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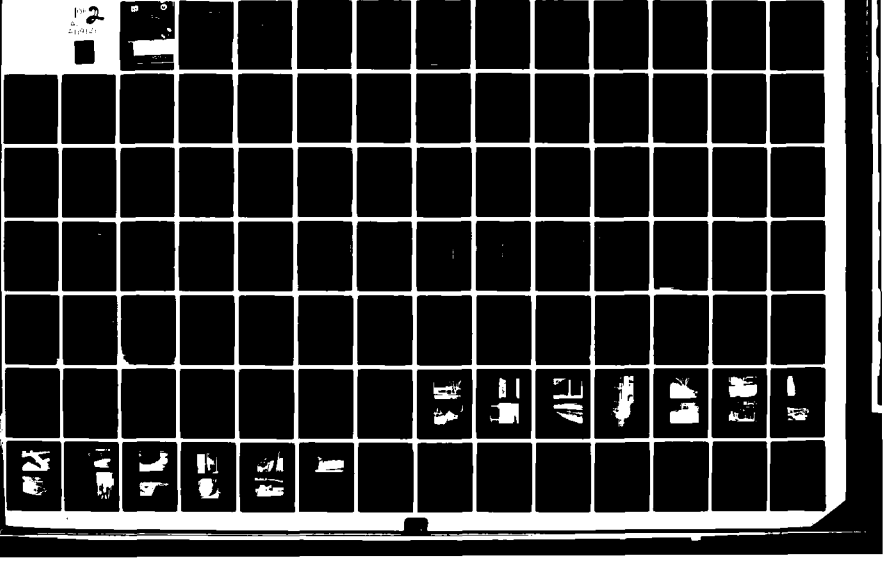

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CONDITION SURVEY OF DEPERE LOCK AND DAM LOWER FOX RIVER, WISCONSIN

by

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June 1982

Final Report

Prepared for U. S. Army Engineer [illegible]
Chicago, Ill.

[redacted]

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

A condition survey was performed at DePere Lock and Dam on the Lower Fox River, Wisconsin. The field investigation included drilling for core samples of concrete, foundation rock, and backfill. Selected specimens of these materials were tested in the laboratory for certain physical and mechanical properties. Results of the field investigation and laboratory tests indicated that the concrete in the lock and dam is locally cracked and lightly deteriorated but structurally sound.

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20. ABSTRACT (Continued)

Cycles of freezing and thawing have caused the concrete deterioration. The lock and dam is founded on competent bedrock. No soft or otherwise weak zones were detected in the bedrock. Soundings should be made to detect any scouring behind the dam. It is suggested that the reinforcing steel in the tainter gate piers, adjacent to the hinge pins, be examined for corrosion.

PREFACE

The investigation described herein was performed for the U. S. Army Engineer District, Chicago, by the U. S. Army Engineer Waterways Experiment Station (WES). The work was authorized by DA Form 2544, No. NCC-IA-80-58, dated 19 March 1980.

The testing program was accomplished under the direction of Mr. Bryant Mather, Chief of the Structures Laboratory (SL), WES, and Mr. John M. Scanlon, Jr., Chief of the Concrete Technology Division (CTD), SL. The core drilling was conducted by the Geotechnical Laboratory (GL), WES, under the direction of Mr. Mark A. Vispi. Laboratory work in the CTD was done with the assistance of Mr. F. S. Stewart and Mrs. Joyce C. Ahlvin. Mr. R. L. Stowe was Project Leader for the investigation. Mr. Stowe and Mrs. Ahlvin prepared the report.

Funds for publication of the report were provided from those made available for operation of the Concrete Technology Information Analysis Center (CTIAC). This is CTIAC Report No. 51.

Commanders and Directors of WES during the conduct of the investigation and the publication of this report were COL N. P. Conover, CE, and COL T. C. Creel, CE. Technical Director was Mr. F. R. Brown.

CONTENTS

CONVERSION FACTORS, INCH-POUND TO METRIC (SI) UNITS OF MEASUREMENT

Inch-pound units of measurement used in this report can be converted to metric (SI) units as follows:

Multiply	By	To Obtain
feet	0.3048	metres
feet per second	0.3048	metres per second
inches	0.0254	metres
miles (U. S. statute)	1.609347	kilometres
pounds (force) per square inch	0.006894757	megapascals
pounds (mass) per cubic foot	16.01846	kilograms per cubic metre
tons (force) per square foot	0.09576052	megapascals

CONDITION SURVEY OF DEPERE LOCK AND DAM
LOWER FOX RIVER, WISCONSIN

PART I: INTRODUCTION

Project Description

1. The following general description of the DePere Lock and Dam is taken from Reference 1.

> "The headwaters of the Fox River rise in Columbia County, Wisconsin, and flow in a Northeasterly direction for about 176 miles into Green Bay. The section of the river from Lake Winnebago to Green Bay is generally referred to as the Lower Fox River and is 39 miles long. It has a change in gradient of about 168 feet; channel widths are generally 500 to 1000 feet and minimum channel depths are 9.6 feet below Depere Lock and 6 feet below Menasha Lock. Upper pool El. 586.7 and lower pool El. 576.8 are referred to mean water level at Fathers Point, Quebec I.G.L.D. (1955) (International Great Lakes Datum)."*

The DePere lock is constructed of concrete and was founded directly on dolomite. The lock has a usable lock chamber of 36 by 146 ft;** the lift is 9.9 ft at normal river stage.

3. The DePere dam is of concrete gravity wall design and is keyed into the foundation. The dam consists of a 296.5-ft-long spillway on the right side of the dam and 335-ft-long spillway on the left side of the dam. The mid-portion of the dam is a 355-ft-long sluiceway containing 14 tainter gates. Connected to the left abutment of the U. S. dam is a privately owned overflow spillway about 350 ft long. It is owned and maintained by the Nicolet Paper Corporation. The crest elevation of the spillway section is 587.66 above I.G.L.D. Flashboard construction, approved in 1896, raises the effective crest elevation of the dam from

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* All elevations (el) cited herein are in feet referred to I.G.L.D. 1955 (International Great Lakes Datum).

** A table of factors for converting inch-pound units of measurement to metric (SI) units is presented on page 3.

586.66 to 587.66 above I.G.L.D. For prior datum planes (Mean Tide New York Datum, 1935), add 1.7 ft to the elevations shown. Typical lock and dam sections are given in Plate 1, which is duplicated from Reference 1.

Location of Study Area

3. DePere Lock and Dam is located adjacent to the town of DePere, Wisconsin, approximately 7.2 miles from the mouth of the Fox River at Green Bay. A general plan view of the lock and dam is presented in Plate 1.

Background

4. In March of 1980 the Waterways Experiment Station (WES) was requested by the U. S. Army Engineer District, Chicago (NCC, North Central Division, Chicago), to review a number of documents, References 1, 2, and 3, and submit a proposal for a condition survey of DePere Lock and Dam. Reference 3 cites a preliminary exploration and testing program which was used as guidance in developing the WES proposal. This is the same exploration and testing program that was used to develop a proposal for the Condition Survey work at Cedars Lock and Dam. The amount of exploration and testing that could be accomplished was governed by available funding.

5. After the proposed work was funded and prior to initiation of the work, District technical staff increased the number of borings. The added borings were drilled and some of the funding allocated for laboratory testing and reporting was diverted to cover the increased drilling cost. The reasons for increasing the number of borings was twofold; first, additional foundation information would be obtained for developing geologic profiles. Secondly, by drilling additional borings with the on-site marine floating plant, crane, etc., cost of mobilization and demobilization would not be incurred for a second drilling effort. Some of the bedrock core from these added borings is preserved at the WES in case further testing is required.

6. Work on this project was initiated by the Chicago District prior to the 1980 realignment of North Central Division. Work continued under the direction of the Chicago District although the Detroit District is now responsible for the geographical area that includes the Lower Fox River.

Objective

7. The objectives of this study were to evaluate subsurface conditions, to assess the in-place concrete conditions, to ascertain selected physical properties of concrete and rock, and to evaluate this information in order that design parameters be presented as guidance for a structural stability analysis. In addition, selected physical properties of backfill materials were to be determined. The Detroit District is scheduled to perform the stability analysis.

Scope

8. The report discusses the drilling effort involved in obtaining samples of soil, concrete, and rock. The physical condition of the in-place exposed concrete is described using a limited amount of information. Selected physical properties of the core samples were determined using standard Corps of Engineers test methods. A limited number of borings were drilled behind the sluiceway dam section for purposes of detecting possible covered scouring. A study was made to consolidate and evaluate engineering information, geologic and boring data, and laboratory test data as they relate to the foundation condition. Available construction and engineering data records were reviewed.

PART II: PRELIMINARY STUDY

Review of Records and Drawings

9. The author made a visit to the Kaukauna Project Office to review available engineering and construction drawings in the hope of finding foundation information. Very little information was available. Construction drawings, records, and photographs do not provide much information about the foundation condition. The drawings indicated that the lock and dam was founded on "nearly horizontal limestone rock." The construction photographs verify that nearly horizontal bedrock exists at the site.

10. Right-of-way fly-over photographs of the Lower Fox River were studied for indications of geologic structures such as joint systems and faults. The photographs were helpful in showing the plate-like bedding near the lock and dam. No indications of faulting were detected in the photographs or on topographic maps of the area. NW-NE jointing is visible in the air photographs. To the Kaukauna Project Engineer's knowledge, scour profiles had not been taken at DePere Lock and Dam; in addition, scour holes behind the dam had not been detected nor filled.

Inspection of Lock and Dam

11. The author and Mr. Steve Running of the Kaukauna Project Office made an inspection of the DePere Lock and Dam site. The main purpose of the inspection was to determine if macroscopic misalignment, settlement, expansion, or contraction of the concrete structures could be detected. Some settlement of masonry bank protection is evident. The settlement occurs upstream of the lock, but in no way affects the operation of the lock. The lock backfill was observed for settlement. The surface condition of the concrete was observed and boring locations assigned. Appendix A presents photographs showing typical conditions of some of the exposed parts of the dam.

Lock chamber walls

12. No misalignment, settlement, or contraction of the concrete walls was detected. Spalling of the concrete has occurred near the top of several construction joints on both walls; see photo No. 3, Appendix A, for the worst example. This spalling is not viewed as a problem and could be repaired during routine maintenance. Three vertical cracks in the left wall and one in the right wall extend from the top of the wall to low pool elevation. The cracks probably extend to the base of the wall. The cracks are generally tight, but where open are open from 1/8 in. to 1/4 in. They appear to pose no problems in terms of the stability of the walls. The tops of the lock walls and the vertical surfaces of the chamber walls are in good condition. (See Photos 1 through 7 in Appendix A.)

Lock embankment

13. The grassed embankment adjacent to both lock walls appears in good condition with local areas showing a little differential settlement in the order of 5 to 9 in. The side slopes are about 1 vertical to 2 horizontal. There is no evidence of seepage. (See Photos 8 and 9 (Appendix A).)

Dam, right abutment pier

14. There is no detectable misalignment, settlement, or contraction in the dam structures. Slight expansion of local areas exists in the concrete where freezing and thawing action has occurred. The upper section of the downstream portion of the abutment pier is in good condition. The lower section contains horizontal and vertical cracks outlined with exudation. Some frost damage is evident. As seen in Photo 11, Appendix A, ground water is seeping along horizontal construction joints resulting in dark stains being deposited on the exposed surface. Spalling of the concrete can be expected with time due to freezing and thawing action along the existing cracks. Until sufficient spalling occurs, repair of the concrete is considered unnecessary.

15. The upstream portion of the abutment pier is in good condition except for an approximate 10-ft-long by 2-ft-deep wedge of concrete at the top of the pier. (See Photos 10 and 12, Appendix A.) A wide

crack (>2 mm, 0.08 in.) can be seen on the top and dam side of the pier. Photo 12 (Appendix A) shows relative movement along the crack. There is no concern about the stability of the pier due to this crack. However, the crack should be measured periodically; if large movement occurs, remedial measures can be taken.

Dam, right spillway

16. The concrete in the foot bridge piers is in generally good condition. Local cracking and exudation is present on the downstream portions of the piers. Light erosion of the downstream face and corners of the piers at the waterline has occurred. The damaged concrete in the piers could be repaired during routine maintenance.

Dam, sluiceway

17. The condition of the concrete in the sluiceway piers is generally good (see Photos 15 through 18, Appendix A). Damage due to freezing and thawing is confined to local areas; the presence of cracks and exudation is evidence of the damage. Small areas of concrete in the piers at and near low pool elevation have been eroded by water and ice action. A few piers have cracks through the piers near the gate hinge pins. Cracks are similarly located in the piers of Cedars Dam on the Lower Fox River. The Chicago District conducted a stability analysis of the cracked concrete piers at Cedars Dam and determined that reinforcement within the piers was effective for gate loads; see Reference 1, Appendix B, page B-4. The analysis made for the piers at Cedars is applicable for the piers at DePere; they have the same dimensions and reinforcement.

18. It is suggested that a study be made to determine if the reinforcing steel in the sluiceway piers is rusted. Infiltrating water along the cracks could have caused reinforcement to rust. The concrete from around the downstream side of the gate hinge pin could be excavated to examine the reinforcing steel. The damaged concrete in the sluiceway piers appears to pose no problems at this time. Repair of damaged concrete could be handled during routine maintenance.

Dam, left spillway

19. The concrete in the foot bridge piers is in generally good condition. Local cracking and exudation is present. See Photos 19 through 21, Appendix A. Light erosion is present near the waterline of the piers; see Photo 22, Appendix A. Concrete repair on the noses of several piers is in good condition. Repair of the damaged concrete could be done during routine maintenance.

Dam, left abutment pier

20. The concrete in the middle and the upstream portions of the left abutment pier is in good condition; a few cracks, some exudation, and light erosion is present. The uppermost downstream portion of the pier (see Photo 23, Appendix A) is heavily deteriorated. This portion of the pier is partly submerged and has sustained more freezing and thawing damage than the remaining concrete in the pier because it is critically saturated. Erosion (by water and ice) has also caused some of the damage. Reinforcing steel is exposed at the downstream face of the pier but only at the waterline.

21. It would be wise to check the integrity of the internal concrete in this section of the pier. If the internal concrete is sound, then repair to the external concrete can be made during routine maintenance. Nondestructive tests, such as ultrasonic velocity measurements, could be made to check the soundness of the internal concrete; core borings could likewise be used.

PART III: FOUNDATION EXPLORATION

Previous Exploration

22. Presumably borings were taken prior to construction which begun in 1936. However, no information derived from such borings was available for review.

Current Drilling

23. Drilling equipment consisted of an Acker Toredo Mark II and a Sprage and Henwood skid-mounted rotary drill rig. A Diamond Core Drill Manufacturers Association standard 4-in. by 5-1/2-in. double tube swivel tube core barrel was used with diamond bits to obtain the concrete and bedrock core. Access to the drill holes was by a marine floating plant and for holes on top of structures by crane. Floating plant was supplied by the Kaukauna Project Office. Continuous samples were obtained in all borings. Appropriate size casing was set in the bedrock when necessary to keep a boring open. A Concord portable drill rig was used in drilling horizontal cores.

24. The boring location plan is presented in Plate 2. A summary of boring information is given in Table 1; presented is the type boring, the location by structure, the elevation of the top of boring, the elevation top of rock, the elevation bottom of rock, and the date when the boring was started. The number of borings and boring locations were determined through mutual agreement by the Chicago District and the WES technical staff. Specific boring locations at the lock and dam were assigned by the WES technical staff. The additional borings requested by the District (see explanation, paragraph 5) are presented in the following tabulation:

No. of Borings	Location	Direction
2	Dam at either end of spillway, 20 ft into rock	Vertical
1	Backfill through overburden only	Vertical
1	Lock wall, 20 ft into rock	Vertical
1	No. 7 sluiceway, pier, 3 ft	Horizontal
1	Lock wall, 3 ft	Horizontal
1	Right dam abutment, 3 ft	Horizontal

25. Two borings were put through the backfill and into bedrock; one boring was drilled on either side of the lock walls. Bedrock was sampled to a depth of 3.1 ft in the landside boring and to a depth of 30.7 ft in the riverside boring. A piezometer was installed in the riverside boring (D WES E-1-80).* It was set at el 569.8 (piezometer tip). Pertinent piezometer data were presented in Plate 3. Piezometer readings were not taken by the WES drill crew. The deeper borings into bedrock were carried from 21 to 25 ft deep. The shorter scour borings were taken about 5 ft into rock.

26. Boring D WES D1-80* was left open while the drill crew remained on site. Water level readings were taken by the lockmaster for a short period of time after the boring was completed. The water level readings are presented in Table 2; the record of water gages is presented in Table 3.

27. Total footage drilled was 27.9, 80.10, and 181.77 ft, respectively, for soil, concrete, and bedrock. All soil, concrete, and bedrock was preserved for possible laboratory testing, the exception being the highly fractured, broken samples. Procedures for preserving and handling the samples are presented in References 4 and 5. Field drilling logs are presented in Appendix B.

28. Core recovery was good in all borings indicating the general good condition of the materials drilled at the lock and dam sites; core recovery averaged 99.5 percent. Drilling water loss was small and restricted to several locations. In boring L1* at el 571.9 to 566, and at

* D, DePere; WES, Waterways Experiment Station; E, embankment; D, dam; L, lock; first number represents boring number; 80, year boring made.

el 562.2, water loss occurred. The zone from el 571.9 to 566.0 contained shale-filled bedding surfaces. Some surfaces were open (<2 mm, 0.08 in.) and stained black. The stained surfaces showed evidence of water solutioning. Slight water loss was detected in boring E1 at el 582.1.

Scour Detection

29. It was intended to drill three scour borings behind the sluiceway section of the dam. It was believed that this section of the dam would likely contain several scour areas if any exist. Water passing through the sluice gates could cause scouring of the bedrock downstream of the concrete apron. Two of these borings were completed; one through the concrete apron just upstream of the downstream vertical apron face and one downstream of gate 13. The drilling barge could not be positioned close up behind the right side of the sluiceway or the right spillway; therefore, the third scour boring was placed behind the left spillway. Low water and rocks prevented access close-in-behind the right side of the sluiceway and right spillway. The three borings behind the dam did not reveal any covered scour areas; no evidence of displaced or recently (postdam construction) disoriented rock blocks were detected.

30. Because of the limited number of borings drilled behind the dam and the fact that scour profiles have not been taken, scouring of the bedrock behind the dam could exist. It is suggested that scour profiles, by sounding, be made. Undercutting of the toe of the dam should likewise be studied.

PART IV: GEOLOGICAL CHARACTERISTICS

Geomorphology

31. DePere Lock and Dam is located in Brown County, Wisconsin, in the lowland between Green Bay and Lake Winnebago. This geographic province of Wisconsin is termed the Eastern Ridges and Lowlands and covers an area of 21,000 square miles, including the 7,500 square miles under Green Bay and Lake Michigan. It is bounded on the east by the lowland of Devonian shale now submerged beneath Lake Michigan and on the north by Green Bay. The western border is found along the contact of the Cambrian sandstone with the Lower Magnesian limestone from the Menominee River (Marinette County) to the Wisconsin River (Sauk and Columbia Counties). On the south the region is delineated by the terminal moraine at the edge of the most recent drift sheet and the Rock River below Jonesville.

32. Once much smaller than at present, the Lower Fox River valley was carved to its present size by the glacier. The immense ice sheet advanced southward cutting out the valley of Lake Michigan, while a tongue cut Green Bay Valley to its present dimensions. A medial moraine, the Kettle Range, was formed on the peninsula between Green Bay and Lake Michigan.

33. The retreat of the glacier, coupled with its cutting action, created a depression at Green Bay. The valley floor rises steeply with Lake Winnebago being 166.7 ft above Green Bay. This caused the Wolf and Upper Fox Rivers to change course and flow into the newly formed valley. Evidence of this can be seen in studies of the ancient shore of Lake Michigan by tracing red clay deposits. Lake Winnebago formed more recently by the deposition of glacial drift in the valley.

34. The western slope of the Upper Fox River valley is gentle, while the eastern slope is quite steep. Cliffs on the east are cut through the Cincinnati shales and Niagara dolomite and extend from Green Bay south past Lake Winnebago. The bedrock at the dam is the

Galena-Platteville dolomite of Ordovician age. The bedrock was assigned to the Galena-Platteville formation, based in part, on information from waterwell logs obtained from the University of Wisconsin Geological and Natural History Survey. All field boring logs identify bedrock as limestone; subsequent petrographic examination shows the bedrock to be dolomite.

Backfill

35. The backfill on either side of the lock is considered as construction fill. Profiles of borings E1 and E2 are presented in Plate 4. The backfill consists of a small smount of inorganic clays, gravelly clays, and sandy clays. Beneath the soils is a layer of dolomite cobbles and boulders mixed with clay. The dolomite bedrock underlays the fill. The rock symbols used in the profiles in Plate 4 are for limestone; the symbols should be for dolomite.

Bedrock Stratigraphy

36. The bedrock beneath DePere Lock and Dam is of the Galena-Platteville formation of the Champlainian series of the Ordovician system. This formation is between 50 and 150 ft thick in this area, as reported on waterwell logs obtained from the Wisconsin Geological and Natural History Survey.

37. The dolomite is gray to light gray, fine to medium grained, dense, moderately hard to hard, shaley, and fossiliferous in places. A few vugs are present. Bedding is massive. Thin shale beds, laminae, and stringers are part of the rock fabric. The shale is gray-green and quite hard. The shale features range in thickness from 0.01 ft to 0.08 ft and occur continuously to a maximum of 0.5-ft separation. The shale occurs along bedding surfaces.

38. There appear to be two types of bedding surfaces in the core; they are designated Types A and B. Type A is irregular with semirounded peaks and valleys. Peak to valley distances range from 1/4 to 3/8 in.;

periods are about 2 in. Type A surfaces are tightly interlocked and are the predominant type of bedding surface. Type B is almost planar, yet gently undulating with a few short asperities and steps; Type B bedding surfaces are interlocked. The thin hard shale is found on both types of surfaces. A few stylolites exist in the core. Core breaks occur along the shale features. No soft, weak seams of shale or clay were detected in the core samples.

39. The dolomite contained solution cavities (termed voids on the geologic cross sections) up to 1/2 in. in diameter. The cavities were generally filled with calcite crystals. One band of cavities occurred between el 565 and 570 and appeared to be continuous under the lock and the dam.

Geologic Cross Sections

40. Three geologic cross sections were drawn; sections A-A', B-B', and C-C' (see Plate 2 for cross section locations). Section A-A' (see Plate 5) was drawn perpendicular to the lock axis and includes borings E1, E2, and L1. Section B-B' (see Plates 6, 7, and 8) was drawn parallel to the dam axis, and section C-C' (see Plate 9) was drawn perpendicular to the dam at about its midlength. Section B-B' contains borings D1, D5, D6, D7, and D8, and section C-C' contains borings D1, D2, D3, and D4.

Structure

41. The main structural feature in the bedrock is the nearly horizontal bedding. Hard shale beds, laminae, and stringers occur throughout the bedrock. However, the shale features are intact and intimately joined to the dolomite. The shale features are considered a part of the rock fabric and are not considered individual troublesome units. There is no distinct geologic feature within the bedrock that can be traced between borings. A band of calcite-filled cavities appears to be traceable beneath the lock and dam.

42. The contact between the concrete and the bedrock core is well bonded in two out of four cases. A loose contact exists in core D7. Shale pieces are embedded in the concrete to a depth of 0.5 ft. During construction, a small amount of bedrock was probably left during cleanup prior to placing concrete. Dark staining and solution activity on four bedding surfaces (D2, el 572.2; D3, el 558.4; D7, el 566.3; and L1, el 566.8) indicate movement of water along bedding. Due to the infrequent evidence of solution activity in the bedrock, solutioning of the bedrock is not considered to be a problem at this time due mainly to its apparent limited extent.

43. The extent of jointing in the bedrock could not be determined with the limited work done during this study. A total of six high angle fractures (joints) were observed in the core. The fractures were dipping from 42 to 70 deg; in general, the fractures were smooth. Several low angle fractures, <15 deg, were observed. Jointing appears not to be a problem at the lock and dam in terms of stability of the two structures.

PART V: TESTS, TEST RESULTS, AND DISCUSSION

Test Specimens and Test Procedures

Cores received

44. Disturbed and undisturbed soil samples were recovered from the two backfill borings. The undisturbed samples were obtained in steel tubes, then pushed into cardboard tubes; 10 cardboard tubes were used. The disturbed samples consist of 11 jars. Core boxes contained the rock core samples recovered from these two borings. Table 4 describes the drill hole number, sample number, type sample, sample depth, and the material description of the soil samples received at the WES.

45. In addition to the soil samples, concrete and rock samples from 12 borings were received at the WES. Shipment of the materials was by government motor freight. All samples were received in good condition, and no sample breakage was detected. Pertinent information concerning the concrete and rock samples is presented in Table 5.

Selection of test specimens

46. Disturbed and undisturbed samples from borings E1-80 and E2-80 were examined and representative samples were chosen for general engineering type testing.

47. A detailed visual examination of core was made in the laboratory to supplement the field boring logs and to assist in the selection of representative test specimens. Concrete specimens were selected for testing based upon physical condition and depth; representative properties throughout the structure could thus be obtained.

48. Three concrete specimens were selected from boring D1; one at the top, middle, and bottom of the boring. These three specimens were deemed representative of the concrete core recovered at the site. Test specimen depths shown in the tables of test results represent the midsection of the test specimen; e.g., el 593.47 is the midpoint of a piece of core with top el being 593.97 and the bottom el being 592.97. Both 6-in. and 4-in.-diameter concrete cores. and 4-in.-diameter rock cores were tested.

49. An attempt was made to select test specimens to be representative of the bedrock in close proximity to the base of the structure. The test assignment locations can be obtained from appropriate tables of test results as well as from appropriate geologic cross sections.

50. Test specimens were selected for testing concurrent with the detailed logging of core; the logging began one week after core arrived at the laboratory. The test specimens were rewrapped and stored in a moist curing room until time for testing; the moist room is maintained at 73.4 $\pm$ 3 F (23 $\pm$ 1.7 C).

Laboratory testing program

51. Soil samples. The testing of the soil samples consisted of the following.

a. Gradation Curve.

b. Atterberg Limits Testing.

c. Triaxial, $\bar{R}$.

52. Concrete cores. The testing program of the concrete cores consisted of the following tests on representative selected cores.

a. Unit Weight, γ .

b. Compressive Strength.

c. Water Content, w .

d. Elastic Moduli, E .

e. Poisson's Ratio, ν .

53. Rock cores. The testing of the bedrock cores consisted of the following tests on representative selected cores. The tests are grouped under either characterization tests or engineering design tests.

a. Characterization tests.

(1) Effective (As Received) and Dry Unit Weight, γ_m and γ_d .

(2) Water Content, w .

(3) Compressive Strength, q_u .

b. Engineering design tests.

(1) Elastic Moduli, E .

(2) Poisson's Ratio, ν .

(3) Triaxial Strength.

(4) Direct Shear Strength.

