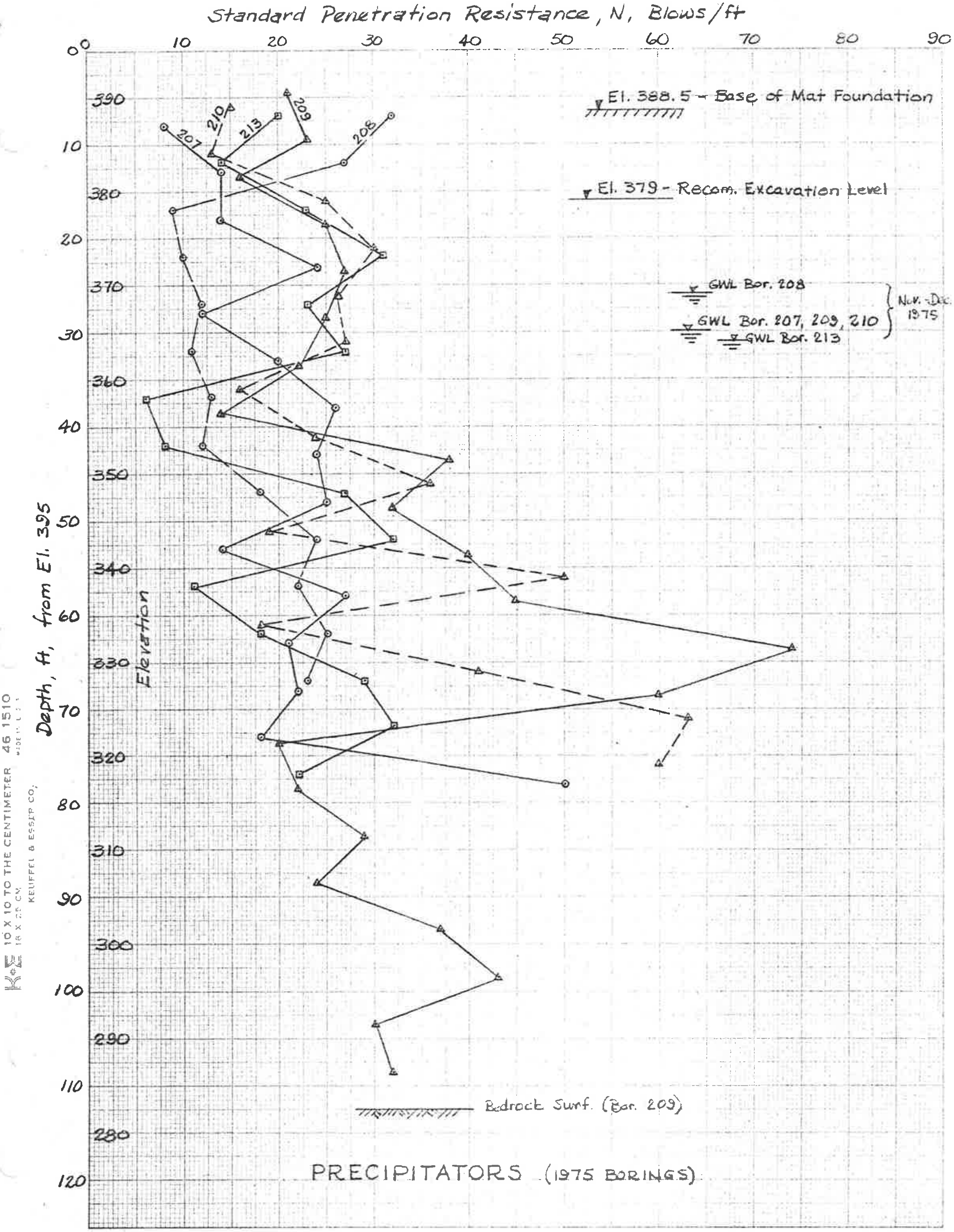
Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
Elevation
0 10 20 30 40 50 60 70 80 90 100 110
390 380 370 360 350 340 330 320 310 300 290 280
325
329
326
327
328
El. 388.5 - Base of Mat Foundation
El. 379 - Recom. Excavation Level
Note: All borings were made by Mayhew rig.
Bedrock Surf.
PRECIPITATORS (1976 BORINGS)

FIG. 10



PRECIPITATORS (1976-77 BORINGS)

FIG. 11



PRECIPITATORS (1975 BORINGS)

FIG. 12

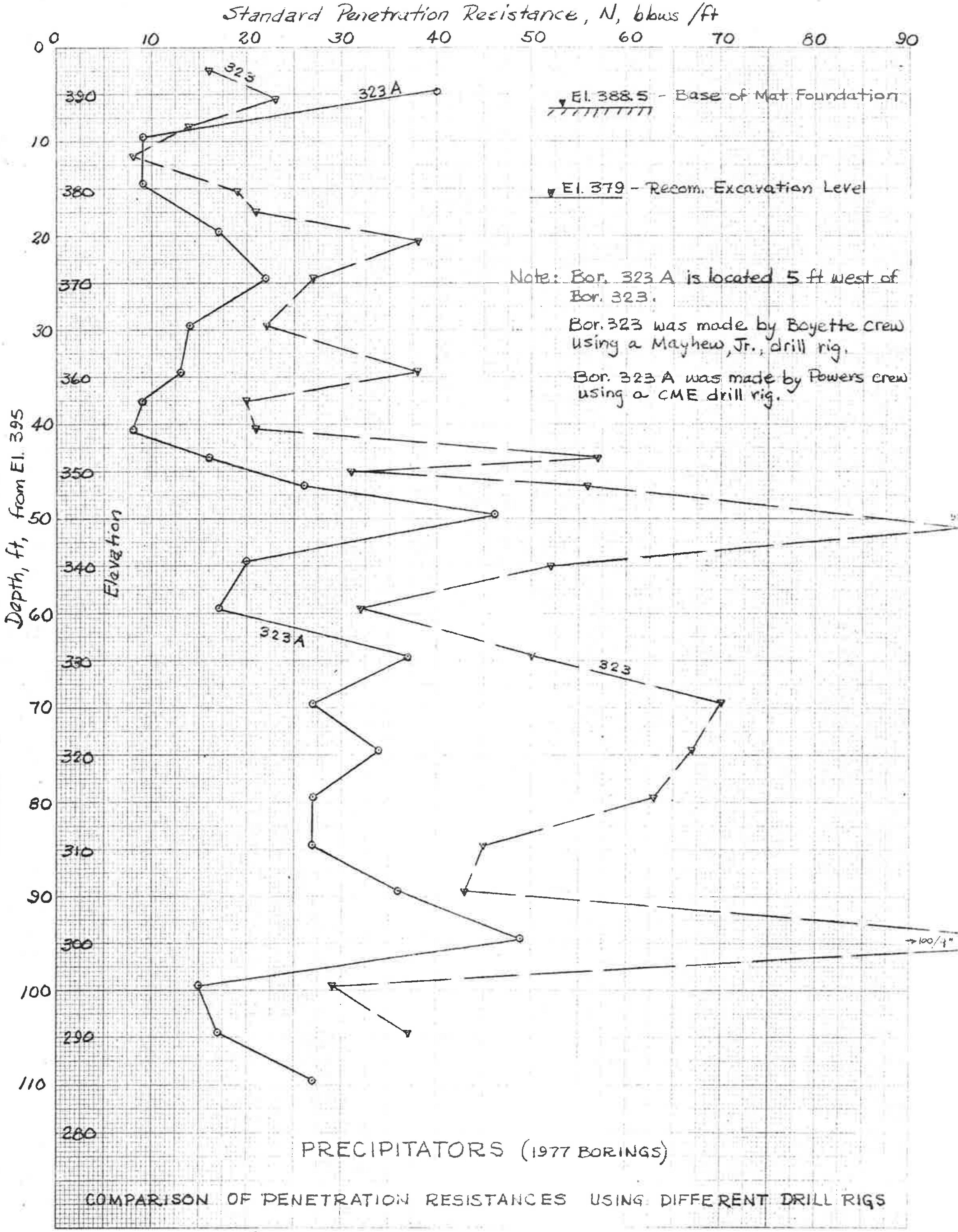
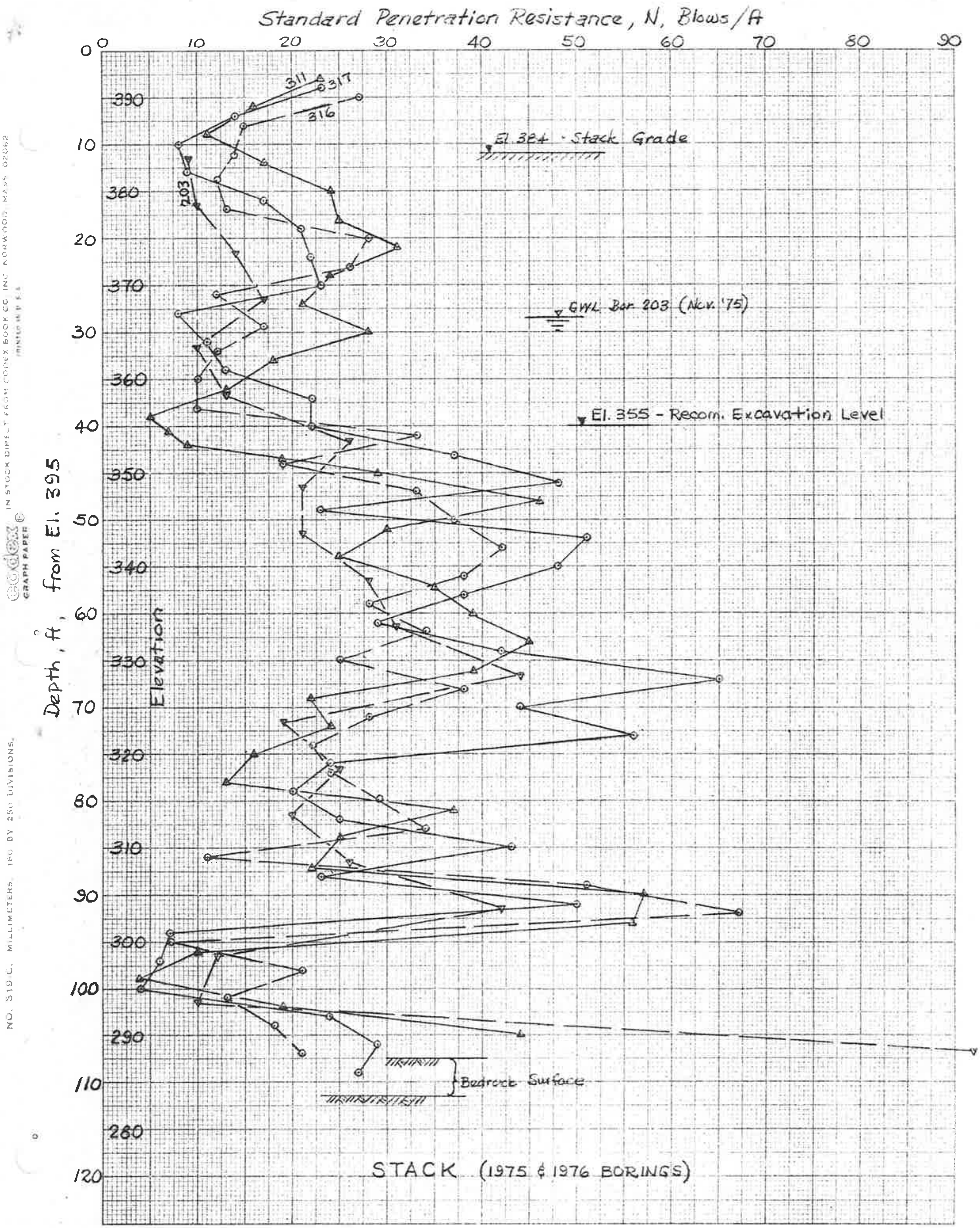
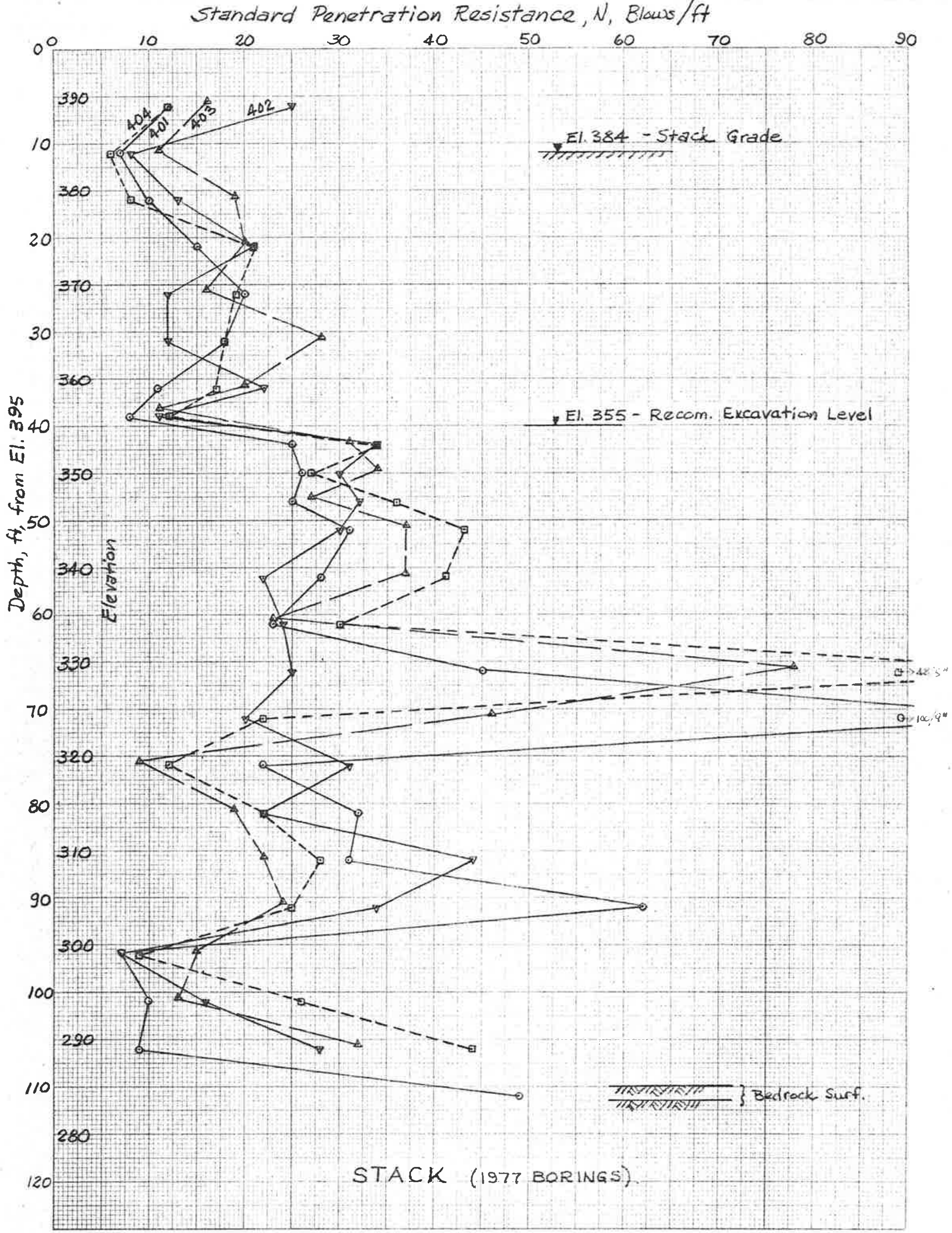

Standard Penetration Resistance, N, blows /ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
0 10 20 30 40 50 60 70 80 90 100 110
Elevation
390 380 370 360 350 340 330 320 310 300 290 280
323
323 A
El. 388.5 - Base of Mat Foundation
El. 379 - Recom. Excavation Level
Note: Bor. 323 A is located 5 ft west of Bor. 323.
Bor. 323 was made by Boyette crew using a Mayhew, Jr., drill rig.
Bor. 323 A was made by Powers crew using a CME drill rig.
100/4"
PRECIPITATORS (1977 BORINGS)
COMPARISON OF PENETRATION RESISTANCES USING DIFFERENT DRILL RIGS

FIG. 13



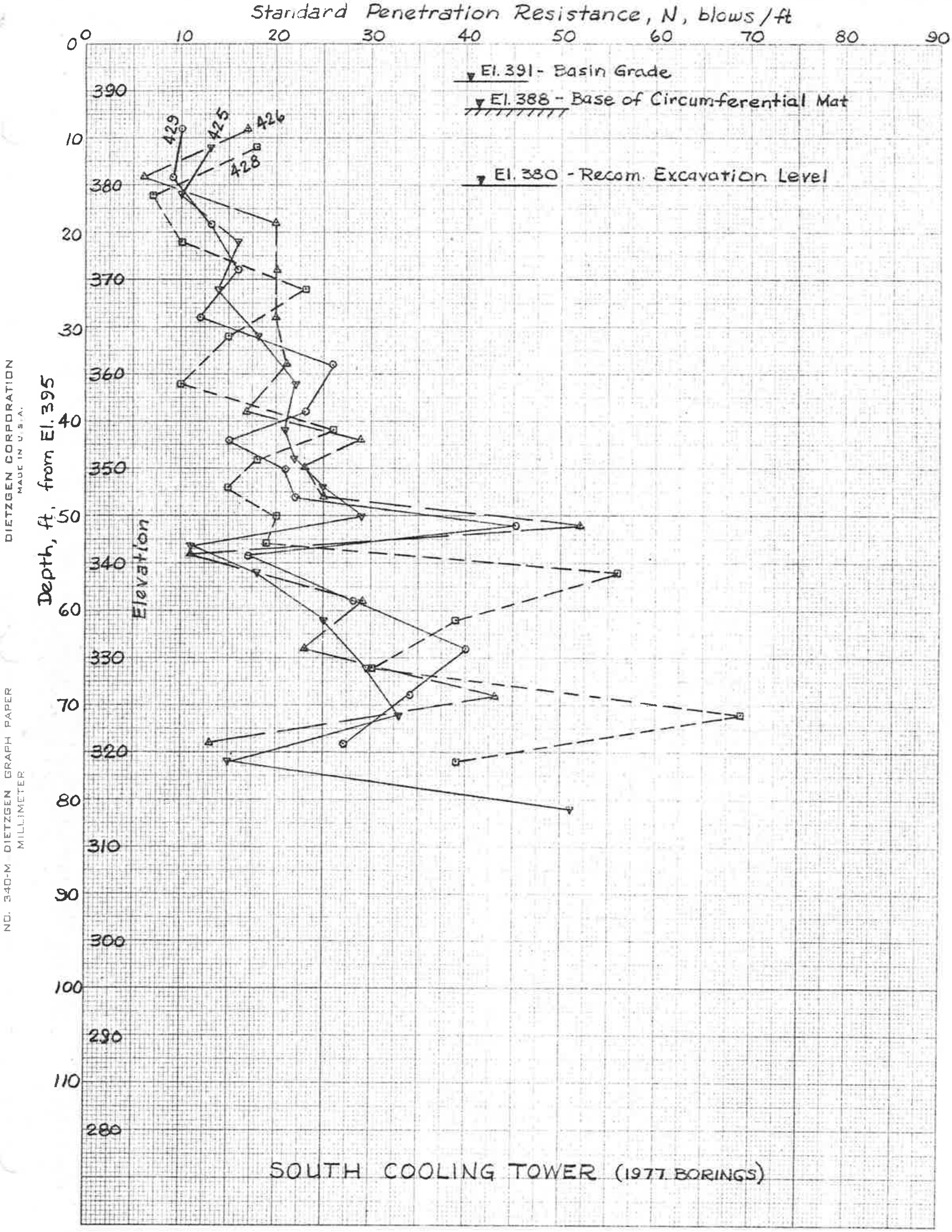
Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
Elevation
0 10 20 30 40 50 60 70 80 90 100 110 120
390 380 370 360 350 340 330 320 310 300 290 280
311
317
316
203
El. 384 - Stack Grade
GWL Bor. 203 (Nov. '75)
El. 355 - Recom. Excavation Level
Bedrock Surface
STACK (1975 & 1976 BORINGS)

FIG. 14



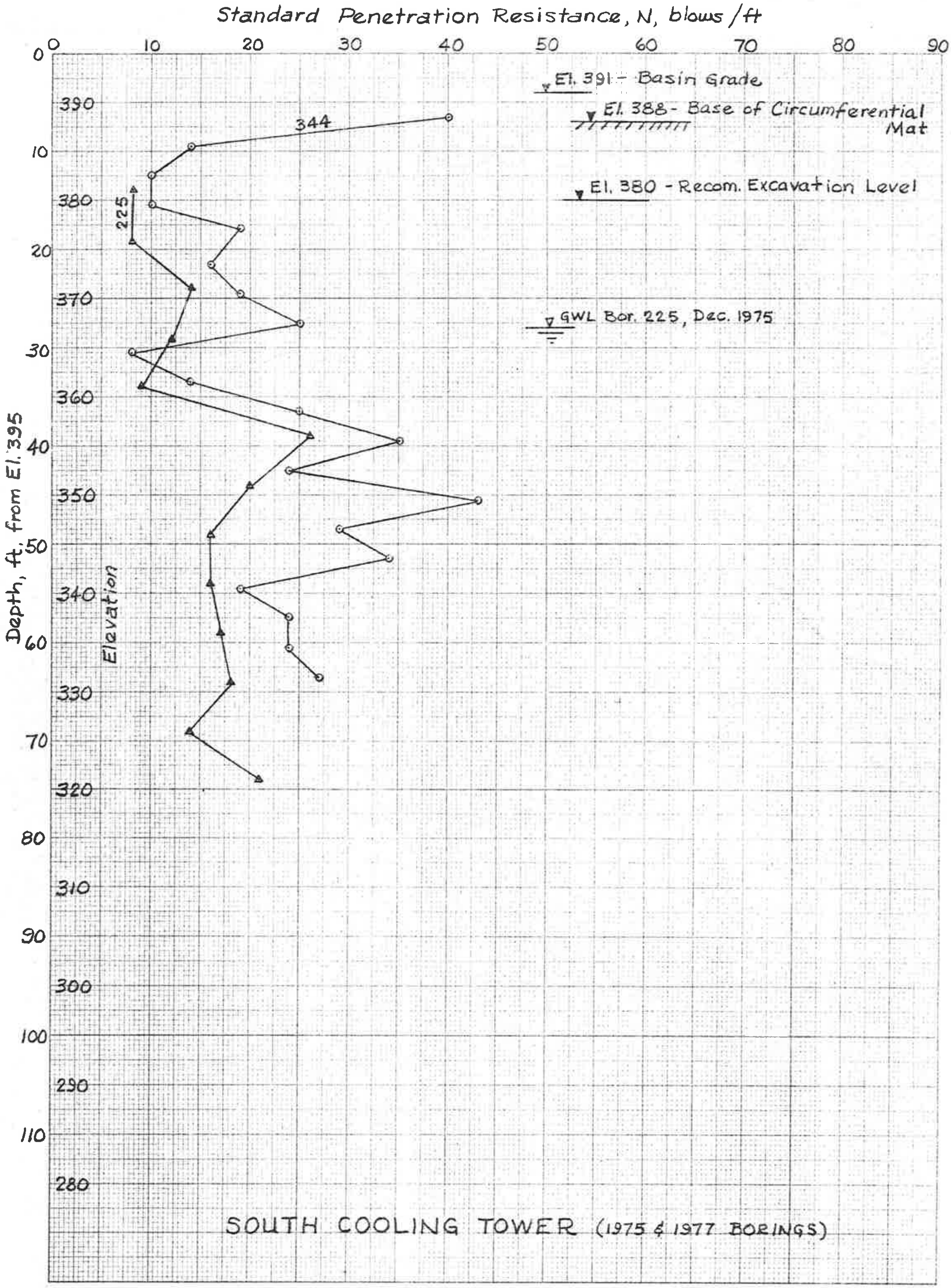
Standard Penetration Resistance, N, Blows/ft
0 10 20 30 40 50 60 70 80 90
Depth, ft, from El. 395
Elevation
404
401
403
402
El. 384 - Stack Grade
El. 355 - Recom. Excavation Level
>48/5"
>100/4"
Bedrock Surf.
STACK (1977 BORINGS)

FIG. 15



SOUTH COOLING TOWER (1977 BORINGS)