(a) Concrete on rock, precut (residual).

(b) Intact (maximum).

(c) Rock on rock, precut (residual).

(d) Cross bed (maximum).

Test procedures

54. The soil testing was accomplished according to EM 1110-2-1906, Laboratory Soils Testing Manual. The characterization properties tests and the engineering design properties tests were conducted in accordance with the appropriate test method tabulated below:

Property	Test Method
Characterization	
Effective Unit Weight (As Received), γ_m	RTM 109-77[5]
Dry Unit Weight, γ_d	RTM 109-77
Water Content, w	RTM 106-77
Compressive Strength, q_u	RTM 111-77 (ASTM D 2938)
Engineering Design	
Elastic Modulus, E	RTM 201-77 (ASTM D 2148)
Direct Shear Strength	RTM 203-77
Poisson's Ratio, ν	RTM 201-77
Triaxial Strength	RTM 202-77

55. For the compression and triaxial compression test, the specimens were cut with a diamond-blade saw and the cut surfaces were ground flat to 0.001 in.; specimens were checked for parallel ends and the perpendicularity of ends to the axis of the specimen. Electrical resistance strain-gages were used for strain measurements. Two each were used in the axial and horizontal directions. The modulus of elasticity and Poisson's ratio were computed from the strain measurements. Axial specimen load was applied with a 440,000-lbf capacity universal testing machine. Confining pressure during the triaxial tests was applied using an electro-hydraulic pump.

Soil Properties

56. All of the laboratory test data from soil samples are presented in Plates 10 through 18. The data consist of the following:

a. Boring E1-80.

(1) Three Atterburg Limits, classification (sieve analysis).

(2) One $\overline{R}$ triaxial test.

b. Boring E2-80.

Two $\overline{R}$ triaxial test.

This report does not present an interpretation or recommended design parameters for the materials in the backfill because of various unknowns. We don't know what type of slope stability analysis will be used by the district, where the failure plane will be assumed within the backfill, and whether the bedrock will be incorporated in the analysis.

Concrete Test Results and Discussion

57. The following comments pertain to the condition of the concrete in the dam. These comments are the results of examination of the core recovered at the dam. The condition of the exposed concrete is discussed in Part II of this report. The concrete characterization and engineering design test results are presented in Table 6.

58. The concrete recovered from borings is nonair-entrained. It is light gray-brown, hard, dense, contains crushed and natural carbonate aggregate 1 in. in maximum size. Large aggregate is rounded to angular. The concrete contains occasional entrapped air voids about 1/4 in. in size and is well consolidated. A few honeycombed areas occur, but they do not affect the structural integrity of the concrete. Minor amounts of white reaction products were found throughout the concrete. The white reaction material probably resulted from alkali-silica reaction and is an alkali carbonate. At this time the concrete is not adversely affected by the process producing the white reaction product, nor will it be in the near future. The concrete in the dam is structurally sound and should serve its intended purpose; the exceptions are those local

exterior areas where frost-damaged concrete exist. The author believes that there is no reason to immediately repair the cracked or frost-damaged concrete in the dam. Repair of these damaged areas could be performed during regular maintenance periods.

59. The average physical properties of the concrete are tabulated below with the standard deviation. Stress versus strain curves are presented in Plate 19 for the three concrete specimens tested:

Test	Average Value	Standard Deviation	No. Specimens
Wet Unit Weight, pcf	152.7	0.98	3
Water Content, %	4.6	0.15	3
Compressive Strength, psi	8540	1260	3
Modulus of Elasticity, x 10^6 psi	6.92	0.7	3
Poisson's ratio	0.20	0.08	3

60. The physical properties of the concrete are characteristic of good quality concrete. The standard deviations are considered small and indicative of uniform concrete properties for the small number of specimens tested.

Rock Test Results and Discussion

61. The results of the characterization properties tests are presented in Table 6 for the bedrock. Stress versus strain curves are presented in Plates 20 and 21. The following tabulation presents a summary of the average characterization properties and selected statistics for the bedrock.

Test	Average Value	Standard Deviation	No. Specimens
Effective Unit Weight, pcf	170.3	2.93	6
Dry Unit Weight, pcf	169.1	3.14	6
Water Content, %	0.7	0.37	6
Compressive Strength, psi	21,070	7590	6
Modulus of Elasticity, x 10^6 psi	8.22	1.73	6
Poisson's Ratio	0.23	0.05	6
Shear Modulus, x 10^6 psi*	3.34	--	6

* Calculated using E and ν.

62. The tabulated rock properties are reasonable for the high quality bedrock beneath the DePere Lock and Dam. The relatively low standard deviations for the different tests indicate consistency of the samples tested with the exception of the compressive strengths. The standard deviation is indicative of a wide range in strength; the low strength is 14,260 psi and the high strength 30,640 psi.

Maximum and residual
shear stress criteria

63. The following discussion of shear stress criteria is taken from Zeiglar (6) and is followed in this report.

64. Designers are commonly interested in the maximum available shear strength. The maximum shear stress points are identified as τ_{max} in Figure 1. The maximum shear stress usually corresponds to the peak of the shear stress versus displacement plot (curve a of Figure 1); however, some confusion may arise where strain-hardening is encountered. When strain-hardening occurs, an initial peak usually occurs at a relatively small displacement, followed by an increase in shear stress to a value greater than the initial peak. When this happens, the first peak is termed the maximum shear stress corresponding to initial failure and the latter is the ultimate shear stress.

65. If the residual shear strength is to be determined from the intact specimens, then displacement is continued until the shear stress approaches the horizontal asymtotic value of residual shear stress τ_R (curve a of Figure 1). When the zone tested exhibits only a residual shear strength, curve b of Figure 1 may be obtained. In such cases, the maximum shear stress attained is the residual shear strength; precut specimens exhibit this type of curve. The shear strength obtained from precut specimens approaches the residual shear strength.

Maximum and residual shear strengths

66. Two types of direct shear tests were conducted to determine maximum strength of intact specimens and sliding friction properties of discontinuous specimens. Maximum strength was measured for intact dolomite parallel to and across bedding planes. Sliding friction properties were measured for specimens along precut surfaces, including concrete on

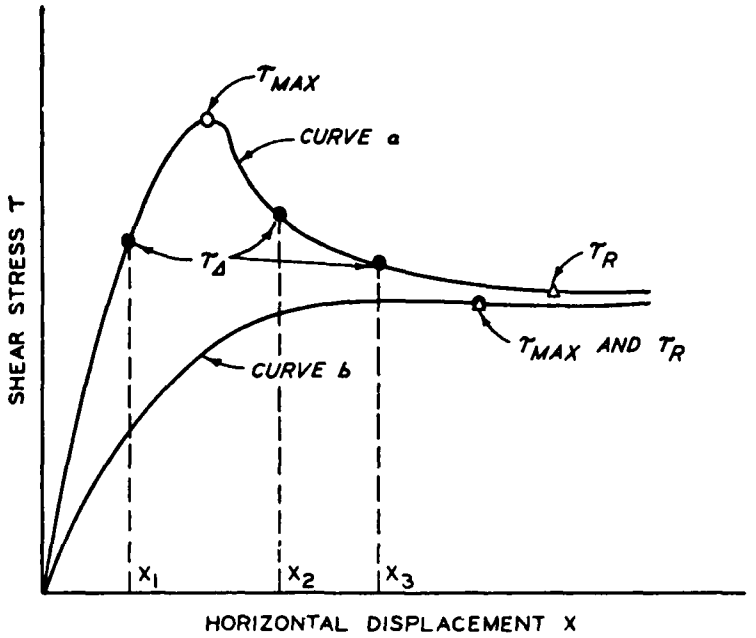


Figure 1. Maximum and residual shear stress and displacement failure criteria, after Zeiglar.[6]

rock and rock on rock. The direct shear test results of intact specimens are presented in Plates 22 and 23; shear stress values, load-deformation curves, and typical normal versus shear deformation curves are presented. The direct shear test results from the discontinuous specimens tested as precut specimens are presented in Plates 24 and 25. Maximum and residual strength failure envelopes for the intact and discontinuous specimens are presented in Figure 2.

67. The foundation rock at the DePere Lock and Dam is the same as the foundation rock at the Cedars Lock and Dam;[7] within the same geologic formation downsection by about 100 ft; the lithology, texture, bedding planes, density, and average compressive strength are considered the same. The foundation core at both sites did not contain any potential weak zones (soft weak clay or shale seams) as mentioned previously. For these reasons, plus the reduced funding for laboratory testing (see para 5), the intact direct shear tests on the Type B bedding surfaces were not performed. The direct shear test results, from the Cedars Lock

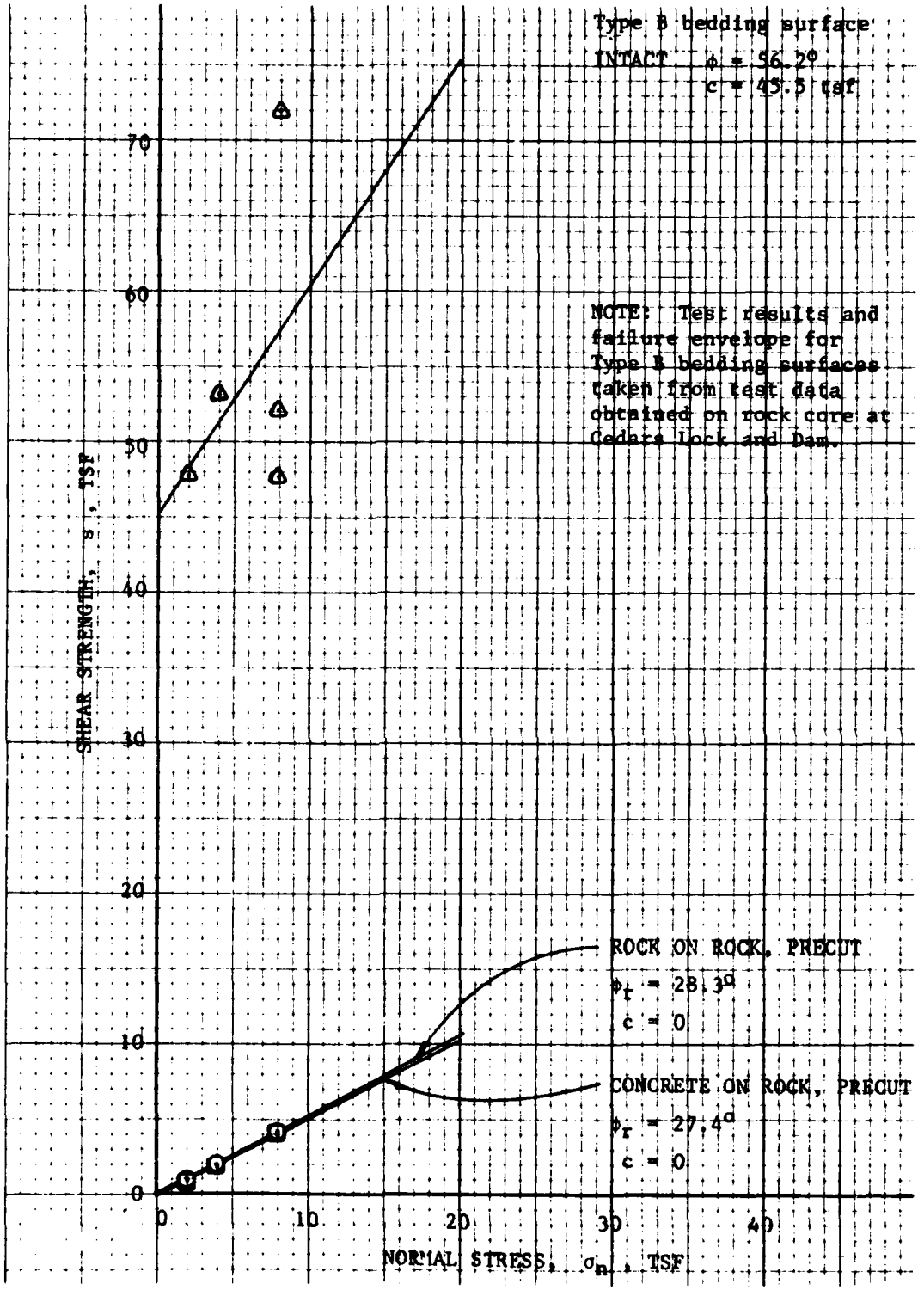


Figure 2. Direct shear test results, maximum and residual shear strength failure envelopes.

and Dam core, that contained the Type B bedding, are presented in this report (see Plate 26). The intact shear strength values from the Cedars' core can reasonably be used for the Type B bedding surfaces found in the foundation rock at DePere Lock and Dam.

68. The shear strength parameters for the Type A bedding surfaces obtained on the DePere core are $\phi = 78.5^{o}$ and $c = 70$ tsf. The phi value compares well with the phi measured from the Cedars' core, which is 81 deg. The shear strength parameters for the Type B surfaces are $\phi = 56.2$ deg and $c = 45.6$ tsf. Specimens with both types of bedding surfaces had good shear breaks. The shear gap between the shear blocks was 1/16 in. The specimens sheared within this gap or within $\pm$3/16 in. of the gap.

69. Almost all shear failures of the intact specimens tested parallel to bedding were by breaking through the hard, thin shale features. Only a few asperities on the Type A surfaces sheared at the base. None of the asperities on the Type B bedding surfaces were sheared. As shear deformation occurred, dilation began and one-half of the specimen rode up over the other. Attempts were not made to determine residual friction from the intact specimens. Precut rock specimens were used to determine the residual strength values. The sliding friction values for precut dolomite are $\phi = 28.3$ deg and $c = 0$.

70. The interlocked bedding plane asperities and the inability to trace continuous bedding plane discontinuities across the site imply that any large-scale failure would involve substantial shearing of intact rock. Therefore, the residual value is not expected to control sliding beneath the lock or dam.

71. After considering (a) the interlocking nature of the bedding surfaces, (b) the intimate and intact shale-dolomite rock fabric, and (c) because previously failed seams or indications of past horizontal movement in the bedrock were not observed, it is thought that peak shearing resistances of the shale features associated with the most nearly planar bedding surfaces (Type B) would control sliding. These peak shear strengths are recommended for computing stability, i.e., $\phi =$ 56 deg and $c = 45.6$ tsf.

72. Cross-bed shear tests were conducted (see Plate 23). The test results indicate a high phi and cohesion; ϕ = 72 deg and c = 63 tsf , which is close to the shear strengths obtained on the intact Type A bedding surfaces (ϕ = 78.5 deg and c = 70 tsf). To be conservative, it is suggested that the intact shear strengths measured for the Type B bedding surfaces, ϕ = 56.2 deg and c = 45.6 tsf , be used for cross-bed shear computations. Stagg and Zienkiewicz[8] state that:

> "When the directions of loading are such that the potential failure surfaces must cut across the structural features, the shear strength will approach that of the intact rock material."

Structural feastures, as mentioned in the quote from Stagg and Zienkiewicz, typically include joints, shear zones, and faults. At this site, the ubiquity of tightly interlocked asperities on the bedding planes justifies their inclusion in the class of "structural features" across which shear must occur.

Recommended Design Values

73. Design should consider the rock and the bedrock structural characteristics described herein. Guidance is presented in the following tabulation as to proper choice of design parameters:

Rock Property	Dolomite
Effective Unit Weight, lb/ft^3	170.3
Dry Unit Weight, lb/ft^3	169.1
Compressive Strength, psi	21,070
Shear Strength	
Intact, Type B bedding	$\phi = 56.2^o$ c = 45.6 tsf
Precut, rock on rock	$\phi_r = 28.3^o$ c = 0
Precut, concrete on rock	$\phi_r = 27.4^o$ c = 0
Cross bedded	$\phi = 56.2^o$ c = 45.6 tsf
Modulus of Elasticity, x 10^6 psi	8.22
Poisson's Ratio	0.23
Shear Modulus, x 10^6 psi	3.34

Conclusions and Recommendations

74. Based upon a visual inspection of the lock and dam, core samples, and laboratory test results, the following conclusions seem warranted:

a. The concrete in the lock appears sound and has held up well in the severe winter conditions considering it is nonair entrained; it should continue to serve its original intended purpose.

b. The concrete in the lock and dam is locally cracked and lightly deteriorated. The deterioration is due to cycles of freezing and thawing. Several tainter gate piers have cracks adjacent to the hinge pins that go through the piers. The cause of these cracks is not postulated. The concrete in the dam is structurally sound and should continue to serve its originally intended purpose.

c. The lock and dam is founded on competent bedrock which contains a minimal number of discontinuities. Jointing is minimal. Shale features occur along interlocked bedding planes; they are thin and considered as part of the rock fabric. No soft or otherwise weak zones were detected in the bedrock.

d. It is our opinion that no significant scour has occurred behind the dam. Sounding behind the dam should be made to establish a scouring datum base.

e. We suggest that a study be conducted to ascertain if the reinforcing steel in the downstream portion of the tainter gate piers is badly corroded. An area around one of the hinge pins could be excavated for this purpose. Cracks in the piers near the hinge pins could be sealed to stop water from entering the concrete and possible corroding the reinforcing steel.

REFERENCES

1. U. S. Army Engineer District, Chicago, "Periodic Inspection Report No. 1," DePere Lock and Dam, Lower Fox River, Wisconsin, Nov 1976.

2. Letter, NCCED-DC, dated 26 Dec 1979, subject "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures - Lower Fox River, Wisconsin, Appleton Locks and Dams;" attached to this letter is NCDED-T (26 Dec 79) 1st Ind, subject as above, and NCCED-DC (26 Dec 79) 2d Ind, subject as above.

3. Letter, NCCED-DC, dated 29 Nov 1976, subject "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures - Lower Fox River, Wisconsin, Appleton and DePere Locks and Dams;" attached to this letter is NCDED-T (29 Nov 76) 1st Ind, subject as above.

4. U. S. Army, Office, Chief of Engineers, "Engineering and Design: Soil Sampling," EM 1110-2-1907, 31 Mar 72, U. S. Government Printing Office, Washington, D. C.

5. U. S. Army Engineer Waterways Experiment Station, CE, "Rock Testing Handbook," Test Standards - 1980, Vicksburg, Miss., Aug 1980.

6. Zeigler, T. W., "In Situ Tests for the Determination of Rock Mass Shear Strength," TR No. S-72-12, Nov 1972, U. S. Army Engineer Waterways Experiment Station, CE, Vicksburg, Miss. (AD 752 422)

7. Letter Report, subject, "Condition Survey of Cedars Lock and Dam, Lower Fox River, Wisconsin," Apr 1981, sent to U. S. Army Engineer District, Chicago.

8. Stagg, K. G. and Zienkiewicz, O. C., Rock Mechanics in Engineering Practice, John Wiley and Sons, London, 1968, p 46.

Table 1

Borings, Locations, Elevations, and Starting Date of Borings

DePere Lock and Dam, Lower Fox River

Boring No.	Type of Boring	Location	El Top of Boring ft	El Top of Rock ft	El Bottom of Boring ft	Horizontal Boring, Depth ft	Start Date
D WES L1-80	⊕	Right Lock Wall	591.80	571.20	550.70		21 July 1980
D WES L2-80	⊕→	Right Lock Wall	587.80	--	587.80	3.15	24 July 1980
D WES E1-80	▲	Backfill, LLW	591.80	578.00	547.30		1 July 1980
D WES E2-80	▲	Backfill, RLW	590.40	576.30	573.20		25 July 1980
D WES D1-80	⊕	Sluiceway Pier 7	593.97	574.92	552.97		11 July 1980
D WES D2-80	⊕	US of Sluiceway Pier 7	577.47	577.47	556.57		7 July 1980
D WES D3-80	⊕	DS of Sluiceway Pier 7	575.23	575.23	553.83		4 July 1980
D WES D4-80	⊕	US of DS Face, Next to Pier 7	576.50	575.30	571.33		10 July 1980
D WES D5-80	⊕	DS of Sluiceway Gate 13	572.80	572.80	567.34		9 July 1980
D WES D6-80	⊕	DS, Left Spillway, between Piers 9 and 10	576.30	576.30	570.81		9 July 1980
D WES D7-80	⊕	Right Spillway Pier 1	591.80	576.60	551.80		16 July 1980
D WES D8-80	⊕	Left Spillway Pier 10	591.80	576.70	553.20		18 July 1980
D WES D9-80	⊕→	Sluiceway Pier 7	584.13	--	584.13	2.85	23 July 1980
D WES D10-80	⊕→	Right Abutment Pier	584.30	--	584.30	2.95	23 July 1980

⊕ Vertical 4-in. core hole.
⊕→ Horizontal 4-in. core hole.
▲ Combined drive sample and core.
▲ Combined drive sample and core with piezometer installed.
LLW, Landside lock wall.
RLW, Riverside lock wall.
US Upstream.
DS Downstream.

Table 2

Water Level Readings in Boring No. DWES D1-80

at DePere Dam, Sluiceway Pier #7

Date	Time	Reading	Elevation*	Gage Readings: Zero Elevation 577.12 Upper Pool	Gage Readings: Zero Elevation 564.76 Lower Pool
8-19-80	11:00 a.m.	13.59	580.38	10.4	15.1
8-20-80	8:00 a.m.	13.63	580.34	10.4	15.4
8-21-80	8:00 a.m.	13.53	580.44	10.4	15.4
8-22-80	8:00 a.m.	13.66	580.31	10.4	15.5
8-23-80	8:00 a.m.	13.35	580.62	10.3	15.5
8-24-80	8:00 a.m.	13.22	580.75	10.5	15.8
8-25-80	8:00 a.m.	13.12	580.85	10.5	15.9
8-26-80	8:00 a.m.	13.25	580.72	10.6	15.7

* Elevation of water in boring hole measured from top of boring hole with elevation of 593.97 I.G.L.D.

Table 3

CHICAGO DISTRICT, CORPS OF ENGINEERS, U. S. ARMY, CHICAGO, ILLINOIS

RECORD OF WATER GAGES AND WEATHER SEP [illegible] 1980

AT De Pue Lock & Dam

DURING MONTH OF Corps of Engineers 19 80

Rock River Project Office

ELEVATION OF ZERO UPPER GAGE 577.12 IGLD* ELEVATION OF ZERO LOWER GAGE 564.76 IGLD*

DATE 19	UPPER GAGE 9 AM	UPPER GAGE 12 N	UPPER GAGE 6 PM	LOWER GAGE 9 AM	LOWER GAGE 12 N	LOWER GAGE 6 PM	WIND	WEATHER
1	9.8	9.8	9.7	15.4	15.5	15.1		
2	9.9	9.9	9.8	15.2	15.0	15.2		
3	9.7	9.7	9.7	15.7	15.1	15.3		
4	9.9	9.6	9.6	15.3	15.8	15.4		
5	9.6	9.6	9.6	15.1	15.4	15.0		
6	9.5	9.5	9.6	15.8	15.5	15.6		
7	9.6	9.8	9.9	14.9	15.2	15.9		
8	9.7	9.8	9.9	15.7	16.4	15.7		
9	9.8	9.9	9.8	15.6	15.5	15.2		
10	10.0	9.9	10.0	15.3	15.8	15.6		
11	10.0	10.2	10.1	15.2	15.4	15.2		
12	10.3	10.4	10.4	15.4	15.3	15.3		
13	10.4	10.4	10.4	15.3	15.4	15.4		
14	10.4	10.4	10.4	15.6	15.7	15.7		
15	10.3	10.2	10.3	15.5	15.9	15.7		
16	10.3	10.3	10.3	15.6	15.2	15.1		
17	10.3	10.4	10.3	15.5	15.2	15.8		
18	10.5	10.5	10.4	15.5	15.6	15.7		
19	10.4	10.4	10.3	15.1	15.4	15.6		
20	10.4	10.4	10.4	15.4	15.4	15.5		
21	10.4	10.4	10.4	15.4	15.6	15.4		
22	10.4	10.4	10.3	15.5	15.6	15.8		
23	10.3	10.3	10.4	15.5	15.7	15.5		
24	10.6	10.5	10.3	15.5	15.4	15.6		
25	10.3	10.6	10.6	15.9	15.5	15.9		
26	10.6	10.7	10.1	15.7	14.9	15.9		
27	10.3	10.3	10.3	15.4	16.6	15.5		
28	10.3	10.3	10.1	16.2	16.0	16.1		
29	10.3	10.4	10.5	15.8	16.2	15.4		
30	10.5	10.3	10.5	15.6	16.1	16.2		
31	10.6	10.5	10.6	15.8	16.3	15.7		
SUMS								
MEANS								

REMARKS 9/24/80 12:30 PM To 1:45 PM opened Tee gate

9/24/80 6:45 PM To 7:00 PM closed Tee gate

Gage Reader Lucille T Bunt

(Over)

NOC Form 30 Sep 56 871 Replaces NOW Form 5-101, which may be used.