FIG. 16



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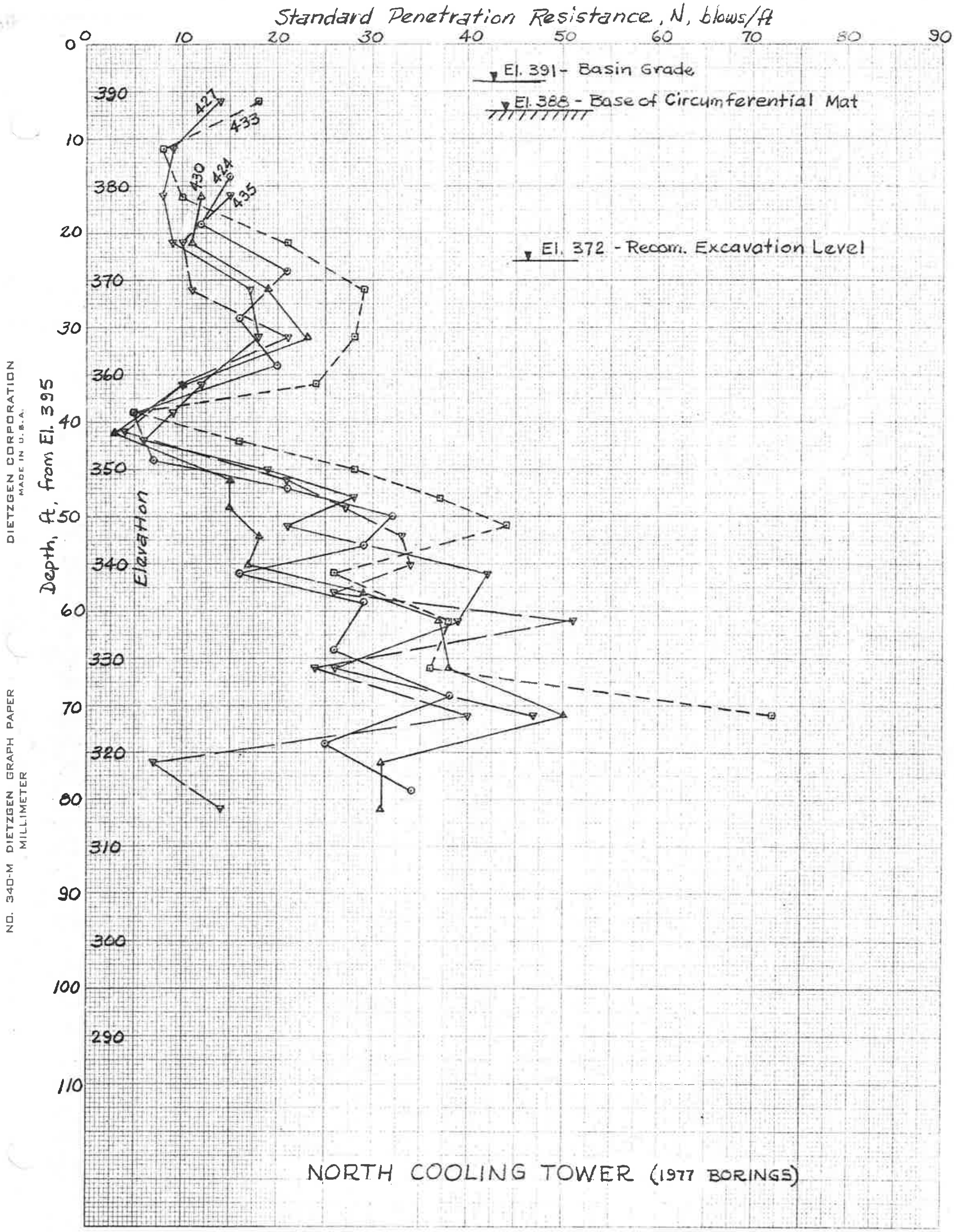
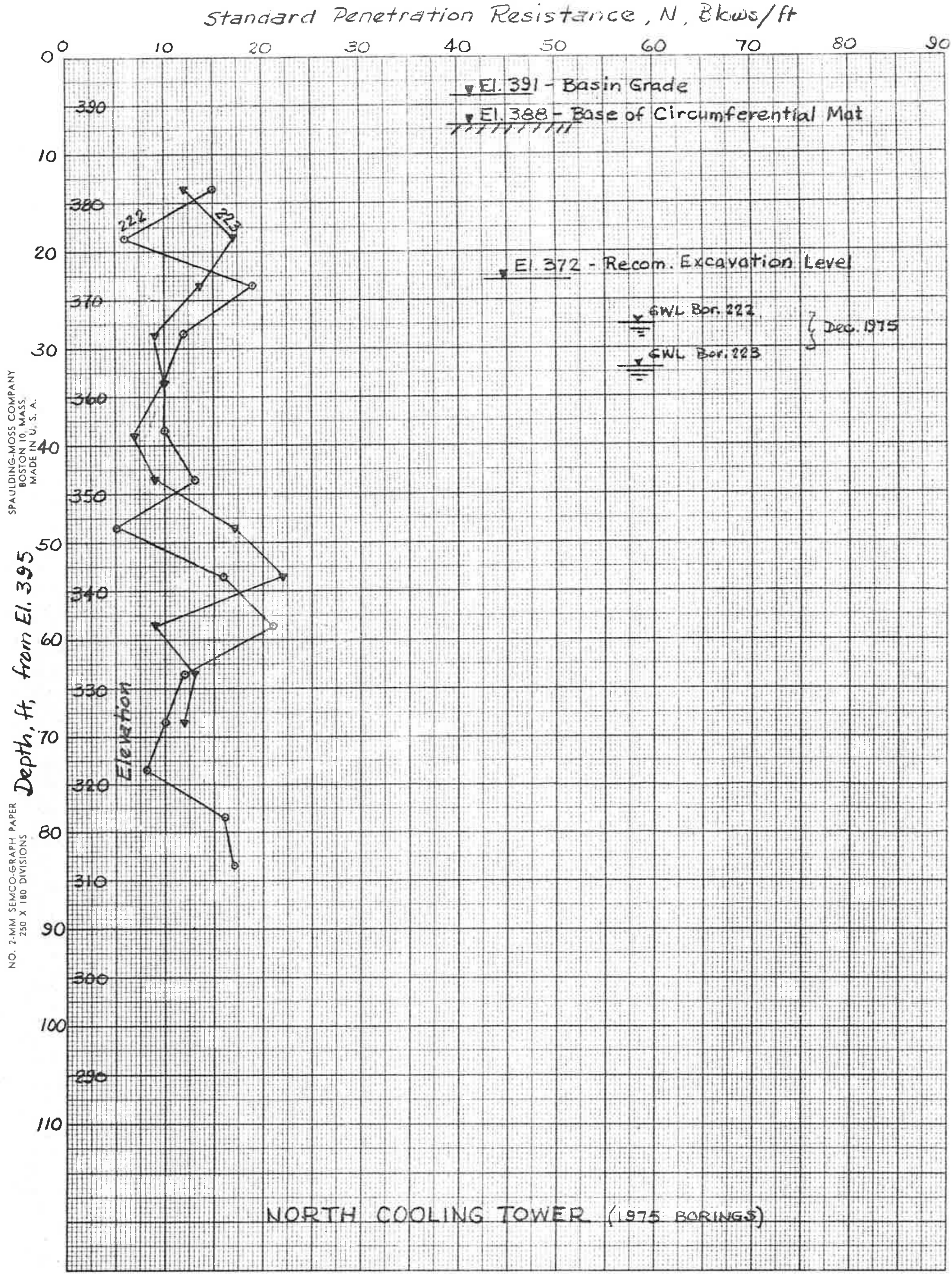
MILLIMETER

FIG. 17



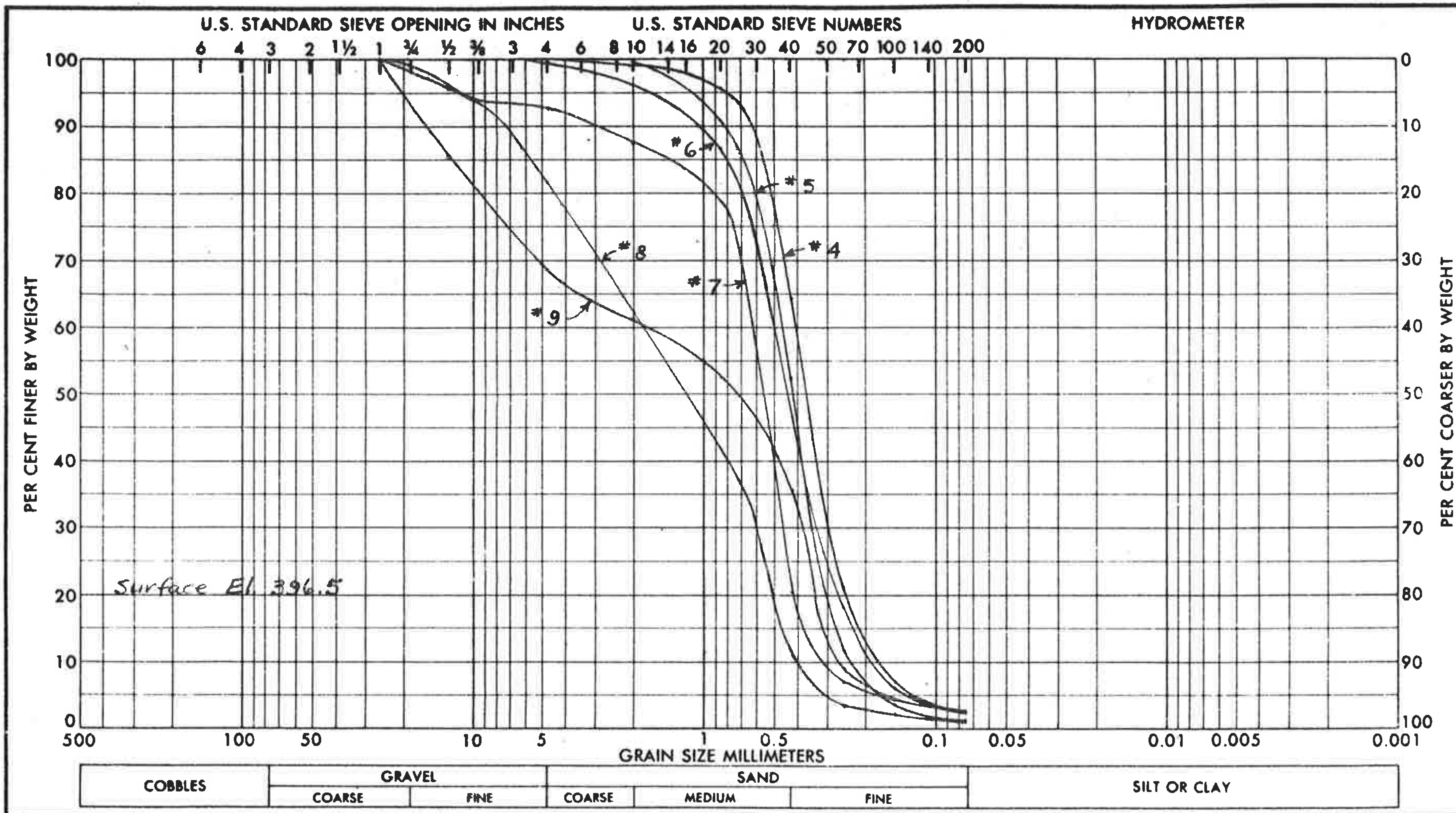
NORTH COOLING TOWER (1977 BORINGS)

FIG. 18



Standard Penetration Resistance, N, Blows/ft
0
10
20
30
40
50
60
70
80
90
Depth, ft, from El. 395
Elevation
390
380
370
360
350
340
330
320
310
300
290
100
110
222
223
El. 391 - Basin Grade
El. 388 - Base of Circumferential Mat
El. 372 - Recom. Excavation Level
GWL Bor. 222
GWL Bor. 223
Dec. 1975
NORTH COOLING TOWER (1975 BORINGS)
SPAULDING-MOSS COMPANY
BOSTON 10, MASS.
MADE IN U. S. A.
NO. 2-MM SEMCO-GRAPH PAPER
250 X 180 DIVISIONS

FIG. 19



SAMPLE NO.	~~ELEV OR~~ DEPTH, ft	CLASSIFICATION	NAT W%	LL	PL	PI
#4	19.0 - 20.5					
#5	25.0 - 26.5					
#6	29.0 - 30.5					
#7	34.0 - 35.5					
#8	39.0 - 40.5					
#9	44.0 - 45.5	**GRADATION CURVES** OF SPLIT - SPOON SAMPLES				

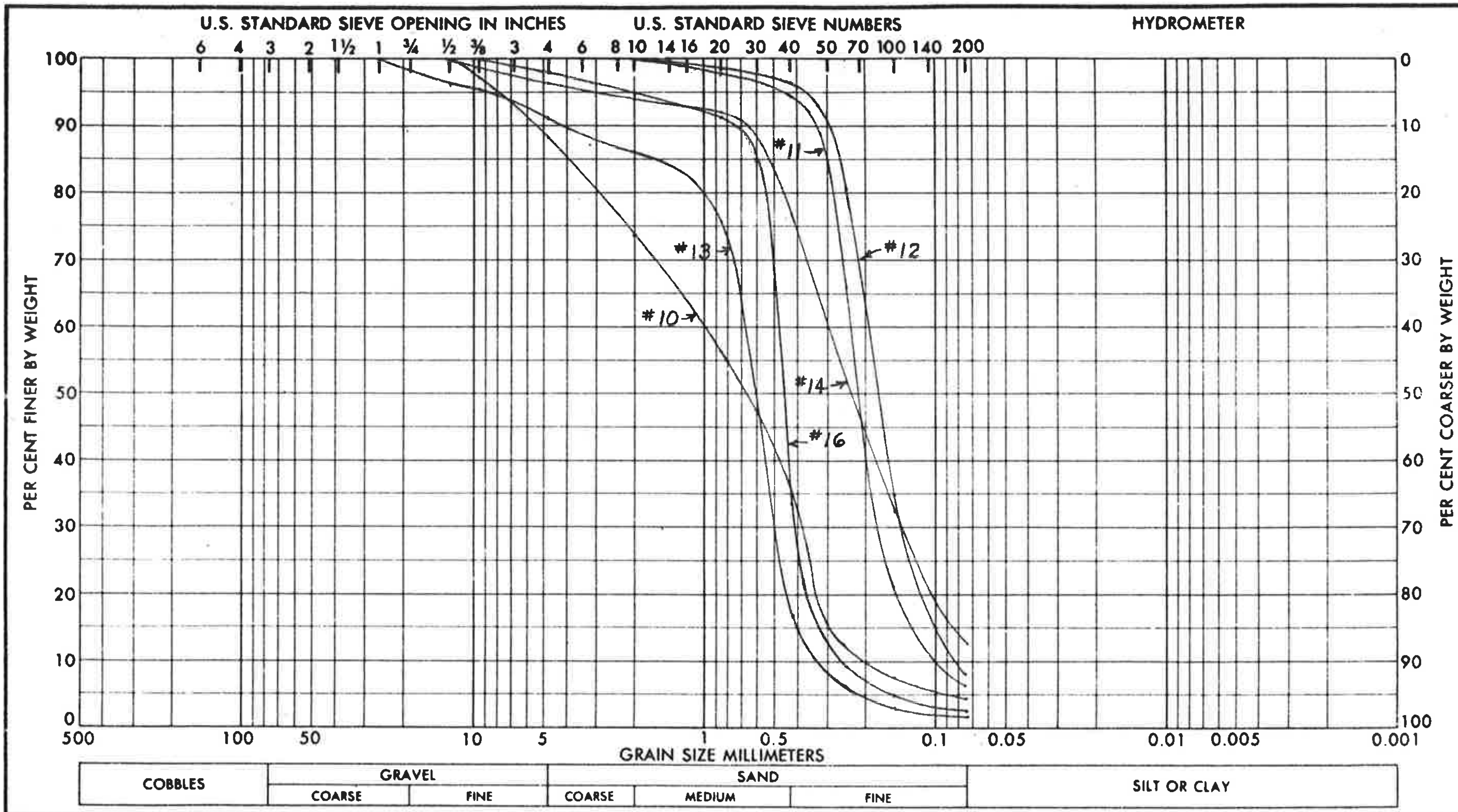
PROJECT ROCKPORT SITE

AREA

BORING NO. 209

DATE Jan. '77

FIG. 20



SAMPLE NO.	~~ELEV OR~~ DEPTH, ft	CLASSIFICATION	NAT W%	LL	PL	PI
#10	49.0 - 50.5					
#11	54.0 - 55.5					
#12	59.0 - 60.5					
#13	64.0 - 65.5					
#14	69.0 - 70.5					
#16	79.0 - 80.5	GRADATION CURVES OF SPLIT-SPOON SAMPLES				

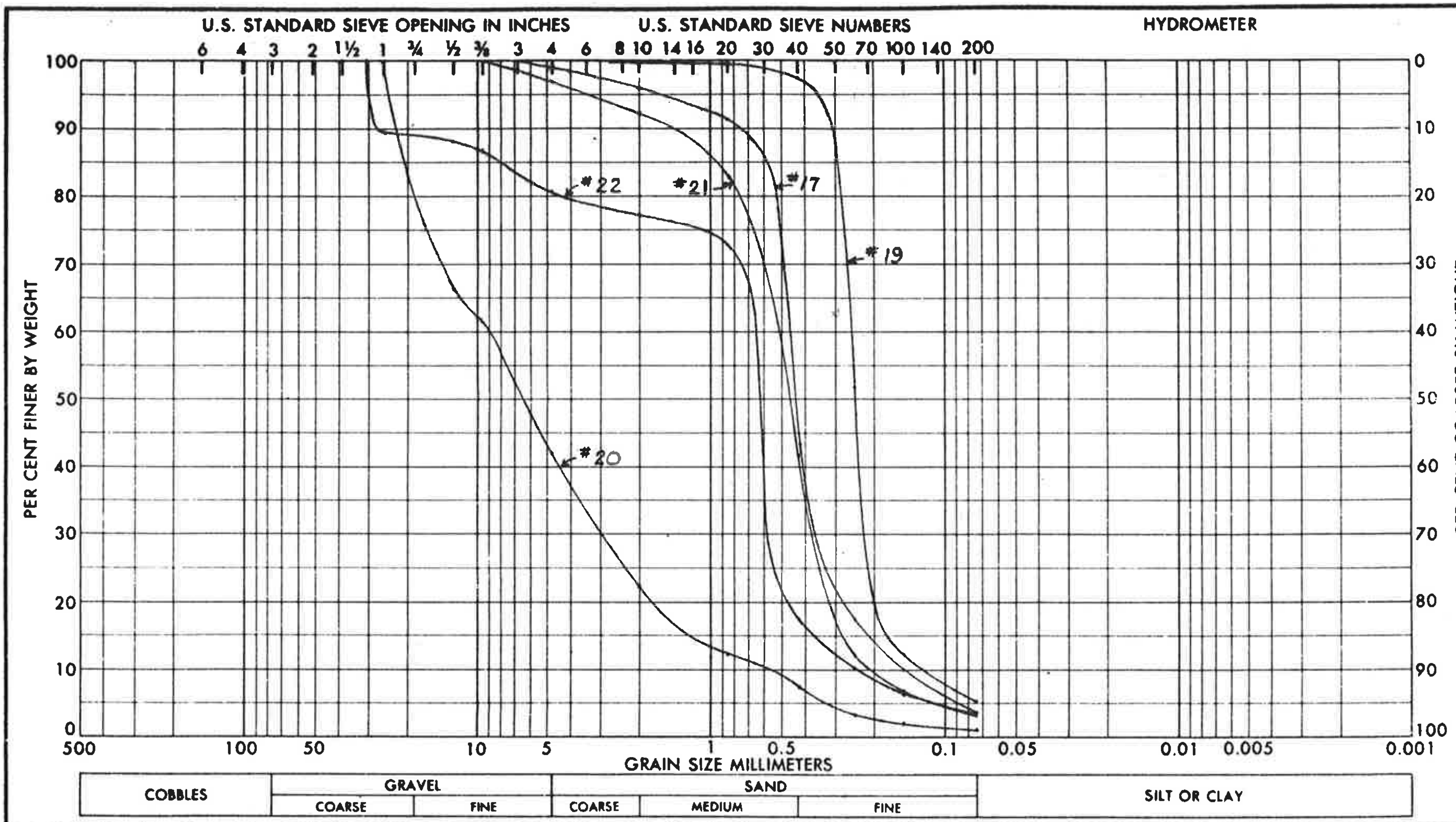
PROJECT ROCKPORT SITE

AREA

BORING NO. 209

DATE Jan. '77

FIG. 21



SAMPLE NO.	~~ELEV OR~~ DEPTH, ft	CLASSIFICATION	NAT W%	LL	PL	PI
#17	84.0 - 85.5					
#19	94.0 - 95.5					
#20	99.0 - 100.5					
#21	104.0 - 105.5					
#22	109.0 - 110.5					

PROJECT ROCKPORT SITE

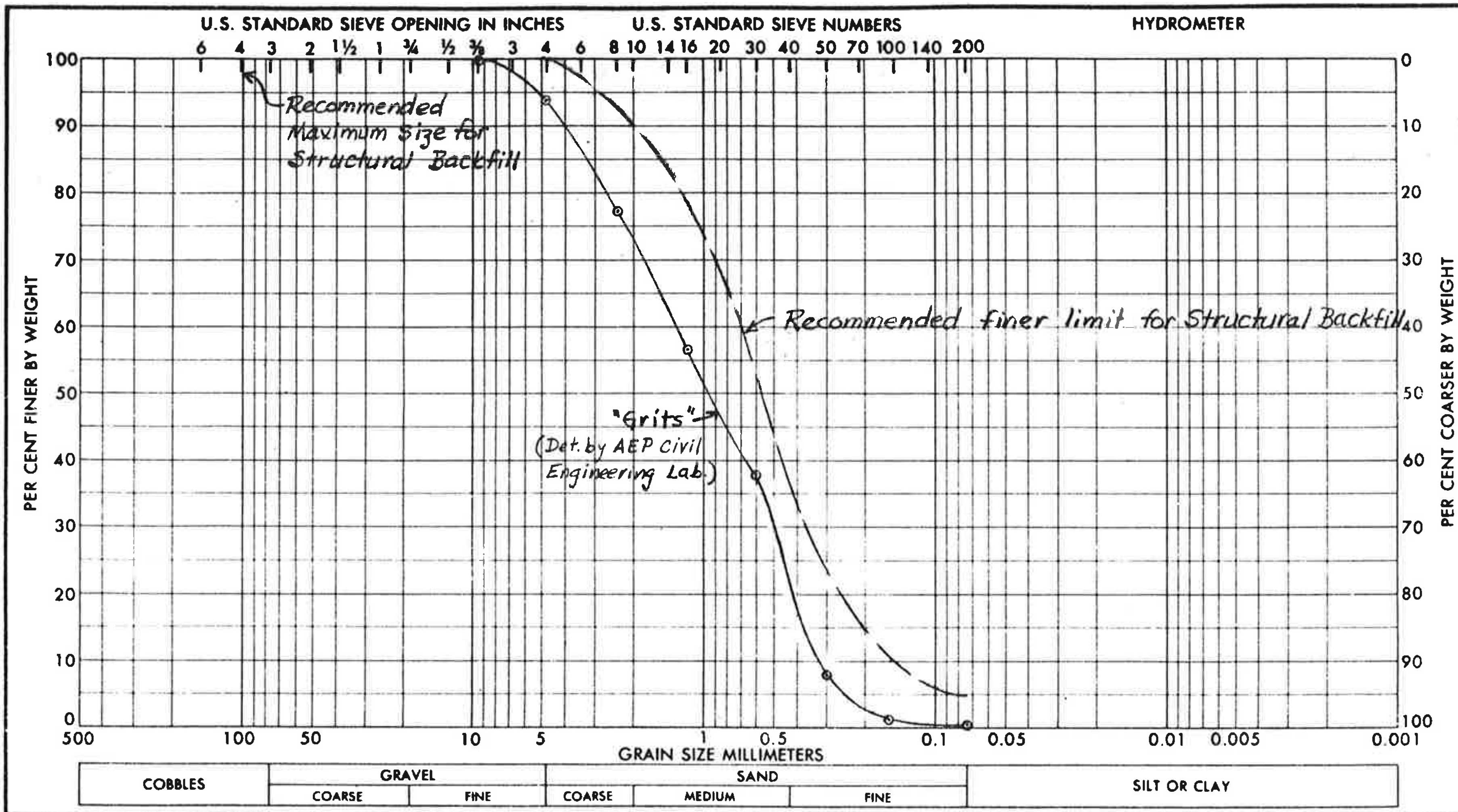
AREA

BORING NO. 209

DATE Jan. '77

GRADATION CURVES OF SPLIT-SPOON SAMPLES

FIG. 22



SAMPLE NO.	ELEV OR DEPTH	CLASSIFICATION	NAT W%	LL	PL	PI

GRADATION CURVES

PROJECT *ROCKPORT SITE*

AREA

BORING NO.

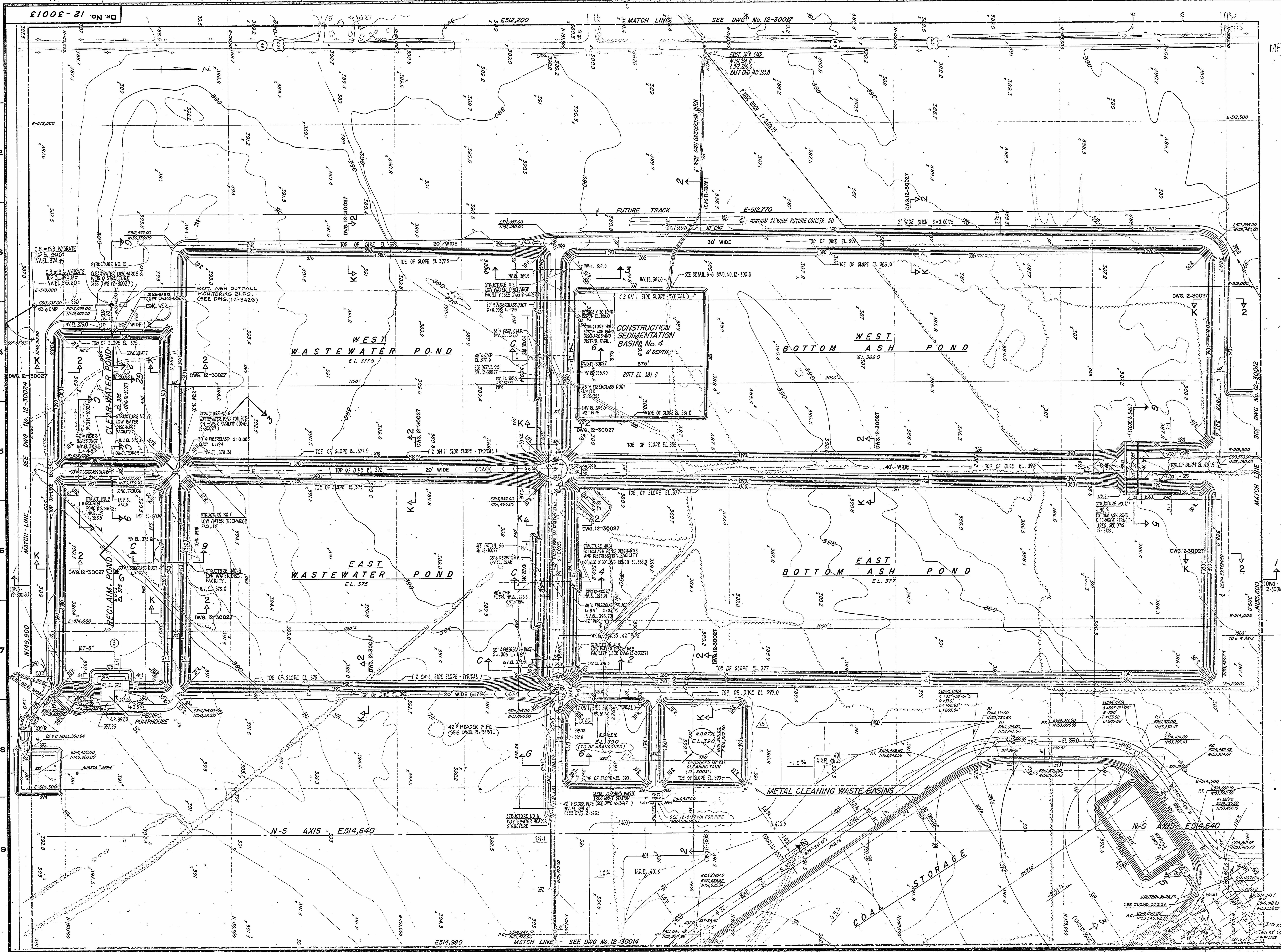
DATE *APRIL 1977*

RECOMMENDED GRADATION FOR STRUCTURAL BACKFILL

FIG. 23

ATTACHMENT C

DESIGN DRAWINGS



GENERAL NOTES

FOR PROFILE OF 66" ϕ CMP SEE SH-12-30028

WASTE WATER PONDS-EAST & WEST, RECLAIM, & CLEAR WATER PONDS, HAVE HAD 1 FT. OF CLAY PLACED ON BOTTOMS AND SIDES-BY FIELD.