*International Great Lake Datum

Table 4

Soil Samples Received, DePere Lock and Dam, Lower Fox River

Date Received	Boring No.	Sample No.	Type Sample		Sample Depth, ft	Field Nomenclature
15 Sep 80	D WES E1-80	1A	5-in. Shelby tube - jar		0.0 - 0.3	Silty clay (CL), brown, Tr rt
15 Sep 80	D WES E1-80	1	5-in. Shelby tube - cardboard		0.3 - 0.85	Silty clay (CL), brown, w/Tr rt
15 Sep 80	D WES E1-80	2A	5-in. Shelby tube - cardboard	1	0.85- 1.2	Silty clay (CL), brown, w/Tr rt
15 Sep 80	D WES E1-80	2	5-in. Shelby tube - cardboard		1.2 - 2.1	Silty clay (CL), brown, w/Tr rt
15 Sep 80	D WES E1-80	3A	5-in. Shelby tube - jar		3.0 - 3.2	Silty clay (CL), brown, w/1/2-in. gravel
15 Sep 80	D WES E1-80	3	5-in. Shelby tube - cardboard	2	3.2 - 4.0	Silty clay (CL), brown, w/1/2-in. gravel
15 Sep 80	D WES E1-80	4A	5-in. Shelby tube - jar		5.0 - 5.1	Clay (CL) w/gravel, brown, w/1/2-in. gravel
15 Sep 80	D WES E1-80	4	5-in. Shelby tube - cardboard	3	5.1 - 5.9	Clay (CL) w/gravel, brown, w/1/2-in. gravel
15 Sep 80	D WES E1-80	5A	5-in. Shelby tube - cardboard		5.9 - 6.0	Clay (CL) w/gravel, brown, w/1-in. gravel
15 Sep 80	D WES E1-80	5	5-in. Shelby tube - cardboard		6.0 - 6.75	Clay (CL) w/Tr F SS, reddish brown
15 Sep 80	D WES E1-80	6A	5-in. Shelby tube - cardboard	4	7.5 - 7.7	Dolomite w/clay, gray brown
15 Sep 80	D WES E1-80	7	4- by 5-1/2-in. core barrel		8.1 - 8.7	Dolomite - gravel w/clay binder - boulder
15 Sep 80	D WES E1-80	8	4- by 5-1/2-in. core barrel		12.6 -13.8	Dolomite - gravel w/clay, gray
15 Sep 80	D WES E2-80	1A	5-in. Shelby tube - cardboard	5	0.0 - 0.85	Organic and clay
15 Sep 80	D WES E2-80	1B	5-in. Shelby tube - jar		0.85- 0.9	Clay, brown
15 Sep 80	D WES E2-80	2A	5-in. Shelby tube - cardboard	6	0.9 - 1.85	Clay soft
15 Sep 80	D WES E2-80	2B	5-in. Shelby tube - jar		1.85- 1.9	Clay soft
15 Sep 80	D WES E2-80	3A	5-in. Shelby tube - cardboard	7	0.0 - 0.45	Organic and clay. Hole offset 1 ft.
15 Sep 80	D WES E2-80	3B	5-in. Shelby tube - jar		0.45- 0.59	Clay, brown
15 Sep 80	D WES E2-80	4A	5-in. Shelby tube - cardboard	8	0.5 - 1.55	Clay, brown
15 Sep 80	D WES E2-80	4B	5-in. Shelby tube - jar		1.50- 1.55	Clay, brown
15 Sep 80	D WES E2-80	5B	Hvorslev - jar		2.5 - 2.7	Clay, brown Tr medium gravel
15 Sep 80	D WES E2-80	5C	Hvorslev - cardboard	9	2.7 - 4.0	Clay, brown Tr medium gravel
15 Sep 80	D WES E2-80	--	Hvorslev - jar		4.0 - 4.2	Clay, brown Tr medium gravel
15 Sep 80	D WES E2-80	6	Hvorslev - jar		4.5 - 4.85	G clay
15 Sep 80	D WES E2-80	7A	4- by 5-1/2-in. core barrel - cardboard	10	4.85- 6.9	G clay
15 Sep 80	D WES E2-80	7B	4- by 5-1/2-in. core barrel - jar		5.85- 6.9	G clay

Table 5

Concrete and Rock Samples Received at WES,

DePere Lock and Dam, Lower Fox River

WES Ref. No.	Drill Hole No.	Date Received	Box No.	Depth, ft	Pieces	Size, in.
Det-6 CON-1-A	D WES-D1-80	15 Sep 80	1 of 9	0.0 - 4.30	2	6
CON-1-B			2 of 9	4.30- 8.60	2	6
CON-1-C			3 of 9	8.60-13.20	3	6
CON-1-D			4 of 9	13.20-18.3	1	6
CON-1						
DC-1-E			5 of 9	18.3 -22.9	5	6
DC-1-F			6 of 9	22.9 -26.85	3	6
DC-1-G			7 of 9	26.85-31.8	4	6
DC-1-H			8 of 9	31.8 -36.05	3	6
DC-1-I			9 of 9	36.05-41.0	5	6
Det-6 DC-2-A	D WES-D2-80		1 of 5	0.0 - 4.5	6	6 & 4
DC-2-B			2 of 5	4.5 - 8.3	6	4
DC-2-C			3 of 5	8.3 -13.05	7	4
DC-2-D			4 of 5	13.05-17.55	7	4
DC-2-E			5 of 5	17.55-20.9	4	4
Det 6 DC-3-A	D WES D3-80		1 of 5	0.0 - 5.15	5	4
DC-3-B			2 of 5	5.15-10.1	4	4
DC-3-C			3 of 5	10.1 -14.6	4	4
DC-3-D			4 of 5	14.6 -18.7	5	4
DC-3-E			5 of 5	18.7 -21.4	2	4
Det-6 CON-2-A	D WES-D4-80		1 of 2	0.0 -		
DC-4-B			2 of 2	5.1/	7	4
Det-6 DC-5-A	D WES-D5-80		1 of 2	0.0 - 5.29	9	NX
-B						
Det-6 DC-6-A	D WES-D6-80		1 of 2	0.0 -		
-B			2 of 2	4.65	14	4
Det-6 CON-3-A	D WES-D7-80		1 of 10	0.0 - 3.15	2	6 & 4
CON-3-B			2 of 10	3.15- 7.85	2	4
CON-3-C			3 of 10	7.85-12.5	3	4
CON-3						
DC-7-D			4 of 10	12.5 -17.5	4	4
DC-7-E			5 of 10	17.5 -22.5	3	4
DC-7-F			6 of 10	22.5 -25.55	5	4
DC-7-G			7 of 10	25.55-30.15	4	4
DC-7-H			8 of 10	30.15-34.2	3	4
DC-7-I			9 of 10	34.2 -38.0	3	4
DC-7-J			10 of 10	38.0 -40.6	2	4

(Continued)

Table 5 (Concluded)

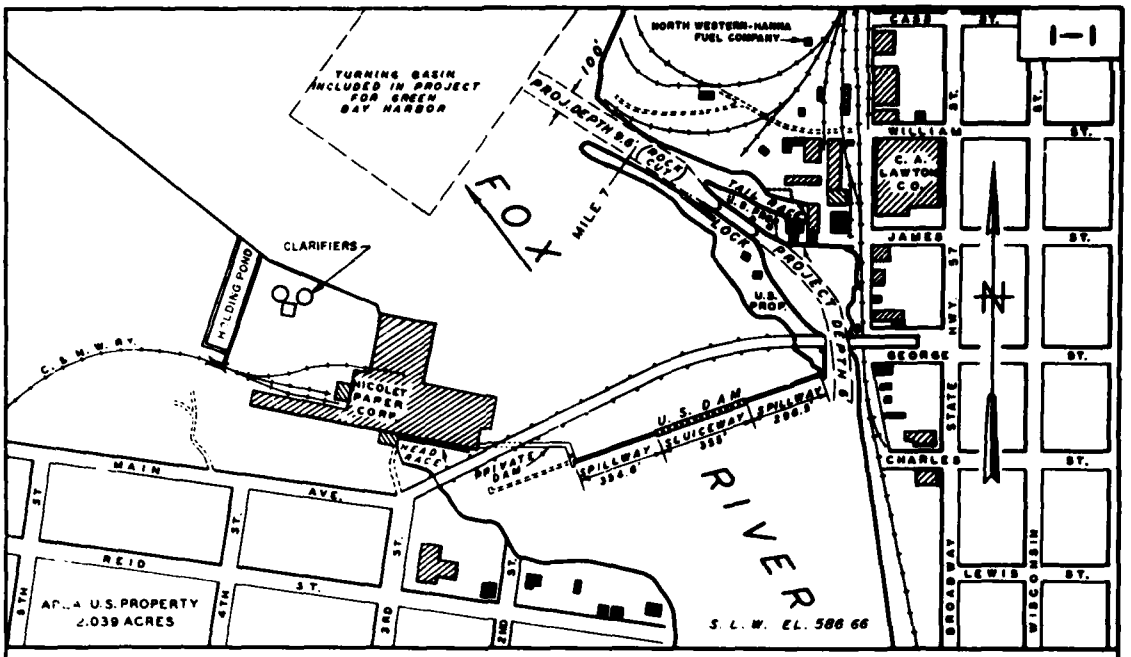
WES Ref. No.	Drill Hole No.	Date Received	Box No.	Depth, ft	Pieces	Size, in.
Det-6 CON-4-A	D WES-D8-80	15 Sep 80	1 of 9	0.0 - 1.49	2	6 & 4
CON-4-B			2 of 9	1.49- 6.45		4
CON-4-C			3 of 9	6.45-11.25		4
CON-4-D			4 of 9	11.25-16.25		4
CON-4						
DC-8-E			5 of 9	16.25-21.15		4
DC-8-F			6 of 9	21.15-25.0		4
DC-8-G			7 of 9	25.0 -29.15		4
DC-8-H			8 of 9	29.15-33.90		4
DC-8-I			9 of 9	33.90-38.65		4
Det-6 CON-5-A	D WES-D9-80		1 of 1	0.0 - 2.85	2	6
Det-6 CON-6-A	D WES-D10-80		1 of 1	0.0 - 2.95	3	6
Det-6 DC-9-A	D WES-E1-80		1 of 7	13.8 -18.25	8	4
DC-9-B			2 of 7	18.25-22.65	6	4
DC-9-C			3 of 7	22.65-27.5	7	4
DC-9-D			4 of 7	27.5 -31.8	4	4
DC-9-E			5 of 7	31.8 -35.7	4	4
DC-9-F			6 of 7	35.7 -40.0	3	4
DC-9-G			7 of 7	40.0 -44.5	3	4
Det-6 CON-7	D WES-E2-80		1 of 1	14.1 -17.5	2	4
Det-6 DC-10-A				17.5 -18.1	3	
Det-6 CON-8-A	D WES-L1-80		1 of 9	0.0 - 4.6	2	6 & 4
CON-8-B			2 of 9	4.6 - 8.6	3	4
CON-8-C			3 of 9	8.6 -11.8	2	4
CON-8-D			4 of 9	11.8 -16.3	1	4
CON-8						
DC-11-E			5 of 9	16.3 -21.1	2	4
DC-11-F			6 of 9	21.1 -25.8	5	4
DC-11-G			7 of 9	25.8 -31.15	7	4
DC-11-H			8 of 9	31.15-35.5	3	4
DC-11-I			9 of 9	35.5 -41.1	5	4
Det-6 CON-9-A	D WES-L2-80		1 of 1	0.0 - 3.15	1	6

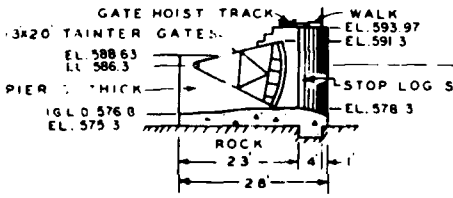
Table 6

Concrete and Rock Core Test Results, DePere Lock and Dam

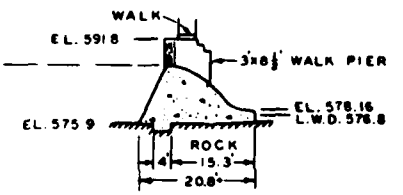
Drill Hole No.	Elevation ft	Wet Unit Weight γ_m (lb/ft^3)	Dry Unit Weight γ_d (lb/ft^3)	Water Content w, pcf	Compressive Strength q_u, psi	Elastic Modulus E x 10^6 psi	Poisson's Ratio
Concrete							
D-1-80	593.47	152.4	145.4	4.8	8,810	7.25	0.26
D-1-80	584.47	153.8	146.4	4.5	7,160	7.39	0.23
D-1-80	575.57	151.9	145.2	4.6	9,640	6.12	0.11
Avg		152.7	145.7	4.6	8,540	6.92	0.20
S		0.98	0.64	0.15	1,260	0.70	0.08
Rock							
D-1-80	568.77	171.2	169.5	1.0	14,260	8.00	0.14
D-1-80	566.77	173.6	172.2	0.8	15,260	8.00	0.21
D-7-80	574.97	164.9	163.4	0.9	16,150	5.31	0.22
D-7-80	572.47	169.8	168.1	1.0	19,520	10.00	0.24
D-8-80	571.40	170.6	169.9	0.4	30,640	8.00	0.24
D-8-80	569.60	171.6	171.4	0.1	30,560	10.00	0.30
Avg		170.3	169.1	0.7	21,070	8.22	0.23
S		2.93	3.14	0.37	7,590	1.73	0.05

Avg, average
s, standard deviation

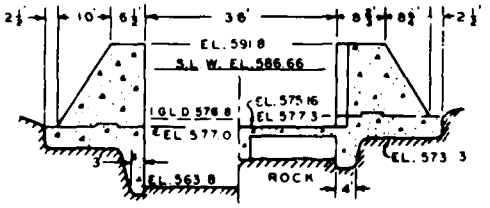




SECTION SLUICEWAY

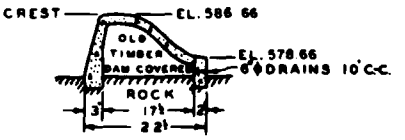


SECTION SPILLWAY



SECTION LOCK CHAMBER

SECTION UPPER GATE RECESS



SECTION PRIVATE DAM

STANDARD LOW WATER AND ELEVATIONS ARE REFERRED TO THE MEAN WATER LEVEL AT FATHER POINT, QUEBEC. I.G.L.D. (1955) (INTERNATIONAL GREAT LAKES DATUM)

PROJECT DEPTH IS REFERRED TO STANDARD LOW WATER.

LOCK

STRUCTURE DATA

AVAILABLE LENGTH	1460'
CLEAR WIDTH	36.0'
LIFT, MEAN STAGE	8.9'
UPPER MITER SILL	EL. 577.16
LOWER MITER SILL	EL. 564.80
BREAST WALL	EL. 577.16

DAM

STRUCTURE DATA

14 SLUICE GATES
LENGTH OF CLEAR SPILLWAY 598.4'
LENGTH OF CLEAR SLUICEWAY 280.0'
12" FLASHBOARDS AUTHORIZED JAN. 27, 1898 (E.D. 13,662)

PRIVATE DAM

LENGTH OF CLEAR SPILLWAY 332.0'

DE PERE LOCK AND DAM
FOX RIVER
WISCONSIN

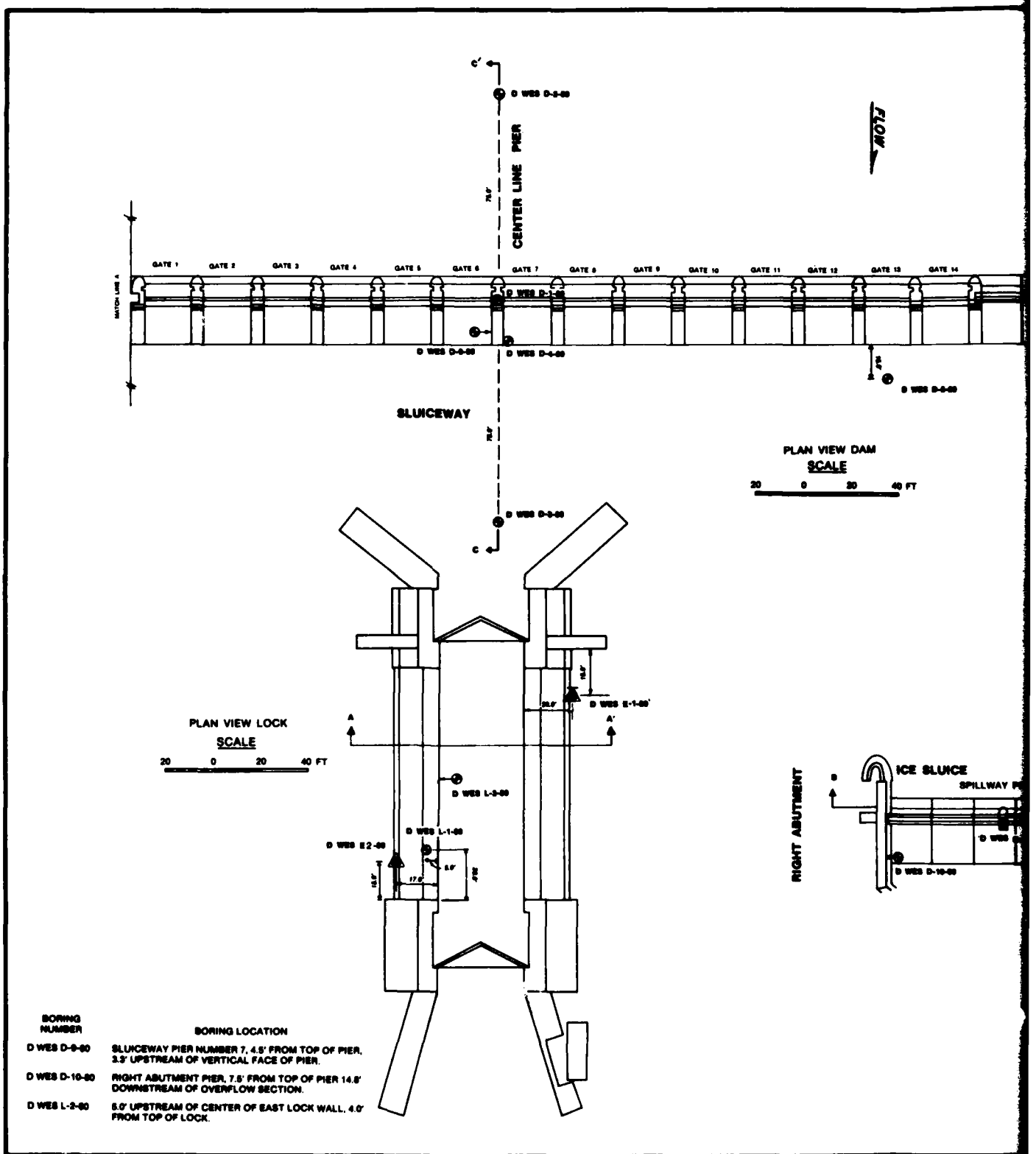
IN 1 SHEET — SHEET NO. 1

SCALE OF FEET
100 0 500 1000 1500

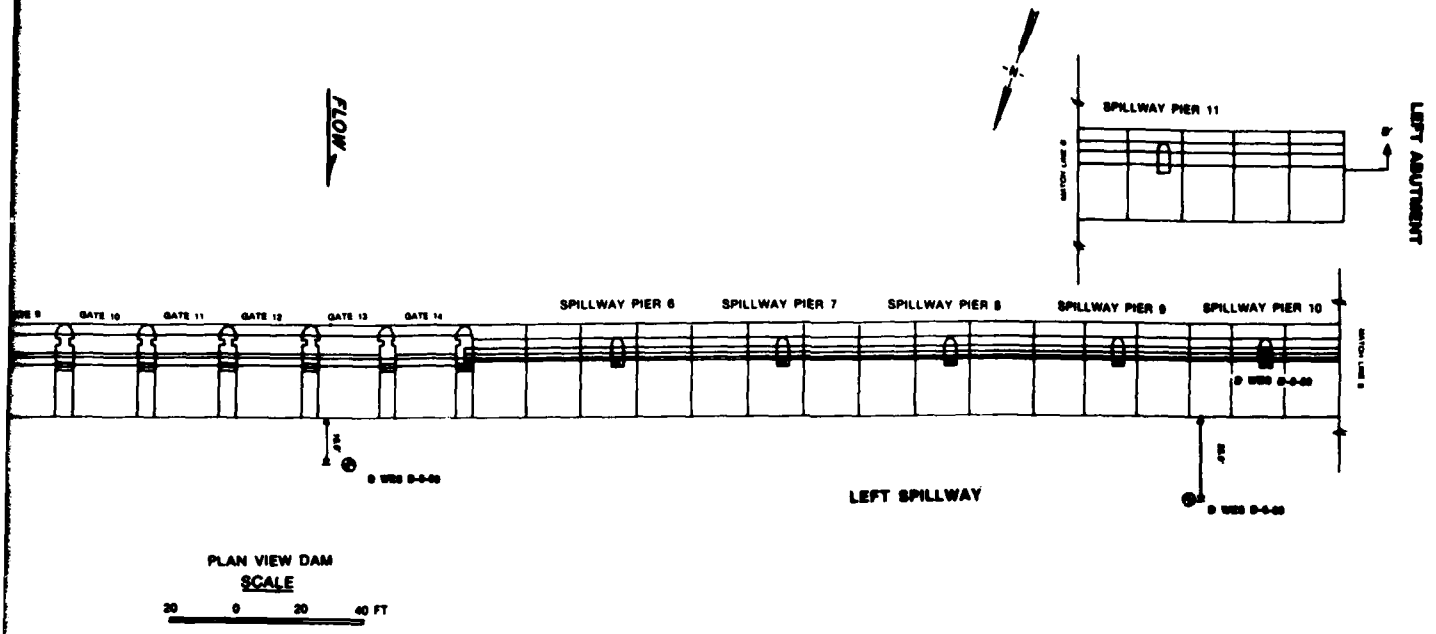
CORPS OF ENGINEERS — CHICAGO, ILLINOIS

30 JUNE 1972

PLATE 1



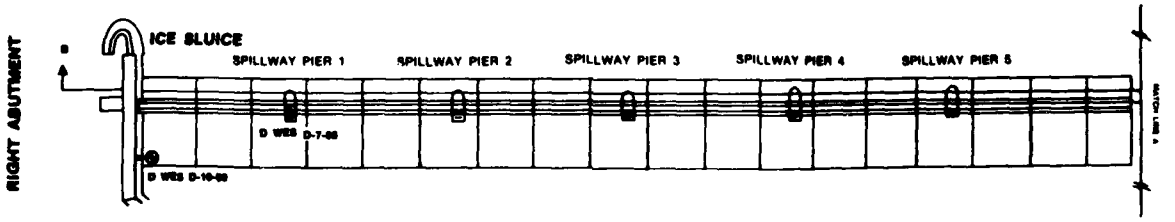
BORING NUMBER	BORING LOCATION
D WES D-3-80	SLUICEWAY PIER NUMBER 7, 4.5' FROM TOP OF PIER, 3.3' UPSTREAM OF VERTICAL FACE OF PIER.
D WES D-10-80	RIGHT ABUTMENT PIER, 7.5' FROM TOP OF PIER 14.8' DOWNSTREAM OF OVERFLOW SECTION.
D WES L-2-80	5.0' UPSTREAM OF CENTER OF EAST LOCK WALL, 4.0' FROM TOP OF LOCK.



PLAN VIEW DAM

SCALE

20 0 20 40 FT



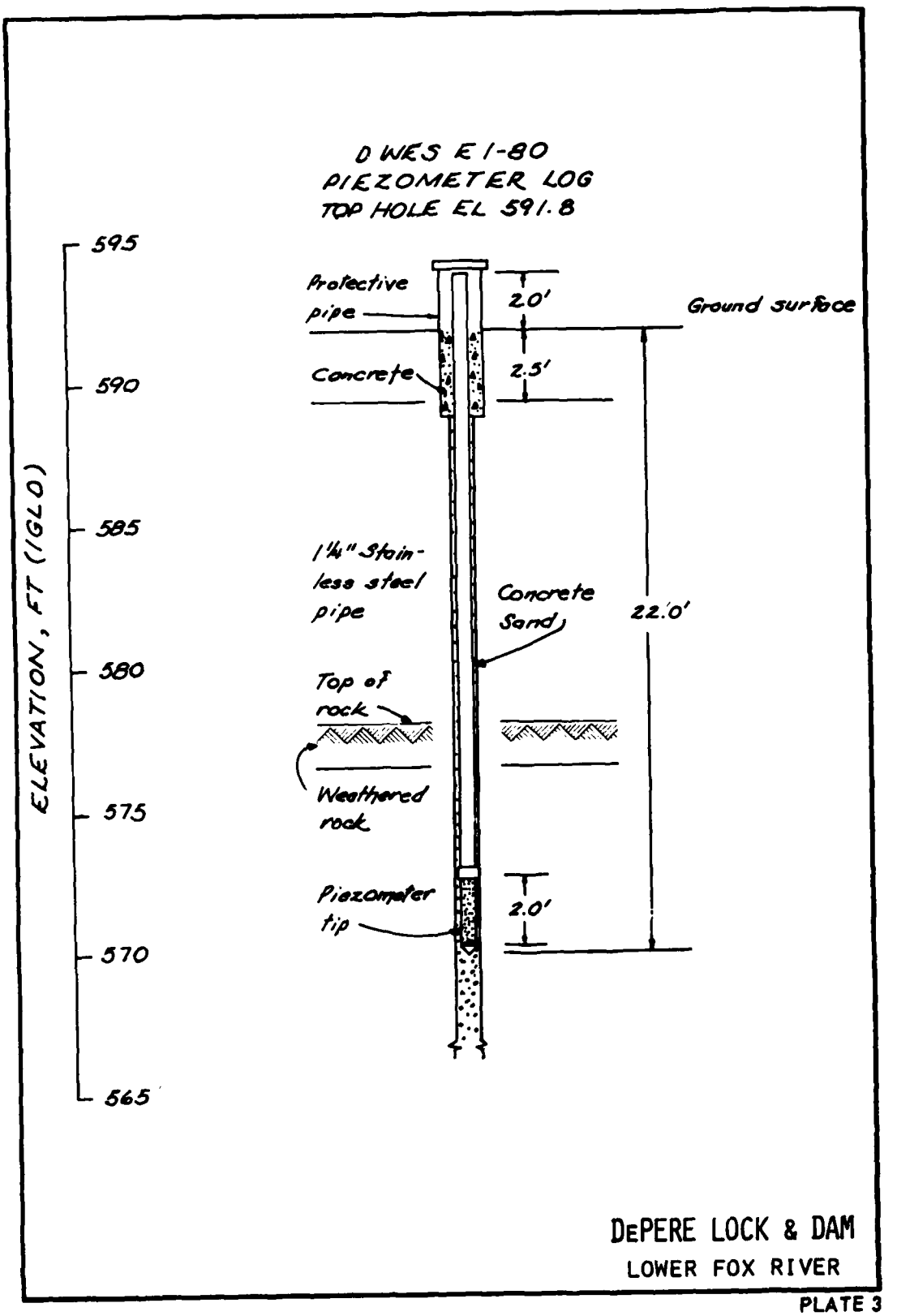
RIGHT SPILLWAY

CONDITION SURVEY
AUGUST 1980

DEPERE LOCK AND DAM

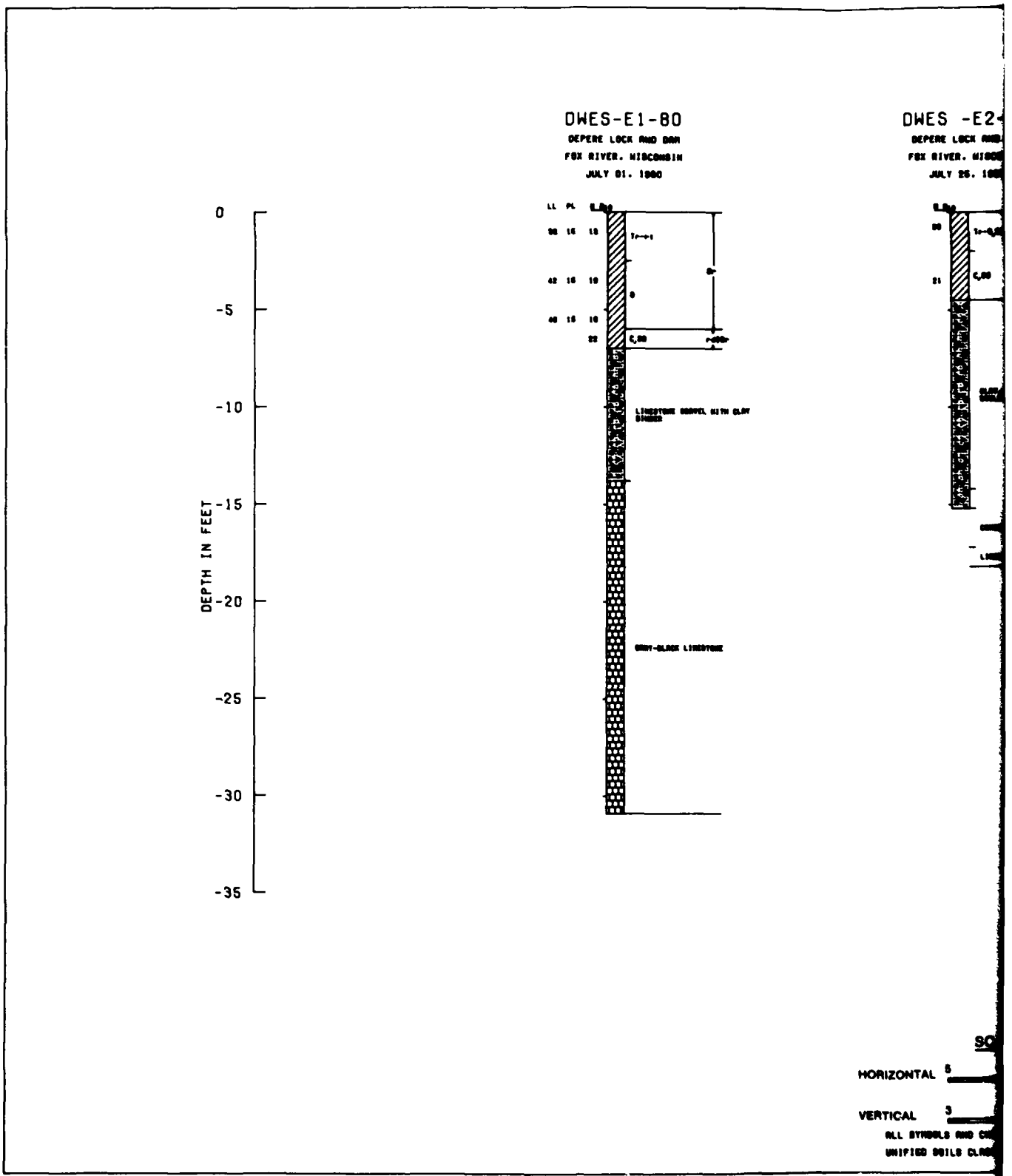
BORING LOCATION PLAN

PLATE 2



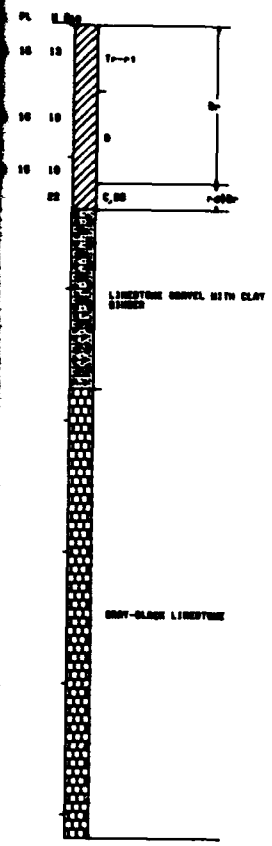
DePERE LOCK & DAM
LOWER FOX RIVER

PLATE 3


DWES-E1-80
DEPERE LOCK AND DAM
FOX RIVER, WISCONSIN
JULY 01, 1980
DWES -E2
DEPERE LOCK AND
FOX RIVER, WISC
JULY 25, 19
0
-5
-10
-15
-20
-25
-30
-35
DEPTH IN FEET
LIMESTONE GRAVEL WITH CLAY BINDER
GRAY-BLACK LIMESTONE
HORIZONTAL 5
VERTICAL 3
ALL SYMBOLS AND
UNIFIED SOILS CLA