DATE	NO.	DESCRIPTION	APP'D.
9/28/84	14	ADDED MH#1, 18"Ø CMP & DITCH AT COAL STATIONS 7, 7E & 7W. AREA M-9. ACY	SF/TS
4/25/84	13	ADDED DET. "K-2" MARKS PER REVISION MADE ON DWG. 12-30027 - REGRADE & REDRESS ON SLOPES ON BOTTOM ASH, WASTEWATER, RECLAIM & CLEARWATER PONDS	SF/TS
9/13/83	12	ADDED BOT. ASH OUTFALL MONITORING BLDG. (4-B) ACY/G.S.	S.F.
3/10/82	11	AS PER RDR NO. ROCK 12-332, EXPANDED SETTLING POND "A" & REGRADED ACCORDINGLY. RD. INDICATED SKIMMER LOCATION PER. RDR #12-290 REVISED DIKE GRADING IN AREAS F-5 & F-6, LOCATION OF STRUCT. #11; ADDED SECT. G-G.	S.F.
9/3/81	10	REVISED DESCRIPTION OF STEEL PIPE TO "FIBERGLASS DUCT." DIST. TO STR. #11. RNS.	S.F.
8/26/80	9	REVISED LOCATION AND GRADING OF SUBSTATION "APPH"	SF
8/11/80	8	ADDED SUBSTATION "APPH" & ROAD NEAR RECLAIM POND, AND GRADED ACCORDINGLY A-8 REVISED ℄ TO ℄ DIMENSION TO 38', WAS 30' B-7.8. RNS	SF
10/29/79	7	REVISED OR ADDED PIPE LENGTHS @ SECT'S. C2, C3, C4, C6, C7, C9, & G3.	HTS
9/26/79	6	REVISED INV. ELS. 30" STEEL PIPE AT STRUCTURES #12 & #13. REVISED INV. ELS AT C.B. #13A & 13B RELOCATED RECIRCULATION PUMPHOUSE, AND REALIGNED BERM ROAD. REGRADED AREA ACCORDINGLY. (A-7) LABELED STRUCTURE #7 "LOW WAT. DISCH. FACILITY." RELOCATED STRUCT. #6 275' EAST OF ℄ DIKE BETWEEN CLEARWATER & RECLAIM PONDS. ADDED CONTROL BUILDING 7W & 4KV/600 OUTDOOR SUB-STA. (9-N).	HTS

REFERENCE DRAWINGS

12-30014 COAL STORAGE AREA - GRADING DRAINAGE & TRACK
12-30003 SEDIMENTATION BASINS LOCATION PLAN
12-30018 WASTEWATER & BOTTOM ASH POND AREA - SECTIONS & DETAILS
12-30022 COAL STORAGE AREA SECTIONS & DETAILS
12-30004 SEDIMENTATION BASINS - PLANS & DETAILS

DATE	NO.	DESCRIPTION	APP'D.
8/7/79	5	REV. SECTIONS C-2, C-3, C-6, & G-3. RELOCATED STRUCT. # 6 & #12 & REVISED INV. ELEVS. RELOCATED STRUCT. # 9 FROM CLEAR WATER POND TO RECLAIM POND. INCREAS. TO 42" ϕ REMOVED C.B. #13A, #13B & STRUCT #10 (SEC. G-2) AT RECLAIM POND AND RELOCATED TO CLEAR WATER POND. REMOVED 48" ϕ STEEL PIPE AT RECLAIM POND. ADDED 66" CMP AT CLEAR WATER POND.	HTS
7/5/79	4	AS PER RDR ROCK 12-055, REVISED COORDINATES OF P.I. FOR CURVE NEAR STA. 7W. ADDED 48" ϕ STEEL PIPE W/C.B.s FROM RECLAIM POND. - A-8 REV. COORD. FOR STA. 7W TO - E514,820.62 - N153,493.10. WAS E514,821.67 - N153,493.80. REVISED DIMENSION ℄ STA. 7 TO ℄ STA. 7W TO 117'-3", WAS 116'-0" - N-9 ADDED 48" ϕ CMP & SLIDE GATES TO SECTIONS C-4 & C-6. REGRADED COAL STOR. AREA. REV. ELEVS OF SETTLING POND "A"; DELETED 30" ϕ CMP FROM SETT. POND "A". RAISED ELEV. OF WEST BOTT. ASH POND TO EL. 386.0, WAS EL. 377.0. CHANGED STRUCTURE NO. 3 TO NO. 13, AND RAISED INVERTS TO EL. 378.5 & 385.5, WAS 376.0 & 376.5. RAISED ELEV. OF WEST WASTEWATER POND TO EL. 377.5, WAS 375.0 & RAISED INV. EL. TO 378.5 @ STRUCT NO. 6, WAS 375.5	HTS
11/7/78	3	REVISED SIZE STEEL PIPE TO 30" ϕ WAS 18" ϕ REVISED LOC. OF SETTLING POND "A" & 30" ϕ CMP. ADDED DIMS. P.I.'S FOR 22' ROAD & CURVES AROUND WEST COAL STOR. AREA.	HTS
4/11/78	2	ADDED STRUCTURE NO. 12 (B5) REVISED GRADING & LOCATIONS OF ROAD & STATIONS 7, 7W AT WEST COAL STORAGE AREA. REVISED INV. 375.74 18" ϕ PIPE, WAS 375.5. ADDED RADII @ ALL PONDS. ADDED INV. ELS. TO 42" HEADER PIPE ALONG DIKE BETW. WASTEWATER & ASH PONDS (E4, 6, 7)	HTS
1/16/90	15	PER RDR-RP-00-03314, REVISED EXIST. NORTH METAL CLEANING POND & ABANDONED THE SOUTH POND. ALSO ADDED REF. NOTE TREATMENT STA.	YBM

REVISIONS

INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT SITE
ROCKPORT, INDIANA

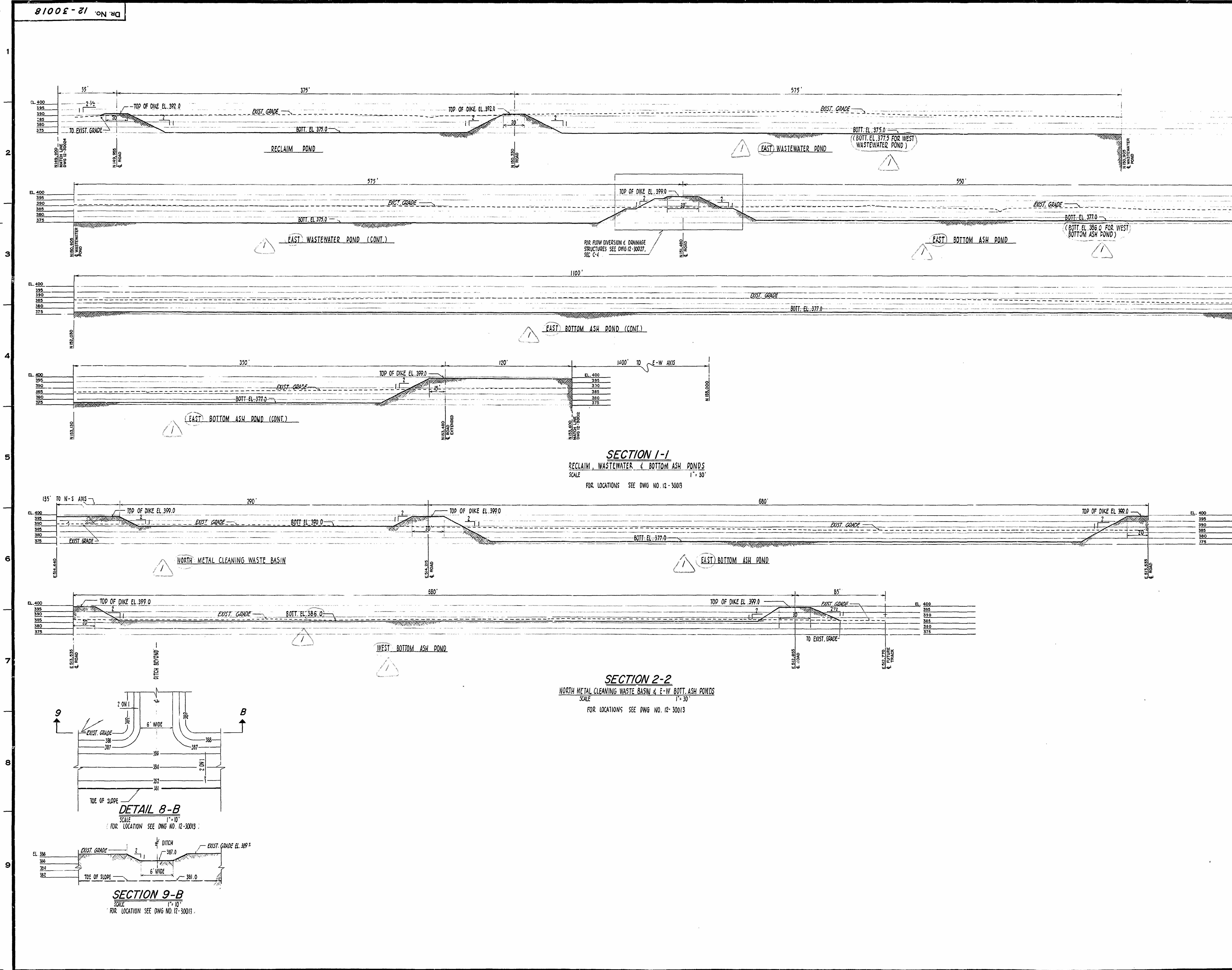
UNIT No. 1 & 2 WASTEWATER & BOTTOM ASH POND AREA GRADING & DRAINAGE

DR. NO. 12-30013-15

ARCH.		ELEC		MECH.		STR.	S.F.

SCALE: 1"=100'
DR. R.N. SWINGLE
CH.
SQ. LDR W.B.
DATE: 7/18/77
APPROVED BY: ENGINEERING DIV / DESIGN DIV

AMERICAN ELECTRIC POWER SERVICE CORP.



GENERAL NOTES

REFERENCE DRAWINGS

12-30013 WASTEWATER & BOTTOM ASH POND AREA, GRADING & DRAINAGE
12-30003 SEDIMENTATION BASINS - LOCATION PLAN
12-30004 SEDIMENTATION BASINS - PLANS & DETAILS

REVISIONS

DATE	NO.	DESCRIPTION	APPD.
1/10/79	1	AS PER CIVIL ENGRG REQUEST. REVISED WEST BOTT. ASH POND EL. TO 386.0, WAS 377.0. ADDED NOTE: BOTT. EL. 377.5 FOR W.W. PD	HTS
8/3/77	0	RELEASED TO FIELD	HTS

INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT SITE
ROCKPORT, INDIANA

UNIT No. 1 & 2 WASTEWATER & BOTTOM ASH POND AREA — SECTIONS & DETAILS

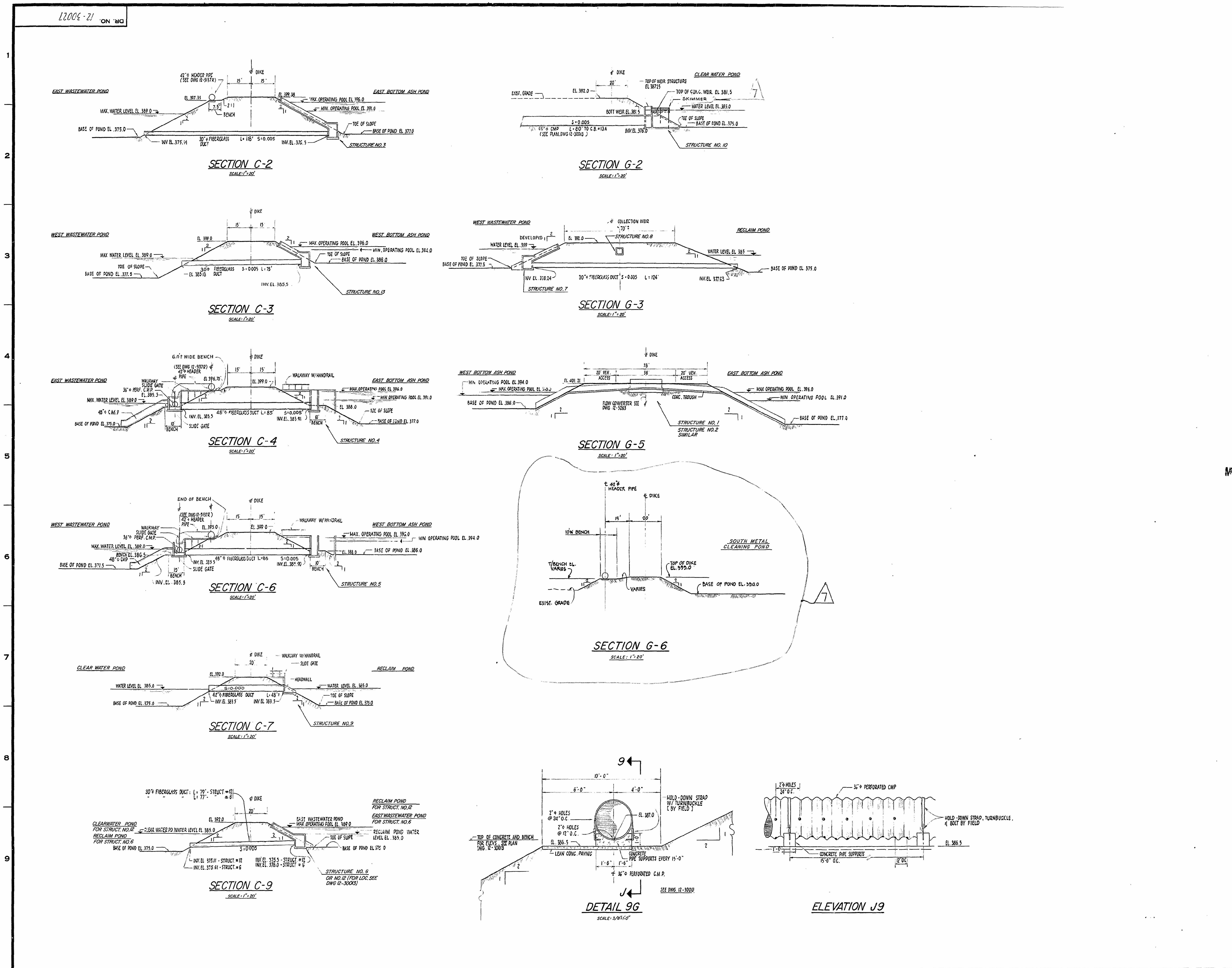
DR. NO. 12-30018-1

ARCH. | ELEC | MECH. | STR. S.F.

SCALE: AS NOTED
DR. R.N. SWINGLE
CH. —
SQ. LDR W.B.
DATE: 7/18/77
APPROVED BY: ENGINEERING DIV / DESIGN DIV

AMERICAN ELECTRIC POWER SERVICE CORP.

DR. NO. 12-30027



GENERAL NOTES

FOR CONTINUATION OF 66"φ CMP - SEC. G-2 SEE PROFILE SH. 12-30028.

REFERENCE DRAWINGS

12-30013 WASTEWATER & BOTTOM ASH POND AREA GRADING & DRAINAGE
12-30024 AREA SOUTH OF RECLAIM POND - GRADING, DRAINAGE & TRACK LAYOUT

REVISIONS

DATE	NO.	DESCRIPTION	APPD.
12/17/81	7	ADDED SKIMMER-SECT. G-2 PER RDR ROCK-R-270 RM ADDED SECTION 'G-6' RS	SF
8/12/81	6	REVISED DESCRIPTION OF STEEL PIPE TO FIBERGLASS DUCT. RWS	SF
8/26/79	5	REVISED PIPE LENGTH DIM'S SEC. C-2, C-3, C-4, & C-6. REMOVED PIPE BENDS SECTION C-3 & C-4. ADDED LENGTH DIMENSION & REVISED INV. EL. OF 30"φ STEEL PIPES. REV. LENGTH DIM. OF 66"φ CMP TO 80'. WAS 100'.	HTS
8/7/79	4	RELOCATED STRUCT. #6 & #12 & REVISED INV. ELEVS AND BASE OF POND ELEVATIONS. REVISED SECTIONS C-2, C-3, C-6 & G-3. RELOCATED STRUCT. #9 FROM CLEAR WATER POND TO RECLAIM PD & REVERSED FLOW.	HTS
7/6/79	3	REVISED SECTION G-2, CHANGED PIPE SIZE 48"φ STEEL. WAS 30"φ.	HTS
1/10/79	2	ADDED 48"φ CMP & SLIDE GATES TO SECTIONS C-4 & C-6. RAISED WEST BOTTOM ASH POND EL. TO 386.0. WAS 377.0. RAISED WEST WASTEWATER POND EL. TO 377.5, WAS 375.0. CORRECTED PIPE SIZE ON SECTION G-3 TO 30"φ. ADDED HOLD-STRAPS WITH TURNBUCKLE TO DETAIL 9G	HTS
11/11/78	1	ADDED STRUCTURE NO. 12 TO SECTION C-9	HTS

NOTE:
GRADE ELEVATION HAS BEEN ESTABLISHED AS ELEVATION TO CONVERT TO PLANT DATUM ADD TO ELEVATIONS SHOWN.

INDIANA & MICHIGAN ELECTRIC CO.
ROCKPORT SITE
ROCKPORT, INDIANA

UNIT No. 1 & 2 WASTEWATER & BOTTOM ASH POND AREA - SECTIONS & DETAILS

DR. NO. 12-30027-7

ARCH.	ELEC.	MECH.	STR.

SCALE: AS SHOWN
DR. R.N. SHINGLE
CH. NB
SQ. LDR. RBF
DATE: 3/31/78
APPROVED BY: ENGINEERING DIV. / DESIGN DIV.

AMERICAN ELECTRIC POWER SERVICE CORP.
2 BROADWAY NEW YORK

ATTACHMENT D

HYDROLOGY AND HYDROLOGIC REPORT

Hydrologic and Hydraulic Analysis Report

Rockport Plant Bottom Ash Pond Complex
Rockport, Indiana

November 2015

Terracon Project Number: N4155126

Prepared for:

American Electric Power
1 Riverside Plaza
Columbus, Ohio

Prepared by:

Terracon Consultants, Inc.
Columbus, Ohio

November 5, 2015

American Electric Power
1 Riverside Plaza
Columbus, OH 43215

Attn: Mr. John Massey-Norton
P: [614] 716 2924
E: jtmasseynorton@aep.com

Re: Hydrologic and Hydraulic Analysis and P.E. Certification
Rockport Plant Bottom Ash Pond Complex, Rockport, Indiana
Terracon Project Number: N4155126

Dear Mr. Massey-Norton:

Terracon Consultants, Inc. is submitting the enclosed report for the Hydrologic and Hydraulic analysis and P.E. Certification for the AEP Rockport Plant Bottom Ash Pond Complex located at Rockport, Indiana. The report analyzes the impoundment's existing design and outlet structures for conformance with the recently mandated USEPA rule 40 CFR Part 257, Hazardous and Solid Waste Management System; Disposal of Coal Combustion Residuals from Electric Utilities (CCR rules).and provides a profession engineer certification.

If you have any questions regarding this submittal, please contact me at (614) 328-5184.

Sincerely,
Terracon Consultants, Inc.

Baba Yahaya

M.S. Finy

Baba M. Yahaya, P.E.
Project Engineer

Mohammad S. Finy, P.E
Department Manager, Geo-Environmental Services

Enclosure

TABLE OF CONTENTS

Page

LIST OF EXHIBITS

LIST OF ATTACHMENTS

1.0 INTRODUCTION

This report provides hydrologic and hydraulic analysis of the existing Bottom Ash Pond Complex (impoundment facility) of the Rockport Plant (plant) located in Rockport, Indiana. The site location is shown on Exhibit 1. The plant uses the impoundment facility to temporarily store Coal Combustion Residuals (CCR). The impoundment facility consists of a series of ponds, and a metal cleaning tank secondary containment basin as shown on Exhibit 2. Six of the ponds including: East Bottom Ash Pond, West Bottom Ash Pond, East Wastewater Pond, West Wastewater Pond, Reclaim Water Pond, and Clearwater Pond are interconnected and receive mainly CCR, wastewater, and stormwater runoff pumped from the plant to the system as its major external influent. The other source of influent is direct precipitation that falls within the perimeter of the impoundment facility during a storm event. The CCR is sluiced into the system at the Bottom Ash Ponds where they settle out, and the sluiced water is then decanted to the wastewater ponds. Effluent from the system eventually discharges through an outlet structure located in the Clearwater Pond.

The intent of this analysis is to determine whether or not the impoundment facility meets the April 17, 2015 USEPA mandated CCR rules requirements.

According to the CCR rules, CCR surface impoundments shall comply with the hydrologic and hydraulic capacity requirements specified under Section 257.82 of the rules and presented below:

Section 257.82

(a) The owner or operator of an existing or new CCR surface impoundment or any lateral expansion of a CCR surface impoundment must design, construct, operate, and maintain an inflow design flood control system as specified in paragraphs (a)(1) and (a)(2) of this section.

(1) The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.

(2) The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.

(3) The inflow design flood is:

(i) For a high hazard potential CCR surface impoundment, as determined under section 257.73(a)(2) or section 257.74(a)(2), the probable maximum flood;

(ii) For a significant hazard potential CCR surface impoundment, as determined under section 257.73(a)(2) or section 257.74(a)(2), the 1,000-year flood;

(iii) For a low hazard potential CCR surface impoundment, as determined under section 257.73(a)(2) or section 257.74(a)(2), the 100-year flood; or

(iv) For an incised CCR surface impoundment, the 25-year flood.

(b) Discharge from the CCR unit must be handled in accordance with the surface water requirements under section 257.3-3.

(c) Inflow design flood control system plan.

(1) Content of the plan. The owner or operator must prepare initial and periodic inflow design flood control system plans for the CCR unit according to the timeframes specified in paragraphs (c)(3) and (c)(4) of this section. These plans must document how the inflow design flood control system has been designed and constructed to meet the requirements of this section. Each plan must be supported by appropriate engineering calculations. The owner or operator of the CCR unit has completed the inflow design flood control system plan when the plan has been placed in the facility's operating record as required by section 257.105(g)(4).

(2) Amendment of the plan. The owner or operator of the CCR unit may amend the written inflow design flood control system plan at any time provided the revised plan is placed in the facility's operating record as required by § 257.105(g)(4). The owner or operator must amend the written inflow design flood control system plan whenever there is a change in conditions that would substantially affect the written plan in effect.

(3) Timeframes for preparing the initial plan.

(i) Existing CCR surface impoundments. The owner or operator of the CCR unit must prepare the initial inflow design flood control system plan no later than October 17, 2016.

(ii) New CCR surface impoundments and any lateral expansion of a CCR surface impoundment. The owner or operator must prepare the initial inflow design flood control system plan no later than the date of initial receipt of CCR in the CCR unit.

(4) Frequency for revising the plan. The owner or operator must prepare periodic inflow design flood control system plans required by paragraph (c)(1) of this section every five years. The date of completing the initial plan is the basis for establishing the deadline to complete the first periodic plan. The owner or operator may complete any required plan prior to the required deadline provided the owner or operator places the completed plan into the facility's operating record within a reasonable amount of time. In all cases, the deadline for completing a subsequent plan is based on the date of completing the previous plan. For purposes of this paragraph, the owner or operator has completed an inflow design flood control system plan when the plan has been placed in the facility's operating record as required by section 257.105(g)(4).

(5) The owner or operator must obtain a certification from a qualified professional engineer stating that the initial and periodic inflow design flood control system plans meet the requirements of this section.

(d) The owner or operator of the CCR unit must comply with the recordkeeping requirements specified in section 257.105(g), the notification requirements specified in section 257.106(g), and the internet requirements specified in section 257.107(g).

2.0 INFLOW DESIGN FLOOD CONTROL SYSTEM

As mentioned in section 1.0, inflow into the impoundment facility include CCR, wastewater, and stormwater runoff from various sources pumped into the facility; and direct precipitation that falls within the perimeter of the facility. Water from the Bottom Ash Ponds flow to the Wastewater Ponds, which flow into a distribution structure and can be discharged into the Reclaim Water Pond or the Clearwater Pond. Discharge water from the Reclaim Water Pond is either pumped back to the plant for recirculation, or flows to the Clearwater Pond and then to the Ohio River via an outlet structure. The CCR, wastewater, and stormwater runoff are pumped into the facility through a series of pipes designed to handle the various required capacities. The pipes discharge into the facility through concrete vaults designed to handle the inflows. The water from the Bottom Ash Ponds flows into the Wastewater Ponds through a reinforced concrete vertical drop inlet connected to a 48 inch diameter fiberglass pipe located in the southern dikes of the Bottom Ash Ponds. The Wastewater Ponds drain to either the Reclaim Water Pond or the Clearwater Pond through a gated distribution structure. A 42 inch diameter fiberglass pipe connects the Reclaim Water Pond to the Clearwater Pond. Effluent from the impoundment facility is discharged through an outlet structure located in the Clearwater Pond. The outlet structure consists of a concrete overflow channel leading to a vault/riser with a 66-inch diameter CMP outflow pipe. The outflow pipe leads to catch basin and then on to an outfall at the Ohio River.