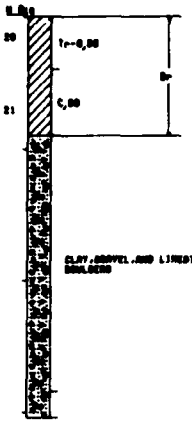
DWES-E1-80

DEPERE LOCK AND DAM
FOX RIVER, WISCONSIN
JULY 01, 1980



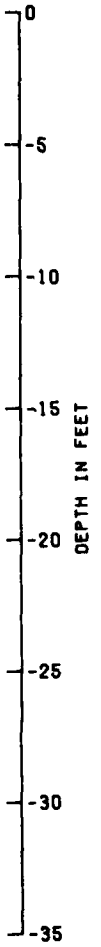
DWES -E2-80

DEPERE LOCK AND DAM
FOX RIVER, WISCONSIN
JULY 25, 1980



CONCRETE WITH LOOSE LIME-
STONE AT CONTACT SURFACE

LIMESTONE IS BROKEN BOTH
HORIZONTALLY & VERTICALLY



SCALES

HORIZONTAL 5 0 5 10 FT

VERTICAL 3 0 3 6 FT

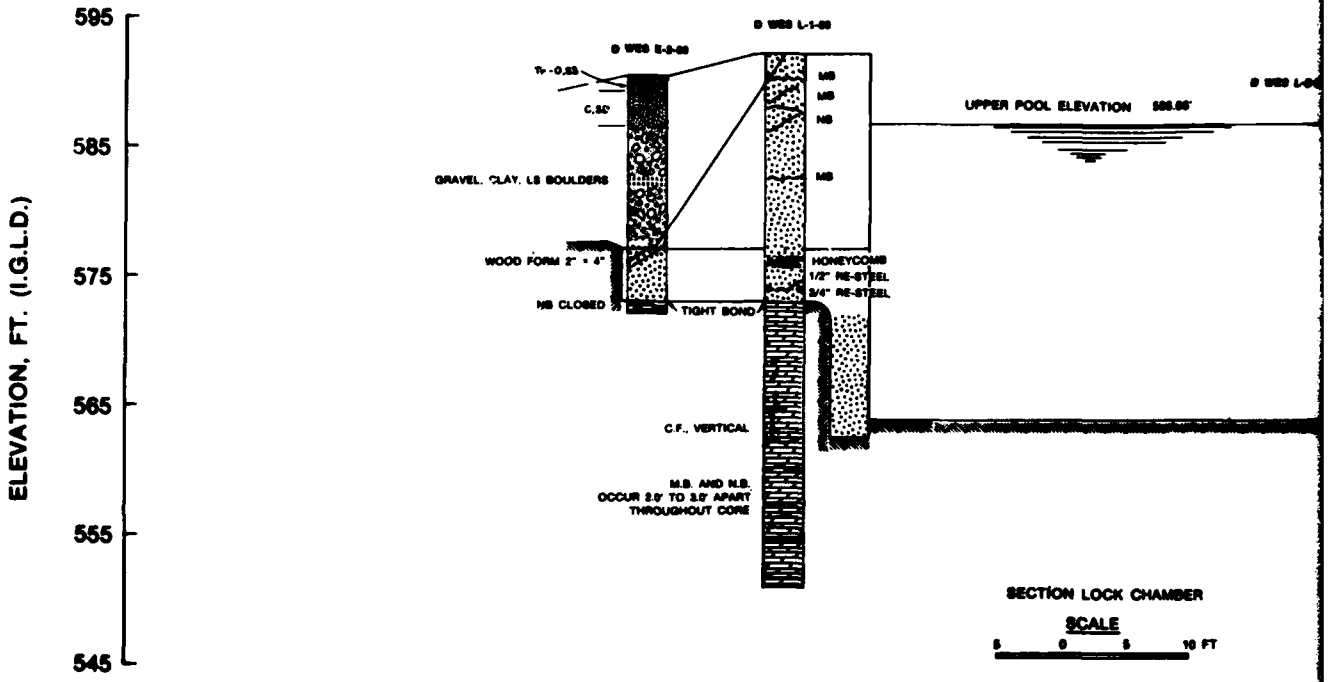
ALL SYMBOLS AND CHARACTERS CONFORM TO THE
UNIFIED SOILS CLASSIFICATION SYSTEM

DEPERE LOCK AND DAM

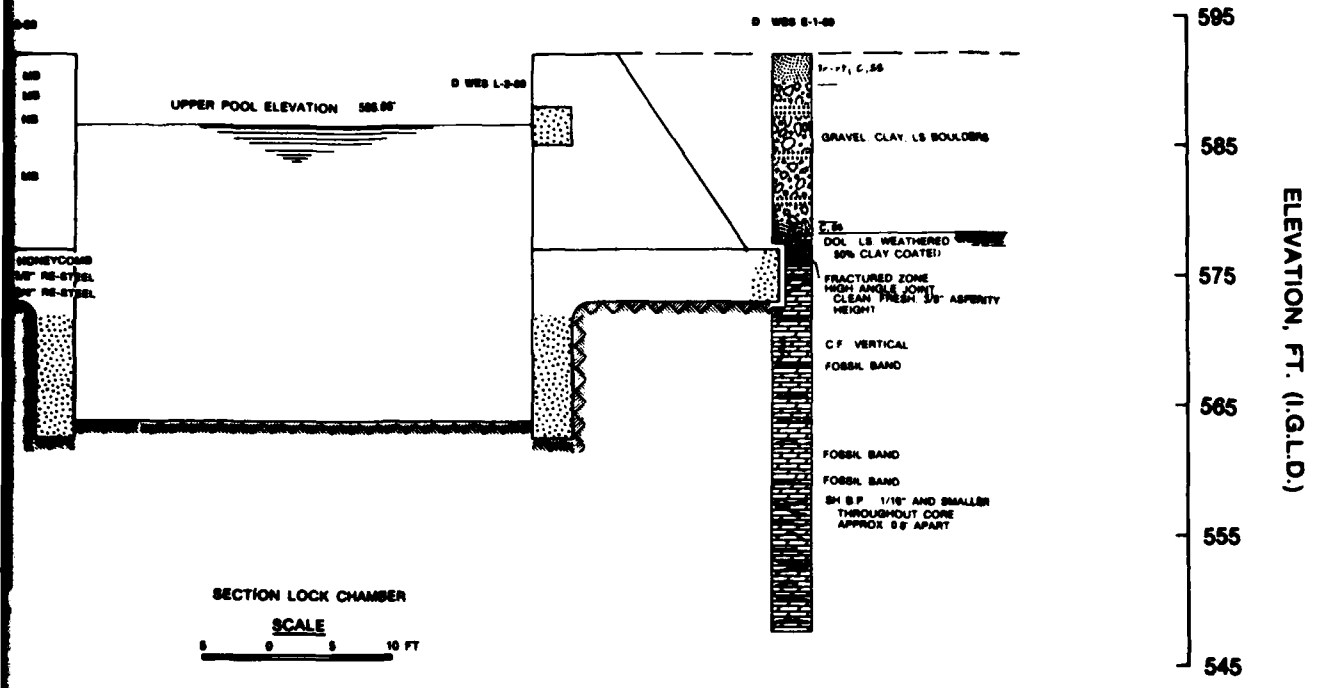
PLATE 4

1

2



BORING NUMBER	ELEVATION, FT TOP OF BORING	ELEVATION, FT BOTTOM OF CORE	CORE SIZE, IN.	CORE RECOVERY, %
D WES E-1-89	591.8	547.3	4	100
D WES E-2-89	589.4	572.3	5, NX	100
D WES L-1-89	591.8	580.7	4	100
D WES L-2-89	587.8	HORIZONTAL	6	100



SECTION LOCK CHAMBER

SCALE

5 0 5 10 FT

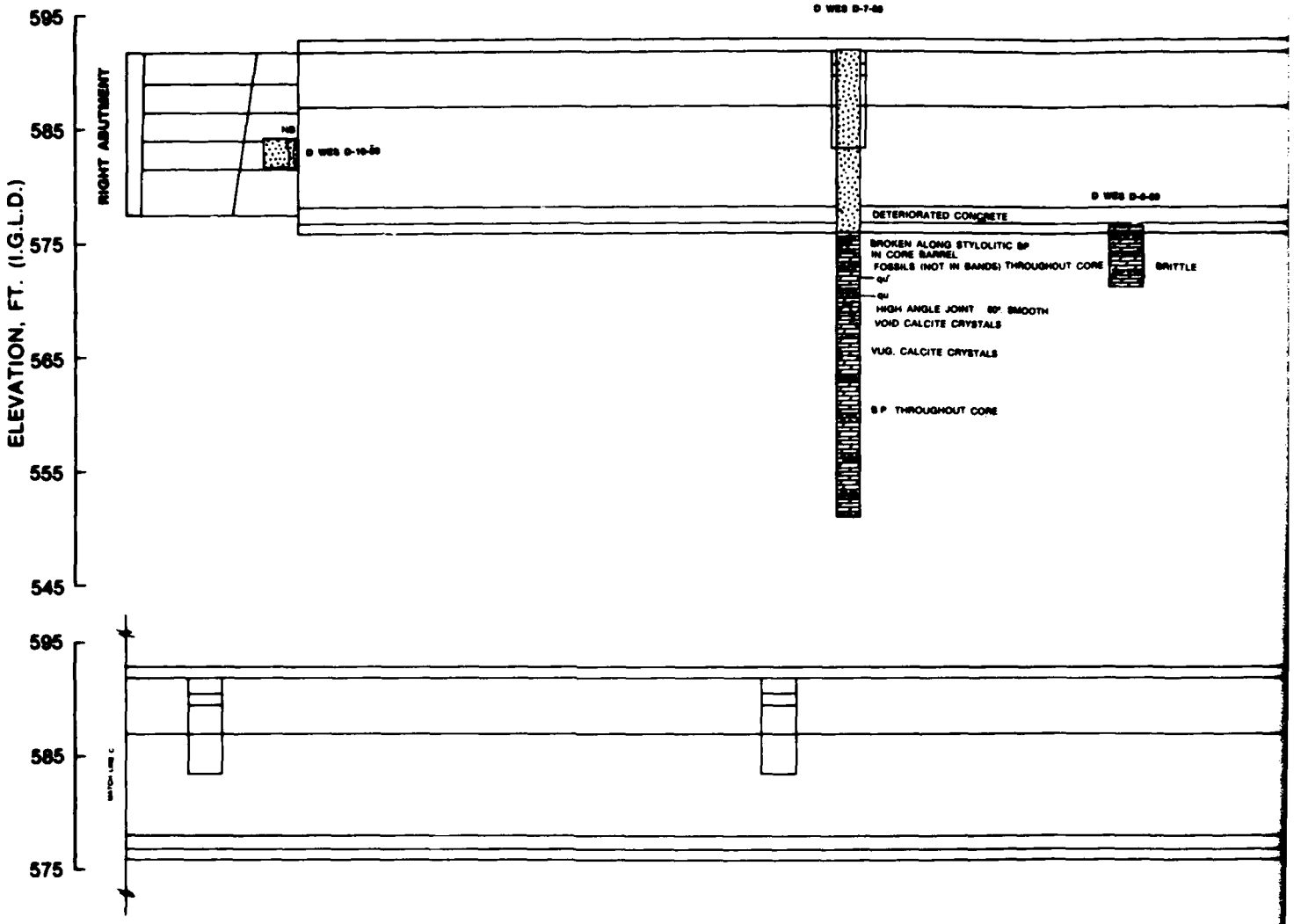
CONDITION SURVEY
AUGUST 1989

DEPERE LOCK AND DAM

GEOLOGIC CROSS SECTION

SECTION A-A'

PLATE 5



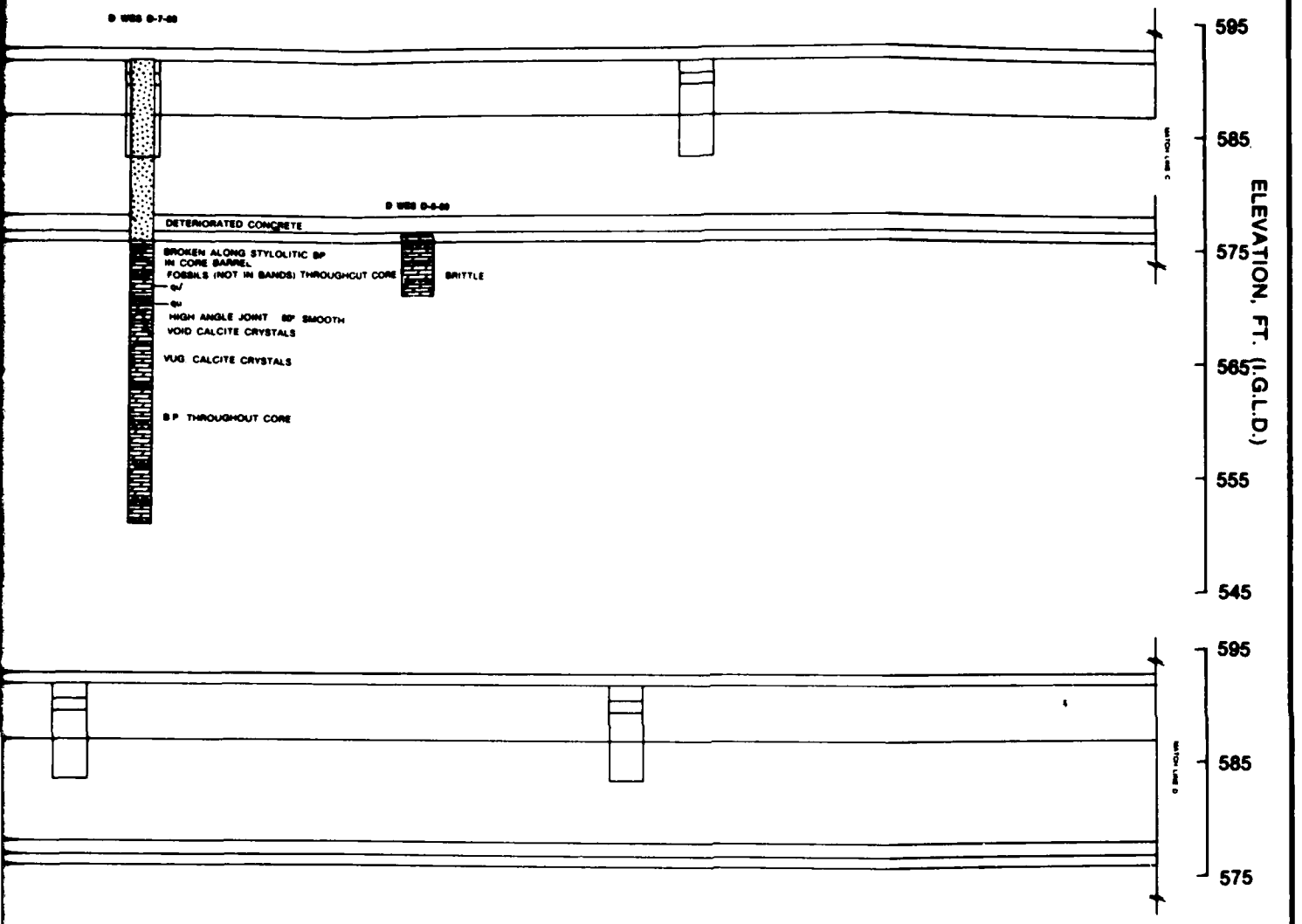
DOWNSTREAM ELEVATION OF RIGHT SPILLWAY SECTION

SCALE

5 0 5 10 FT

BORING NUMBER	ELEVATION, FT TOP OF BORING	ELEVATION, FT BOTTOM OF CORE	CORE SIZE, IN.	CORE RECOVERY, %
D WES D-6-60	578.3	578.81	4	100
D WES D-7-60	591.8	551.2	6, 4	100
D WES D-10-60	584.3	HORIZONTAL	4	94

STANDARD LOW WATER AND ELEVATIONS ARE REFERRED TO MEAN WATER LEVEL AT FATHER POINT, QUEBEC I G.L.D (1955) (INTERNATIONAL GREAT LAKES DATUM)



DOWNSTREAM ELEVATION OF RIGHT SPILLWAY SECTION

SCALE

5 0 5 10 FT

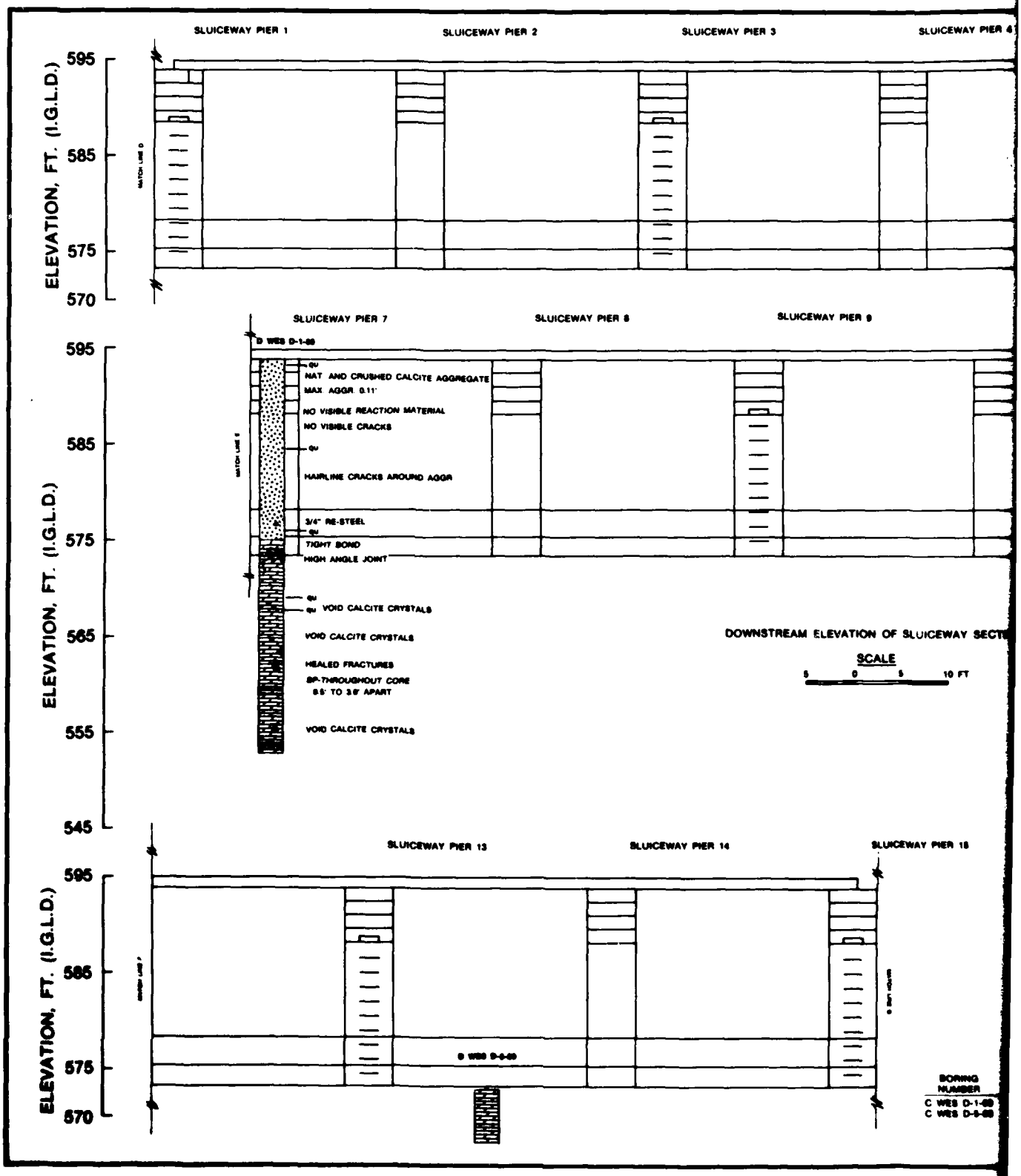
CONDITION SURVEY
AUGUST 1980

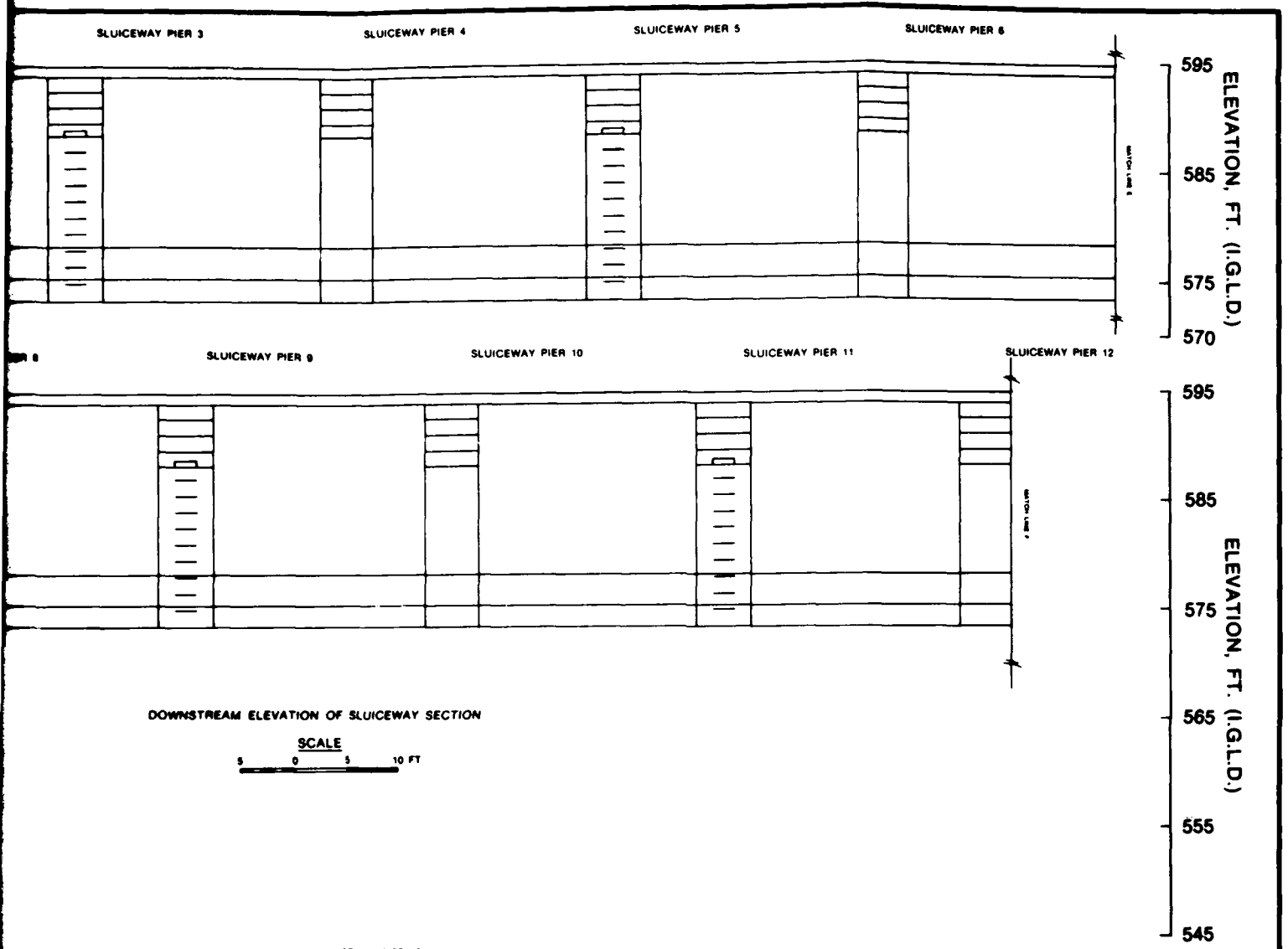
DEPERE LOCK AND DAM

GEOLOGIC CROSS SECTION

SECTION B-B'