Water balance information provided by AEP indicates that influent is pumped into the facility at the rate of approximately 12 million gallons per day (MGD) (19 cfs) to the Bottom Ash Pond, and 13 MGD (20 cfs) to the Wastewater pond. Information on the influent is presented in Attachment 1. The additional inflow due to direct precipitation is dependent on the hazard potential classification of the facility. The facility is classified as a “low hazard potential” facility. The hazard potential classification approach is presented in Section 2.2 of this report. The additional inflow under this low hazard potential classification is the peak discharge during and following the 100-year flood. However, to be more conservative for the purpose of this analysis, the additional inflow is estimated as the peak discharge during and following the 1000-year flood The peak discharge from the 1000-year inflow design flood is estimated using Bentley’s PondPack software (see Section 2.3 of this report).

2.1 Hazard Potential Classification

Hazard potential classification means the possible adverse incremental consequences that result from the release of water or stored contents due to failure of the diked CCR surface impoundment or mis-operation of the diked CCR surface impoundment or its appurtenances. The hazardous potential classifications for CCR surface impoundments include high hazard potential, significant hazard potential, and low hazard potential.

- A High hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation will probably cause loss of human life.

- A significant hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life, but can cause economic loss, environmental damage, disruption of lifeline facilities, or impact other concerns.

- A Low hazard potential CCR surface impoundment means a diked surface impoundment where failure or mis-operation results in no probable loss of human life and low economic and/or environmental losses. Losses are principally limited to the surface impoundment owner's property.

The Rockport Plant impoundment facility is classified as a low hazard potential impoundment. This classification is in concurrence with the hazard potential assessment presented in the March 2011USEPA report titled "Dam Safety Assessment of CCW Impoundments, Rockport Power Plant". The report was prepared for the USEPA by O'Brien & Gere and presents safety assessment of the impoundment facility.

Pursuant to Section 257.73(a)(2) of the CCR rules, the hazard potential classification assessments of this facility will be performed every five years.

2.2 Computation Methods

The impoundment facility was modeled and analyzed for its adequacy to collect and control the peak discharge resulting from 1000-year design storm using Bentley's PondPack version 8i software released March 5, 2012 (PondPack).

PondPack is a versatile software program to model site drainage studies. The program can be used to model rainfall and runoff from watersheds to detention and retention facilities, outlet structures, and channels using various.

The SCS Hydrograph method was used to estimate the peak discharge (inflow) resulting from direct precipitation that falls within the perimeter of the each pond. PondPack computes the peak discharge using the equation:

$$q_p = q_u * A_m * Q * F_p$$

Where q_p = Peak discharge (cfs)
q_u = Unit peak discharge (csm/in)
A_m = Drainage area (mi^2)
Q = Runoff (in)
F_p = Pond and swamp adjustment factor

Other applicable intermediate equations used by the model are included in the model output presented in Attachment 3.

The model requires precipitation depth, catchment area, runoff curve number and time of concentration as input to estimate the peak discharge. Hydraulically, development of the PondPack model requires input defining the facility's structural components, including pond, inlet, and outlet structures. Operationally, the east and west Bottom Ash/Wastewater Ponds operate in alternate sequences where the active set receives influent and the inactive set is cleaned out. For this analysis, a scenario in which water flows from the West Bottom Ash Pond to the West Wastewater Pond and to the Clearwater Pond is considered and modeled (See Exhibit 3). Each pond's surface area defines its catchment area (See Exhibit 2). A precipitation depth of 10.3 inches corresponding to the 1000 year storm (see Attachment 2) was used. A curve number of 100 was used since the rainfall will be direct runoff. A minimum time of concentration of 5 minutes was used. The water from the West Bottom Ash Pond flows into the West Wastewater Pond through a reinforced concrete vertical drop inlet connected to a 48 inch diameter fiberglass pipe located in the southern dike of the Bottom Ash Pond. The West Wastewater Pond drains to the Clearwater Pond through a gated distribution structure. A 66 inch diameter CMP pipe leads from the Clearwater Pond to a catch basin and eventually to an outfall at the Ohio River.

2.3 Results

From the PondPack analysis, the total volume of influent pumped into the system (77 acre-feet) in a 24 hour period is larger than the volume of precipitation (48 acre-feet) resulting from the 1000-year storm. However, the peak flows into the system due to the 1000-year storm are higher than the influent pumping rates. The Influent volumes and peak flow rates are summarized in the following tables 1 and 2.

Table 1. Influent Volumes

Pond	Pumped Influent (Acre-feet)	1000-year Storm (Acre-feet)
West Bottom Ash Pond	37.7	29.2
West Wastewater Pond	39.7	15.4
Clearwater Pond	0	3.4

Table 2. Peak Influent Flow Rate

Pond	Pumped Influent (cfs)	1000-year Storm (cfs)
West Bottom Ash Pond	19	451
West Wastewater Pond	20	227
Clearwater Pond	0	50

The maximum water surface elevation and freeboard resulting from the pumped influent and 1000-year storm are summarized in the table below:

Table 3. Water Elevation and Freeboard

Pond	Maximum Water Elevation (ft)	Freeboard (ft)
West Bottom Ash Pond	395.2	3.8
West Wastewater Pond	389.4	2.6
Clearwater Pond	382.0	10

The inflow and outflow hydrographs are included in the PondPack Model presented in Attachment 3.

It can be concluded from the above results that the Bottom Ash Pond Complex has adequate hydrologic and hydraulic capacity to collect and control the peak discharge resulting from the 1000-year inflow design flood and therefore meets the April 17, 2015 USEPA mandated CCR rules requirements.

3.0 DISCHARGE FROM THE IMPOUNDMENT FACILITY

The discharge from the impoundment facility to the Ohio River is handled in accordance with the Plant's NPDES Permit. This conforms to the requirements Section 257.82 (b) of the CCR rules.

4.0 INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN

The inflow design flood control system plan will be prepared pursuant to Section 257.82 (c) of the CCR rules. The plan will document how the inflow design flood control system has been designed and constructed to meet the rules requirements.

5.0 RECORDKEEPING, NOTIFICATION, AND INTERNET REQUIREMENTS

Pursuant to Sections 257.105(g), 257.106(g) and 257.107(g), the initial and periodic inflow design flood control system plan as required by Section 257.82(c) will be placed in the facility's operating records, as well as published on the facility's CCR rule compliance data information website. AEP will notify the Director of Indiana Department of Environmental Protection when the information is placed in the operating record and on the website.

6.0 REFERENCES

- AEP Project Drawing Numbers 12-30013-1,12-30013-15, and 12-30027-7, containing cross section and details for the Rockport Bottom Ash Pond Complex.

- Dam Safety Assessment of CCW Impoundments, Rockport Power Plant. Prepared for the USEPA. Prepared by O'Brien & Gere Engineers, Inc. March 24, 2011.

7.0 P.E. CERTIFICATION

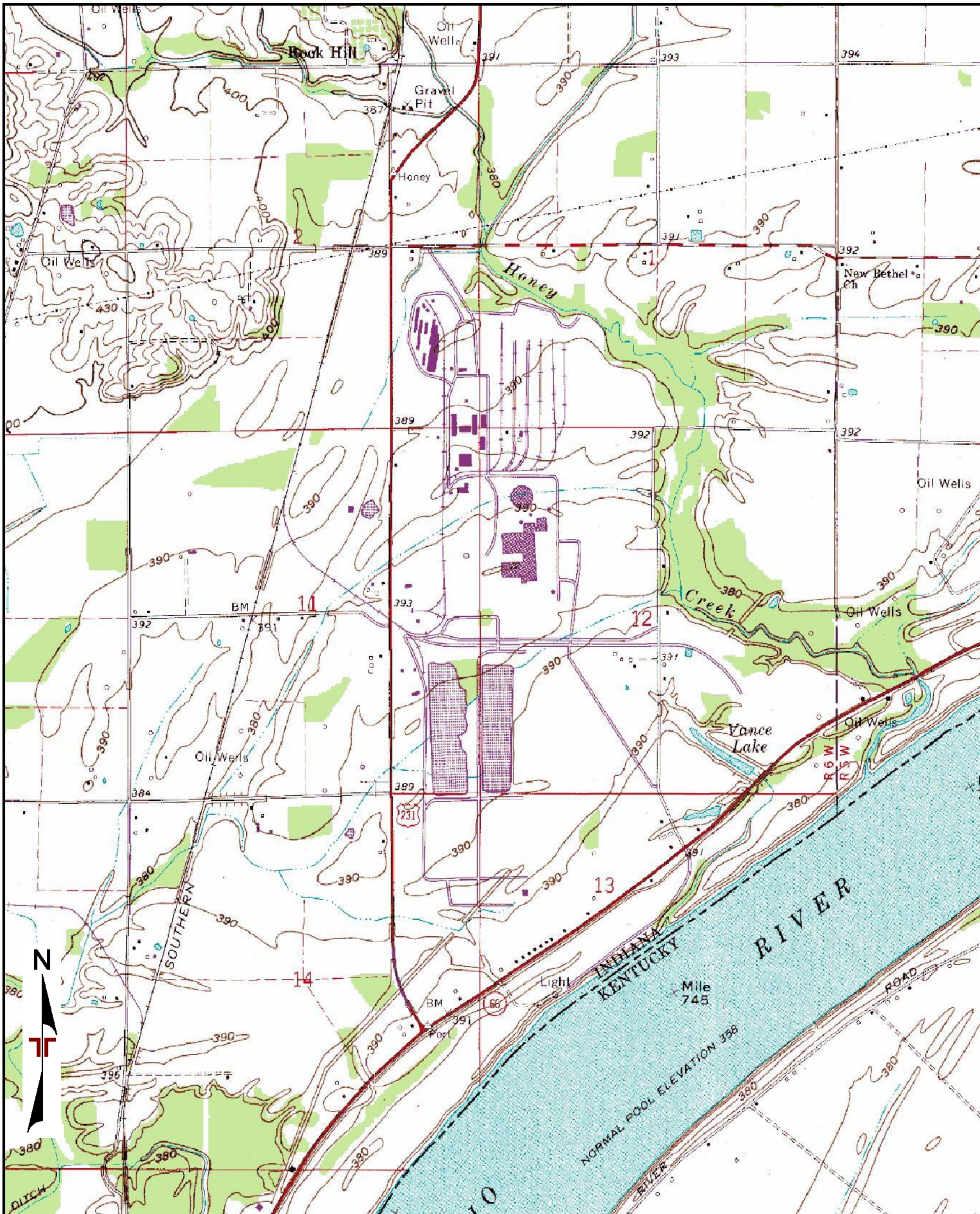
Based on the site reconnaissance visit, hazard potential assessment, and the hydrologic and hydraulic analysis performed by Terracon personnel, I hereby certify that the significant hazard potential classification for the Rockport Plant Bottom Ash Pond Complex in this report was conducted in accordance with requirements of Section 257.73 of the CCR Rules and that the facility has adequate hydrologic and hydraulic capacity to collect and control the peak discharge resulting from 1000-year design storm.

Baba Yahaya 11-5-15

BABA M. YAHAYA
REGISTERED
PE11500100
STATE OF
INDIANA
PROFESSIONAL ENGINEER

Baba M. Yahaya, P.E.
Certifying Engineer
PE11500100

EXHIBITS



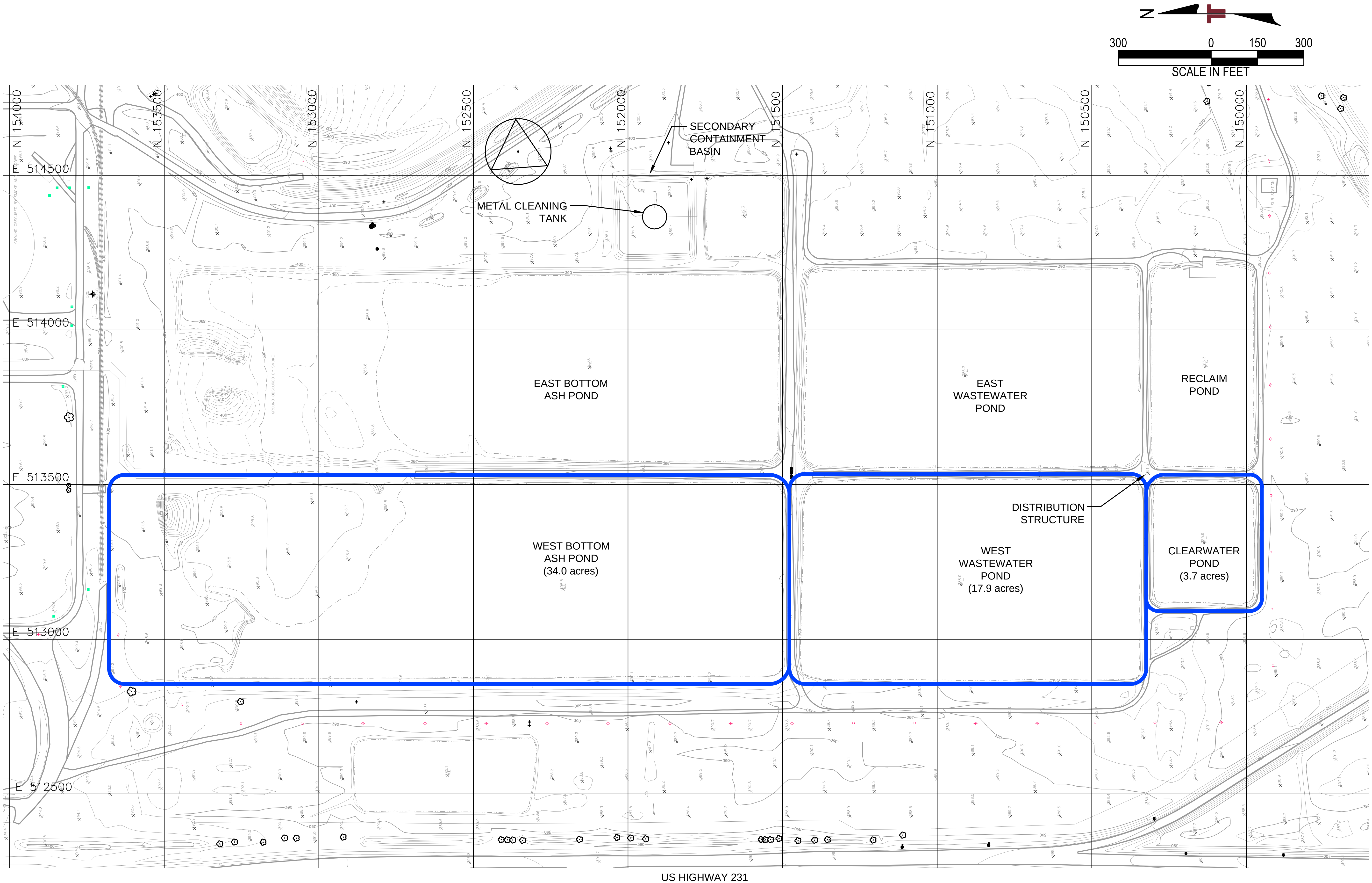
TOPOGRAPHIC MAP IMAGE COURTESY OF THE U.S. GEOLOGICAL SURVEY
QUADRANGLES INCLUDE: ROCKPORT, IN (1/1/1982).

Project Manager: BMY	Project No. E2135001	Terracon	SITE LOCATION	Exhibit
Drawn by: DAB	Scale: 1"=24,000 SF		ROCKPORT PLANT	
Checked by: MSF	File Name: Siltloc3	51 Lost Mound Drive, Suite 135	AMERICAN ELECTRIC POWER	1-A
Approved by: MSF	Date: 9/10/2015	Chattanooga, Tennessee 37406	ROCKPORT PLANT BOTTOM ASH POND COMPLEX	

DIAGRAM IS FOR GENERAL LOCATION ONLY, AND IS NOT INTENDED FOR CONSTRUCTION PURPOSES

AERIAL PHOTOGRAPHY PROVIDED BY MICROSOFT BING MAPS

Project Manager: BMY	Project No. N4155126	Terracon	SITE LOCATION MAP	Exhibit
Drawn by: DAB	Scale: AS SHOWN	800 MORRISON ROAD COLUMBUS, OHIO 43230	ROCKPORT PLANT AMERICAN ELECTRIC POWER ROCKPORT PLANT BOTTOM ASH POND COMPLEX	1-B
Checked by: MSF	File Name: Siltloc3			
Approved by: MSF	Date: 9/10/2015			



NOTE

THE AERIAL TOPOGRAPHY WAS OBTAINED FROM HENDERSON AERIAL SURVEYS INC., DATED 11/10/2007.

LEGENG

POND CATCHMENT AREAS

EXHIBIT 2

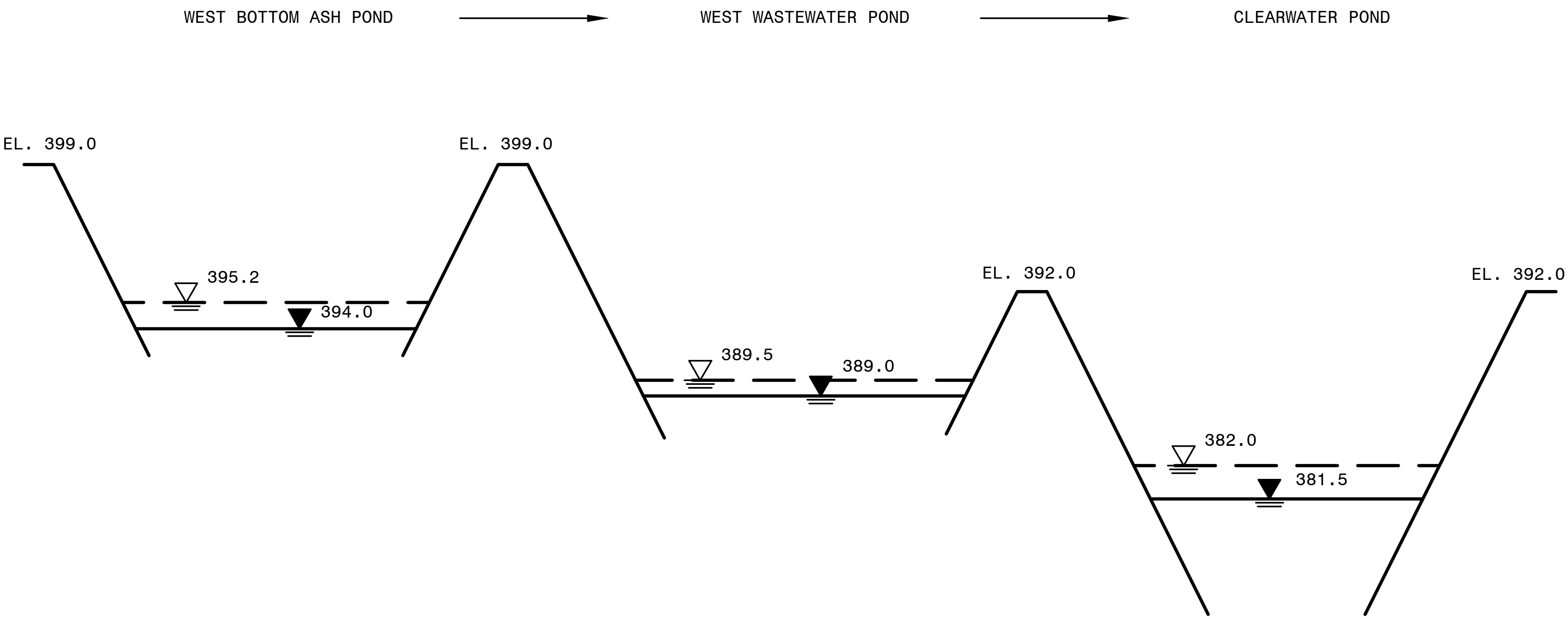
DESIGNED BY: BMY
DRAWN BY: DAB
APPVD. BY: MSF
SCALE: 1"=300'
DATE: 10/23/15
JOB NO. N4155126
ACAD NO. SET1
SHEET NO.: 2 OF 3

SITE PLAN

ROCKPORT PLANT
AMERICAN ELECTRIC POWER
ROCKPORT PLANT BOTTOM ASH POND COMPLEX
ROCKPORT IN

Terracon
Consulting Engineers and Scientists
800 MORRISON ROAD COLUMBUS, OHIO 43230
PH. (614) 863-3113 FAX. (614) 863-0475

REV.	DATE	BY	DESCRIPTION



LEGEND

395.2 MAX. RESULTANT POOL LEVELS DURING THE DESIGN STORM

394.0 NORMAL OPERATING POOL LEVELS

NOTE:

EMBANKMENT CREST ELEVATIONS AND NORMAL OPERATING POOL LEVELS SHOWN WERE TAKEN FROM PROJECT DRAWING NUMBER 12-30027.

EXHIBIT 3

DESIGNED BY:	BMY
DRAWN BY:	DAB
APPVD. BY:	MSF
SCALE:	1"=300'
DATE:	10/14/15
JOB NO.	N4155126
ACAD NO.	SET1
SHEET NO.:	3 OF 3

SITE PLAN

ROCKPORT PLANT
AMERICAN ELECTRIC POWER
ROCKPORT PLANT BOTTOM ASH POND COMPLEX
ROCKPORT IN

Terracon
Consulting Engineers and Scientists
800 MORRISON ROAD COLUMBUS, OHIO 43230
PH. (614) 863-3113 FAX. (614) 863-0475

REV.	DATE	BY	DESCRIPTION

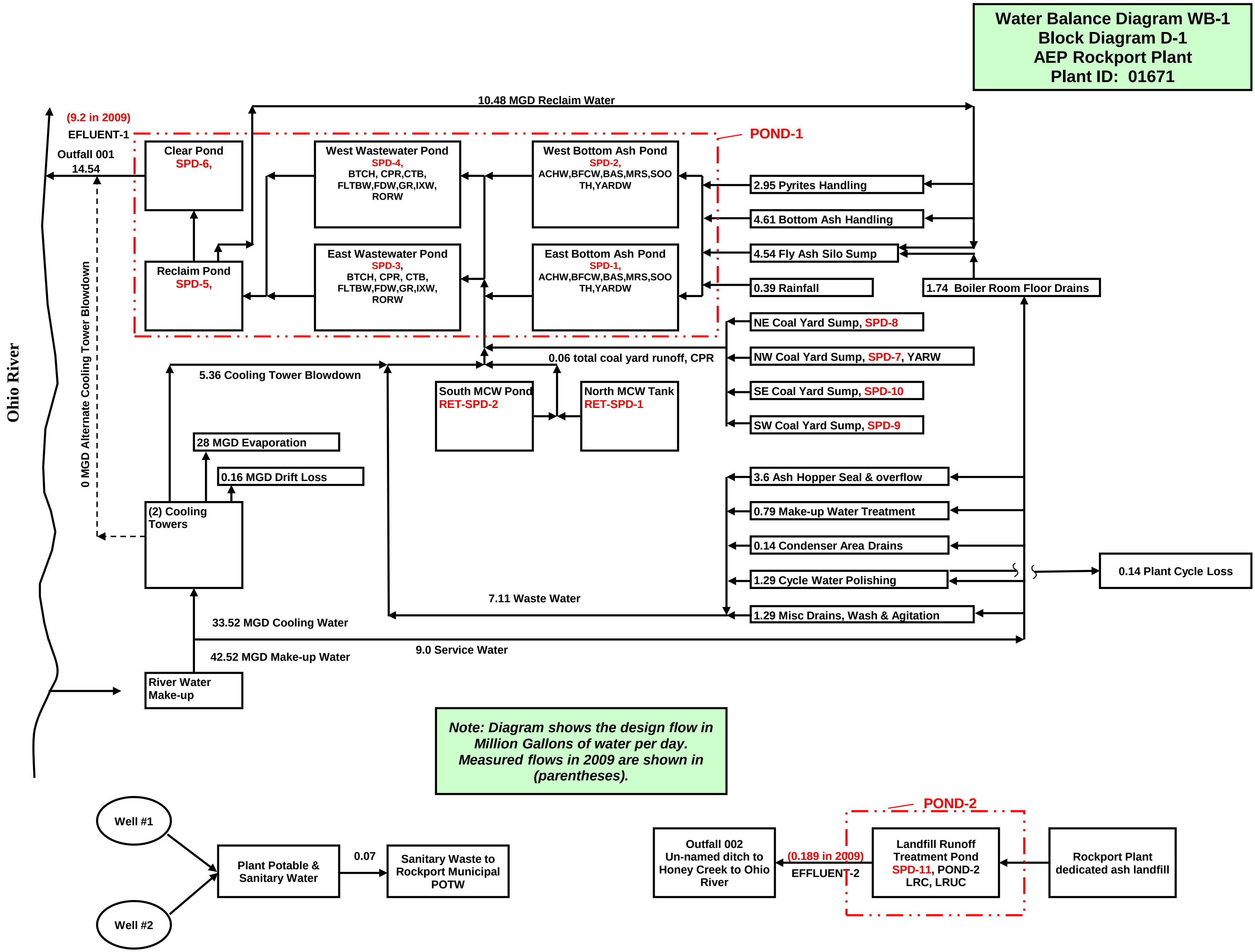
ATTACHMENT 1

Pumped Influent and Water Balance Information

Rockport Plant Bottom Ash Pond Complex
Pumped Influent

Influent Sources	Rate (mgd)	cfs
To Bottom Ash Pond		
Pyrites Handling	2.95	
Bottom Ash Handling	4.61	
Fly Ash Silo Sump	4.54	
Total	**12.1**	**19**
To Wastewater Pond		
Coal Yard Runoff	0.06	
Wastewater	7.11	
Cooling Tower Blowdown	5.36	
Total	**12.53**	**20**

Note:
Influent pumped is compiled from the attached water balance data provided by AEP.



Water Balance Diagram WB-1
Block Diagram D-1
AEP Rockport Plant
Plant ID: 01671
10.48 MGD Reclaim Water
(9.2 in 2009)
EFLUENT-1
Outfall 001
14.54
POND-1
Clear Pond
SPD-6,
West Wastewater Pond
SPD-4,
BTCH, CPR,CTB, FLTBW,FDW,GR,IXW, RORW
West Bottom Ash Pond
SPD-2,
ACHW,BFCW,BAS,MRS,SOOTH,YARDW
2.95 Pyrites Handling
4.61 Bottom Ash Handling
4.54 Fly Ash Silo Sump
0.39 Rainfall
1.74 Boiler Room Floor Drains
Reclaim Pond
SPD-5,
East Wastewater Pond
SPD-3,
BTCH, CPR, CTB, FLTBW,FDW,GR,IXW, RORW
East Bottom Ash Pond
SPD-1,
ACHW,BFCW,BAS,MRS,SOOTH,YARDW
NE Coal Yard Sump, SPD-8
0.06 total coal yard runoff, CPR
NW Coal Yard Sump, SPD-7, YARW
Ohio River
0 MGD Alternate Cooling Tower Blowdown
5.36 Cooling Tower Blowdown
South MCW Pond
RET-SPD-2
North MCW Tank
RET-SPD-1
SE Coal Yard Sump, SPD-10
SW Coal Yard Sump, SPD-9
28 MGD Evaporation
0.16 MGD Drift Loss
(2) Cooling Towers
3.6 Ash Hopper Seal & overflow
0.79 Make-up Water Treatment
0.14 Condenser Area Drains
1.29 Cycle Water Polishing
0.14 Plant Cycle Loss
7.11 Waste Water
1.29 Misc Drains, Wash & Agitation
33.52 MGD Cooling Water
9.0 Service Water
42.52 MGD Make-up Water
River Water Make-up
Note: Diagram shows the design flow in Million Gallons of water per day. Measured flows in 2009 are shown in (parentheses).
POND-2
Well #1
Plant Potable & Sanitary Water
0.07
Sanitary Waste to Rockport Municipal POTW
Well #2
Outfall 002
Un-named ditch to Honey Creek to Ohio River
(0.189 in 2009)
EFFLUENT-2
Landfill Runoff Treatment Pond
SPD-11, POND-2
LRC, LRUC
Rockport Plant dedicated ash landfill

ATTACHMENT 2

Precipitation Data

NOAA Atlas 14, Volume 2, Version 3
Location name: Rockport, Indiana, US*
Latitude: 37.9217°, Longitude: -87.0364°
Elevation: 399 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.362** (0.331-0.396)	**0.427** (0.391-0.468)	**0.498** (0.456-0.545)	**0.556** (0.507-0.607)	**0.629** (0.572-0.687)	**0.686** (0.620-0.749)	**0.739** (0.665-0.807)	**0.795** (0.711-0.869)	**0.866** (0.768-0.947)	**0.919** (0.809-1.01)
10-min	**0.571** (0.522-0.625)	**0.675** (0.618-0.740)	**0.790** (0.724-0.865)	**0.877** (0.800-0.959)	**0.985** (0.895-1.08)	**1.07** (0.966-1.17)	**1.15** (1.03-1.25)	**1.23** (1.10-1.34)	**1.33** (1.18-1.46)	**1.40** (1.24-1.54)
15-min	**0.709** (0.648-0.776)	**0.841** (0.770-0.921)	**0.987** (0.904-1.08)	**1.10** (1.00-1.20)	**1.24** (1.12-1.35)	**1.34** (1.21-1.47)	**1.44** (1.30-1.58)	**1.54** (1.38-1.69)	**1.67** (1.48-1.82)	**1.76** (1.55-1.93)
30-min	**0.960** (0.877-1.05)	**1.15** (1.05-1.26)	**1.38** (1.27-1.52)	**1.57** (1.43-1.71)	**1.80** (1.64-1.97)	**1.98** (1.79-2.17)	**2.16** (1.95-2.36)	**2.34** (2.10-2.56)	**2.58** (2.29-2.82)	**2.76** (2.44-3.03)
60-min	**1.19** (1.09-1.30)	**1.43** (1.31-1.56)	**1.76** (1.61-1.93)	**2.02** (1.84-2.21)	**2.37** (2.16-2.59)	**2.66** (2.40-2.90)	**2.95** (2.65-3.21)	**3.25** (2.90-3.55)	**3.66** (3.24-4.00)	**3.98** (3.50-4.36)
2-hr	**1.43** (1.31-1.56)	**1.73** (1.59-1.88)	**2.15** (1.97-2.34)	**2.49** (2.28-2.71)	**2.95** (2.69-3.20)	**3.32** (3.01-3.60)	**3.70** (3.34-4.02)	**4.10** (3.68-4.46)	**4.65** (4.13-5.06)	**5.09** (4.48-5.55)
3-hr	**1.54** (1.42-1.68)	**1.86** (1.71-2.03)	**2.31** (2.12-2.52)	**2.68** (2.46-2.92)	**3.20** (2.91-3.47)	**3.62** (3.28-3.93)	**4.05** (3.65-4.40)	**4.51** (4.04-4.90)	**5.16** (4.56-5.61)	**5.67** (4.98-6.19)
6-hr	**1.89** (1.74-2.07)	**2.28** (2.09-2.49)	**2.83** (2.60-3.09)	**3.29** (3.01-3.59)	**3.94** (3.58-4.28)	**4.47** (4.04-4.85)	**5.04** (4.53-5.47)	**5.64** (5.03-6.12)	**6.49** (5.71-7.06)	**7.19** (6.26-7.83)
12-hr	**2.26** (2.07-2.47)	**2.72** (2.50-2.98)	**3.37** (3.09-3.69)	**3.91** (3.57-4.27)	**4.67** (4.24-5.10)	**5.30** (4.79-5.78)	**5.96** (5.36-6.50)	**6.67** (5.95-7.27)	**7.67** (6.76-8.38)	**8.48** (7.39-9.29)
24-hr	**2.71** (2.52-2.93)	**3.26** (3.03-3.52)	**4.06** (3.77-4.38)	**4.71** (4.36-5.08)	**5.65** (5.19-6.08)	**6.42** (5.87-6.91)	**7.23** (6.56-7.81)	**8.09** (7.28-8.76)	**9.32** (8.27-10.1)	**10.3** (9.05-11.3)
2-day	**3.25** (3.01-3.51)	**3.90** (3.61-4.22)	**4.85** (4.49-5.25)	**5.64** (5.21-6.10)	**6.78** (6.22-7.34)	**7.73** (7.05-8.38)	**8.75** (7.90-9.51)	**9.84** (8.81-10.7)	**11.4** (10.1-12.5)	**12.7** (11.1-14.1)
3-day	**3.46** (3.22-3.74)	**4.15** (3.86-4.49)	**5.17** (4.79-5.59)	**6.01** (5.55-6.49)	**7.23** (6.64-7.82)	**8.25** (7.53-8.94)	**9.35** (8.46-10.2)	**10.5** (9.45-11.5)	**12.2** (10.8-13.5)	**13.7** (11.9-15.1)
4-day	**3.68** (3.42-3.97)	**4.41** (4.10-4.76)	**5.48** (5.09-5.92)	**6.38** (5.90-6.89)	**7.68** (7.07-8.30)	**8.77** (8.02-9.51)	**9.95** (9.02-10.8)	**11.2** (10.1-12.3)	**13.1** (11.6-14.4)	**14.6** (12.8-16.2)
7-day	**4.30** (3.98-4.67)	**5.15** (4.78-5.59)	**6.42** (5.94-6.97)	**7.51** (6.92-8.15)	**9.12** (8.35-9.90)	**10.5** (9.54-11.4)	**12.0** (10.8-13.1)	**13.7** (12.2-15.0)	**16.2** (14.1-17.9)	**18.3** (15.7-20.4)
10-day	**4.85** (4.49-5.25)	**5.80** (5.38-6.29)	**7.20** (6.66-7.80)	**8.39** (7.73-9.09)	**10.1** (9.28-11.0)	**11.6** (10.6-12.6)	**13.2** (11.9-14.4)	**15.0** (13.4-16.4)	**17.6** (15.4-19.4)	**19.7** (17.1-21.9)
20-day	**6.68** (6.27-7.13)	**7.93** (7.45-8.47)	**9.54** (8.94-10.2)	**10.8** (10.1-11.6)	**12.6** (11.8-13.5)	**14.1** (13.0-15.1)	**15.6** (14.3-16.7)	**17.1** (15.7-18.4)	**19.2** (17.4-20.9)	**20.9** (18.7-22.8)
30-day	**8.23** (7.76-8.74)	**9.73** (9.17-10.3)	**11.5** (10.8-12.2)	**13.0** (12.2-13.7)	**14.9** (14.0-15.8)	**16.4** (15.3-17.5)	**18.0** (16.7-19.2)	**19.6** (18.1-20.9)	**21.7** (19.8-23.3)	**23.3** (21.1-25.2)
45-day	**10.4** (9.84-11.0)	**12.2** (11.6-12.9)	**14.3** (13.5-15.0)	**15.8** (15.0-16.7)	**17.9** (16.9-18.9)	**19.5** (18.3-20.6)	**21.1** (19.7-22.4)	**22.6** (21.1-24.1)	**24.6** (22.8-26.3)	**26.1** (24.0-28.1)
60-day	**12.4** (11.7-13.1)	**14.6** (13.8-15.4)	**16.9** (16.0-17.8)	**18.6** (17.6-19.6)	**20.8** (19.6-21.9)	**22.4** (21.1-23.7)	**23.9** (22.5-25.4)	**25.4** (23.8-27.0)	**27.3** (25.4-29.1)	**28.7** (26.6-30.7)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

Back to Top

PF graphical

ATTACHMENT 3

PondPack Model and Output

Scenario: Post-Development 1000 Year

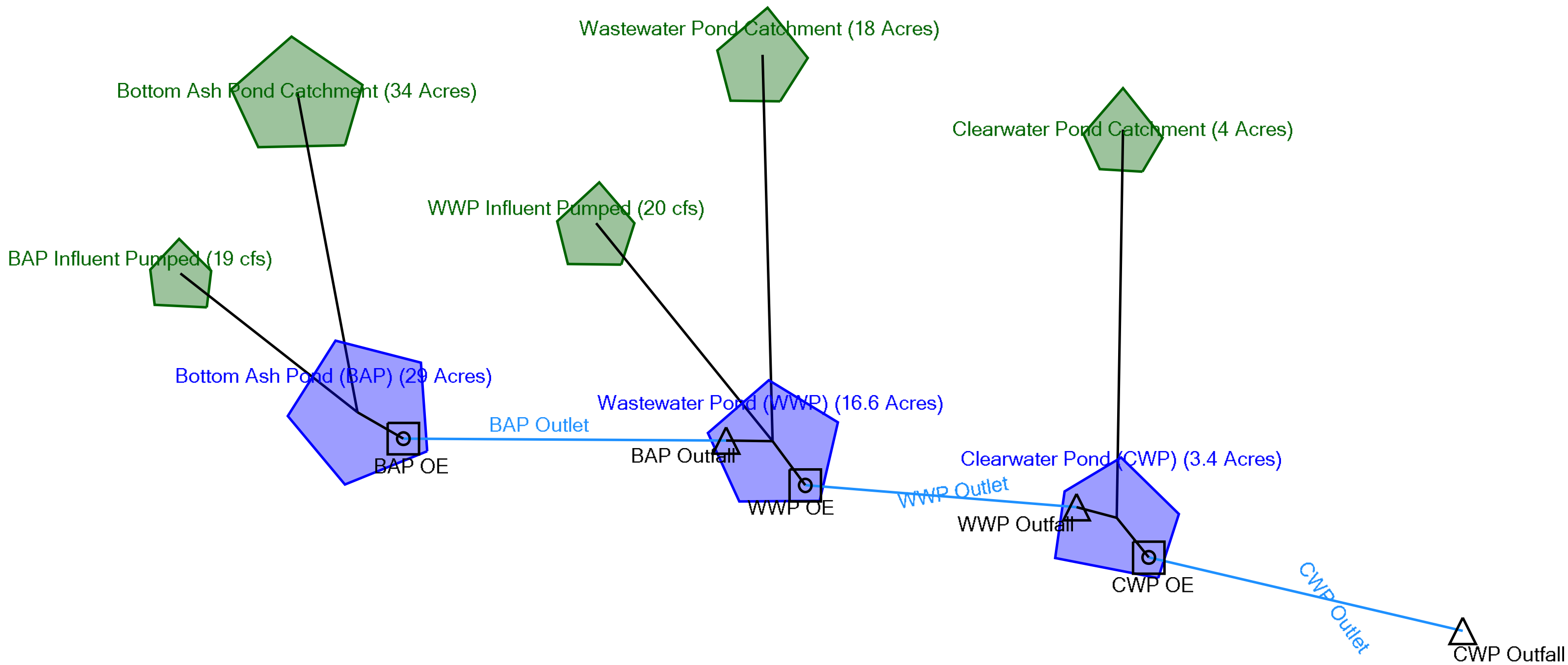


Table of Contents

Table of Contents

Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
BAP Influent Pumped	Post-Development 1000 Year	1,000	37.686	0.000	19.00
Bottom Ash Pond Catchment	Post-Development 1000 Year	1,000	29.162	11.900	450.92
Clearwater Pond Catchment	Post-Development 1000 Year	1,000	3.430	11.950	50.41
WWP Influent Pumped	Post-Development 1000 Year	1,000	39.669	0.000	20.00
Wastewater Pond Catchment	Post-Development 1000 Year	1,000	15.436	11.950	226.83

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
CWP Outfall	Post-Development 1000 Year	1,000	94.142	12.100	123.59

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
Bottom Ash Pond (BAP) (IN)	Post-Development 1000 Year	1,000	66.848	11.900	469.92	(N/A)	(N/A)
Bottom Ash Pond (BAP) (OUT)	Post-Development 1000 Year	1,000	38.722	13.650	34.94	395.18	32.797
Clearwater Pond (CWP) (IN)	Post-Development 1000 Year	1,000	94.743	12.000	139.81	(N/A)	(N/A)
Clearwater Pond (CWP) (OUT)	Post-Development 1000 Year	1,000	94.142	12.100	123.59	381.95	2.573
Wastewater Pond (WWP) (IN)	Post-Development 1000 Year	1,000	93.828	11.950	273.13	(N/A)	(N/A)
Wastewater Pond (WWP) (OUT)	Post-Development 1000 Year	1,000	91.313	12.150	103.29	389.41	22.806

Time-Depth Curve: 1000 Year	
Label	1000 Year
Start Time	0.000 hours
Increment	0.100 hours
End Time	24.000 hours
Return Event	1,000 years

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
0.000	0.0	0.0	0.0	0.0	0.0
0.500	0.1	0.1	0.1	0.1	0.1
1.000	0.1	0.1	0.1	0.1	0.2
1.500	0.2	0.2	0.2	0.2	0.2
2.000	0.2	0.2	0.3	0.3	0.3
2.500	0.3	0.3	0.3	0.3	0.3
3.000	0.4	0.4	0.4	0.4	0.4
3.500	0.4	0.4	0.5	0.5	0.5
4.000	0.5	0.5	0.5	0.5	0.6
4.500	0.6	0.6	0.6	0.6	0.6
5.000	0.6	0.7	0.7	0.7	0.7
5.500	0.7	0.8	0.8	0.8	0.8
6.000	0.8	0.8	0.9	0.9	0.9
6.500	0.9	0.9	1.0	1.0	1.0
7.000	1.0	1.0	1.1	1.1	1.1
7.500	1.1	1.1	1.2	1.2	1.2
8.000	1.2	1.3	1.3	1.3	1.3
8.500	1.4	1.4	1.4	1.5	1.5
9.000	1.5	1.5	1.6	1.6	1.6
9.500	1.7	1.7	1.7	1.8	1.8
10.000	1.9	1.9	2.0	2.0	2.0
10.500	2.1	2.2	2.2	2.3	2.3
11.000	2.4	2.5	2.6	2.7	2.8
11.500	2.9	3.2	3.6	4.4	5.8
12.000	6.8	7.0	7.2	7.3	7.5
12.500	7.6	7.7	7.7	7.8	7.9
13.000	8.0	8.0	8.1	8.1	8.2
13.500	8.2	8.3	8.3	8.4	8.4
14.000	8.4	8.5	8.5	8.6	8.6
14.500	8.6	8.7	8.7	8.7	8.8
15.000	8.8	8.8	8.9	8.9	8.9
15.500	8.9	9.0	9.0	9.0	9.0
16.000	9.1	9.1	9.1	9.1	9.2
16.500	9.2	9.2	9.2	9.2	9.3
17.000	9.3	9.3	9.3	9.4	9.4

CUMULATIVE RAINFALL (in)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Depth (in)	Depth (in)	Depth (in)	Depth (in)	Depth (in)
17.500	9.4	9.4	9.4	9.4	9.5
18.000	9.5	9.5	9.5	9.5	9.6
18.500	9.6	9.6	9.6	9.6	9.6
19.000	9.7	9.7	9.7	9.7	9.7
19.500	9.7	9.7	9.8	9.8	9.8
20.000	9.8	9.8	9.8	9.8	9.9
20.500	9.9	9.9	9.9	9.9	9.9
21.000	9.9	9.9	10.0	10.0	10.0
21.500	10.0	10.0	10.0	10.0	10.1
22.000	10.1	10.1	10.1	10.1	10.1
22.500	10.1	10.1	10.1	10.2	10.2
23.000	10.2	10.2	10.2	10.2	10.2
23.500	10.2	10.3	10.3	10.3	10.3
24.000	10.3	(N/A)	(N/A)	(N/A)	(N/A)

Unit Hydrograph Method (Computational Notes)
Definition of Terms

At	Total area (acres): At = Ai+Ap
Ai	Impervious area (acres)
Ap	Pervious area (acres)
CNi	Runoff curve number for impervious area
CNp	Runoff curve number for pervious area
fLoss	f loss constant infiltration (depth/time)
gKs	Saturated Hydraulic Conductivity (depth/time)
Md	Volumetric Moisture Deficit
Psi	Capillary Suction (length)
hK	Horton Infiltration Decay Rate (time^-1)
fo	Initial Infiltration Rate (depth/time)
fc	Ultimate(capacity)Infiltration Rate (depth/time)
Ia	Initial Abstraction (length)
dt	Computational increment (duration of unit excess rainfall) Default dt is smallest value of 0.1333Tc, rtm, and th (Smallest dt is then adjusted to match up with Tp)
UDdt	User specified override computational main time increment (only used if UDdt is => .1333Tc)
D(t)	Point on distribution curve (fraction of P) for time step t
K	2 / (1 + (Tr/Tp)): default K = 0.75: (for Tr/Tp = 1.67)
Ks	Hydrograph shape factor = Unit Conversions * K: = ((1hr/3600sec) * (1ft/12in) * ((5280ft)**2/sq.mi)) * K Default Ks = 645.333 * 0.75 = 484
Lag	Lag time from center of excess runoff (dt) to Tp: Lag = 0.6Tc
P	Total precipitation depth, inches
Pa(t)	Accumulated rainfall at time step t
Pi(t)	Incremental rainfall at time step t
qp	Peak discharge (cfs) for 1in. runoff, for 1hr, for 1 sq.mi. = (Ks * A * Q) / Tp (where Q = 1in. runoff, A=sq.mi.)
Qu(t)	Unit hydrograph ordinate (cfs) at time step t
Q(t)	Final hydrograph ordinate (cfs) at time step t
Rai(t)	Accumulated runoff (inches) at time step t for impervious area
Rap(t)	Accumulated runoff (inches) at time step t for pervious area
Rii(t)	Incremental runoff (inches) at time step t for impervious area
Rip(t)	Incremental runoff (inches) at time step t for pervious area
R(t)	Incremental weighted total runoff (inches)
Rtm	Time increment for rainfall table
Si	S for impervious area: Si = (1000/CNi) - 10
Sp	S for pervious area: Sp = (1000/CNp) - 10
t	Time step (row) number
Tc	Time of concentration
Tb	Time (hrs) of entire unit hydrograph: Tb = Tp + Tr
Tp	Time (hrs) to peak of a unit hydrograph: Tp = (dt/2) + Lag
Tr	Time (hrs) of receding limb of unit hydrograph: Tr = ratio of Tp

Subsection: Unit Hydrograph Equations

Unit Hydrograph Method
Computational Notes
Precipitation

Column (1)	Time for time step t
Column (2)	D(t) = Point on distribution curve for time step t
Column (3)	Pi(t) = Pa(t) - Pa(t-1): Col.(4) - Preceding Col.(4)
Column (4)	Pa(t) = D(t) x P: Col.(2) x P

Pervious Area Runoff (using SCS Runoff CN Method)

Column (5)	Rap(t) = Accumulated pervious runoff for time step t
	If (Pa(t) is <= 0.2Sp) then use: Rap(t) = 0.0
	If (Pa(t) is > 0.2Sp) then use:
	
	Rap(t) = (Col.(4)-0.2Sp)**2 / (Col.(4)+0.8Sp)

Column (6)	Rip(t) = Incremental pervious runoff for time step t Rip(t) = Rap(t) - Rap(t-1) Rip(t) = Col.(5) for current row - Col.(5) for preceding row.

Impervious Area Runoff

Column (7 & 8)...	Did not specify to use impervious areas.

Incremental Weighted Runoff

Column (9)	R(t) = (Ap/At) x Rip(t) + (Ai/At) x Rii(t) R(t) = (Ap/At) x Col.(6) + (Ai/At) x Col.(8)

SCS Unit Hydrograph Method

Column (10)	Q(t) is computed with the SCS unit hydrograph method using R(t) and Qu(t).

Peak Discharge	19.00 ft³/s
Time to Peak	7.900 hours
Hydrograph Volume	37.686 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	19.00	19.00	19.00	19.00	19.00
0.500	19.00	19.00	19.00	19.00	19.00
1.000	19.00	19.00	19.00	19.00	19.00
1.500	19.00	19.00	19.00	19.00	19.00
2.000	19.00	19.00	19.00	19.00	19.00
2.500	19.00	19.00	19.00	19.00	19.00
3.000	19.00	19.00	19.00	19.00	19.00
3.500	19.00	19.00	19.00	19.00	19.00
4.000	19.00	19.00	19.00	19.00	19.00
4.500	19.00	19.00	19.00	19.00	19.00
5.000	19.00	19.00	19.00	19.00	19.00
5.500	19.00	19.00	19.00	19.00	19.00
6.000	19.00	19.00	19.00	19.00	19.00
6.500	19.00	19.00	19.00	19.00	19.00
7.000	19.00	19.00	19.00	19.00	19.00
7.500	19.00	19.00	19.00	19.00	19.00
8.000	19.00	19.00	19.00	19.00	19.00
8.500	19.00	19.00	19.00	19.00	19.00
9.000	19.00	19.00	19.00	19.00	19.00
9.500	19.00	19.00	19.00	19.00	19.00
10.000	19.00	19.00	19.00	19.00	19.00
10.500	19.00	19.00	19.00	19.00	19.00
11.000	19.00	19.00	19.00	19.00	19.00
11.500	19.00	19.00	19.00	19.00	19.00
12.000	19.00	19.00	19.00	19.00	19.00
12.500	19.00	19.00	19.00	19.00	19.00
13.000	19.00	19.00	19.00	19.00	19.00
13.500	19.00	19.00	19.00	19.00	19.00
14.000	19.00	19.00	19.00	19.00	19.00
14.500	19.00	19.00	19.00	19.00	19.00
15.000	19.00	19.00	19.00	19.00	19.00
15.500	19.00	19.00	19.00	19.00	19.00
16.000	19.00	19.00	19.00	19.00	19.00
16.500	19.00	19.00	19.00	19.00	19.00
17.000	19.00	19.00	19.00	19.00	19.00
17.500	19.00	19.00	19.00	19.00	19.00
18.000	19.00	19.00	19.00	19.00	19.00
18.500	19.00	19.00	19.00	19.00	19.00
19.000	19.00	19.00	19.00	19.00	19.00

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
19.500	19.00	19.00	19.00	19.00	19.00
20.000	19.00	19.00	19.00	19.00	19.00
20.500	19.00	19.00	19.00	19.00	19.00
21.000	19.00	19.00	19.00	19.00	19.00
21.500	19.00	19.00	19.00	19.00	19.00
22.000	19.00	19.00	19.00	19.00	19.00
22.500	19.00	19.00	19.00	19.00	19.00
23.000	19.00	19.00	19.00	19.00	19.00
23.500	19.00	19.00	19.00	19.00	19.00
24.000	19.00	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	10.3 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	34.000 acres

Computational Time Increment	0.011 hours
Time to Peak (Computed)	11.911 hours
Flow (Peak, Computed)	457.92 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.900 hours
Flow (Peak Interpolated Output)	450.92 ft³/s

Drainage Area	
SCS CN (Composite)	100.000
Area (User Defined)	34.000 acres
Maximum Retention (Pervious)	0.0 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	10.3 in
Runoff Volume (Pervious)	29.184 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	29.162 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.083 hours
Computational Time Increment	0.011 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	462.28 ft³/s
Unit peak time, Tp	0.056 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.222 hours
Total unit time, Tb	0.278 hours

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	10.3 in
Time of Concentration (Composite)	0.083 hours
Area (User Defined)	34.000 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.34	3.03	3.44	3.54
0.250	3.59	3.63	3.63	3.64	3.66
0.500	3.70	3.71	3.71	3.73	3.77
0.750	3.78	3.78	3.80	3.84	3.85
1.000	3.85	3.88	3.91	3.92	3.92
1.250	3.95	3.98	3.99	3.99	4.02
1.500	4.05	4.06	4.06	4.09	4.12
1.750	4.13	4.13	4.16	4.19	4.20
2.000	4.20	4.23	4.26	4.27	4.27
2.250	4.30	4.33	4.34	4.34	4.37
2.500	4.40	4.41	4.41	4.44	4.47
2.750	4.48	4.48	4.51	4.54	4.55
3.000	4.55	4.58	4.62	4.62	4.63
3.250	4.65	4.69	4.69	4.70	4.72
3.500	4.76	4.76	4.77	4.79	4.83
3.750	4.84	4.84	4.86	4.90	4.91
4.000	4.91	4.93	4.97	5.00	5.04
4.250	5.07	5.11	5.14	5.18	5.21
4.500	5.25	5.29	5.32	5.36	5.39
4.750	5.43	5.46	5.50	5.53	5.57
5.000	5.60	5.64	5.67	5.71	5.74
5.250	5.78	5.82	5.85	5.89	5.92
5.500	5.96	5.99	6.03	6.06	6.10
5.750	6.13	6.17	6.20	6.24	6.27
6.000	6.31	6.34	6.38	6.42	6.45
6.250	6.49	6.52	6.56	6.59	6.63
6.500	6.66	6.70	6.73	6.77	6.80
6.750	6.84	6.87	6.91	6.95	6.98
7.000	7.02	7.05	7.09	7.12	7.16
7.250	7.19	7.23	7.26	7.30	7.33
7.500	7.37	7.40	7.44	7.47	7.51
7.750	7.55	7.58	7.62	7.65	7.69
8.000	7.72	7.81	7.91	8.07	8.24
8.250	8.42	8.60	8.77	8.95	9.12