PLATE 6

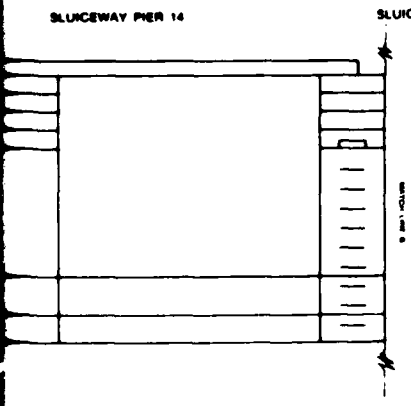

SLUICEWAY PIER 1
SLUICEWAY PIER 2
SLUICEWAY PIER 3
SLUICEWAY PIER 4
ELEVATION, FT. (I.G.L.D.)
595
585
575
570
SLUICEWAY PIER 7
SLUICEWAY PIER 8
SLUICEWAY PIER 9
D WES D-1-60
NAT AND CRUSHED CALCITE AGGREGATE
MAX AGGR 0.11"
NO VISIBLE REACTION MATERIAL
NO VISIBLE CRACKS
HAIRLINE CRACKS AROUND AGGR
3/4" RE-STEEL
TIGHT BOND
HIGH ANGLE JOINT
VOID CALCITE CRYSTALS
VOID CALCITE CRYSTALS
HEALED FRACTURES
SP-THROUGHOUT CORE
8.5' TO 3.6' APART
VOID CALCITE CRYSTALS
DOWNSTREAM ELEVATION OF SLUICEWAY SECTI
SCALE
5 0 5 10 FT
545
SLUICEWAY PIER 13
SLUICEWAY PIER 14
SLUICEWAY PIER 15
C WES D-5-60
BORING NUMBER
C WES D-1-60
C WES D-5-60



DOWNSTREAM ELEVATION OF SLUICEWAY SECTION

SCALE

5 0 5 10 FT



BORING NUMBER	ELEVATION FT TOP OF BORING	ELEVATION FT BOTTOM OF CORE	CORE SIZE IN	CORE RECOVERY, %
C WES D-1-80	580 97	552 97	4	100
C WES D-5-80	572 8	567 3	NX	100

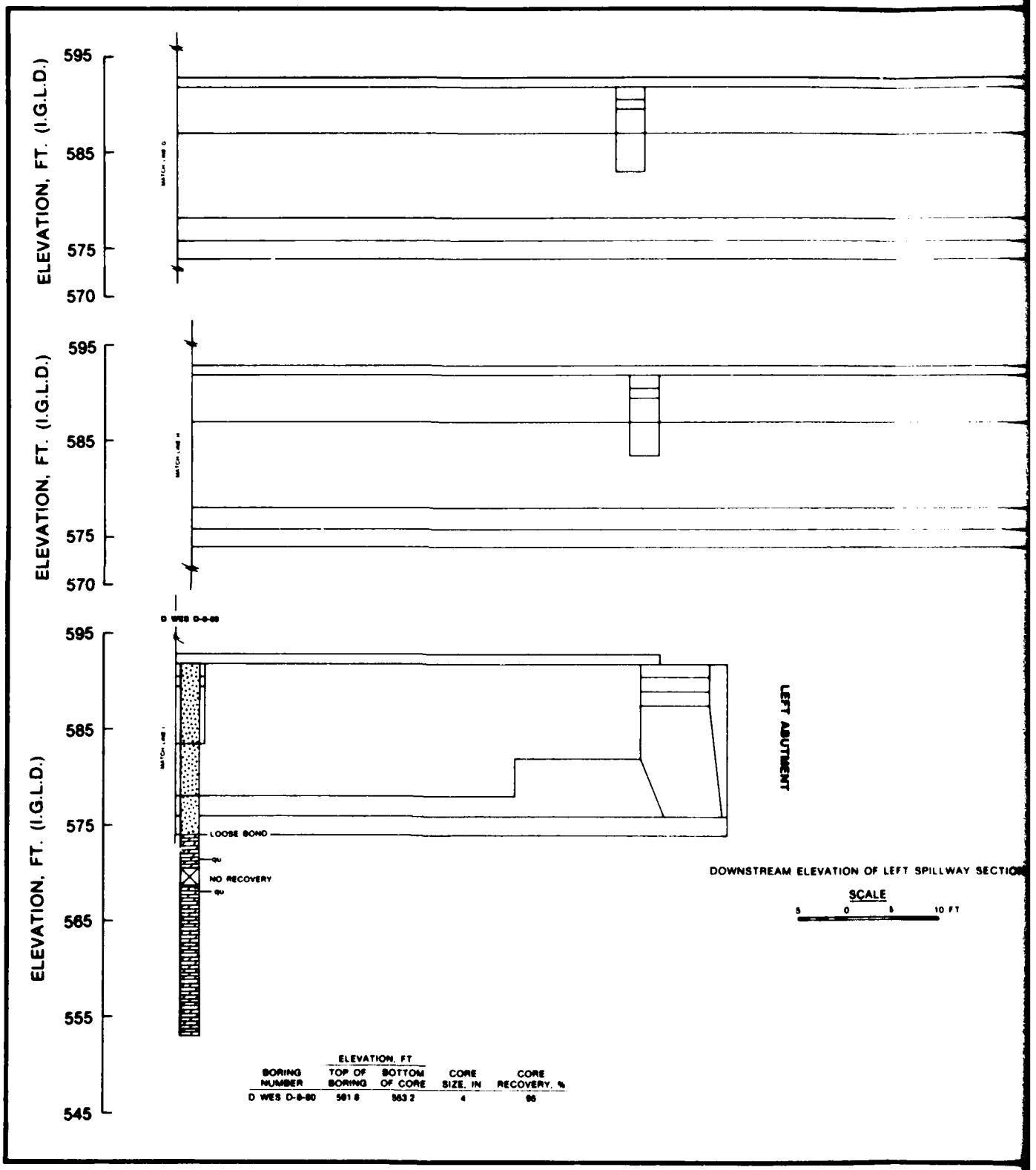
CONDITION SURVEY
AUGUST 1980

DEPERE LOCK AND DAM

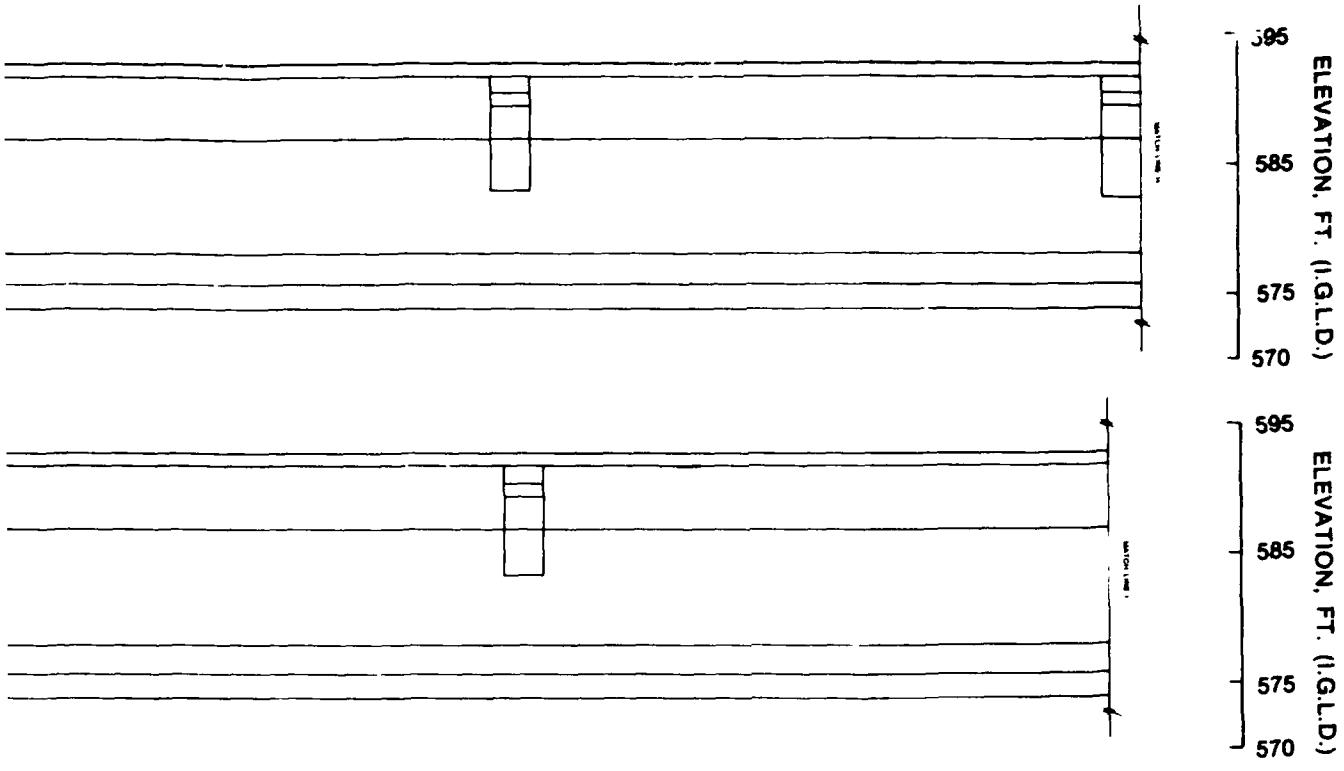
GEOLOGIC CROSS SECTION

SECTION B-B'

PLATE 7



BORING NUMBER	ELEVATION, FT TOP OF BORING	ELEVATION, FT BOTTOM OF CORE	CORE SIZE, IN	CORE RECOVERY, %
D WES D-8-80	581.8	563.2	4	66



LEFT ABUTMENT

NNSTREAM ELEVATION OF LEFT SPILLWAY SECTION

SCALE

5 0 5 10 FT

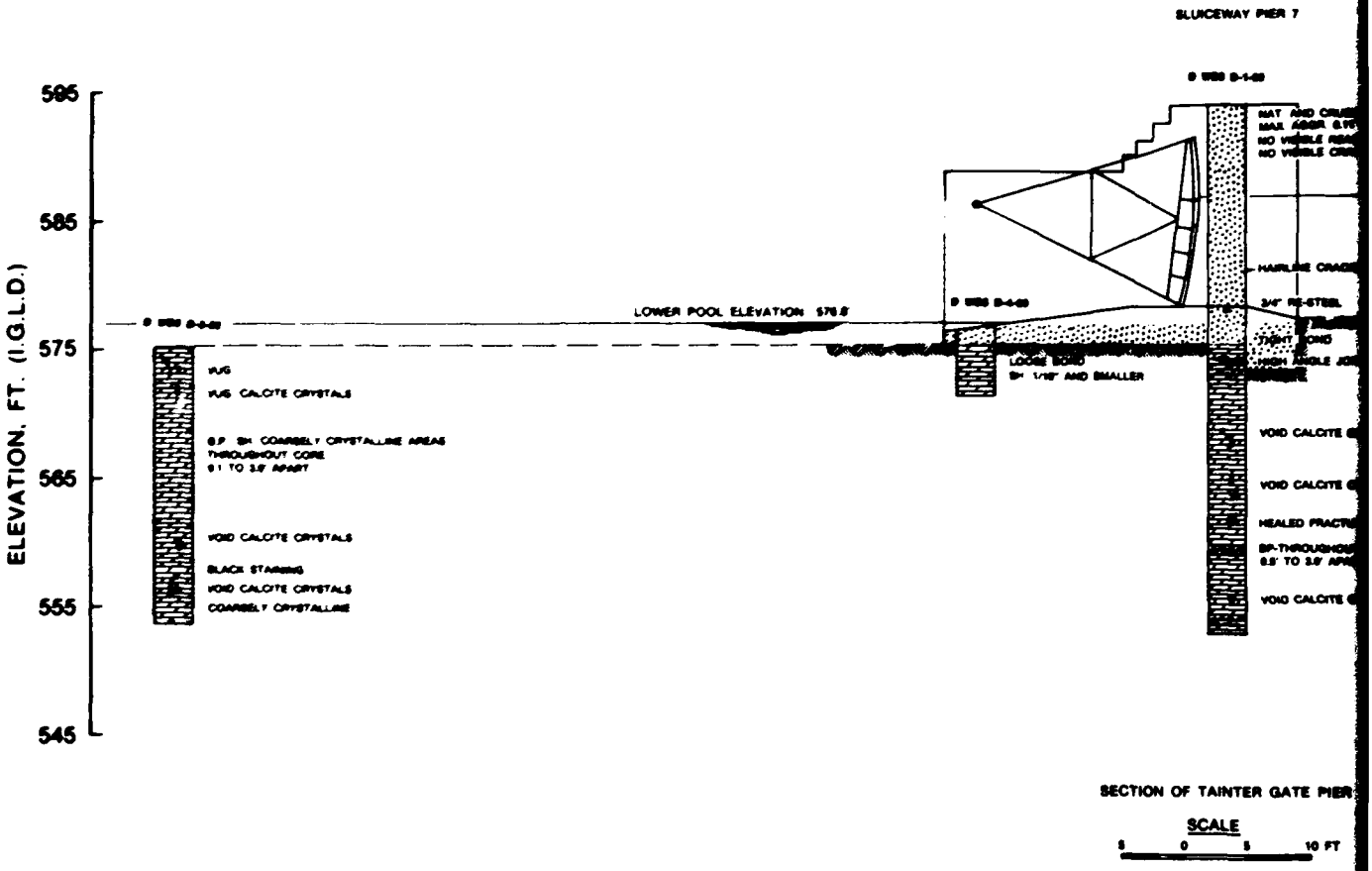
CONDITION SURVEY
AUGUST 1980

DEPERE LOCK AND DAM

GEOLOGIC CROSS SECTION

SECTION B-B'

PLATE 8



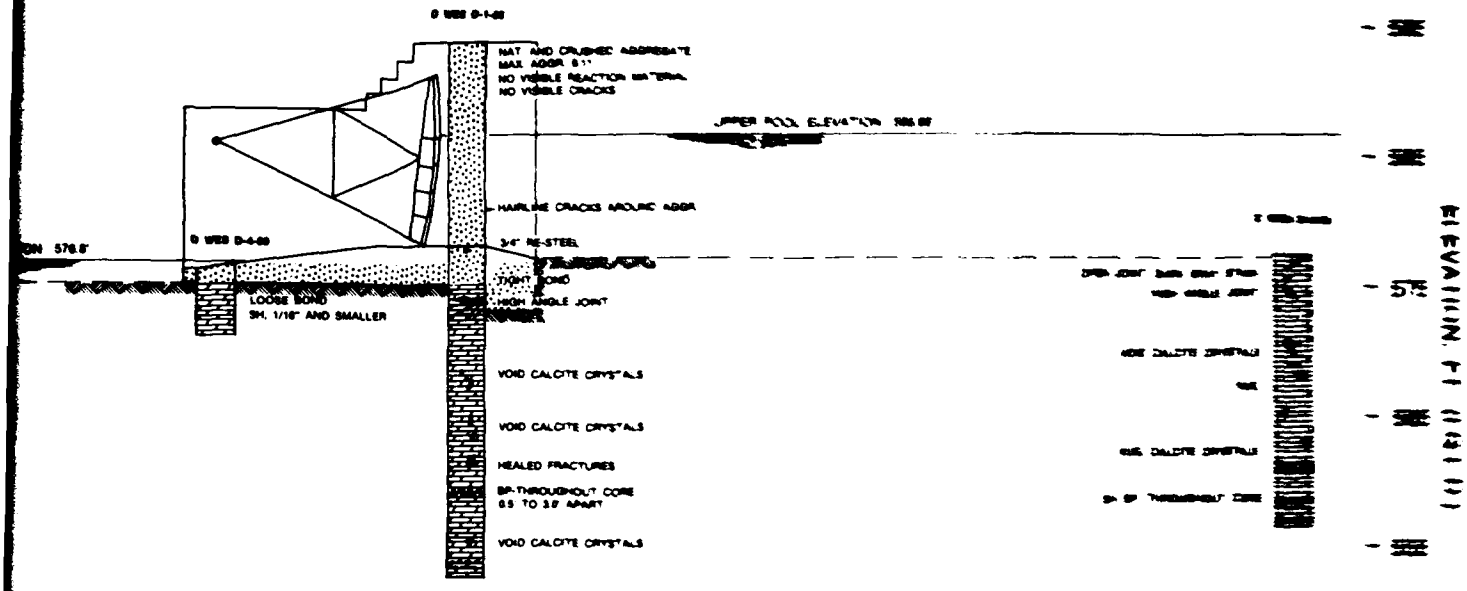
SECTION OF TAINTER GATE PIER

SCALE

5 0 5 10 FT

BORING NUMBER	ELEVATION FT TOP OF BORING	BOTTOM OF CORE	CORE SIZE IN	CORE RECOVERY %
D WES D-1-60	583 97	562 97	4	100
D WES D-2-60	577 4	566 4	4	100
D WES D-3-60	575 2	564 3	4	100
D WES D-4-60	576 5	571 33	4	100

SLUICEWAY PIER 7



SECTION OF TAINTER GATE PIER

SCALE

5 0 5 10 FT

DEPERE LOCK AND DAM

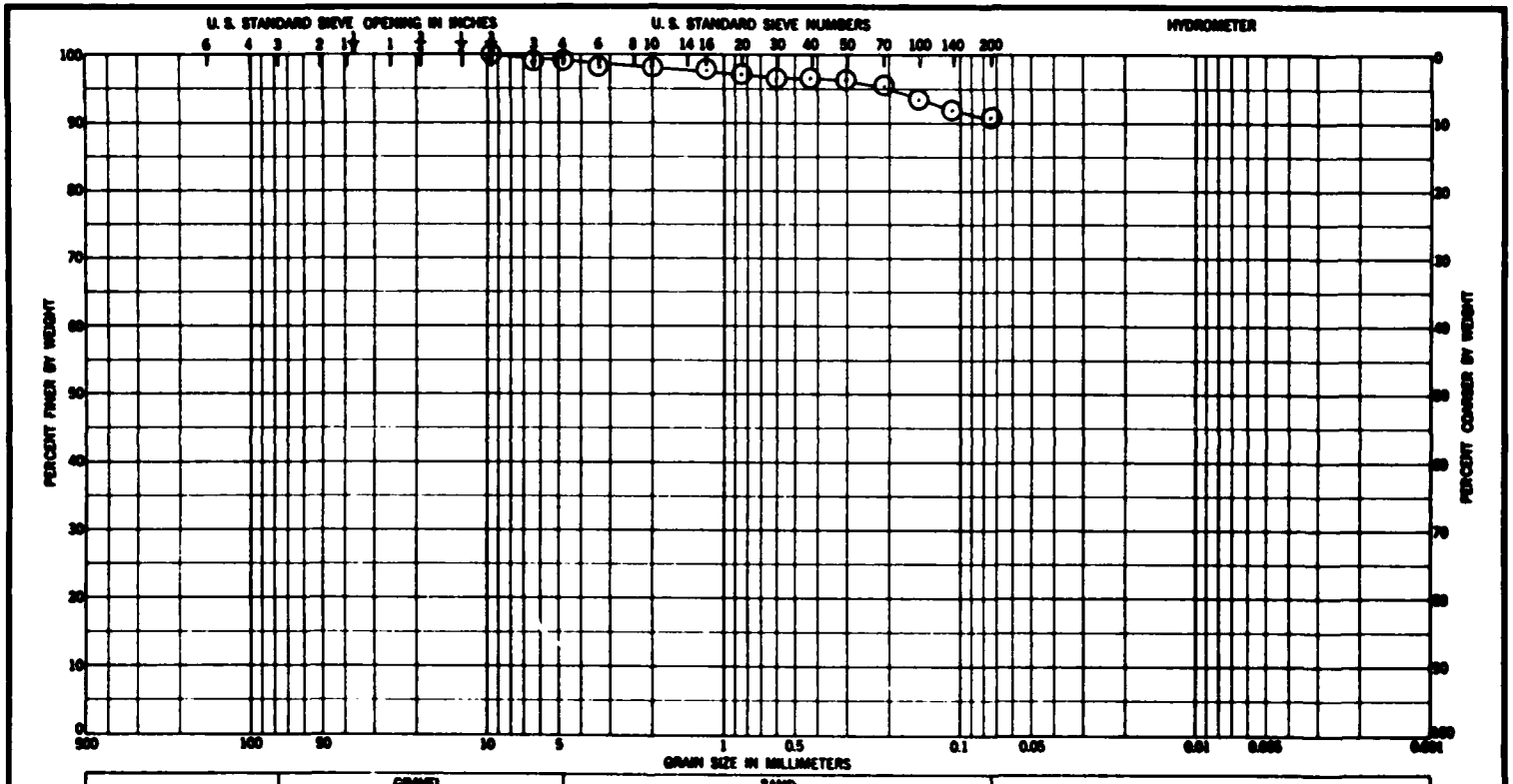
GEOLOGIC CROSS SECTION

SECTION C-C

PLATE 2

1

2



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
1A		CLAY (CL), W/SAND: BROWN	13.3	36	15	21

GRADATION CURVES

Project DEPERE LOCK & DAM

Area

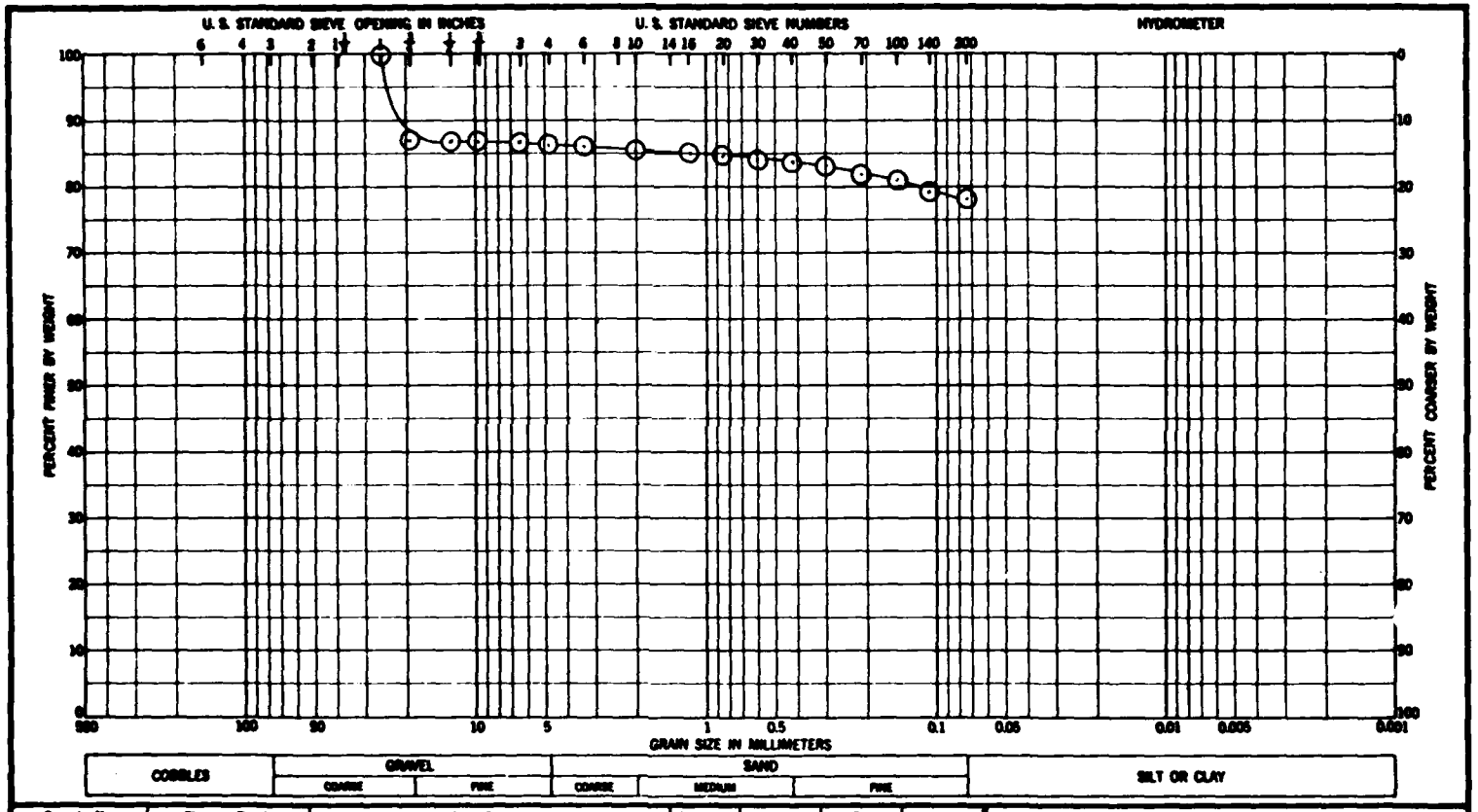
Boring No. E-1

Date 23 MARCH 1981

PLATE 10

ENG FORM 1 MAY 68 2087

PLATE 11



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
3		GRAVELLY CLAY (CL)W/SAND BROWN	18.6	42	16	26
		INSUFFICIENT SAMPLE FOR ACCURATE GRADATION				