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
8.500	9.30	9.48	9.65	9.83	10.01
8.750	10.18	10.36	10.54	10.71	10.89
9.000	11.07	11.18	11.27	11.29	11.30
9.250	11.30	11.30	11.30	11.30	11.30
9.500	11.30	11.41	11.54	11.78	12.06
9.750	12.34	12.62	12.90	13.19	13.47
10.000	13.75	14.09	14.44	14.84	15.26
10.250	15.68	16.11	16.53	16.96	17.38
10.500	17.80	18.33	18.89	19.56	20.26
10.750	20.96	21.67	22.37	23.08	23.79
11.000	24.49	25.57	26.75	28.31	29.98
11.250	31.66	33.36	35.05	36.75	38.44
11.500	40.14	56.87	77.58	114.03	154.85
11.750	203.17	253.87	346.60	450.92	421.08
12.000	356.88	240.08	108.67	73.28	61.97
12.250	56.32	52.12	48.11	44.07	40.06
12.500	36.02	33.18	30.61	29.29	28.28
12.750	27.34	26.42	25.51	24.59	23.67
13.000	22.75	21.99	21.27	20.72	20.22
13.250	19.72	19.22	18.73	18.24	17.74
13.500	17.25	16.81	16.38	16.01	15.65
13.750	15.30	14.94	14.59	14.24	13.88
14.000	13.53	13.27	13.03	12.87	12.72
14.250	12.61	12.50	12.37	12.23	12.11
14.500	12.00	11.87	11.73	11.62	11.51
14.750	11.38	11.24	11.12	11.02	10.88
15.000	10.74	10.63	10.52	10.39	10.25
15.250	10.14	10.03	9.89	9.75	9.64
15.500	9.53	9.40	9.26	9.15	9.04
15.750	8.91	8.77	8.65	8.54	8.41
16.000	8.27	8.18	8.11	8.05	8.00
16.250	7.96	7.92	7.87	7.82	7.78
16.500	7.74	7.70	7.64	7.60	7.57
16.750	7.52	7.47	7.43	7.39	7.34
17.000	7.29	7.25	7.21	7.17	7.11
17.250	7.07	7.04	6.99	6.94	6.90
17.500	6.86	6.81	6.76	6.72	6.69
17.750	6.64	6.58	6.55	6.51	6.46
18.000	6.41	6.37	6.33	6.28	6.23
18.250	6.19	6.16	6.11	6.05	6.02
18.500	5.98	5.93	5.88	5.84	5.80
18.750	5.75	5.70	5.66	5.63	5.58
19.000	5.53	5.49	5.45	5.40	5.35

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
19.250	5.31	5.27	5.22	5.17	5.13
19.500	5.10	5.05	5.00	4.96	4.92
19.750	4.87	4.82	4.78	4.74	4.69
20.000	4.64	4.62	4.60	4.58	4.56
20.250	4.56	4.56	4.54	4.53	4.52
20.500	4.52	4.51	4.49	4.49	4.48
20.750	4.47	4.45	4.45	4.45	4.44
21.000	4.42	4.42	4.41	4.40	4.38
21.250	4.38	4.38	4.37	4.35	4.34
21.500	4.34	4.33	4.31	4.31	4.31
21.750	4.29	4.28	4.27	4.27	4.26
22.000	4.24	4.24	4.24	4.22	4.21
22.250	4.20	4.20	4.19	4.17	4.17
22.500	4.17	4.15	4.14	4.13	4.13
22.750	4.12	4.10	4.10	4.10	4.08
23.000	4.07	4.06	4.06	4.05	4.03
23.250	4.03	4.03	4.01	4.00	3.99
23.500	3.99	3.98	3.96	3.96	3.96
23.750	3.94	3.92	3.92	3.92	3.92
24.000	3.92	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	10.3 in
Time of Concentration (Composite)	0.100 hours
Area (User Defined)	4.000 acres

Computational Time Increment	0.013 hours
Time to Peak (Computed)	11.920 hours
Flow (Peak, Computed)	52.32 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	50.41 ft³/s

Drainage Area	
SCS CN (Composite)	100.000
Area (User Defined)	4.000 acres
Maximum Retention (Pervious)	0.0 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	10.3 in
Runoff Volume (Pervious)	3.433 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	3.430 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.100 hours
Computational Time Increment	0.013 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	45.32 ft³/s
Unit peak time, Tp	0.067 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.267 hours
Total unit time, Tb	0.333 hours

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	10.3 in
Time of Concentration (Composite)	0.100 hours
Area (User Defined)	4.000 acres

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.11	0.31	0.39	0.41
0.250	0.42	0.43	0.43	0.43	0.43
0.500	0.43	0.44	0.44	0.44	0.44
0.750	0.44	0.44	0.45	0.45	0.45
1.000	0.45	0.45	0.46	0.46	0.46
1.250	0.46	0.47	0.47	0.47	0.47
1.500	0.48	0.48	0.48	0.48	0.48
1.750	0.49	0.49	0.49	0.49	0.49
2.000	0.49	0.50	0.50	0.50	0.50
2.250	0.50	0.51	0.51	0.51	0.51
2.500	0.52	0.52	0.52	0.52	0.53
2.750	0.53	0.53	0.53	0.53	0.54
3.000	0.54	0.54	0.54	0.54	0.54
3.250	0.55	0.55	0.55	0.55	0.55
3.500	0.56	0.56	0.56	0.56	0.57
3.750	0.57	0.57	0.57	0.58	0.58
4.000	0.58	0.58	0.58	0.59	0.59
4.250	0.60	0.60	0.60	0.61	0.61
4.500	0.62	0.62	0.63	0.63	0.63
4.750	0.64	0.64	0.65	0.65	0.65
5.000	0.66	0.66	0.67	0.67	0.67
5.250	0.68	0.68	0.69	0.69	0.70
5.500	0.70	0.70	0.71	0.71	0.72
5.750	0.72	0.72	0.73	0.73	0.74
6.000	0.74	0.75	0.75	0.75	0.76
6.250	0.76	0.77	0.77	0.77	0.78
6.500	0.78	0.79	0.79	0.80	0.80
6.750	0.80	0.81	0.81	0.82	0.82
7.000	0.82	0.83	0.83	0.84	0.84
7.250	0.84	0.85	0.85	0.86	0.86
7.500	0.87	0.87	0.87	0.88	0.88
7.750	0.89	0.89	0.89	0.90	0.90
8.000	0.91	0.92	0.93	0.94	0.97
8.250	0.98	1.01	1.03	1.05	1.07

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
8.500	1.09	1.11	1.13	1.15	1.17
8.750	1.19	1.21	1.23	1.26	1.27
9.000	1.30	1.31	1.32	1.33	1.33
9.250	1.33	1.33	1.33	1.33	1.33
9.500	1.33	1.34	1.35	1.38	1.41
9.750	1.44	1.48	1.51	1.54	1.57
10.000	1.61	1.65	1.69	1.73	1.78
10.250	1.83	1.88	1.93	1.98	2.03
10.500	2.08	2.14	2.21	2.28	2.37
10.750	2.44	2.53	2.61	2.70	2.77
11.000	2.86	2.97	3.12	3.28	3.48
11.250	3.66	3.88	4.06	4.28	4.46
11.500	4.70	6.12	8.61	12.13	17.20
11.750	22.20	28.52	37.49	50.28	50.41
12.000	43.39	32.29	16.19	10.02	7.82
12.250	6.91	6.26	5.80	5.29	4.86
12.500	4.34	4.01	3.67	3.50	3.36
12.750	3.25	3.13	3.03	2.92	2.82
13.000	2.70	2.62	2.52	2.46	2.39
13.250	2.34	2.27	2.22	2.16	2.11
13.500	2.04	1.99	1.94	1.90	1.85
13.750	1.81	1.77	1.73	1.68	1.65
14.000	1.60	1.57	1.54	1.52	1.50
14.250	1.49	1.47	1.46	1.44	1.43
14.500	1.42	1.40	1.38	1.37	1.36
14.750	1.34	1.33	1.31	1.30	1.29
15.000	1.27	1.25	1.24	1.23	1.21
15.250	1.20	1.18	1.17	1.15	1.14
15.500	1.12	1.11	1.09	1.08	1.07
15.750	1.05	1.04	1.02	1.01	0.99
16.000	0.98	0.97	0.96	0.95	0.94
16.250	0.94	0.93	0.93	0.92	0.92
16.500	0.91	0.91	0.90	0.90	0.89
16.750	0.89	0.88	0.88	0.87	0.87
17.000	0.86	0.85	0.85	0.84	0.84
17.250	0.83	0.83	0.82	0.82	0.81
17.500	0.81	0.80	0.80	0.79	0.79
17.750	0.78	0.78	0.77	0.77	0.76
18.000	0.76	0.75	0.75	0.74	0.73
18.250	0.73	0.73	0.72	0.71	0.71
18.500	0.70	0.70	0.69	0.69	0.68
18.750	0.68	0.67	0.67	0.66	0.66
19.000	0.65	0.65	0.64	0.64	0.63

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
19.250	0.63	0.62	0.62	0.61	0.61
19.500	0.60	0.60	0.59	0.58	0.58
19.750	0.57	0.57	0.56	0.56	0.55
20.000	0.55	0.54	0.54	0.54	0.54
20.250	0.54	0.54	0.53	0.53	0.53
20.500	0.53	0.53	0.53	0.53	0.53
20.750	0.53	0.52	0.52	0.52	0.52
21.000	0.52	0.52	0.52	0.52	0.52
21.250	0.52	0.52	0.51	0.51	0.51
21.500	0.51	0.51	0.51	0.51	0.51
21.750	0.51	0.50	0.50	0.50	0.50
22.000	0.50	0.50	0.50	0.50	0.50
22.250	0.49	0.49	0.49	0.49	0.49
22.500	0.49	0.49	0.49	0.49	0.49
22.750	0.48	0.48	0.48	0.48	0.48
23.000	0.48	0.48	0.48	0.48	0.47
23.250	0.47	0.47	0.47	0.47	0.47
23.500	0.47	0.47	0.47	0.47	0.47
23.750	0.46	0.46	0.46	0.46	0.46
24.000	0.46	(N/A)	(N/A)	(N/A)	(N/A)

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	10.3 in
Time of Concentration (Composite)	0.100 hours
Area (User Defined)	18.000 acres

Computational Time Increment	0.013 hours
Time to Peak (Computed)	11.920 hours
Flow (Peak, Computed)	235.44 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	11.950 hours
Flow (Peak Interpolated Output)	226.83 ft³/s

Drainage Area	
SCS CN (Composite)	100.000
Area (User Defined)	18.000 acres
Maximum Retention (Pervious)	0.0 in
Maximum Retention (Pervious, 20 percent)	0.0 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	10.3 in
Runoff Volume (Pervious)	15.450 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	15.436 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.100 hours
Computational Time Increment	0.013 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	203.95 ft³/s
Unit peak time, Tp	0.067 hours

SCS Unit Hydrograph Parameters	
Unit receding limb, Tr	0.267 hours
Total unit time, Tb	0.333 hours

Storm Event	1000 Year
Return Event	1,000 years
Duration	24.000 hours
Depth	10.3 in
Time of Concentration (Composite)	0.100 hours
Area (User Defined)	18.000 acres

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
0.000	0.00	0.50	1.41	1.75	1.85
0.250	1.89	1.91	1.92	1.92	1.94
0.500	1.95	1.96	1.96	1.97	1.99
0.750	2.00	2.00	2.01	2.03	2.03
1.000	2.04	2.05	2.07	2.07	2.07
1.250	2.08	2.10	2.11	2.11	2.12
1.500	2.14	2.15	2.15	2.16	2.18
1.750	2.18	2.19	2.20	2.22	2.22
2.000	2.22	2.23	2.25	2.26	2.26
2.250	2.27	2.29	2.30	2.30	2.31
2.500	2.33	2.33	2.34	2.35	2.36
2.750	2.37	2.37	2.38	2.40	2.41
3.000	2.41	2.42	2.44	2.45	2.45
3.250	2.46	2.48	2.48	2.49	2.50
3.500	2.51	2.52	2.52	2.53	2.55
3.750	2.56	2.56	2.57	2.59	2.60
4.000	2.60	2.61	2.63	2.64	2.66
4.250	2.68	2.70	2.72	2.74	2.76
4.500	2.78	2.79	2.81	2.83	2.85
4.750	2.87	2.89	2.90	2.92	2.94
5.000	2.96	2.98	3.00	3.02	3.04
5.250	3.05	3.07	3.09	3.11	3.13
5.500	3.15	3.17	3.19	3.20	3.22
5.750	3.24	3.26	3.28	3.30	3.32
6.000	3.34	3.35	3.37	3.39	3.41
6.250	3.43	3.45	3.47	3.49	3.50
6.500	3.52	3.54	3.56	3.58	3.60
6.750	3.62	3.64	3.65	3.67	3.69
7.000	3.71	3.73	3.75	3.76	3.78
7.250	3.80	3.82	3.84	3.86	3.88
7.500	3.90	3.91	3.93	3.95	3.97
7.750	3.99	4.01	4.03	4.05	4.06
8.000	4.08	4.12	4.18	4.25	4.34
8.250	4.43	4.53	4.62	4.72	4.80

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
8.500	4.90	4.99	5.09	5.18	5.28
8.750	5.36	5.46	5.55	5.65	5.74
9.000	5.84	5.90	5.95	5.97	5.98
9.250	5.98	5.98	5.98	5.98	5.98
9.500	5.98	6.02	6.09	6.20	6.35
9.750	6.49	6.65	6.79	6.95	7.09
10.000	7.25	7.40	7.60	7.79	8.03
10.250	8.23	8.48	8.68	8.93	9.13
10.500	9.38	9.62	9.93	10.25	10.64
10.750	10.98	11.39	11.73	12.14	12.48
11.000	12.88	13.36	14.03	14.74	15.67
11.250	16.49	17.46	18.28	19.25	20.08
11.500	21.13	27.53	38.73	54.59	77.41
11.750	99.89	128.36	168.70	226.25	226.83
12.000	195.25	145.32	72.86	45.09	35.21
12.250	31.11	28.15	26.12	23.82	21.87
12.500	19.55	18.03	16.53	15.74	15.10
12.750	14.63	14.10	13.65	13.12	12.68
13.000	12.15	11.77	11.35	11.06	10.77
13.250	10.52	10.24	10.00	9.71	9.47
13.500	9.19	8.97	8.72	8.54	8.33
13.750	8.16	7.95	7.78	7.58	7.41
14.000	7.21	7.07	6.93	6.84	6.75
14.250	6.69	6.63	6.57	6.49	6.43
14.500	6.37	6.31	6.23	6.17	6.11
14.750	6.04	5.97	5.91	5.84	5.78
15.000	5.70	5.65	5.58	5.52	5.44
15.250	5.38	5.32	5.26	5.18	5.12
15.500	5.06	5.00	4.92	4.86	4.80
15.750	4.74	4.66	4.60	4.54	4.47
16.000	4.40	4.35	4.30	4.27	4.24
16.250	4.22	4.20	4.18	4.15	4.13
16.500	4.10	4.08	4.05	4.03	4.01
16.750	3.99	3.96	3.94	3.92	3.90
17.000	3.87	3.85	3.82	3.80	3.77
17.250	3.75	3.73	3.71	3.68	3.66
17.500	3.64	3.61	3.59	3.57	3.54
17.750	3.52	3.49	3.47	3.45	3.43
18.000	3.40	3.38	3.36	3.33	3.31
18.250	3.28	3.26	3.24	3.21	3.19
18.500	3.17	3.15	3.12	3.10	3.08
18.750	3.05	3.02	3.00	2.98	2.96
19.000	2.93	2.91	2.89	2.87	2.84

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
19.250	2.82	2.80	2.77	2.74	2.72
19.500	2.70	2.68	2.65	2.63	2.61
19.750	2.59	2.56	2.54	2.52	2.49
20.000	2.46	2.45	2.44	2.43	2.42
20.250	2.41	2.41	2.41	2.40	2.39
20.500	2.39	2.39	2.38	2.38	2.37
20.750	2.37	2.36	2.36	2.36	2.35
21.000	2.34	2.34	2.34	2.33	2.32
21.250	2.32	2.32	2.31	2.30	2.30
21.500	2.30	2.29	2.29	2.28	2.28
21.750	2.28	2.27	2.26	2.26	2.26
22.000	2.25	2.24	2.24	2.24	2.23
22.250	2.23	2.22	2.22	2.21	2.21
22.500	2.21	2.20	2.19	2.19	2.19
22.750	2.18	2.17	2.17	2.17	2.16
23.000	2.15	2.15	2.15	2.14	2.14
23.250	2.13	2.13	2.13	2.12	2.11
23.500	2.11	2.11	2.10	2.10	2.09
23.750	2.09	2.08	2.08	2.08	2.08
24.000	2.08	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	20.00 ft³/s
Time to Peak	7.900 hours
Hydrograph Volume	39.669 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	20.00	20.00	20.00	20.00	20.00
0.500	20.00	20.00	20.00	20.00	20.00
1.000	20.00	20.00	20.00	20.00	20.00
1.500	20.00	20.00	20.00	20.00	20.00
2.000	20.00	20.00	20.00	20.00	20.00
2.500	20.00	20.00	20.00	20.00	20.00
3.000	20.00	20.00	20.00	20.00	20.00
3.500	20.00	20.00	20.00	20.00	20.00
4.000	20.00	20.00	20.00	20.00	20.00
4.500	20.00	20.00	20.00	20.00	20.00
5.000	20.00	20.00	20.00	20.00	20.00
5.500	20.00	20.00	20.00	20.00	20.00
6.000	20.00	20.00	20.00	20.00	20.00
6.500	20.00	20.00	20.00	20.00	20.00
7.000	20.00	20.00	20.00	20.00	20.00
7.500	20.00	20.00	20.00	20.00	20.00
8.000	20.00	20.00	20.00	20.00	20.00
8.500	20.00	20.00	20.00	20.00	20.00
9.000	20.00	20.00	20.00	20.00	20.00
9.500	20.00	20.00	20.00	20.00	20.00
10.000	20.00	20.00	20.00	20.00	20.00
10.500	20.00	20.00	20.00	20.00	20.00
11.000	20.00	20.00	20.00	20.00	20.00
11.500	20.00	20.00	20.00	20.00	20.00
12.000	20.00	20.00	20.00	20.00	20.00
12.500	20.00	20.00	20.00	20.00	20.00
13.000	20.00	20.00	20.00	20.00	20.00
13.500	20.00	20.00	20.00	20.00	20.00
14.000	20.00	20.00	20.00	20.00	20.00
14.500	20.00	20.00	20.00	20.00	20.00
15.000	20.00	20.00	20.00	20.00	20.00
15.500	20.00	20.00	20.00	20.00	20.00
16.000	20.00	20.00	20.00	20.00	20.00
16.500	20.00	20.00	20.00	20.00	20.00
17.000	20.00	20.00	20.00	20.00	20.00
17.500	20.00	20.00	20.00	20.00	20.00
18.000	20.00	20.00	20.00	20.00	20.00
18.500	20.00	20.00	20.00	20.00	20.00
19.000	20.00	20.00	20.00	20.00	20.00

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.100 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
19.500	20.00	20.00	20.00	20.00	20.00
20.000	20.00	20.00	20.00	20.00	20.00
20.500	20.00	20.00	20.00	20.00	20.00
21.000	20.00	20.00	20.00	20.00	20.00
21.500	20.00	20.00	20.00	20.00	20.00
22.000	20.00	20.00	20.00	20.00	20.00
22.500	20.00	20.00	20.00	20.00	20.00
23.000	20.00	20.00	20.00	20.00	20.00
23.500	20.00	20.00	20.00	20.00	20.00
24.000	20.00	(N/A)	(N/A)	(N/A)	(N/A)

Summary for Hydrograph Addition at 'CWP Outfall'

Upstream Link	Upstream Node
CWP Outlet	Clearwater Pond (CWP)

Node Inflows

Inflow Type	Element	Volume (ac-ft)	Time to Peak (hours)	Flow (Peak) (ft^3/s)
Flow (From)	CWP Outlet	94.142	12.100	123.59
Flow (In)	CWP Outfall	94.142	12.100	123.59

Peak Discharge	34.94 ft³/s
Time to Peak	13.650 hours
Hydrograph Volume	38.722 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.06	0.12	0.18	0.24
0.250	0.30	0.37	0.43	0.49	0.55
0.500	0.62	0.68	0.74	0.80	0.87
0.750	0.93	0.99	1.05	1.11	1.17
1.000	1.23	1.30	1.36	1.42	1.48
1.250	1.54	1.60	1.66	1.72	1.78
1.500	1.84	1.90	1.96	2.02	2.08
1.750	2.14	2.20	2.26	2.32	2.37
2.000	2.43	2.49	2.55	2.61	2.67
2.250	2.73	2.78	2.84	2.90	2.96
2.500	3.02	3.07	3.13	3.19	3.24
2.750	3.30	3.36	3.42	3.47	3.53
3.000	3.59	3.64	3.70	3.75	3.81
3.250	3.87	3.92	3.98	4.03	4.09
3.500	4.15	4.20	4.26	4.31	4.37
3.750	4.42	4.48	4.53	4.59	4.64
4.000	4.69	4.75	4.80	4.86	4.91
4.250	4.96	5.02	5.07	5.13	5.18
4.500	5.23	5.29	5.34	5.40	5.45
4.750	5.50	5.56	5.61	5.66	5.72
5.000	5.77	5.82	5.88	5.93	5.98
5.250	6.04	6.09	6.14	6.19	6.25
5.500	6.30	6.35	6.40	6.46	6.51
5.750	6.56	6.62	6.67	6.72	6.77
6.000	6.82	6.88	6.93	6.98	7.03
6.250	7.09	7.14	7.19	7.24	7.29
6.500	7.34	7.40	7.45	7.50	7.55
6.750	7.60	7.65	7.71	7.76	7.81
7.000	7.86	7.91	7.96	8.01	8.07
7.250	8.12	8.17	8.22	8.27	8.32
7.500	8.37	8.42	8.47	8.52	8.57
7.750	8.63	8.68	8.73	8.78	8.83
8.000	8.88	8.93	8.98	9.03	9.08
8.250	9.13	9.18	9.24	9.29	9.34
8.500	9.40	9.45	9.50	9.57	9.67
8.750	9.77	9.87	9.97	10.07	10.17
9.000	10.27	10.38	10.48	10.58	10.68
9.250	10.78	10.88	10.98	11.08	11.18
9.500	11.28	11.38	11.48	11.58	11.68

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
9.750	11.78	11.88	11.98	12.08	12.19
10.000	12.29	12.40	12.51	12.61	12.73
10.250	12.84	12.95	13.07	13.18	13.30
10.500	13.42	13.54	13.67	13.79	13.92
10.750	14.06	14.19	14.33	14.47	14.61
11.000	14.76	14.91	15.07	15.23	15.40
11.250	15.58	15.76	15.95	16.15	16.36
11.500	16.58	16.84	17.20	17.70	18.40
11.750	19.33	20.50	22.04	24.08	26.30
12.000	28.62	30.53	31.60	32.12	32.48
12.250	32.78	33.05	33.28	33.49	33.68
12.500	33.83	33.96	34.07	34.17	34.26
12.750	34.35	34.42	34.49	34.55	34.61
13.000	34.66	34.71	34.74	34.78	34.81
13.250	34.84	34.86	34.88	34.90	34.91
13.500	34.92	34.93	34.94	34.94	34.94
13.750	34.93	34.93	34.92	34.91	34.90
14.000	34.89	34.87	34.85	34.83	34.81
14.250	34.79	34.77	34.75	34.72	34.70
14.500	34.68	34.65	34.63	34.60	34.57
14.750	34.55	34.52	34.49	34.46	34.43
15.000	34.40	34.37	34.34	34.31	34.27
15.250	34.24	34.21	34.17	34.14	34.10
15.500	34.06	34.03	33.99	33.95	33.91
15.750	33.87	33.83	33.79	33.75	33.71
16.000	33.67	33.63	33.58	33.54	33.50
16.250	33.45	33.41	33.37	33.33	33.28
16.500	33.24	33.20	33.15	33.11	33.07
16.750	33.02	32.98	32.94	32.89	32.85
17.000	32.81	32.77	32.72	32.68	32.64
17.250	32.59	32.55	32.51	32.46	32.42
17.500	32.38	32.33	32.29	32.25	32.20
17.750	32.16	32.12	32.07	32.03	31.99
18.000	31.94	31.90	31.86	31.81	31.77
18.250	31.73	31.68	31.64	31.60	31.55
18.500	31.51	31.47	31.42	31.38	31.34
18.750	31.29	31.25	31.21	31.16	31.12
19.000	31.08	31.03	30.99	30.95	30.90
19.250	30.86	30.82	30.77	30.73	30.69
19.500	30.64	30.60	30.56	30.51	30.47
19.750	30.43	30.38	30.34	30.30	30.25
20.000	30.21	30.17	30.12	30.08	30.04
20.250	29.99	29.95	29.91	29.87	29.82

Subsection: Hydrograph
Label: BAP Outlet

Return Event: 1,000 years
Storm Event: 1000 Year

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
20.500	29.78	29.74	29.70	29.66	29.62
20.750	29.58	29.54	29.50	29.46	29.42
21.000	29.38	29.34	29.30	29.26	29.22
21.250	29.18	29.14	29.11	29.07	29.03
21.500	28.99	28.96	28.92	28.88	28.84
21.750	28.81	28.77	28.74	28.70	28.66
22.000	28.63	28.59	28.56	28.52	28.49
22.250	28.45	28.42	28.38	28.35	28.31
22.500	28.28	28.25	28.21	28.18	28.15
22.750	28.11	28.08	28.05	28.01	27.98
23.000	27.95	27.92	27.88	27.85	27.82
23.250	27.79	27.76	27.73	27.69	27.66
23.500	27.63	27.60	27.57	27.54	27.51
23.750	27.48	27.45	27.42	27.39	27.36
24.000	27.33	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	34.94 ft³/s
Time to Peak	13.650 hours
Hydrograph Volume	38.722 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.06	0.12	0.18	0.24
0.250	0.30	0.37	0.43	0.49	0.55
0.500	0.62	0.68	0.74	0.80	0.87
0.750	0.93	0.99	1.05	1.11	1.17
1.000	1.23	1.30	1.36	1.42	1.48
1.250	1.54	1.60	1.66	1.72	1.78
1.500	1.84	1.90	1.96	2.02	2.08
1.750	2.14	2.20	2.26	2.32	2.37
2.000	2.43	2.49	2.55	2.61	2.67
2.250	2.73	2.78	2.84	2.90	2.96
2.500	3.02	3.07	3.13	3.19	3.24
2.750	3.30	3.36	3.42	3.47	3.53
3.000	3.59	3.64	3.70	3.75	3.81
3.250	3.87	3.92	3.98	4.03	4.09
3.500	4.15	4.20	4.26	4.31	4.37
3.750	4.42	4.48	4.53	4.59	4.64
4.000	4.69	4.75	4.80	4.86	4.91
4.250	4.96	5.02	5.07	5.13	5.18
4.500	5.23	5.29	5.34	5.40	5.45
4.750	5.50	5.56	5.61	5.66	5.72
5.000	5.77	5.82	5.88	5.93	5.98
5.250	6.04	6.09	6.14	6.19	6.25
5.500	6.30	6.35	6.40	6.46	6.51
5.750	6.56	6.62	6.67	6.72	6.77
6.000	6.82	6.88	6.93	6.98	7.03
6.250	7.09	7.14	7.19	7.24	7.29
6.500	7.34	7.40	7.45	7.50	7.55
6.750	7.60	7.65	7.71	7.76	7.81
7.000	7.86	7.91	7.96	8.01	8.07
7.250	8.12	8.17	8.22	8.27	8.32
7.500	8.37	8.42	8.47	8.52	8.57
7.750	8.63	8.68	8.73	8.78	8.83
8.000	8.88	8.93	8.98	9.03	9.08
8.250	9.13	9.18	9.24	9.29	9.34
8.500	9.40	9.45	9.50	9.57	9.67
8.750	9.77	9.87	9.97	10.07	10.17
9.000	10.27	10.38	10.48	10.58	10.68
9.250	10.78	10.88	10.98	11.08	11.18
9.500	11.28	11.38	11.48	11.58	11.68

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
9.750	11.78	11.88	11.98	12.08	12.19
10.000	12.29	12.40	12.51	12.61	12.73
10.250	12.84	12.95	13.07	13.18	13.30
10.500	13.42	13.54	13.67	13.79	13.92
10.750	14.06	14.19	14.33	14.47	14.61
11.000	14.76	14.91	15.07	15.23	15.40
11.250	15.58	15.76	15.95	16.15	16.36
11.500	16.58	16.84	17.20	17.70	18.40
11.750	19.33	20.50	22.04	24.08	26.30
12.000	28.62	30.53	31.60	32.12	32.48
12.250	32.78	33.05	33.28	33.49	33.68
12.500	33.83	33.96	34.07	34.17	34.26
12.750	34.35	34.42	34.49	34.55	34.61
13.000	34.66	34.71	34.74	34.78	34.81
13.250	34.84	34.86	34.88	34.90	34.91
13.500	34.92	34.93	34.94	34.94	34.94
13.750	34.93	34.93	34.92	34.91	34.90
14.000	34.89	34.87	34.85	34.83	34.81
14.250	34.79	34.77	34.75	34.72	34.70
14.500	34.68	34.65	34.63	34.60	34.57
14.750	34.55	34.52	34.49	34.46	34.43
15.000	34.40	34.37	34.34	34.31	34.27
15.250	34.24	34.21	34.17	34.14	34.10
15.500	34.06	34.03	33.99	33.95	33.91
15.750	33.87	33.83	33.79	33.75	33.71
16.000	33.67	33.63	33.58	33.54	33.50
16.250	33.45	33.41	33.37	33.33	33.28
16.500	33.24	33.20	33.15	33.11	33.07
16.750	33.02	32.98	32.94	32.89	32.85
17.000	32.81	32.77	32.72	32.68	32.64
17.250	32.59	32.55	32.51	32.46	32.42
17.500	32.38	32.33	32.29	32.25	32.20
17.750	32.16	32.12	32.07	32.03	31.99
18.000	31.94	31.90	31.86	31.81	31.77
18.250	31.73	31.68	31.64	31.60	31.55
18.500	31.51	31.47	31.42	31.38	31.34
18.750	31.29	31.25	31.21	31.16	31.12
19.000	31.08	31.03	30.99	30.95	30.90
19.250	30.86	30.82	30.77	30.73	30.69
19.500	30.64	30.60	30.56	30.51	30.47
19.750	30.43	30.38	30.34	30.30	30.25
20.000	30.21	30.17	30.12	30.08	30.04
20.250	29.99	29.95	29.91	29.87	29.82

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
20.500	29.78	29.74	29.70	29.66	29.62
20.750	29.58	29.54	29.50	29.46	29.42
21.000	29.38	29.34	29.30	29.26	29.22
21.250	29.18	29.14	29.11	29.07	29.03
21.500	28.99	28.96	28.92	28.88	28.84
21.750	28.81	28.77	28.74	28.70	28.66
22.000	28.63	28.59	28.56	28.52	28.49
22.250	28.45	28.42	28.38	28.35	28.31
22.500	28.28	28.25	28.21	28.18	28.15
22.750	28.11	28.08	28.05	28.01	27.98
23.000	27.95	27.92	27.88	27.85	27.82
23.250	27.79	27.76	27.73	27.69	27.66
23.500	27.63	27.60	27.57	27.54	27.51
23.750	27.48	27.45	27.42	27.39	27.36
24.000	27.33	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	469.92 ft³/s
Time to Peak	11.900 hours
Hydrograph Volume	66.848 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	19.00	20.34	22.03	22.44	22.54
0.250	22.59	22.63	22.63	22.64	22.66
0.500	22.70	22.71	22.71	22.73	22.77
0.750	22.78	22.78	22.80	22.84	22.85
1.000	22.85	22.88	22.91	22.92	22.92
1.250	22.95	22.98	22.99	22.99	23.02
1.500	23.05	23.06	23.06	23.09	23.12
1.750	23.13	23.13	23.16	23.19	23.20
2.000	23.20	23.23	23.26	23.27	23.27
2.250	23.30	23.33	23.34	23.34	23.37
2.500	23.40	23.41	23.41	23.44	23.47
2.750	23.48	23.48	23.51	23.54	23.55
3.000	23.55	23.58	23.62	23.62	23.63
3.250	23.65	23.69	23.69	23.70	23.72
3.500	23.76	23.76	23.77	23.79	23.83
3.750	23.84	23.84	23.86	23.90	23.91
4.000	23.91	23.93	23.97	24.00	24.04
4.250	24.07	24.11	24.14	24.18	24.21
4.500	24.25	24.29	24.32	24.36	24.39
4.750	24.43	24.46	24.50	24.53	24.57
5.000	24.60	24.64	24.67	24.71	24.74
5.250	24.78	24.82	24.85	24.89	24.92
5.500	24.96	24.99	25.03	25.06	25.10
5.750	25.13	25.17	25.20	25.24	25.27
6.000	25.31	25.34	25.38	25.42	25.45
6.250	25.49	25.52	25.56	25.59	25.63
6.500	25.66	25.70	25.73	25.77	25.80
6.750	25.84	25.87	25.91	25.95	25.98
7.000	26.02	26.05	26.09	26.12	26.16
7.250	26.19	26.23	26.26	26.30	26.33
7.500	26.37	26.40	26.44	26.47	26.51
7.750	26.55	26.58	26.62	26.65	26.69
8.000	26.72	26.81	26.91	27.07	27.24
8.250	27.42	27.60	27.77	27.95	28.12
8.500	28.30	28.48	28.65	28.83	29.01
8.750	29.18	29.36	29.54	29.71	29.89
9.000	30.07	30.18	30.27	30.29	30.30
9.250	30.30	30.30	30.30	30.30	30.30
9.500	30.30	30.41	30.54	30.78	31.06

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
9.750	31.34	31.62	31.90	32.19	32.47
10.000	32.75	33.09	33.44	33.84	34.26
10.250	34.68	35.11	35.53	35.96	36.38
10.500	36.80	37.33	37.89	38.56	39.26
10.750	39.96	40.67	41.37	42.08	42.79
11.000	43.49	44.57	45.75	47.31	48.98
11.250	50.66	52.36	54.05	55.75	57.44
11.500	59.14	75.87	96.58	133.03	173.85
11.750	222.17	272.87	365.60	469.92	440.08
12.000	375.88	259.08	127.67	92.28	80.97
12.250	75.32	71.12	67.11	63.07	59.06
12.500	55.02	52.18	49.61	48.29	47.28
12.750	46.34	45.42	44.51	43.59	42.67
13.000	41.75	40.99	40.27	39.72	39.22
13.250	38.72	38.22	37.73	37.24	36.74
13.500	36.25	35.81	35.38	35.01	34.65
13.750	34.30	33.94	33.59	33.24	32.88
14.000	32.53	32.27	32.03	31.87	31.72
14.250	31.61	31.50	31.37	31.23	31.11
14.500	31.00	30.87	30.73	30.62	30.51
14.750	30.38	30.24	30.12	30.02	29.88
15.000	29.74	29.63	29.52	29.39	29.25
15.250	29.14	29.03	28.89	28.75	28.64
15.500	28.53	28.40	28.26	28.15	28.04
15.750	27.91	27.77	27.65	27.54	27.41
16.000	27.27	27.18	27.11	27.05	27.00
16.250	26.96	26.92	26.87	26.82	26.78
16.500	26.74	26.70	26.64	26.60	26.57
16.750	26.52	26.47	26.43	26.39	26.34
17.000	26.29	26.25	26.21	26.17	26.11
17.250	26.07	26.04	25.99	25.94	25.90
17.500	25.86	25.81	25.76	25.72	25.69
17.750	25.64	25.58	25.55	25.51	25.46
18.000	25.41	25.37	25.33	25.28	25.23
18.250	25.19	25.16	25.11	25.05	25.02
18.500	24.98	24.93	24.88	24.84	24.80
18.750	24.75	24.70	24.66	24.63	24.58
19.000	24.53	24.49	24.45	24.40	24.35
19.250	24.31	24.27	24.22	24.17	24.13
19.500	24.10	24.05	24.00	23.96	23.92
19.750	23.87	23.82	23.78	23.74	23.69
20.000	23.64	23.62	23.60	23.58	23.56
20.250	23.56	23.56	23.54	23.53	23.52

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
20.500	23.52	23.51	23.49	23.49	23.48
20.750	23.47	23.45	23.45	23.45	23.44
21.000	23.42	23.42	23.41	23.40	23.38
21.250	23.38	23.38	23.37	23.35	23.34
21.500	23.34	23.33	23.31	23.31	23.31
21.750	23.29	23.28	23.27	23.27	23.26
22.000	23.24	23.24	23.24	23.22	23.21
22.250	23.20	23.20	23.19	23.17	23.17
22.500	23.17	23.15	23.14	23.13	23.13
22.750	23.12	23.10	23.10	23.10	23.08
23.000	23.07	23.06	23.06	23.05	23.03
23.250	23.03	23.03	23.01	23.00	22.99
23.500	22.99	22.98	22.96	22.96	22.96
23.750	22.94	22.92	22.92	22.92	22.92
24.000	22.92	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	123.59 ft³/s
Time to Peak	12.100 hours
Hydrograph Volume	94.142 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.25	0.94	1.90	3.02
0.250	4.20	5.39	6.57	7.71	8.81
0.500	9.85	10.83	11.75	12.61	13.42
0.750	14.17	14.88	15.53	16.15	16.72
1.000	17.25	17.75	18.21	18.64	19.05
1.250	19.43	19.78	20.12	20.43	20.72
1.500	21.00	21.26	21.50	21.73	21.95
1.750	22.16	22.36	22.54	22.72	22.89
2.000	23.05	23.21	23.35	23.50	23.63
2.250	23.76	23.89	24.01	24.13	24.24
2.500	24.35	24.46	24.56	24.66	24.76
2.750	24.86	24.95	25.05	25.14	25.23
3.000	25.31	25.40	25.48	25.57	25.65
3.250	25.73	25.81	25.89	25.96	26.04
3.500	26.12	26.19	26.27	26.34	26.42
3.750	26.49	26.56	26.63	26.70	26.78
4.000	26.85	26.92	26.99	27.06	27.13
4.250	27.20	27.27	27.34	27.42	27.49
4.500	27.56	27.63	27.71	27.78	27.86
4.750	27.93	28.00	28.08	28.15	28.23
5.000	28.30	28.38	28.45	28.53	28.60
5.250	28.68	28.76	28.83	28.91	28.98
5.500	29.06	29.13	29.21	29.28	29.36
5.750	29.43	29.51	29.59	29.66	29.74
6.000	29.81	29.89	29.96	30.04	30.11
6.250	30.19	30.27	30.34	30.42	30.49
6.500	30.57	30.64	30.72	30.79	30.87
6.750	30.94	31.02	31.09	31.17	31.24
7.000	31.32	31.39	31.47	31.54	31.62
7.250	31.69	31.76	31.84	31.91	31.99
7.500	32.06	32.14	32.21	32.29	32.36
7.750	32.43	32.51	32.58	32.66	32.73
8.000	32.80	32.88	32.96	33.04	33.12
8.250	33.21	33.31	33.41	33.51	33.62
8.500	33.74	33.86	33.98	34.10	34.23
8.750	34.37	34.50	34.65	34.80	34.95
9.000	35.10	35.26	35.43	35.59	35.75
9.250	35.90	36.05	36.20	36.35	36.49
9.500	36.63	36.76	36.90	37.05	37.20

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
9.750	37.35	37.52	37.70	37.88	38.07
10.000	38.27	38.47	38.69	38.91	39.15
10.250	39.39	39.64	39.91	40.18	40.47
10.500	40.76	41.06	41.37	41.69	42.03
10.750	42.39	42.77	43.16	43.56	43.98
11.000	44.42	44.87	45.35	45.86	46.42
11.250	47.02	47.68	48.38	49.12	49.90
11.500	50.72	51.80	53.53	56.26	60.41
11.750	66.23	73.64	82.73	94.15	106.36
12.000	116.21	122.31	123.59	121.44	118.68
12.250	116.19	114.09	112.26	110.58	108.96
12.500	107.37	105.80	104.27	102.79	101.37
12.750	100.02	98.73	97.49	96.29	95.12
13.000	93.99	92.89	91.82	90.78	89.78
13.250	88.82	87.88	86.98	86.10	85.25
13.500	84.42	83.62	82.83	82.08	81.34
13.750	80.63	79.94	79.27	78.62	77.99
14.000	77.37	76.77	76.19	75.63	75.09
14.250	74.57	74.07	73.59	73.12	72.67
14.500	72.24	71.82	71.41	71.01	70.63
14.750	70.26	69.90	69.56	69.22	68.84
15.000	68.40	67.95	67.50	67.05	66.62
15.250	66.20	65.80	65.42	65.06	64.71
15.500	64.38	64.06	63.76	63.48	63.21
15.750	62.94	62.69	62.45	62.22	62.00
16.000	61.79	61.58	61.38	61.19	61.01
16.250	60.84	60.67	60.51	60.36	60.22
16.500	60.08	59.94	59.81	59.69	59.56
16.750	59.45	59.33	59.22	59.12	59.01
17.000	58.91	58.81	58.71	58.62	58.52
17.250	58.43	58.34	58.25	58.17	58.08
17.500	58.00	57.91	57.83	57.75	57.67
17.750	57.58	57.50	57.43	57.35	57.27
18.000	57.19	57.11	57.04	56.96	56.88
18.250	56.81	56.73	56.66	56.58	56.51
18.500	56.43	56.36	56.29	56.21	56.14
18.750	56.07	55.99	55.92	55.85	55.77
19.000	55.70	55.63	55.55	55.48	55.41
19.250	55.34	55.26	55.19	55.12	55.05
19.500	54.97	54.90	54.83	54.76	54.68
19.750	54.61	54.54	54.47	54.39	54.32
20.000	54.25	54.18	54.11	54.04	53.97
20.250	53.90	53.83	53.77	53.70	53.64

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
20.500	53.58	53.52	53.46	53.40	53.34
20.750	53.28	53.23	53.17	53.12	53.06
21.000	53.01	52.96	52.91	52.85	52.80
21.250	52.75	52.70	52.65	52.60	52.55
21.500	52.51	52.46	52.41	52.36	52.31
21.750	52.27	52.22	52.18	52.13	52.08
22.000	52.04	51.99	51.95	51.90	51.86
22.250	51.82	51.77	51.73	51.69	51.64
22.500	51.60	51.56	51.51	51.47	51.43
22.750	51.39	51.35	51.30	51.26	51.22
23.000	51.18	51.14	51.10	51.06	51.02
23.250	50.98	50.94	50.90	50.86	50.82
23.500	50.78	50.74	50.71	50.67	50.63
23.750	50.59	50.55	50.51	50.48	50.44
24.000	50.40	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	139.81 ft³/s
Time to Peak	12.000 hours
Hydrograph Volume	94.743 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.71	3.44	4.98	6.37
0.250	7.65	8.84	9.93	10.95	11.89
0.500	12.76	13.57	14.32	15.02	15.67
0.750	16.28	16.84	17.36	17.85	18.31
1.000	18.73	19.13	19.50	19.85	20.18
1.250	20.48	20.78	21.05	21.30	21.54
1.500	21.77	21.99	22.19	22.38	22.57
1.750	22.74	22.91	23.07	23.22	23.37
2.000	23.51	23.64	23.77	23.90	24.02
2.250	24.13	24.25	24.36	24.46	24.56
2.500	24.67	24.76	24.86	24.95	25.05
2.750	25.14	25.22	25.31	25.40	25.48
3.000	25.56	25.64	25.72	25.80	25.88
3.250	25.96	26.04	26.11	26.19	26.26
3.500	26.34	26.41	26.48	26.55	26.63
3.750	26.70	26.77	26.84	26.91	26.98
4.000	27.05	27.12	27.19	27.26	27.33
4.250	27.41	27.48	27.55	27.63	27.70
4.500	27.77	27.85	27.92	28.00	28.07
4.750	28.14	28.22	28.29	28.37	28.44
5.000	28.52	28.60	28.67	28.75	28.82
5.250	28.90	28.97	29.05	29.12	29.20
5.500	29.28	29.35	29.43	29.50	29.58
5.750	29.65	29.73	29.80	29.88	29.95
6.000	30.03	30.11	30.18	30.26	30.33
6.250	30.41	30.48	30.56	30.63	30.71
6.500	30.78	30.86	30.93	31.01	31.08
6.750	31.16	31.23	31.31	31.38	31.46
7.000	31.53	31.61	31.68	31.76	31.83
7.250	31.91	31.98	32.05	32.13	32.20
7.500	32.28	32.35	32.43	32.50	32.57
7.750	32.65	32.72	32.80	32.87	32.94
8.000	33.02	33.10	33.18	33.27	33.37
8.250	33.48	33.59	33.70	33.83	33.95
8.500	34.07	34.20	34.34	34.47	34.61
8.750	34.76	34.91	35.07	35.23	35.39
9.000	35.56	35.73	35.89	36.05	36.20
9.250	36.34	36.49	36.62	36.76	36.89
9.500	37.02	37.16	37.31	37.47	37.64

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
9.750	37.82	38.02	38.21	38.42	38.63
10.000	38.85	39.08	39.32	39.57	39.84
10.250	40.11	40.40	40.68	40.99	41.29
10.500	41.61	41.93	42.29	42.65	43.05
10.750	43.45	43.88	44.30	44.76	45.21
11.000	45.69	46.20	46.78	47.40	48.11
11.250	48.83	49.64	50.45	51.33	52.21
11.500	53.18	55.59	59.70	65.82	74.86
11.750	85.35	97.35	111.47	131.36	139.61
12.000	139.81	133.98	119.32	113.31	110.88
12.250	109.60	108.52	107.31	105.82	104.36
12.500	102.77	101.34	99.90	98.61	97.39
12.750	96.22	95.07	93.97	92.87	91.81
13.000	90.76	89.76	88.78	87.85	86.95
13.250	86.08	85.23	84.41	83.60	82.83
13.500	82.06	81.33	80.61	79.93	79.26
13.750	78.61	77.98	77.37	76.77	76.19
14.000	75.62	75.07	74.55	74.05	73.56
14.250	73.10	72.65	72.22	71.80	71.39
14.500	71.00	70.62	70.25	69.89	69.55
14.750	69.21	68.88	68.57	68.26	67.61
15.000	67.10	66.64	66.20	65.78	65.39
15.250	65.02	64.67	64.34	64.03	63.73
15.500	63.45	63.18	62.92	62.67	62.44
15.750	62.21	61.99	61.78	61.57	61.38
16.000	61.18	61.00	60.82	60.66	60.50
16.250	60.35	60.20	60.07	59.93	59.80
16.500	59.68	59.56	59.44	59.33	59.22
16.750	59.12	59.01	58.91	58.81	58.72
17.000	58.62	58.53	58.44	58.35	58.26
17.250	58.17	58.08	58.00	57.92	57.83
17.500	57.75	57.67	57.59	57.51	57.43
17.750	57.35	57.27	57.20	57.12	57.04
18.000	56.97	56.89	56.82	56.74	56.67
18.250	56.59	56.52	56.44	56.37	56.29
18.500	56.22	56.15	56.07	56.00	55.93
18.750	55.85	55.78	55.71	55.63	55.56
19.000	55.49	55.42	55.34	55.27	55.20
19.250	55.13	55.05	54.98	54.91	54.84
19.500	54.76	54.69	54.62	54.55	54.48
19.750	54.40	54.33	54.26	54.19	54.11
20.000	54.04	53.97	53.90	53.83	53.77
20.250	53.70	53.64	53.58	53.52	53.46

Subsection: Hydrograph
Label: Clearwater Pond (CWP) (IN)

Return Event: 1,000 years
Storm Event: 1000 Year

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
20.500	53.40	53.34	53.29	53.23	53.18
20.750	53.12	53.07	53.01	52.96	52.91
21.000	52.86	52.81	52.76	52.71	52.66
21.250	52.61	52.56	52.51	52.46	52.41
21.500	52.37	52.32	52.27	52.22	52.18
21.750	52.13	52.09	52.04	52.00	51.95
22.000	51.91	51.86	51.82	51.78	51.73
22.250	51.69	51.65	51.60	51.56	51.52
22.500	51.48	51.43	51.39	51.35	51.31
22.750	51.27	51.23	51.18	51.15	51.10
23.000	51.06	51.02	50.98	50.94	50.90
23.250	50.86	50.83	50.79	50.75	50.71
23.500	50.67	50.63	50.59	50.55	50.52
23.750	50.48	50.44	50.40	50.37	50.33
24.000	50.30	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	103.29 ft³/s
Time to Peak	12.150 hours
Hydrograph Volume	91.313 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.60	3.12	4.59	5.96
0.250	7.23	8.41	9.51	10.52	11.46
0.500	12.33	13.14	13.89	14.58	15.23
0.750	15.83	16.39	16.92	17.40	17.86
1.000	18.28	18.67	19.05	19.39	19.72
1.250	20.02	20.31	20.58	20.83	21.07
1.500	21.30	21.51	21.71	21.90	22.08
1.750	22.26	22.42	22.58	22.73	22.87
2.000	23.01	23.14	23.27	23.40	23.51
2.250	23.63	23.74	23.85	23.95	24.05
2.500	24.15	24.25	24.34	24.43	24.52
2.750	24.61	24.69	24.78	24.86	24.94
3.000	25.02	25.10	25.18	25.26	25.34
3.250	25.41	25.49	25.56	25.63	25.71
3.500	25.78	25.85	25.92	25.99	26.06
3.750	26.13	26.20	26.27	26.34	26.40
4.000	26.47	26.54	26.61	26.67	26.74
4.250	26.81	26.88	26.95	27.02	27.09
4.500	27.16	27.23	27.30	27.37	27.44
4.750	27.51	27.58	27.65	27.72	27.79
5.000	27.86	27.93	28.00	28.08	28.15
5.250	28.22	28.29	28.36	28.43	28.50
5.500	28.58	28.65	28.72	28.79	28.86
5.750	28.93	29.00	29.08	29.15	29.22
6.000	29.29	29.36	29.43	29.50	29.57
6.250	29.65	29.72	29.79	29.86	29.93
6.500	30.00	30.07	30.14	30.21	30.28
6.750	30.35	30.43	30.50	30.57	30.64
7.000	30.71	30.78	30.85	30.92	30.99
7.250	31.06	31.13	31.20	31.27	31.34
7.500	31.41	31.48	31.55	31.62	31.69
7.750	31.76	31.83	31.90	31.97	32.04
8.000	32.11	32.18	32.25	32.33	32.41
8.250	32.49	32.58	32.68	32.78	32.88
8.500	32.98	33.09	33.21	33.32	33.44
8.750	33.57	33.70	33.83	33.97	34.12
9.000	34.27	34.42	34.57	34.72	34.87
9.250	35.02	35.16	35.30	35.43	35.56
9.500	35.69	35.82	35.95	36.09	36.23