GRADATION CURVES

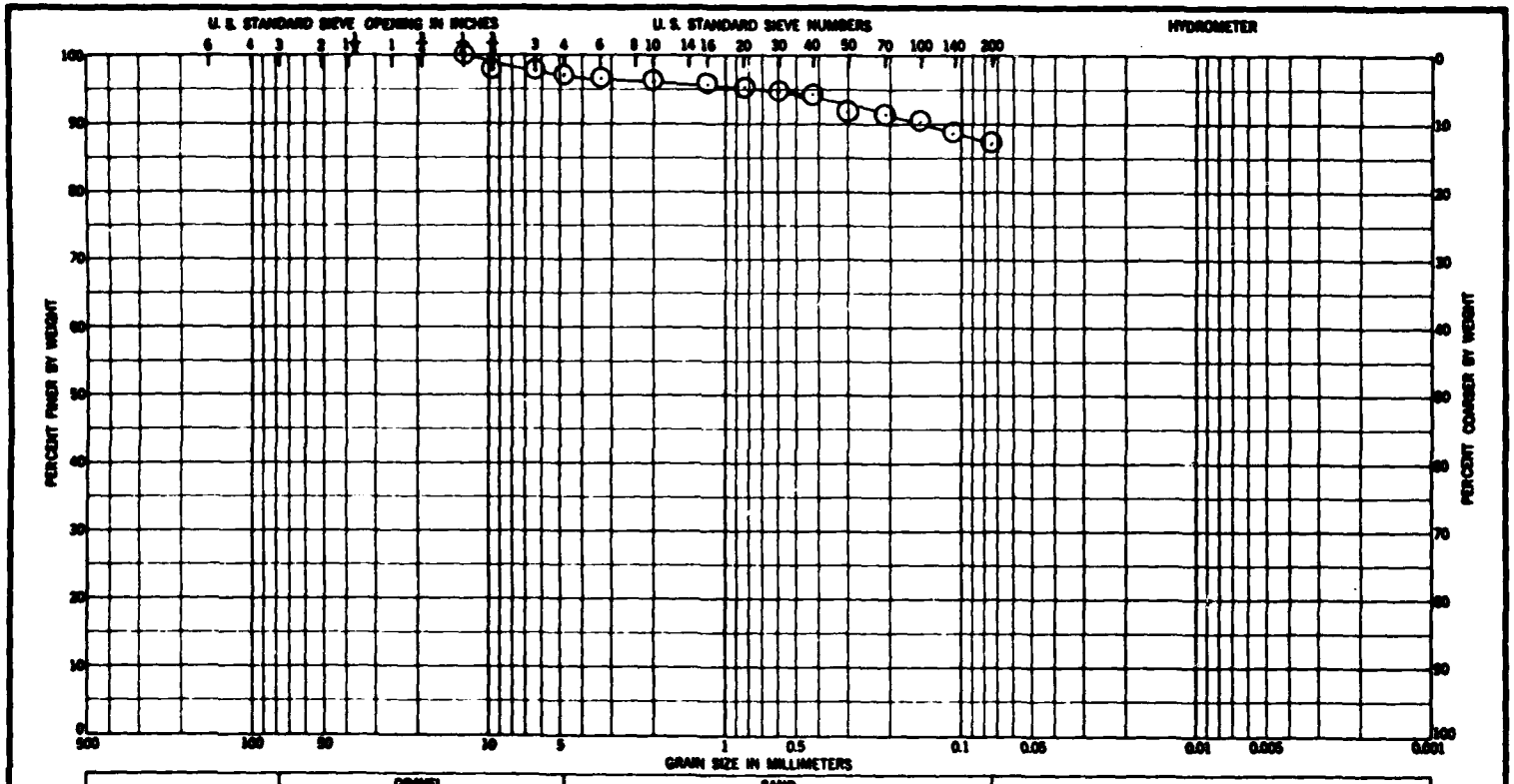
Project DEPERE LOCK & DAM

Area

Boring No. E-1

Date 23 MARCH 1981

ENG FORM 1 MAY 69 2087



Sample No.	Elev or Depth	Classification	Nat w %	LL	PL	PI
4A		CLAY (CL) W/SAND BROWN	17.6	40	15	25
		INSUFFICIENT SAMPLE FOR ACCURATE GRADATION				

Project DEPERE LOCK & DAM

Area

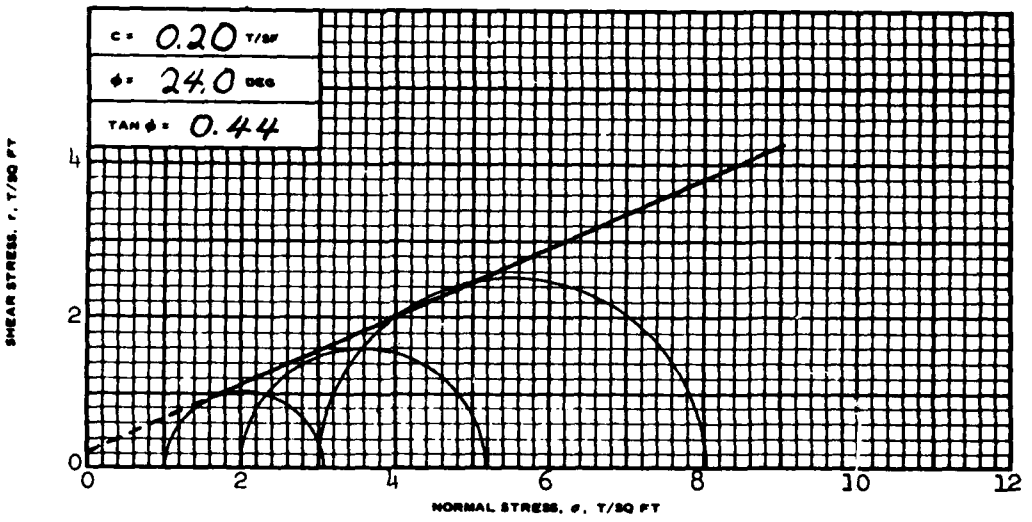
Boring No. E-1

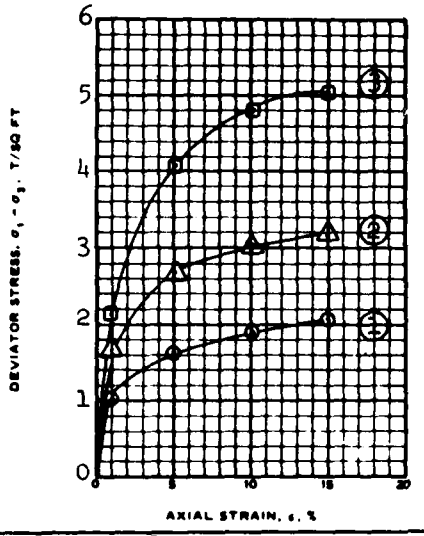
Date 23 MARCH, 1981

GRADATION CURVES

PLATE 12

ENG FORM 1 MAY 63 2087





SPECIMEN NO.			1	2	3
INITIAL	WATER CONTENT, %	w_o	22.3	23.2	20.3
	DRY DENSITY LB/CU FT	γd_o	105.2	104.3	108.5
	SATURATION, %	S_o	98.8	100+	97.6
	VOID RATIO	e_o	0.614	0.628	0.566
BEFORE SHEAR	WATER CONTENT, %	w_c	21.9	21.5	19.0
	DRY DENSITY LB/CU FT	γd_c	108.5	109.3	113.9
	SATURATION, %	S_c	100+	100+	100+
	VOID RATIO	e_c	0.565	0.553	0.491
	FINAL BACK PRESSURE, T/SQ FT	u_b	5.76	5.76	5.76
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	2.06	3.19	5.04
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f	1000	1000	1000
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$			
INITIAL DIAMETER, IN.		D_o	1.39	1.39	1.40
INITIAL HEIGHT, IN.		H_o	3.00	3.00	3.00

CONTROLLED- STRAIN TEST

DESCRIPTION OF SPECIMENS CLAY (CL), REDDISH BROWN; COARSE SAND

LL	PL	PI	Gs

TYPE OF SPECIMEN UNDISTURBED TYPE OF TEST $\bar{R}$

REMARKS:

PROJECT DEPERE LOCK & DAM

BORING NO. E-1 SAMPLE NO. 5

DEPTH/ELEV

LABORATORY USAEWES DATE 19 JAN 81

SHEET 1 OF 2

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110-2-1906)

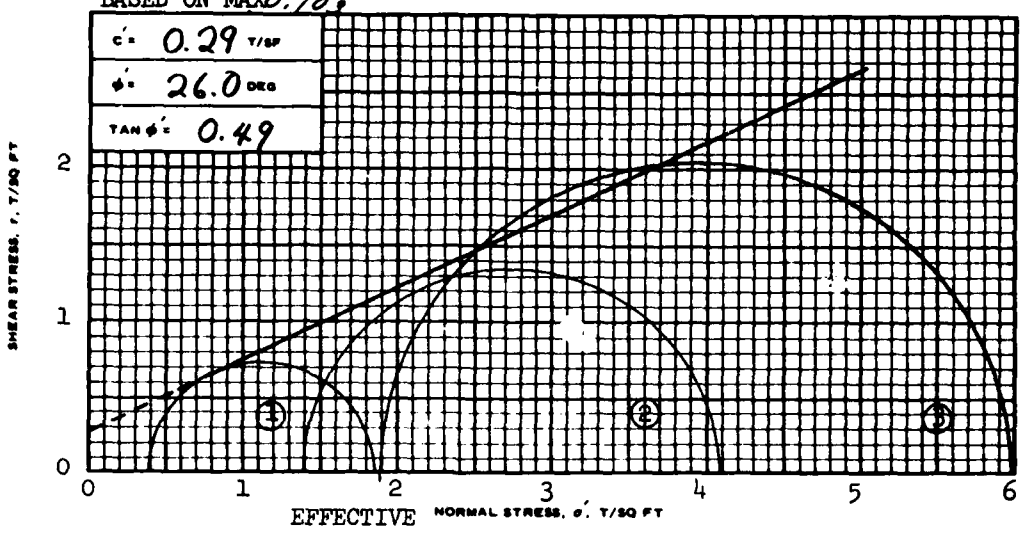
PLATE 13

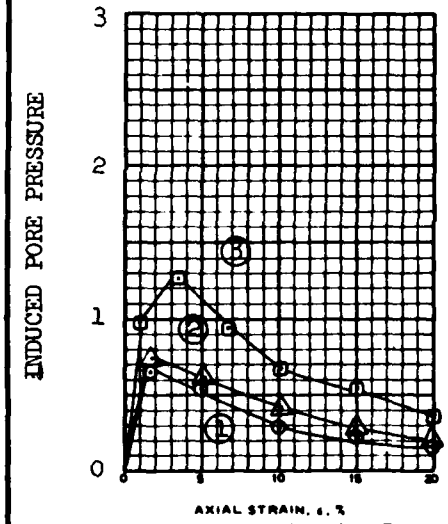
BASED ON MAX σ'_1/σ'_3

c' = 0.29 T/SF

ϕ' = 26.0 DEG

TAN ϕ' = 0.49





SPECIMEN NO.			1	2	3	
INITIAL	WATER CONTENT, %	w_o				
	DRY DENSITY LB/CU FT	γd_o				
	SATURATION, %	S_o				
	VOID RATIO	e_o				
BEFORE SHEAR	WATER CONTENT, %	w_c				
	DRY DENSITY LB/CU FT	γd_c				
	SATURATION, %	S_c				
	VOID RATIO	e_c				
	FINAL BACK PRESSURE, T/SQ FT	u_b				
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	0.39	1.38	1.89	
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	1.45	2.69	4.07	
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f				
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$				
INITIAL DIAMETER, IN.		D_o				
INITIAL HEIGHT, IN.		H_o				

CONTROLLED- TEST

DESCRIPTION OF SPECIMENS

LL	PL	PI	Gs

TYPE OF SPECIMEN UNDISTURBED TYPE OF TEST $\overline{R}$

REMARKS:

PROJECT DEPERE LOCK & DAM

BORING NO. SAMPLE NO. 5

DEPTH/ELEV

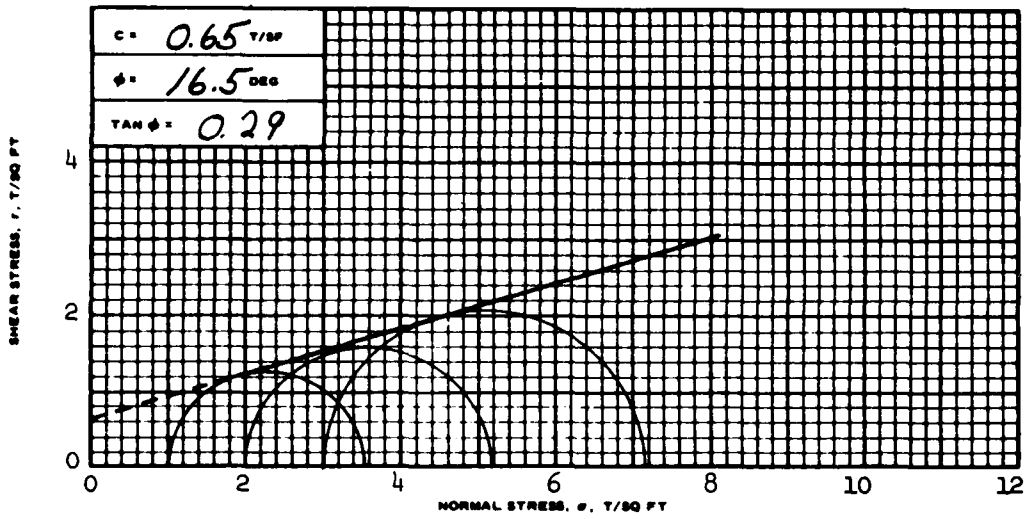
LABORATORY USAEWES DATE 19 JAN 81

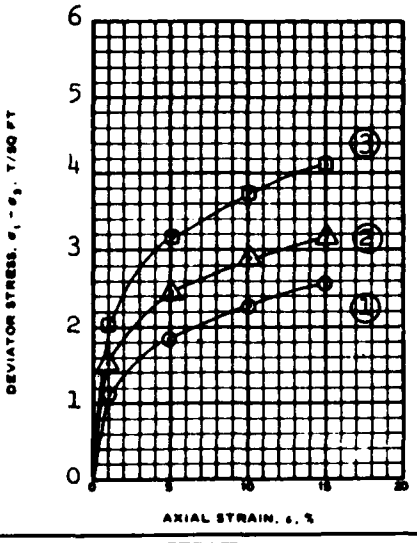
SHEET 2 OF 2

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110-2-1906)

PLATE 14





SPECIMEN NO.			1	2	3
INITIAL	WATER CONTENT, %	w_o	19.6	19.5	19.3
	DRY DENSITY LB/CU FT	γ_{d_o}	109.5	108.2	109.7
	SATURATION, %	S_o	96.8	93.1	95.7
	VOID RATIO	e_o	0.551	0.570	0.548
BEFORE SHEAR	WATER CONTENT, %	w_c	19.5	19.2	18.2
	DRY DENSITY LB/CU FT	γ_{d_c}	113.6	114.4	117.7
	SATURATION, %	S_c	107.3	107.9	111.9
	VOID RATIO	e_c	0.494	0.484	0.442
	FINAL BACK PRESSURE, T/SQ FT	u_b	5.04	5.04	5.04
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	2.56	3.18	4.14
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f	1071	1071	1071
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$			
INITIAL DIAMETER, IN.		D_o	1.39	1.40	1.39
INITIAL HEIGHT, IN.		H_o	3.00	3.00	3.00

CONTROLLED- STRAIN TEST

DESCRIPTION OF SPECIMENS

LL	PL	PI	Gs

TYPE OF SPECIMEN UNDISTURBED TYPE OF TEST $\overline{R}$

REMARKS:

PROJECT DEPERE LOCK & DAM

BORING NO. E-2 SAMPLE NO. 4-A

DEPTH/ELEV

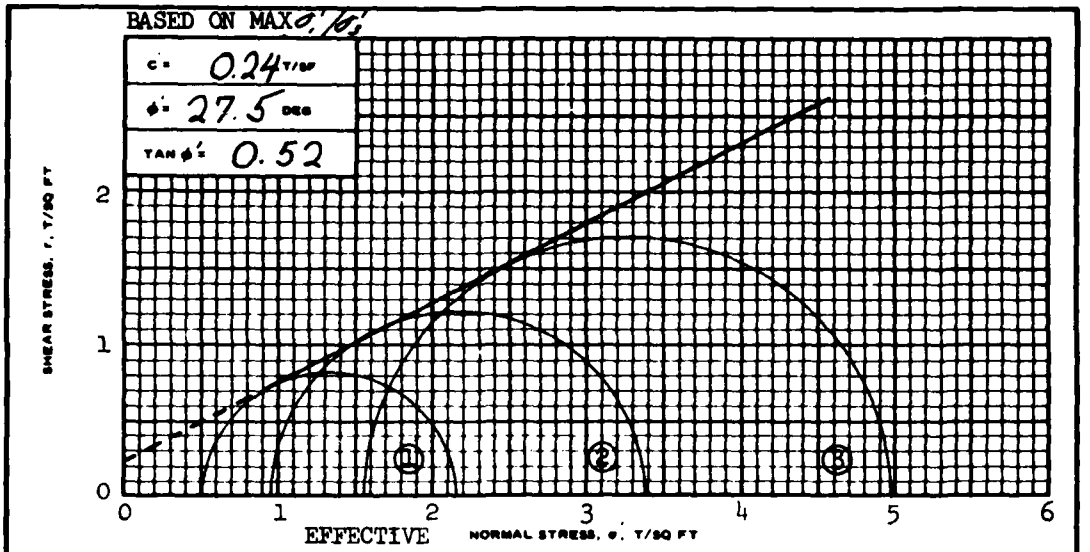
LABORATORY USAEWES DATE 19 JAN 81

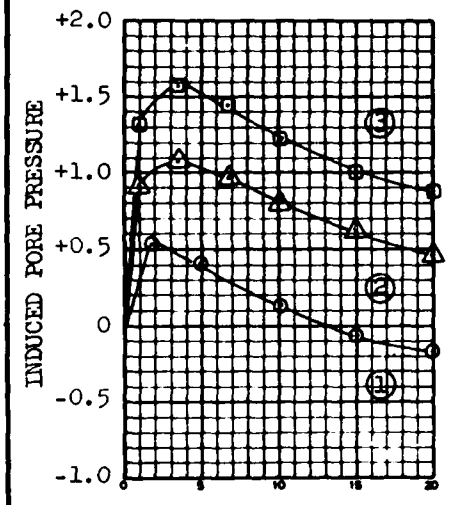
SHEET 1 OF 2 JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110-2-1906)

PLATE 15

BASED ON MAX $\sigma_1 - \sigma_3$





SPECIMEN NO.			1	2	3	
INITIAL	WATER CONTENT, %	w_o				
	DRY DENSITY LB/CU FT	γ_{d_o}				
	SATURATION, %	S_o				
	VOID RATIO	e_o				
BEFORE SHEAR	WATER CONTENT, %	w_c				
	DRY DENSITY LB/CU FT	γ_{d_c}				
	SATURATION, %	S_c				
	VOID RATIO	e_c				
	FINAL BACK PRESSURE, T/SQ FT	u_b				
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	0.51	0.95	1.56	
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	1.65	2.42	3.42	
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f				
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$				
INITIAL DIAMETER, IN.		D_o				
INITIAL HEIGHT, IN.		H_o				

CONTROLLED- TEST

DESCRIPTION OF SPECIMENS CLAY (CL), BROWN; COARSE SAND

LL	PL	PI	Gs	TYPE OF SPECIMEN	TYPE OF TEST

REMARKS:

PROJECT DEPERE LOCK & DAM

BORING NO. E-2 SAMPLE NO. 4-A

DEPTH/ELEV

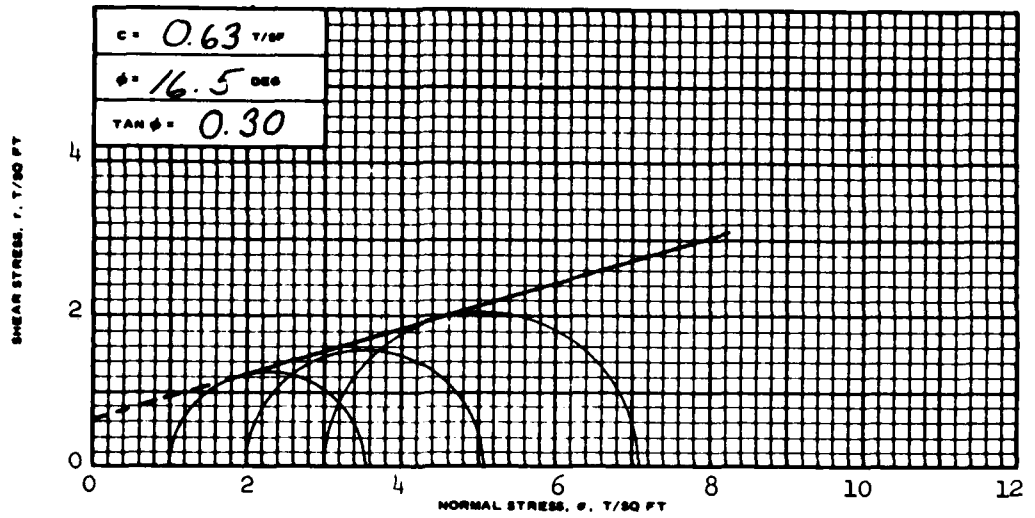
LABORATORY USAEWES DATE 19 JAN 81

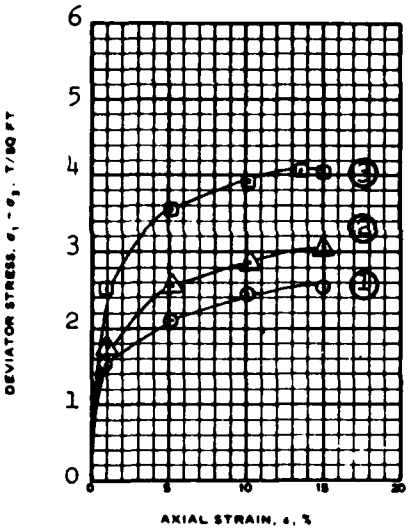
SHEET 2 OF 2

JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110-2-1906)

PLATE 16





SPECIMEN NO.			1	2	3
INITIAL	WATER CONTENT, %	w_o	20.3	21.4	21.0
	DRY DENSITY LB/CU FT	γ_{d_o}	107.8	104.0	105.4
	SATURATION, %	s_o	96.1	92.0	93.6
	VOID RATIO	e_o	0.575	0.633	0.611
BEFORE SHEAR	WATER CONTENT, %	w_c	21.6	21.8	20.9
	DRY DENSITY LB/CU FT	γ_{d_c}	109.4	107.7	110.1
	SATURATION, %	s_c	100+	100+	100+
	VOID RATIO	e_c	0.552	0.577	0.542
	FINAL BACK PRESSURE, T/SQ FT	u_b	6.48	6.48	6.48
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	1.0	2.0	3.0
MAXIMUM DEVIATOR STRESS, T/SQ FT	$(\sigma_1 - \sigma_3)_{MAX}$		2.55	3.05	4.05
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f	1071	1071	964
ULTIMATE DEVIATOR STRESS, T/SQ FT	$(\sigma_1 - \sigma_3)_{ULT}$				
INITIAL DIAMETER, IN.		D_o	1.40	1.41	1.40
INITIAL HEIGHT, IN.		H_o	3.00	3.00	3.00

CONTROLLED- STRAIN TEST

DESCRIPTION OF SPECIMENS CLAY (CL), BROWN; COARSE SAND

LL	PL	PI	Gs

TYPE OF SPECIMEN UNDISTURBED TYPE OF TEST $\bar{R}$

REMARKS:

PROJECT DEPERE LOCK & DAM

BORING NO. E-2 SAMPLE NO. 5-B

DEPTH/ELEV

LABORATORY USAEWES DATE 19 JAN 81

SHEET 1 OF 2 JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110-2-1906)

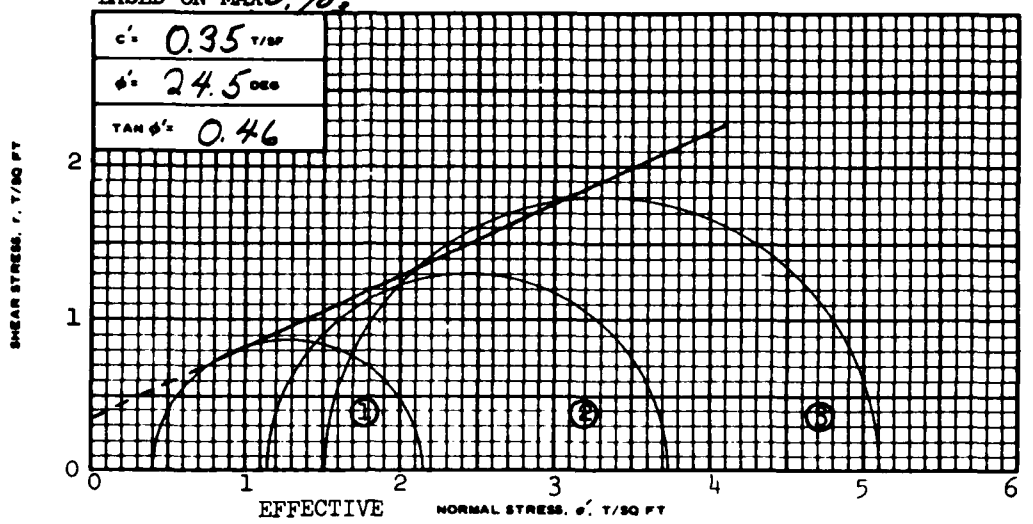
PLATE 17

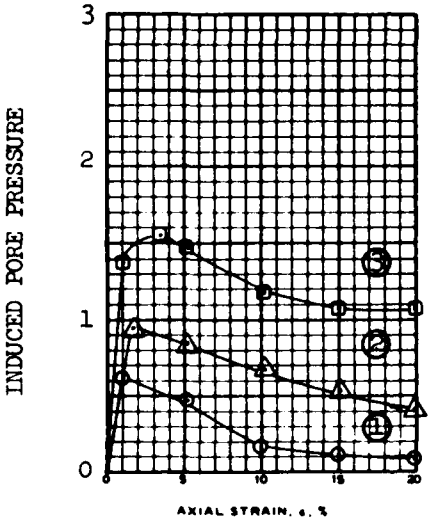
BASED ON MAX σ_1'/σ_3'

c': 0.35 T/SF

ϕ': 24.5 DEG

TAN ϕ': 0.46





SPECIMEN NO.			1	2	3	
INITIAL	WATER CONTENT, %	w_o				
	DRY DENSITY LB/ CU FT	γ_{d_o}				
	SATURATION, %	S_o				
	VOID RATIO	e_o				
BEFORE SHEAR	WATER CONTENT, %	w_c				
	DRY DENSITY LB/CU FT	γ_{d_c}				
	SATURATION, %	S_c				
	VOID RATIO	e_c				
	FINAL BACK PRESSURE, T/SQ FT	u_b				
MINOR PRINCIPAL STRESS, T/SQ FT		σ_3	0.40	1.15	1.52	
MAXIMUM DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{MAX}$	1.75	2.58	3.57	
TIME TO $(\sigma_1 - \sigma_3)_{MAX}$, MIN		t_f				
ULTIMATE DEVIATOR STRESS, T/SQ FT		$(\sigma_1 - \sigma_3)_{ULT}$				
INITIAL DIAMETER, IN.		D_o				
INITIAL HEIGHT, IN.		H_o				

CONTROLLED- TEST

DESCRIPTION OF SPECIMENS

LL	PL	PI	Gs	TYPE OF SPECIMEN	TYPE OF TEST

REMARKS:

PROJECT DEPERE LOCK & DAM

BORING NO E-2 SAMPLE NO. 5-B

DEPTH/ELEV

LABORATORY USAEWES DATE 19 JAN 81

SHEET 2 OF 2 JMS TRIAXIAL COMPRESSION TEST REPORT

ENG FORM NO. 2089 REV JUNE 1970 PREVIOUS EDITION IS OBSOLETE TRANSLUCENT (EM 1110-2-1906)

PLATE 18

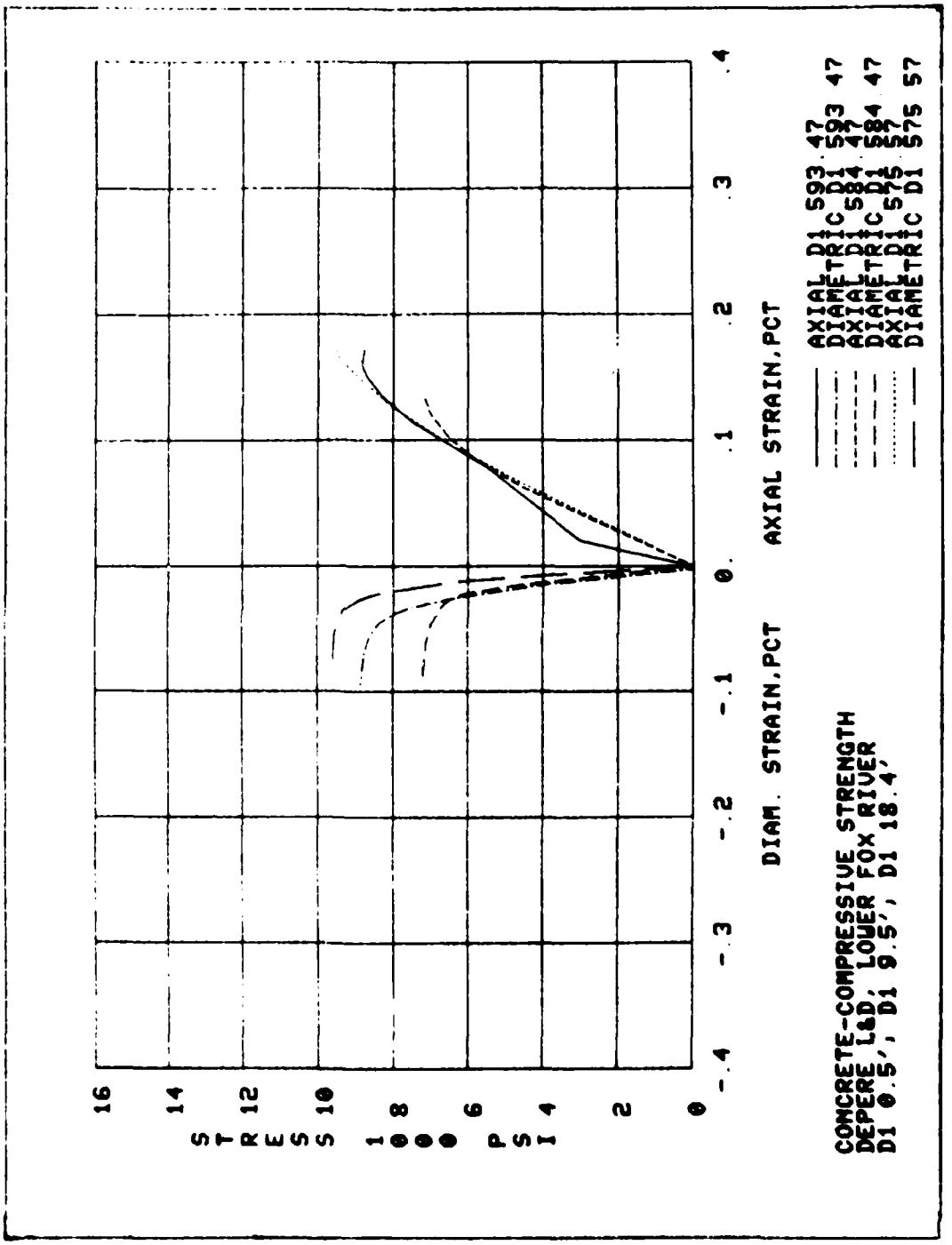

STRESS PSI 1000
16
14
12
10
8
6
4
2
0
-.4
-.3
-.2
-.1
0.
.1
.2
.3
.4
DIAM. STRAIN,PCT
AXIAL STRAIN,PCT
AXIAL D1 593 47
DIAMETRIC D1 593 47
AXIAL D1 584 47
DIAMETRIC D1 584 47
AXIAL D1 575 57
DIAMETRIC D1 575 57
CONCRETE-COMPRESSIVE STRENGTH
DEPERE L&D, LOWER FOX RIVER
D1 0.5', D1 9.5', D1 18.4'

PLATE 19

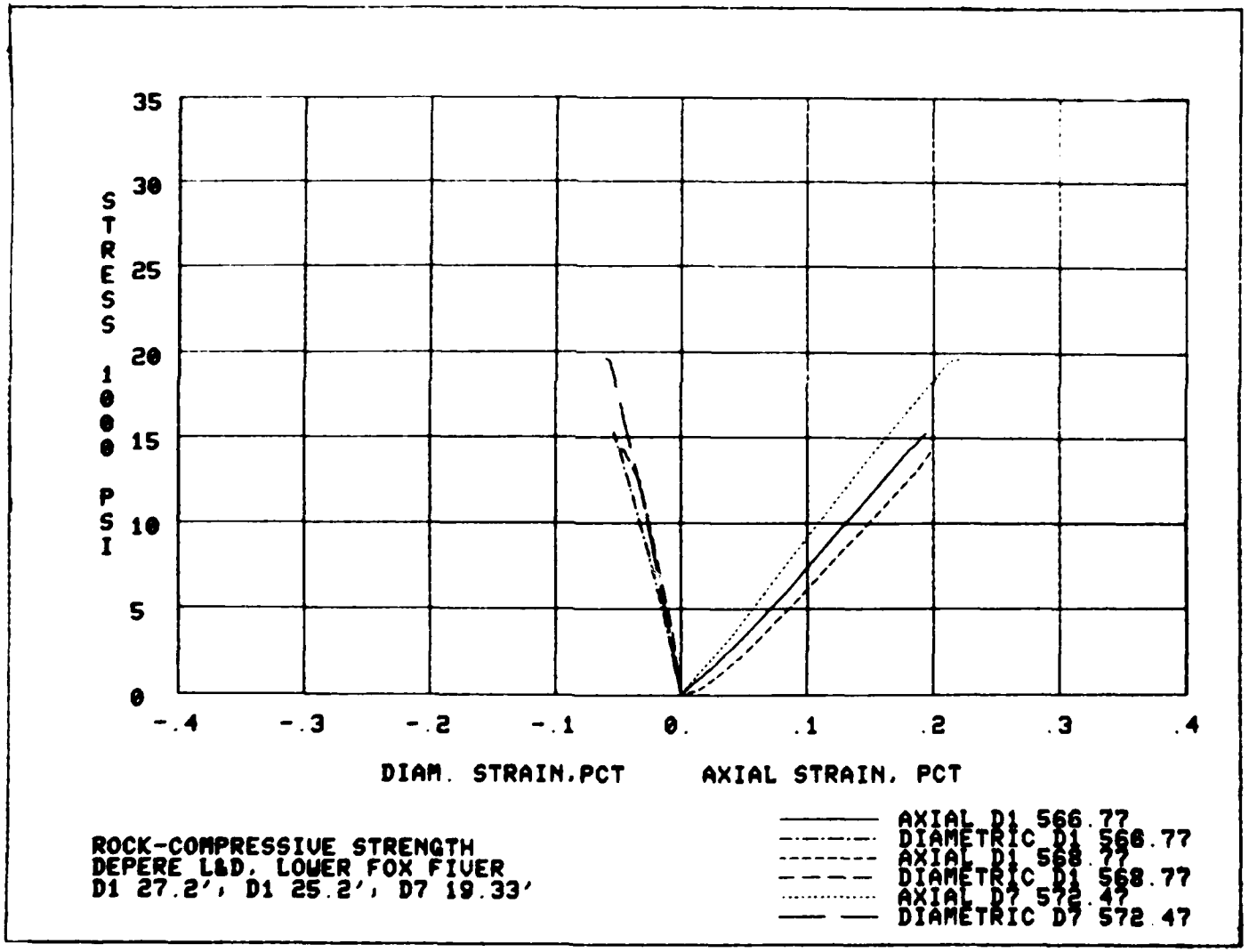
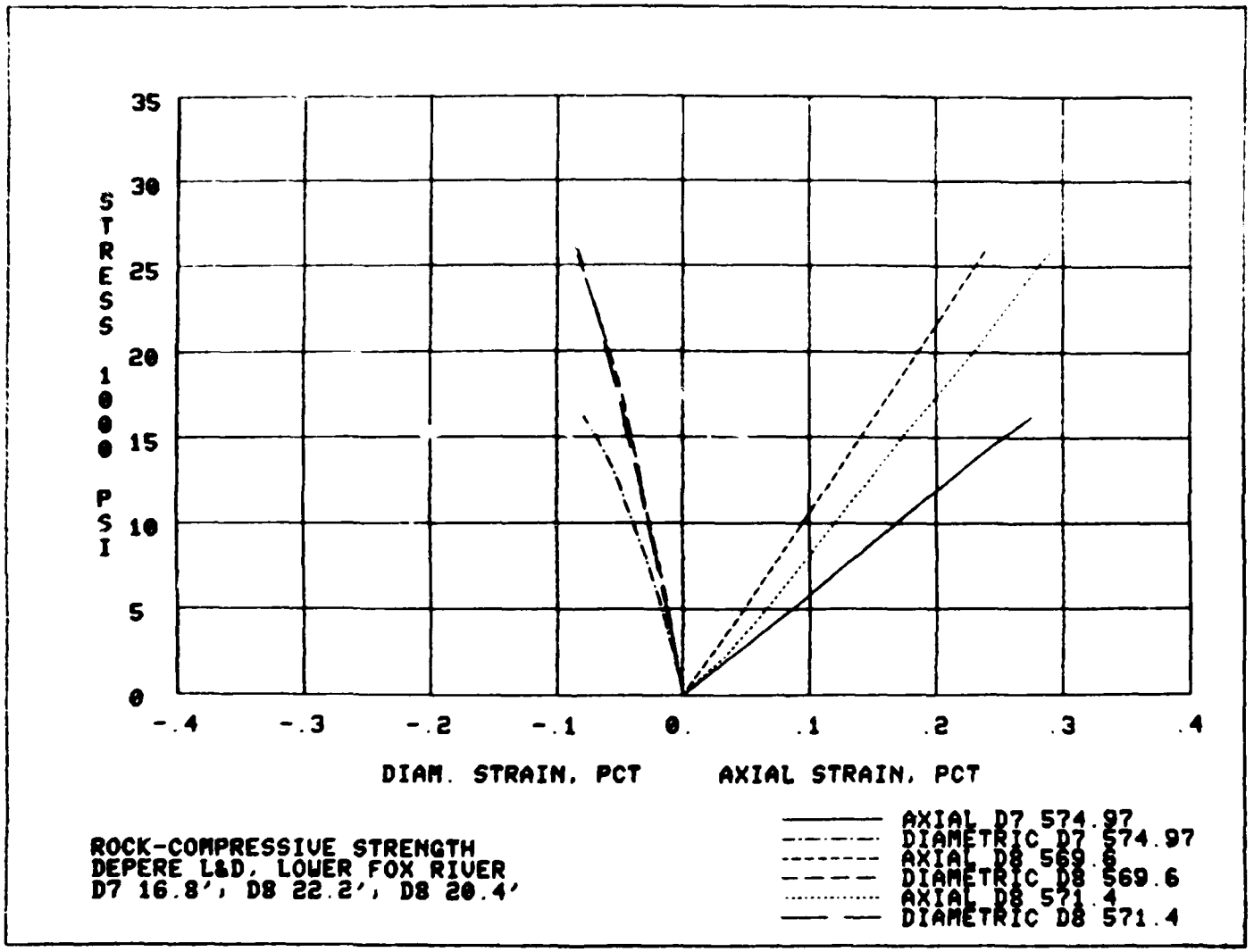
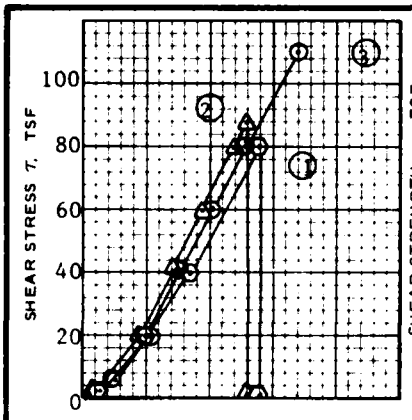
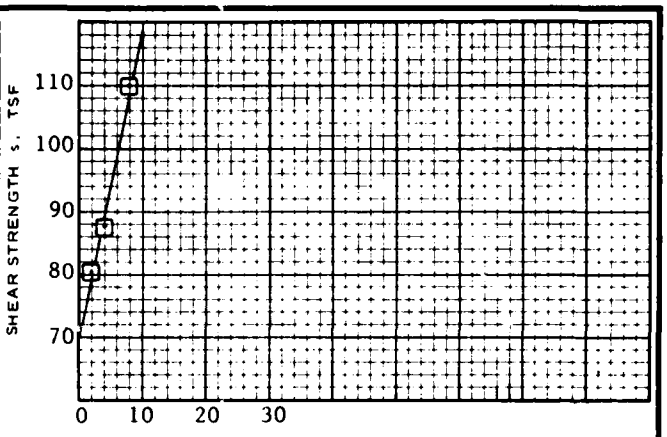

35
30
25
20
15
10
5
0
STRESS 1000 PSI
-.4
-.3
-.2
-.1
0.
.1
.2
.3
.4
DIAM. STRAIN.PCT
AXIAL STRAIN. PCT
AXIAL D1 566.77
DIAMETRIC D1 566.77
AXIAL D1 568.77
DIAMETRIC D1 568.77
AXIAL D7 572.47
DIAMETRIC D7 572.47
ROCK-COMPRESSIVE STRENGTH
DEPERE L&D. LOWER FOX FIVER
D1 27.2', D1 25.2', D7 19.33'

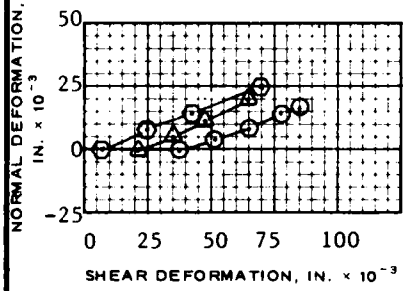
PLATE 20

PLATE 21


35
30
25
20
15
10
5
0
STRESS 1000 PSI
-.4
-.3
-.2
-.1
0.
.1
.2
.3
.4
DIAM. STRAIN, PCT
AXIAL STRAIN, PCT
ROCK-COMPRESSIVE STRENGTH
DEPERE L&D, LOWER FOX RIVER
D7 16.8', D8 22.2', D8 20.4'
AXIAL D7 574.97
DIAMETRIC D7 574.97
AXIAL D8 569.6
DIAMETRIC D8 569.6
AXIAL D8 571.4
DIAMETRIC D8 571.4







Expansion
Compression

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	78.5°	
TAN ϕ =	4.9285	
c =	70 TSF	

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_d						
WATER CONTENT	w	%	%	%	%	%	%
NORMAL STRESS, TSF	σ	2	4	8			
MAXIMUM SHEAR STRESS, TSF	τ_f	81	88	110			
TIME TO FAILURE, MINUTES	t_f	17.5	16.3	21.3			
ULTIMATE SHEAR STRESS, TSF	τ_r	--	--	--			
INITIAL DIAMETER, IN.	Do	3.95	3.95	3.95			
INITIAL HEIGHT, IN.	Ho	5.20	5.20	5.19			

DESCRIPTION OF MATERIAL Intact, Type A bedding, dolomite

REMARKS

Test No.	Boring No.	Elevation ft
1	L1-80	557.2
2	L1-80	557.7
3	D3-80	560.2

PROJECT DePere Lock and Dam
Lower Fox River

AREA

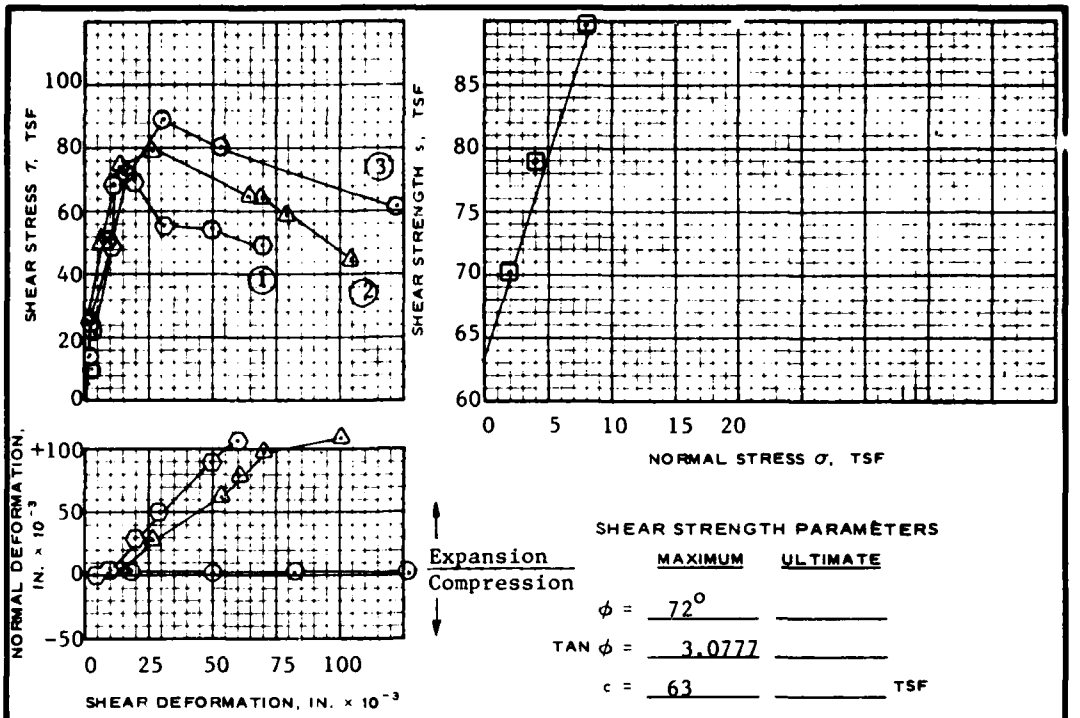
BORING NO. | SAMPLE NO.

DEPTH
EL | DATE April 1981

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490 EDITION OF JUN 65 IS OBSOLETE

PLATE 22



SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	72°	
TAN ϕ =	3.0777	
c =	63 TSF	

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_d						
WATER CONTENT	w	%	%	%	%	%	%
NORMAL STRESS, TSF	σ	2	4	8			
MAXIMUM SHEAR STRESS, TSF	τ_f	70.4	79.1	89.9			
TIME TO FAILURE, MINUTES	t_f	6	7	8			
ULTIMATE SHEAR STRESS, TSF	τ_r	49.6	45.5	57.4			
INITIAL DIAMETER, IN.	Do						
INITIAL HEIGHT, IN.	Ho						

DESCRIPTION OF MATERIAL Cross bedded, dolomite

REMARKS

Test No.	Boring No.	Elevation ft
1	D1-80	565.7
2	D1-80	564.7
3	D1-80	569.9

PROJECT DePere Lock and Dam
Lower Fox River

AREA

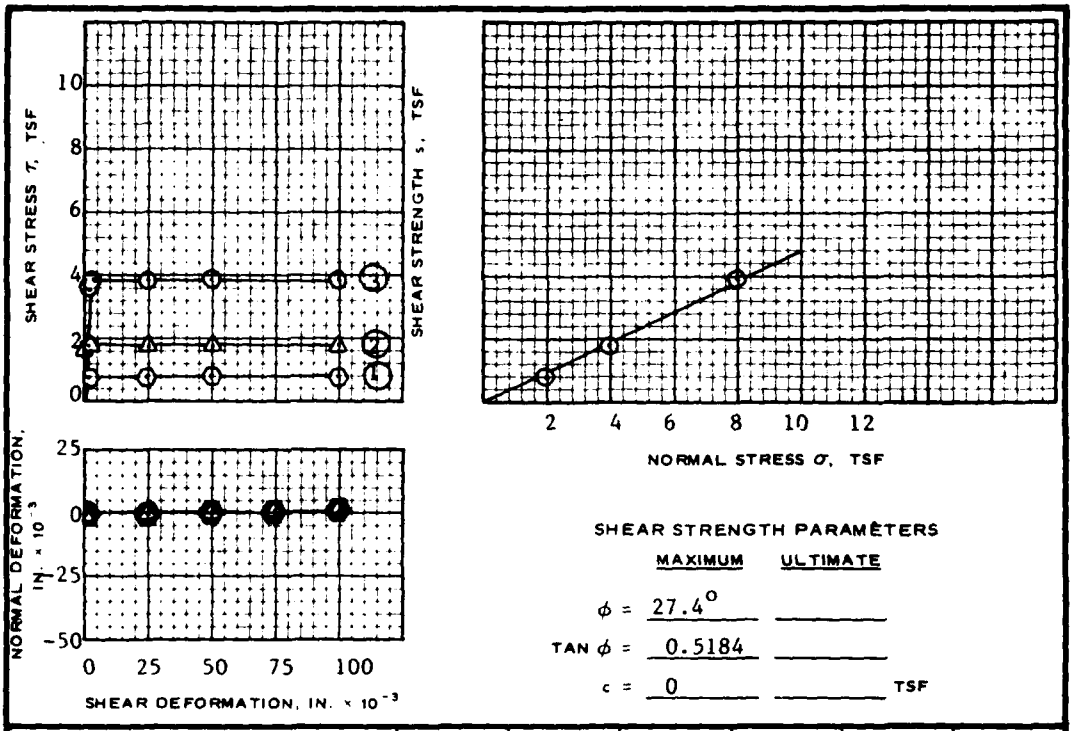
BORING NO. | SAMPLE NO.

DEPTH EL | DATE April 1981

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490 EDITION OF JUN 65 IS OBSOLETE

PLATE 23



SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	27.4°	
TAN ϕ =	0.5184	
c =	0	TSF

TEST NO.			1	2	3			
WET DENSITY, PCF	Concrete	γ_d	151.6	152.3	152.6			
	Rock		170.3	170.9	171.0			
WATER CONTENT	Concrete	w	4.3 %	4.1 %	4.1 %	%	%	%
	Rock		0.6 %	0.6 %	0.4 %			
NORMAL STRESS, TSF		σ	2	4	8			
MAXIMUM SHEAR STRESS, TSF		τ_f	0.8	1.8	3.9			
TIME TO FAILURE, MINUTES		t_f	7.5	28	39			
ULTIMATE SHEAR STRESS, TSF		τ_r	0.8	1.8	3.9			
INITIAL DIAMETER, IN.		Do	3.95	3.95	3.95			
INITIAL HEIGHT, IN.		Ho	5.90	5.87	5.92			

DESCRIPTION OF MATERIAL Concrete on rock (dolomite), precut

REMARKS

Test No.	Boring No.	Elevation, ft Concrete	Rock
1	D8-80	577.2	575.5
2	D8-80	577.4	575.2
3	D8-80	577.6	575.0

Rate of strain = 0.004 in./min

PROJECT DePere Lock and Dam
Lower Fox River

AREA

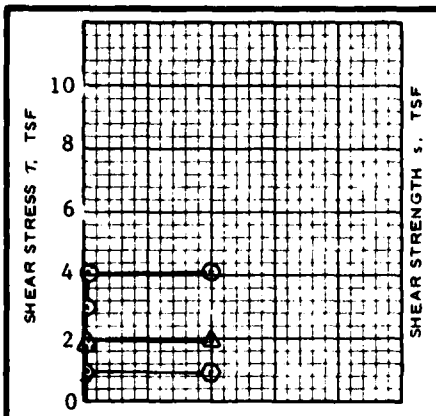
BORING NO. | SAMPLE NO.

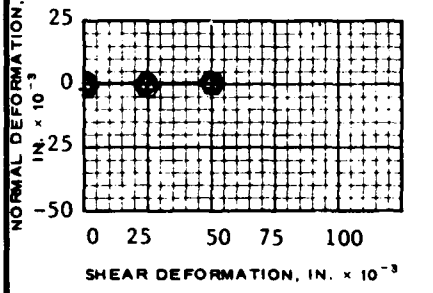
DEPTH EL | DATE April 1981

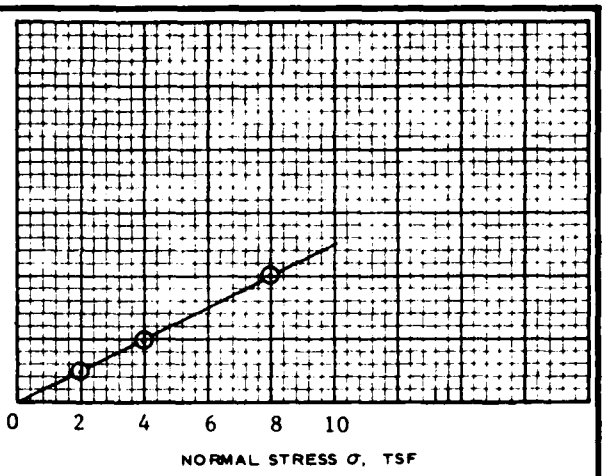
DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490 EDITION OF JUN 65 IS OBSOLETE

PLATE 24







SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	28.3°	
TAN ϕ =	0.5384	
c =	0	TSF

TEST NO.		1	2	3			
WET DENSITY, PCF	γ_d	170.9	170.1	170.6			
WATER CONTENT	w	0.6%	0.5%	0.6%	%	%	%
NORMAL STRESS, TSF	σ	2	4	8			
MAXIMUM SHEAR STRESS, TSF	τ_f	0.99	1.98	4.20			
TIME TO FAILURE, MINUTES	t_f	10	23	31			
ULTIMATE SHEAR STRESS, TSF	τ_r	0.99	1.98	4.20			
INITIAL DIAMETER, IN.	Do	3.95	3.95	3.95			
INITIAL HEIGHT, IN.	Ho	5.55	5.53	5.53			

DESCRIPTION OF MATERIAL Rock on rock (dolomite), precut

REMARKS

Test No.	Boring No.	Elevation ft
1	D8-80	567.1
2	D8-80	568.4
3	D7-80	569.2

PROJECT DePere Lock and Dam
Lower Fox River

AREA

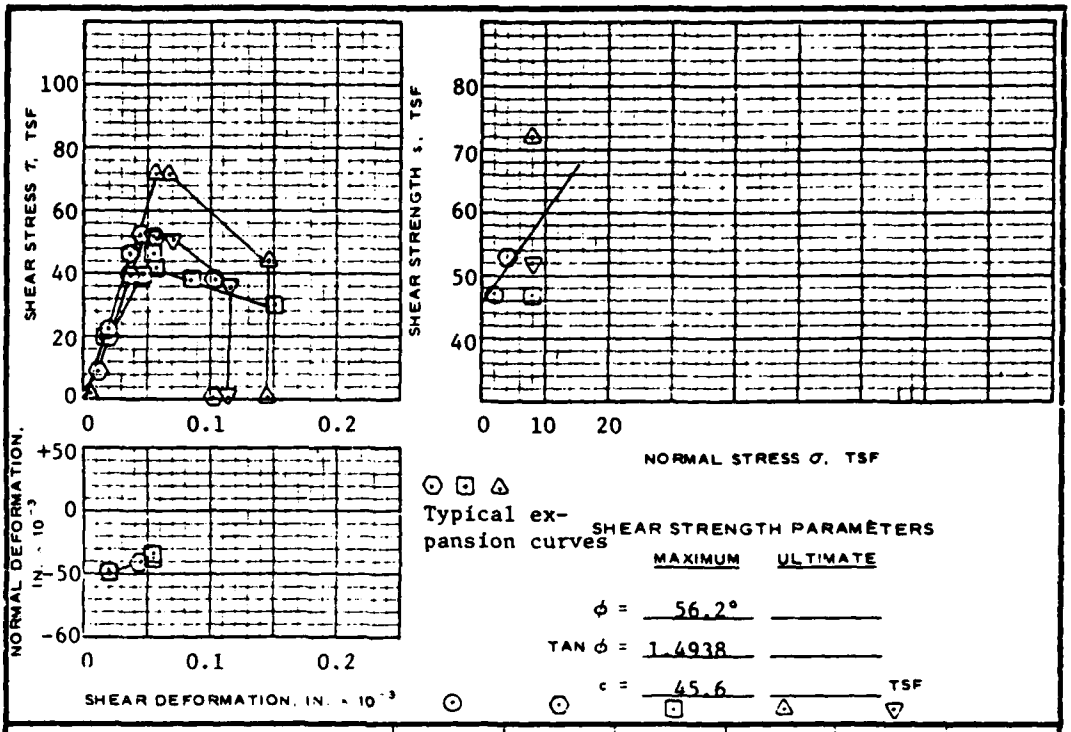
BORING NO. | SAMPLE NO.