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
9.750	36.38	36.54	36.71	36.88	37.06
10.000	37.24	37.43	37.63	37.84	38.05
10.250	38.28	38.51	38.75	39.00	39.26
10.500	39.52	39.80	40.08	40.37	40.68
10.750	41.01	41.34	41.70	42.06	42.44
11.000	42.83	43.23	43.66	44.12	44.62
11.250	45.17	45.76	46.39	47.05	47.75
11.500	48.48	49.47	51.10	53.69	57.65
11.750	63.15	68.83	73.98	81.08	89.21
12.000	96.42	101.68	103.13	103.29	103.06
12.250	102.69	102.26	101.51	100.52	99.50
12.500	98.43	97.33	96.22	95.12	94.03
12.750	92.97	91.94	90.93	89.95	88.99
13.000	88.06	87.15	86.26	85.39	84.55
13.250	83.74	82.95	82.19	81.44	80.72
13.500	80.02	79.34	78.67	78.03	77.40
13.750	76.80	76.21	75.64	75.08	74.54
14.000	74.02	73.50	73.01	72.53	72.06
14.250	71.61	71.18	70.76	70.36	69.96
14.500	69.59	69.22	68.87	68.52	68.19
14.750	67.87	67.56	67.25	66.96	66.32
15.000	65.84	65.38	64.96	64.56	64.18
15.250	63.83	63.49	63.18	62.88	62.59
15.500	62.32	62.07	61.82	61.59	61.37
15.750	61.16	60.95	60.75	60.56	60.38
16.000	60.20	60.03	59.87	59.71	59.56
16.250	59.41	59.27	59.14	59.01	58.89
16.500	58.77	58.65	58.54	58.43	58.33
16.750	58.23	58.13	58.03	57.94	57.85
17.000	57.76	57.67	57.59	57.50	57.42
17.250	57.34	57.26	57.18	57.10	57.02
17.500	56.94	56.87	56.79	56.72	56.64
17.750	56.57	56.50	56.43	56.35	56.28
18.000	56.21	56.14	56.07	56.00	55.93
18.250	55.86	55.79	55.72	55.65	55.58
18.500	55.52	55.45	55.38	55.31	55.24
18.750	55.18	55.11	55.04	54.97	54.90
19.000	54.84	54.77	54.70	54.63	54.57
19.250	54.50	54.43	54.37	54.30	54.23
19.500	54.16	54.10	54.03	53.96	53.90
19.750	53.83	53.76	53.69	53.63	53.56
20.000	53.49	53.43	53.36	53.30	53.23
20.250	53.17	53.11	53.05	52.99	52.93

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
20.500	52.87	52.81	52.76	52.70	52.65
20.750	52.60	52.54	52.49	52.44	52.39
21.000	52.34	52.29	52.24	52.19	52.14
21.250	52.09	52.04	52.00	51.95	51.90
21.500	51.86	51.81	51.76	51.72	51.67
21.750	51.63	51.58	51.54	51.50	51.45
22.000	51.41	51.36	51.32	51.28	51.24
22.250	51.19	51.15	51.11	51.07	51.03
22.500	50.99	50.94	50.90	50.86	50.82
22.750	50.78	50.74	50.70	50.66	50.62
23.000	50.58	50.55	50.51	50.47	50.43
23.250	50.39	50.35	50.31	50.28	50.24
23.500	50.20	50.16	50.13	50.09	50.05
23.750	50.02	49.98	49.94	49.91	49.87
24.000	49.84	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	273.13 ft³/s
Time to Peak	11.950 hours
Hydrograph Volume	93.828 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	20.00	20.56	21.53	21.93	22.09
0.250	22.19	22.28	22.35	22.42	22.49
0.500	22.57	22.64	22.70	22.78	22.86
0.750	22.93	22.99	23.06	23.14	23.21
1.000	23.27	23.34	23.42	23.49	23.55
1.250	23.62	23.70	23.77	23.83	23.90
1.500	23.98	24.05	24.11	24.18	24.26
1.750	24.32	24.38	24.45	24.53	24.60
2.000	24.66	24.73	24.80	24.87	24.93
2.250	25.00	25.07	25.14	25.20	25.27
2.500	25.34	25.41	25.47	25.53	25.61
2.750	25.67	25.73	25.80	25.87	25.94
3.000	26.00	26.06	26.14	26.20	26.26
3.250	26.33	26.40	26.46	26.52	26.59
3.500	26.66	26.72	26.78	26.84	26.92
3.750	26.98	27.04	27.10	27.17	27.24
4.000	27.29	27.36	27.43	27.50	27.57
4.250	27.65	27.72	27.79	27.86	27.94
4.500	28.01	28.08	28.15	28.23	28.30
4.750	28.37	28.44	28.51	28.59	28.66
5.000	28.73	28.80	28.88	28.95	29.02
5.250	29.09	29.16	29.23	29.31	29.38
5.500	29.45	29.52	29.59	29.66	29.73
5.750	29.80	29.88	29.95	30.02	30.09
6.000	30.16	30.23	30.30	30.37	30.44
6.250	30.51	30.59	30.65	30.73	30.80
6.500	30.87	30.94	31.01	31.08	31.15
6.750	31.22	31.29	31.36	31.43	31.50
7.000	31.57	31.64	31.71	31.78	31.85
7.250	31.92	31.99	32.06	32.13	32.20
7.500	32.27	32.34	32.41	32.48	32.55
7.750	32.61	32.69	32.75	32.82	32.89
8.000	32.96	33.05	33.16	33.28	33.43
8.250	33.56	33.71	33.85	34.01	34.14
8.500	34.30	34.44	34.59	34.74	34.94
8.750	35.13	35.33	35.52	35.72	35.91
9.000	36.11	36.27	36.43	36.55	36.66
9.250	36.76	36.87	36.97	37.06	37.16
9.500	37.26	37.40	37.57	37.78	38.03

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
9.750	38.26	38.53	38.77	39.03	39.27
10.000	39.54	39.80	40.11	40.41	40.76
10.250	41.07	41.43	41.75	42.11	42.43
10.500	42.80	43.16	43.60	44.04	44.57
10.750	45.04	45.58	46.06	46.61	47.09
11.000	47.64	48.28	49.10	49.97	51.07
11.250	52.06	53.22	54.24	55.41	56.44
11.500	57.71	64.37	75.93	92.29	115.81
11.750	139.21	168.86	210.74	270.33	273.13
12.000	243.87	195.84	124.46	97.20	87.69
12.250	83.89	81.20	79.40	77.32	75.54
12.500	73.38	71.99	70.60	69.91	69.37
12.750	68.98	68.52	68.14	67.68	67.29
13.000	66.82	66.47	66.09	65.84	65.58
13.250	65.36	65.10	64.88	64.61	64.39
13.500	64.11	63.90	63.66	63.47	63.27
13.750	63.09	62.88	62.70	62.49	62.31
14.000	62.09	61.94	61.78	61.67	61.57
14.250	61.48	61.40	61.32	61.21	61.13
14.500	61.05	60.96	60.86	60.77	60.68
14.750	60.59	60.49	60.40	60.31	60.22
15.000	60.11	60.02	59.92	59.83	59.72
15.250	59.62	59.53	59.43	59.32	59.22
15.500	59.12	59.03	58.91	58.81	58.71
15.750	58.61	58.49	58.39	58.29	58.19
16.000	58.06	57.97	57.89	57.81	57.74
16.250	57.67	57.61	57.54	57.47	57.41
16.500	57.34	57.28	57.21	57.14	57.08
16.750	57.01	56.94	56.88	56.81	56.75
17.000	56.67	56.61	56.55	56.48	56.41
17.250	56.34	56.28	56.21	56.14	56.08
17.500	56.01	55.95	55.88	55.81	55.75
17.750	55.68	55.61	55.55	55.48	55.42
18.000	55.34	55.28	55.21	55.15	55.08
18.250	55.01	54.95	54.88	54.81	54.75
18.500	54.68	54.62	54.54	54.48	54.41
18.750	54.35	54.28	54.21	54.15	54.08
19.000	54.01	53.94	53.88	53.81	53.74
19.250	53.68	53.61	53.55	53.47	53.41
19.500	53.35	53.28	53.21	53.14	53.08
19.750	53.01	52.94	52.88	52.81	52.75
20.000	52.67	52.61	52.56	52.51	52.45
20.250	52.41	52.36	52.31	52.26	52.22

Subsection: Hydrograph
Label: Wastewater Pond (WWP) (IN)

Return Event: 1,000 years
Storm Event: 1000 Year

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
20.500	52.18	52.13	52.08	52.03	51.99
20.750	51.95	51.90	51.85	51.81	51.77
21.000	51.72	51.68	51.64	51.59	51.54
21.250	51.50	51.46	51.42	51.37	51.33
21.500	51.29	51.25	51.20	51.16	51.13
21.750	51.08	51.04	51.00	50.96	50.92
22.000	50.88	50.84	50.80	50.76	50.72
22.250	50.68	50.64	50.60	50.56	50.52
22.500	50.49	50.45	50.40	50.37	50.33
22.750	50.29	50.25	50.22	50.18	50.14
23.000	50.10	50.07	50.03	50.00	49.96
23.250	49.92	49.89	49.85	49.81	49.78
23.500	49.75	49.71	49.67	49.64	49.60
23.750	49.57	49.53	49.50	49.47	49.44
24.000	49.41	(N/A)	(N/A)	(N/A)	(N/A)

Peak Discharge	103.29 ft³/s
Time to Peak	12.150 hours
Hydrograph Volume	91.313 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	1.60	3.12	4.59	5.96
0.250	7.23	8.41	9.51	10.52	11.46
0.500	12.33	13.14	13.89	14.58	15.23
0.750	15.83	16.39	16.92	17.40	17.86
1.000	18.28	18.67	19.05	19.39	19.72
1.250	20.02	20.31	20.58	20.83	21.07
1.500	21.30	21.51	21.71	21.90	22.08
1.750	22.26	22.42	22.58	22.73	22.87
2.000	23.01	23.14	23.27	23.40	23.51
2.250	23.63	23.74	23.85	23.95	24.05
2.500	24.15	24.25	24.34	24.43	24.52
2.750	24.61	24.69	24.78	24.86	24.94
3.000	25.02	25.10	25.18	25.26	25.34
3.250	25.41	25.49	25.56	25.63	25.71
3.500	25.78	25.85	25.92	25.99	26.06
3.750	26.13	26.20	26.27	26.34	26.40
4.000	26.47	26.54	26.61	26.67	26.74
4.250	26.81	26.88	26.95	27.02	27.09
4.500	27.16	27.23	27.30	27.37	27.44
4.750	27.51	27.58	27.65	27.72	27.79
5.000	27.86	27.93	28.00	28.08	28.15
5.250	28.22	28.29	28.36	28.43	28.50
5.500	28.58	28.65	28.72	28.79	28.86
5.750	28.93	29.00	29.08	29.15	29.22
6.000	29.29	29.36	29.43	29.50	29.57
6.250	29.65	29.72	29.79	29.86	29.93
6.500	30.00	30.07	30.14	30.21	30.28
6.750	30.35	30.43	30.50	30.57	30.64
7.000	30.71	30.78	30.85	30.92	30.99
7.250	31.06	31.13	31.20	31.27	31.34
7.500	31.41	31.48	31.55	31.62	31.69
7.750	31.76	31.83	31.90	31.97	32.04
8.000	32.11	32.18	32.25	32.33	32.41
8.250	32.49	32.58	32.68	32.78	32.88
8.500	32.98	33.09	33.21	33.32	33.44
8.750	33.57	33.70	33.83	33.97	34.12
9.000	34.27	34.42	34.57	34.72	34.87
9.250	35.02	35.16	35.30	35.43	35.56
9.500	35.69	35.82	35.95	36.09	36.23

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
9.750	36.38	36.54	36.71	36.88	37.06
10.000	37.24	37.43	37.63	37.84	38.05
10.250	38.28	38.51	38.75	39.00	39.26
10.500	39.52	39.80	40.08	40.37	40.68
10.750	41.01	41.34	41.70	42.06	42.44
11.000	42.83	43.23	43.66	44.12	44.62
11.250	45.17	45.76	46.39	47.05	47.75
11.500	48.48	49.47	51.10	53.69	57.65
11.750	63.15	68.83	73.98	81.08	89.21
12.000	96.42	101.68	103.13	103.29	103.06
12.250	102.69	102.26	101.51	100.52	99.50
12.500	98.43	97.33	96.22	95.12	94.03
12.750	92.97	91.94	90.93	89.95	88.99
13.000	88.06	87.15	86.26	85.39	84.55
13.250	83.74	82.95	82.19	81.44	80.72
13.500	80.02	79.34	78.67	78.03	77.40
13.750	76.80	76.21	75.64	75.08	74.54
14.000	74.02	73.50	73.01	72.53	72.06
14.250	71.61	71.18	70.76	70.36	69.96
14.500	69.59	69.22	68.87	68.52	68.19
14.750	67.87	67.56	67.25	66.96	66.32
15.000	65.84	65.38	64.96	64.56	64.18
15.250	63.83	63.49	63.18	62.88	62.59
15.500	62.32	62.07	61.82	61.59	61.37
15.750	61.16	60.95	60.75	60.56	60.38
16.000	60.20	60.03	59.87	59.71	59.56
16.250	59.41	59.27	59.14	59.01	58.89
16.500	58.77	58.65	58.54	58.43	58.33
16.750	58.23	58.13	58.03	57.94	57.85
17.000	57.76	57.67	57.59	57.50	57.42
17.250	57.34	57.26	57.18	57.10	57.02
17.500	56.94	56.87	56.79	56.72	56.64
17.750	56.57	56.50	56.43	56.35	56.28
18.000	56.21	56.14	56.07	56.00	55.93
18.250	55.86	55.79	55.72	55.65	55.58
18.500	55.52	55.45	55.38	55.31	55.24
18.750	55.18	55.11	55.04	54.97	54.90
19.000	54.84	54.77	54.70	54.63	54.57
19.250	54.50	54.43	54.37	54.30	54.23
19.500	54.16	54.10	54.03	53.96	53.90
19.750	53.83	53.76	53.69	53.63	53.56
20.000	53.49	53.43	53.36	53.30	53.23
20.250	53.17	53.11	53.05	52.99	52.93

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
20.500	52.87	52.81	52.76	52.70	52.65
20.750	52.60	52.54	52.49	52.44	52.39
21.000	52.34	52.29	52.24	52.19	52.14
21.250	52.09	52.04	52.00	51.95	51.90
21.500	51.86	51.81	51.76	51.72	51.67
21.750	51.63	51.58	51.54	51.50	51.45
22.000	51.41	51.36	51.32	51.28	51.24
22.250	51.19	51.15	51.11	51.07	51.03
22.500	50.99	50.94	50.90	50.86	50.82
22.750	50.78	50.74	50.70	50.66	50.62
23.000	50.58	50.55	50.51	50.47	50.43
23.250	50.39	50.35	50.31	50.28	50.24
23.500	50.20	50.16	50.13	50.09	50.05
23.750	50.02	49.98	49.94	49.91	49.87
24.000	49.84	(N/A)	(N/A)	(N/A)	(N/A)

Subsection: Elevation-Area Volume Curve
Label: Bottom Ash Pond (BAP)

Return Event: 1,000 years
Storm Event: 1000 Year

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
394.00	0.0	27.747	0.000	0.000	0.000
395.00	0.0	27.980	83.590	27.863	27.863
396.00	0.0	28.213	84.288	28.096	55.959
397.00	0.0	28.447	84.989	28.330	84.289
398.00	0.0	28.681	85.691	28.564	112.853
399.00	0.0	28.916	86.395	28.798	141.651

Subsection: Elevation-Area Volume Curve
Label: Clearwater Pond (CWP)

Return Event: 1,000 years
Storm Event: 1000 Year

Elevation (ft)	Planimeter (ft^2)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
381.00	0.0	2.676	0.000	0.000	0.000
382.00	0.0	2.739	8.123	2.708	2.708
383.00	0.0	2.802	8.311	2.770	5.478
384.00	0.0	2.865	8.500	2.833	8.311
385.00	0.0	2.929	8.691	2.897	11.208
386.00	0.0	2.994	8.884	2.961	14.170
387.00	0.0	3.059	9.079	3.026	17.196
388.00	0.0	3.125	9.276	3.092	20.288
389.00	0.0	3.191	9.474	3.158	23.446
390.00	0.0	3.258	9.674	3.225	26.670
391.00	0.0	3.326	9.875	3.292	29.962
392.00	0.0	3.394	10.079	3.360	33.322

Subsection: Elevation-Area Volume Curve
Label: Wastewater Pond (WWP)

Return Event: 1,000 years
Storm Event: 1000 Year

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr(A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
388.00	0.0	16.003	0.000	0.000	0.000
389.00	0.0	16.159	48.241	16.080	16.080
390.00	0.0	16.315	48.710	16.237	32.317
391.00	0.0	16.472	49.181	16.394	48.711
392.00	0.0	16.630	49.653	16.551	65.262

Requested Pond Water Surface Elevations	
Minimum (Headwater)	394.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	399.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	BAP Riser	Forward	BAP Culvert	394.00	399.00
Culvert-Circular	BAP Culvert	Forward	TW	385.90	399.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: BAP Riser Structure Type: Inlet Box	
Number of Openings	1
Elevation	394.00 ft
Orifice Area	28.3 ft²
Orifice Coefficient	0.600
Weir Length	9.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: BAP Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	48.0 in
Length	85.00 ft
Length (Computed Barrel)	85.00 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.900
Kb	0.005
Kr	0.900
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0340
M	1.5000
C	0.0553
Y	0.5400
T1 ratio (HW/D)	0.000
T2 ratio (HW/D)	1.422
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	385.90 ft	T1 Flow	87.96 ft³/s
T2 Elevation	391.59 ft	T2 Flow	100.53 ft³/s

Requested Pond Water Surface Elevations	
Minimum (Headwater)	381.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	392.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Inlet Box	CWP Riser	Forward	CWP Culvert	387.25	392.00
Rectangular Weir	CWP Weir	Forward	CWP Culvert	381.50	392.00
Culvert-Circular	CWP Culvert	Forward	TW	376.00	392.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: CWP Riser
Structure Type: Inlet Box

Number of Openings	1
Elevation	387.25 ft
Orifice Area	28.3 ft²
Orifice Coefficient	0.600
Weir Length	16.00 ft
Weir Coefficient	3.00 (ft^0.5)/s
K Reverse	1.000
Manning's n	0.000
Kev, Charged Riser	0.000
Weir Submergence	False
Orifice H to crest	False

Structure ID: CWP Culvert Structure Type: Culvert-Circular	
Number of Barrels	1
Diameter	66.0 in
Length	80.00 ft
Length (Computed Barrel)	80.00 ft
Slope (Computed)	0.005 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.900
Kb	0.003
Kr	0.900
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 1
K	0.0340
M	1.5000
C	0.0553
Y	0.5400
T1 ratio (HW/D)	1.260
T2 ratio (HW/D)	1.422
Slope Correction Factor	-0.500

Use unsubmerged inlet control 0 equation below T1 elevation.
Use submerged inlet control 0 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	382.93 ft	T1 Flow	195.01 ft³/s
T2 Elevation	383.82 ft	T2 Flow	222.87 ft³/s

Structure ID: CWP Weir Structure Type: Rectangular Weir	
Number of Openings	1
Elevation	381.50 ft
Weir Length	180.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW Structure Type: TW Setup, DS Channel	
Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft^3/s
Flow Tolerance (Maximum)	10.000 ft^3/s

Requested Pond Water Surface Elevations	
Minimum (Headwater)	388.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	392.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Rectangular Weir	WWP Weir	Forward + Reverse	WWP Culvert	389.00	392.00
Culvert-Box	WWP Culvert	Forward	TW	383.50	392.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: WWP Culvert Structure Type: Culvert-Box	
Number of Barrels	1
Width	3.00 ft
Height	4.00 ft
Length	50.00 ft
Length (Computed Barrel)	50.00 ft
Slope (Computed)	0.000 ft/ft

Outlet Control Data	
Manning's n	0.013
Ke	0.000
Kb	0.006
Kr	0.000
Convergence Tolerance	0.00 ft

Inlet Control Data	
Equation Form	Form 2
K	0.5000
M	0.6670
C	0.0446
Y	0.6500
T1 ratio (HW/D)	1.153
T2 ratio (HW/D)	1.364
Slope Correction Factor	-0.500

Use unsubmerged inlet control 1 equation below T1 elevation.
Use submerged inlet control 1 equation above T2 elevation

In transition zone between unsubmerged and submerged inlet control,
interpolate between flows at T1 & T2...

T1 Elevation	388.11 ft	T1 Flow	84.00 ft³/s
T2 Elevation	388.95 ft	T2 Flow	96.00 ft³/s

Structure ID: WWP Weir
Structure Type: Rectangular Weir

Number of Openings	1
Elevation	389.00 ft
Weir Length	250.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Peak Discharge	123.59 ft³/s
Time to Peak	12.100 hours
Hydrograph Volume	94.142 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
0.000	0.00	0.25	0.94	1.90	3.02
0.250	4.20	5.39	6.57	7.71	8.81
0.500	9.85	10.83	11.75	12.61	13.42
0.750	14.17	14.88	15.53	16.15	16.72
1.000	17.25	17.75	18.21	18.64	19.05
1.250	19.43	19.78	20.12	20.43	20.72
1.500	21.00	21.26	21.50	21.73	21.95
1.750	22.16	22.36	22.54	22.72	22.89
2.000	23.05	23.21	23.35	23.50	23.63
2.250	23.76	23.89	24.01	24.13	24.24
2.500	24.35	24.46	24.56	24.66	24.76
2.750	24.86	24.95	25.05	25.14	25.23
3.000	25.31	25.40	25.48	25.57	25.65
3.250	25.73	25.81	25.89	25.96	26.04
3.500	26.12	26.19	26.27	26.34	26.42
3.750	26.49	26.56	26.63	26.70	26.78
4.000	26.85	26.92	26.99	27.06	27.13
4.250	27.20	27.27	27.34	27.42	27.49
4.500	27.56	27.63	27.71	27.78	27.86
4.750	27.93	28.00	28.08	28.15	28.23
5.000	28.30	28.38	28.45	28.53	28.60
5.250	28.68	28.76	28.83	28.91	28.98
5.500	29.06	29.13	29.21	29.28	29.36
5.750	29.43	29.51	29.59	29.66	29.74
6.000	29.81	29.89	29.96	30.04	30.11
6.250	30.19	30.27	30.34	30.42	30.49
6.500	30.57	30.64	30.72	30.79	30.87
6.750	30.94	31.02	31.09	31.17	31.24
7.000	31.32	31.39	31.47	31.54	31.62
7.250	31.69	31.76	31.84	31.91	31.99
7.500	32.06	32.14	32.21	32.29	32.36
7.750	32.43	32.51	32.58	32.66	32.73
8.000	32.80	32.88	32.96	33.04	33.12
8.250	33.21	33.31	33.41	33.51	33.62
8.500	33.74	33.86	33.98	34.10	34.23
8.750	34.37	34.50	34.65	34.80	34.95
9.000	35.10	35.26	35.43	35.59	35.75
9.250	35.90	36.05	36.20	36.35	36.49
9.500	36.63	36.76	36.90	37.05	37.20

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
9.750	37.35	37.52	37.70	37.88	38.07
10.000	38.27	38.47	38.69	38.91	39.15
10.250	39.39	39.64	39.91	40.18	40.47
10.500	40.76	41.06	41.37	41.69	42.03
10.750	42.39	42.77	43.16	43.56	43.98
11.000	44.42	44.87	45.35	45.86	46.42
11.250	47.02	47.68	48.38	49.12	49.90
11.500	50.72	51.80	53.53	56.26	60.41
11.750	66.23	73.64	82.73	94.15	106.36
12.000	116.21	122.31	123.59	121.44	118.68
12.250	116.19	114.09	112.26	110.58	108.96
12.500	107.37	105.80	104.27	102.79	101.37
12.750	100.02	98.73	97.49	96.29	95.12
13.000	93.99	92.89	91.82	90.78	89.78
13.250	88.82	87.88	86.98	86.10	85.25
13.500	84.42	83.62	82.83	82.08	81.34
13.750	80.63	79.94	79.27	78.62	77.99
14.000	77.37	76.77	76.19	75.63	75.09
14.250	74.57	74.07	73.59	73.12	72.67
14.500	72.24	71.82	71.41	71.01	70.63
14.750	70.26	69.90	69.56	69.22	68.84
15.000	68.40	67.95	67.50	67.05	66.62
15.250	66.20	65.80	65.42	65.06	64.71
15.500	64.38	64.06	63.76	63.48	63.21
15.750	62.94	62.69	62.45	62.22	62.00
16.000	61.79	61.58	61.38	61.19	61.01
16.250	60.84	60.67	60.51	60.36	60.22
16.500	60.08	59.94	59.81	59.69	59.56
16.750	59.45	59.33	59.22	59.12	59.01
17.000	58.91	58.81	58.71	58.62	58.52
17.250	58.43	58.34	58.25	58.17	58.08
17.500	58.00	57.91	57.83	57.75	57.67
17.750	57.58	57.50	57.43	57.35	57.27
18.000	57.19	57.11	57.04	56.96	56.88
18.250	56.81	56.73	56.66	56.58	56.51
18.500	56.43	56.36	56.29	56.21	56.14
18.750	56.07	55.99	55.92	55.85	55.77
19.000	55.70	55.63	55.55	55.48	55.41
19.250	55.34	55.26	55.19	55.12	55.05
19.500	54.97	54.90	54.83	54.76	54.68
19.750	54.61	54.54	54.47	54.39	54.32
20.000	54.25	54.18	54.11	54.04	53.97
20.250	53.90	53.83	53.77	53.70	53.64

HYDROGRAPH ORDINATES (ft^3/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)	Flow (ft^3/s)
20.500	53.58	53.52	53.46	53.40	53.34
20.750	53.28	53.23	53.17	53.12	53.06
21.000	53.01	52.96	52.91	52.85	52.80
21.250	52.75	52.70	52.65	52.60	52.55
21.500	52.51	52.46	52.41	52.36	52.31
21.750	52.27	52.22	52.18	52.13	52.08
22.000	52.04	51.99	51.95	51.90	51.86
22.250	51.82	51.77	51.73	51.69	51.64
22.500	51.60	51.56	51.51	51.47	51.43
22.750	51.39	51.35	51.30	51.26	51.22
23.000	51.18	51.14	51.10	51.06	51.02
23.250	50.98	50.94	50.90	50.86	50.82
23.500	50.78	50.74	50.71	50.67	50.63
23.750	50.59	50.55	50.51	50.48	50.44
24.000	50.40	(N/A)	(N/A)	(N/A)	(N/A)

Index