DEPTH EL | DATE April 1981

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490 EDITION OF JUN 65 IS OBSOLETE

PLATE 25



Typical expansion curves

SHEAR STRENGTH PARAMETERS

	MAXIMUM	ULTIMATE
ϕ =	56.2°	
TAN ϕ =	1.4938	
c =	45.6	TSF

TEST NO.	Boring No. Elevation, ft		D2-80 681.6	E1-80 684.7	D1-80 685.7	D2-80 662.2	D2-80 664.4	
WET DENSITY, PCF		γ_d						
WATER CONTENT		w	%	%	%	%	%	%
NORMAL STRESS, TSF		σ	2	4	8	8	8	
MAXIMUM SHEAR STRESS, TSF		τ_f	47.7	53.0	47.0	72.0	52.0	
TIME TO FAILURE, MINUTES		t_f	13.8	11.3	13.0	15.0	13.8	
ULTIMATE SHEAR STRESS, TSF		τ_r	--	--	--	--	--	
INITIAL DIAMETER, IN.		D_o	3.95	3.95	3.95	3.95	3.95	
INITIAL HEIGHT, IN.		H_o	5.90	5.85	5.87	5.9	5.87	

DESCRIPTION OF MATERIAL Intact, type B bedding surface, dolomite

REMARKS Rate of strain 0.004 in/min. All specimens had a brittle failure; load noise and rapid decrease of shear load to zero at max deformation attained.

PROJECT Cedars Lock & Dam
Lower Fox River
AREA
BORING NO. See Test No. SAMPLE NO.
DEPTH EL See Test No. DATE March 1980

DIRECT SHEAR TEST REPORT (ROCK)

WES FORM APR 75 1490 EDITION OF JUN 65 IS OBSOLETE

PLATE 26

APPENDIX A

PHOTOGRAPHS OF LOCK AND DAM

Photo 1. Project sign adjacent to upstream gate of lock.

Photo 2. Taken from upstream right approach wall looking downstream at lock.

Photo 3. Taken from left lock wall looking at right lock wall. Spalling at vertical construction joint. Note pop-outs.

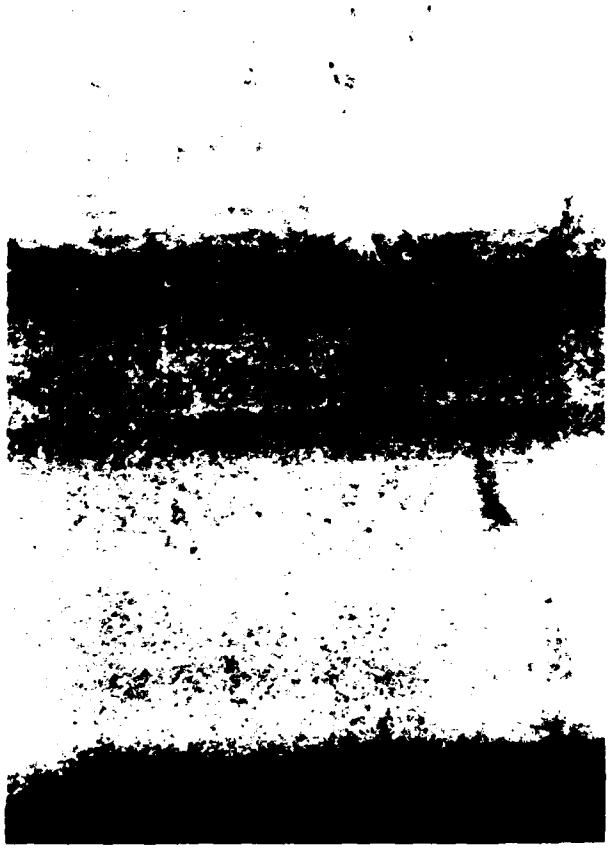


Photo 4. Taken from right lock wall looking at left lock wall. Note vertical crack and good condition of concrete surface.

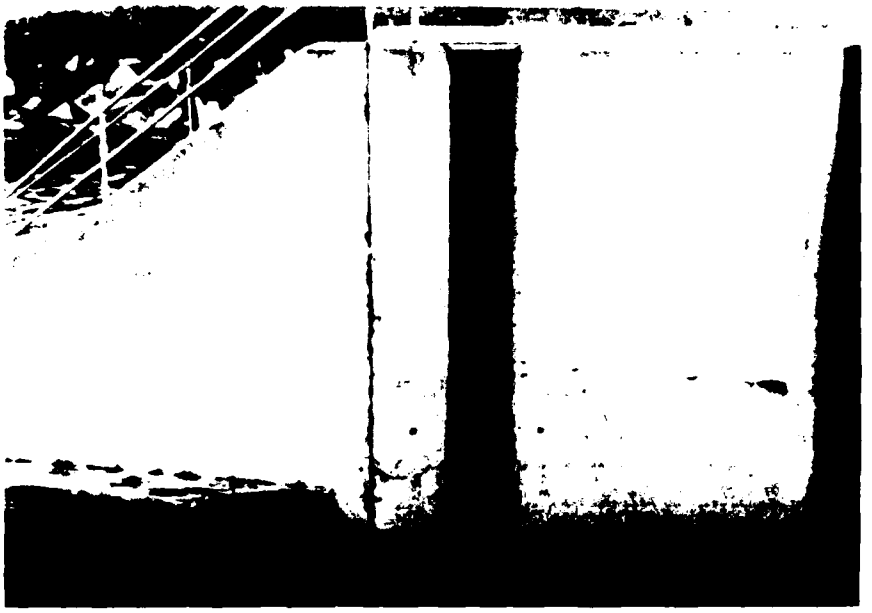


Photo 5. Taken from left lock wall looking at right wall gate monolith just downstream of gate.

Photo 6. Taken from left lock wall looking downstream at right approach wall. Canal from a mill in background.

Photo 7. Taken from upstream right approach wall looking at left approach wall. Hand crank for upstream gage visable to right of photograph. Lockmaster living quarters visable. Nicolet Paper Corporation plant can be seen across the river.

Photo 8. Taken from near upper gates on right side of lock embankment, looking downstream, minor settlement evident but embankment in good condition.

Photo 9. Taken from near lower gates on left side of lock embankment, looking upstream, minor settlement evident, embankment in good condition.

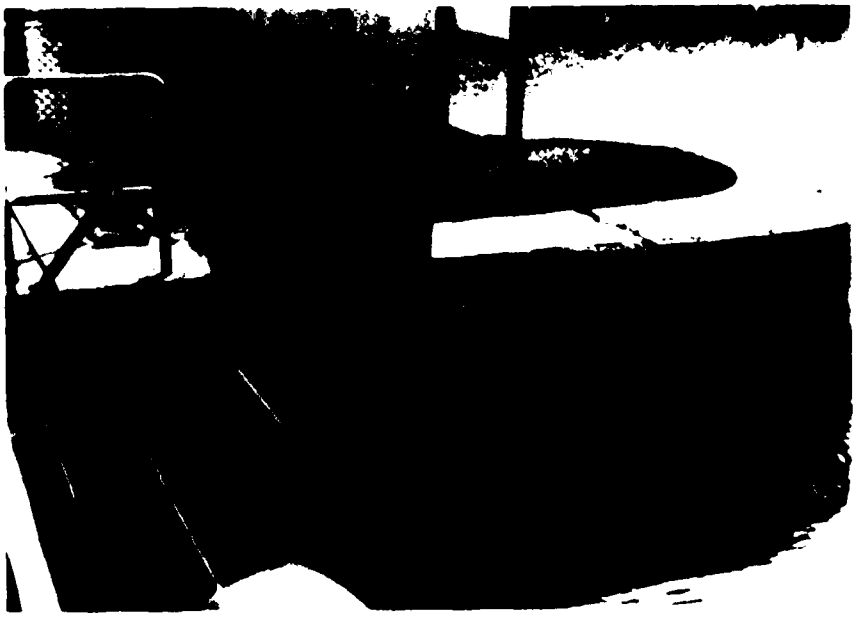


Photo 10. Taken from right spillway, looking at upstream portion of right dam abutment pier. Crack evident, concrete in good condition.

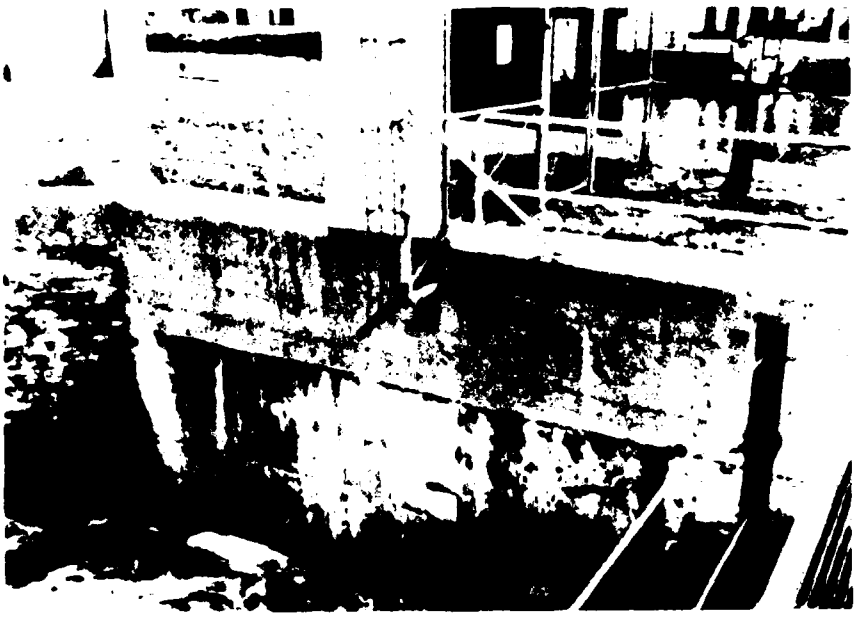


Photo 11. Taken from right spillway, looking at downstream portion of right dam abutment pier. Top concrete in good condition. White exudation coming from horizontal joint and cracks.

Photo 12. Taken from right abutment, looking upstream at wide crack on top of abutment pier. Cracked section of concrete appears raised.

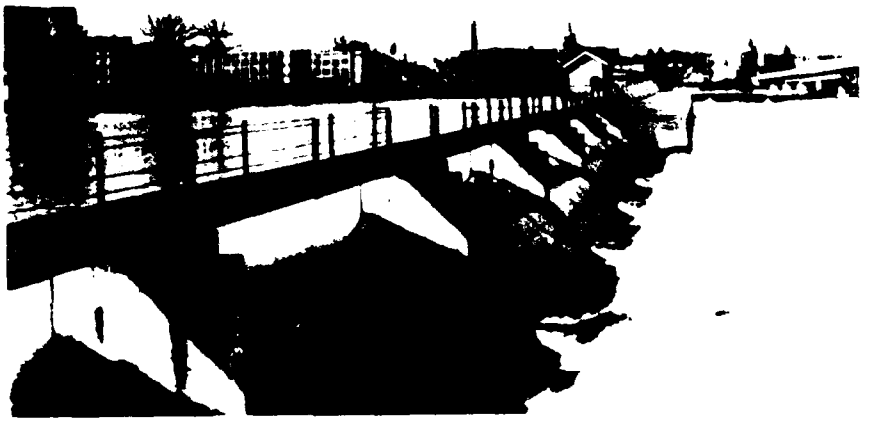


Photo 13. Taken from right dam abutment, looking across right spillway. Minor amount of white exudation and cracking; spillway pier No. 1.

Photo 14. Taken from same location as Photo 12. Close-up of spillway pier No. 1. Boring D WES D7-80 was drilled through pier.

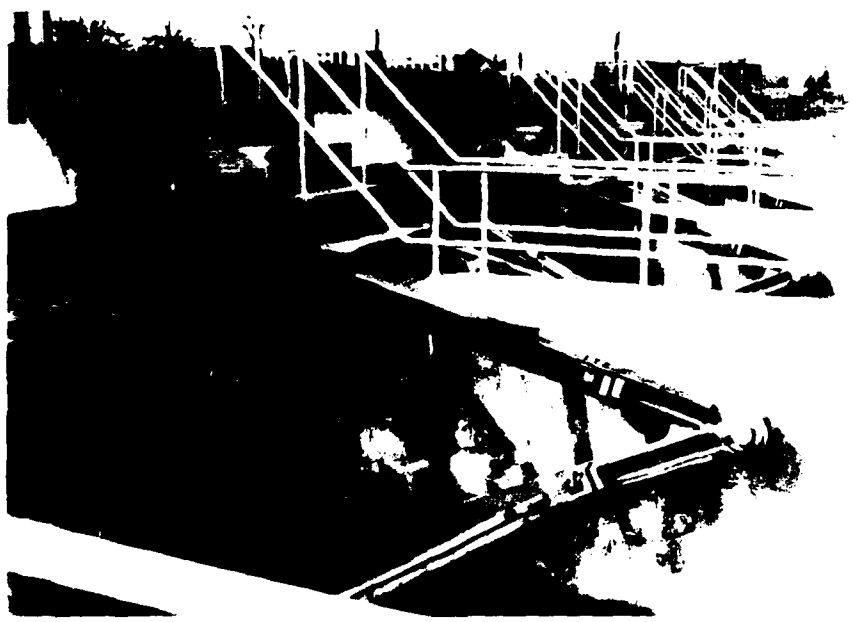


Photo 15. Taken from sluiceway pier No. 10, looking upstream. Except for local cracking and exudation, concrete is in generally good condition.

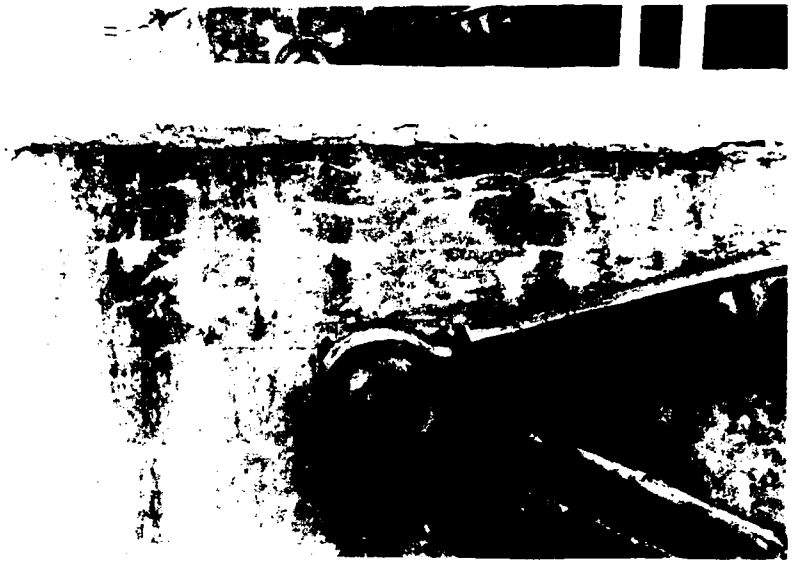


Photo 16. Taken from sluiceway pier, cracking is typical of freeze-thaw action; white exudation present at cracks.

Photo 17. Taken from sluiceway pier, typical diagonal cracking from hinge pin, cracks go through piers.

Photo 18. Taken from sluiceway pier, looking downstream, erosion of concrete near low pool elevation.

Photo 19. Taken from sluiceway pier No. 15, looking across left spillway, concrete in pier in good condition. Private dam seen just downstream of left abutment.

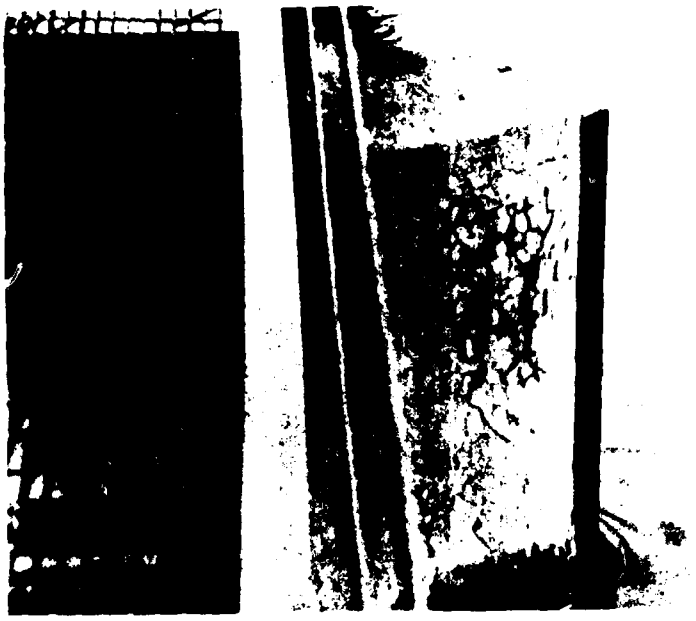


Photo 20. Taken from left spillway, looking upstream at nose of pier, pattern cracking with water seeping from cracks causing the cracks to appear dark brown.

Photo 21. Taken from left spillway, looking upstream at walkway pier, patched concrete in good condition.

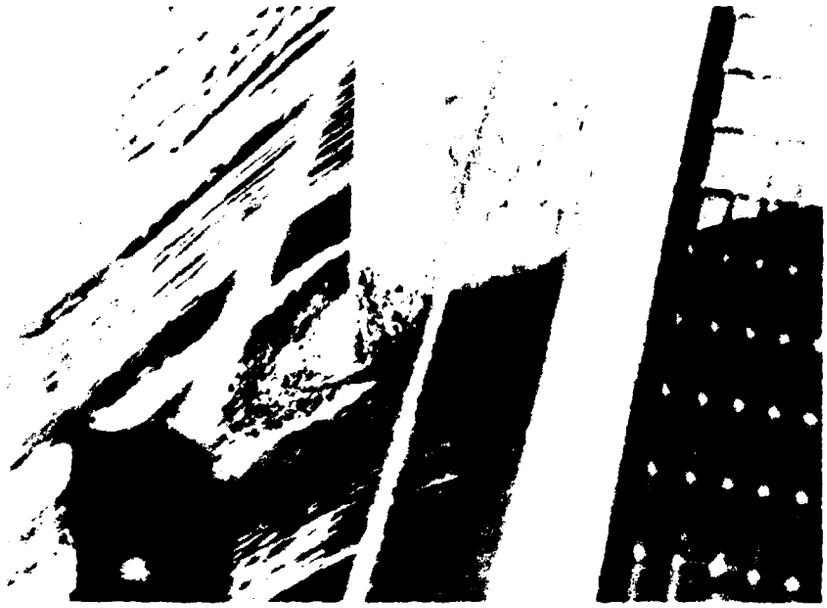


Photo 22. Taken from left spillway, looking at downstream portion of walkway pier, light erosion at waterline.

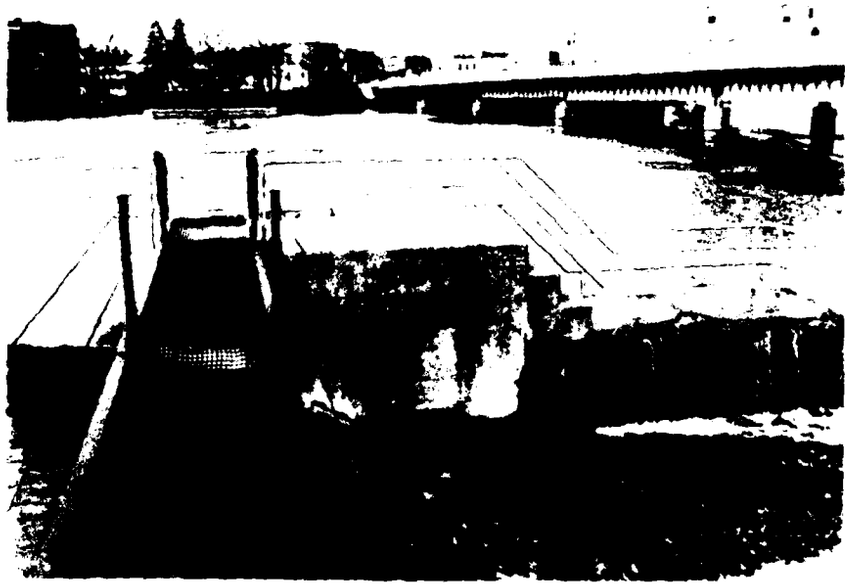


Photo 23. Taken from left spillway, looking at left dam abutment pier.

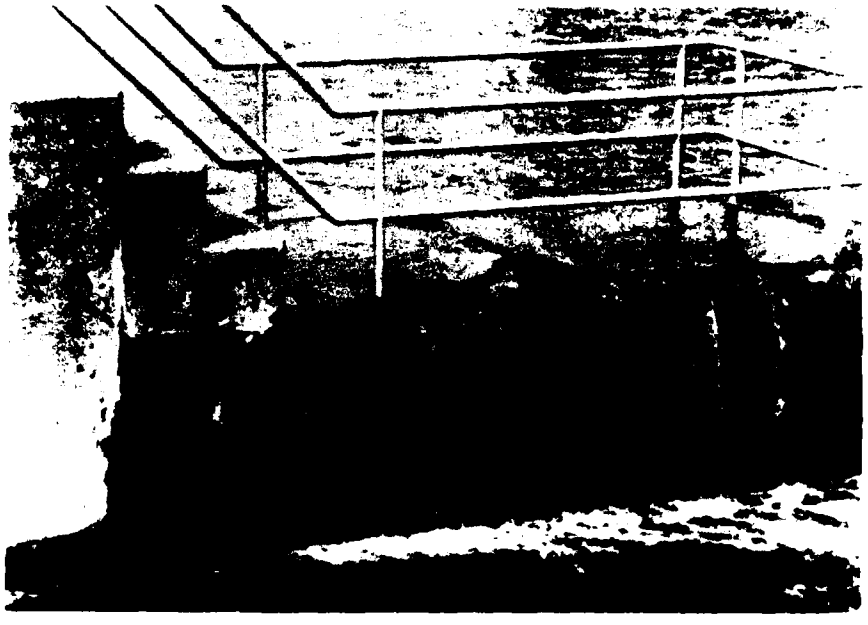


Photo 24. Close-up of downstream end of left abutment pier.

APPENDIX B

DRILLING LOGS

NOTE: Field boring logs identify bedrock as limestone; subsequent petrographic examination showed the bedrock to be dolomite.

Hole No. DWES-L1-EC

DRILLING LOG	DIVISION	INSTALLATION De Percle Lock & Dam	SHEET 1 OF 6 SHEETS

1. PROJECT: De Pere Lock & Dam
2. LOCATION (Coordinates or Station): See Pacc Sik
3. DRILLING AGENCY: CELUCS
4. HOLE NO. (As shown on drawing title and file number): DWES-L1-EC
5. NAME OF DRILLER: C Deal
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF [overburden] Concrete 20.65
8. DEPTH DRILLED INTO ROCK: 20.45 FT
9. TOTAL DEPTH OF HOLE: 41.1 FT
10. SIZE AND TYPE OF BIT: 6¼ x 6" 7P...
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1955 MSL 4½ x 4" Bit
12. MANUFACTURER'S DESIGNATION OF DRILL: Acker
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED —
14. TOTAL NUMBER CORE BOXES: 9
15. ELEVATION GROUND WATER: —
16. DATE HOLE: STARTED 21 July 1980 COMPLETED 22 July 80
17. ELEVATION TOP OF HOLE: 591.8
18. TOTAL CORE RECOVERY FOR BORING: 100%
19. SIGNATURE OF INSPECTOR: [signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
591.8	0	Δ	Concrete Grey Brown Color with Natural Agg. Avg Size Approx ½" and Range is from ⅛" to ¾". Reaction Product Noticeable	100%	Box 1	Run #1. Run 1.9' Rec 1.9' Loss — Gain —. Began 3 15, End 4 40, Time 85 min, Drl time 85 min, hyd press 100-300#, Water press —, RPM 150, Drl Action Smooth, Water ret Lt Brown w/whi..., Remarks —
590.8	1	Δ				
589.8	2	Δ	Run #1 RQD-100% / MB Begin 4" Diam			
588.8	3	Δ	Concrete Same. RQD-99%	100%	Box 1	Run #2. WL —, Began 5 05, End 5 30, Time 25 min, Drl time 25 min, hyd press 300#, Water press —, RPM 150, Drl Action Smooth, Water ret Lt Brown w/wh..., Remarks —
587.8	4	Δ	MB		4.6	
586.8	5	Δ			Box 2	
585.8	6	Δ	MB. Run #2			
584.8	7	Δ	Concrete Same. RQD-100%	100%	Box 2	Run #3. Run 5.0' Rec 5.0' Loss — Gain —. WL —, Began 8 20, End 8 50, Time 30 min, Drl time 30 min, hyd press 300#, Water press —, RPM 150, Drl Action Smooth, Water ret Same, Remarks —
583.8	8	Δ			8.6	
582.8	9	Δ			Box 3	
581.8	10	Δ	MB			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO.

Hole No. L-1-60

DRILLING LOG	Division	Installation	Sheet 2 of 6 Sheets
		Dejoire Lock & Dam	

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
5818	10					
5808	11				Box 3	
			Run #3		118	Run #4
5798	12					WL — Run 4.5 Began 9 co Rec 4.5 End 9 28 Loss — Time 28 MIN Gain — Drl time 28 MIN Hyd press 300 PSI ± Water press — RPM 158 ± Drl Action Smooth Water ret Lt. Brown/Wh.k Remarks
5788	13		Concrete			
			RQD = 100%	100%	Box 4	
5778	14					
5768	15					
5758	16		Run #4 RQD = 100%		163	
			J = Honeycomb			Run #5
5748	17					WL — Run 4.8 Began 9.40 Rec 4.8 End 10:28 Loss — Time 48 MIN Gain — Drl time 28 MIN Hyd press 300 PSI ± Water press — RPM 150 ± Drl Action Smooth Water ret Lt. Brown/Wh.k Remarks
5738	18		Concrete: RQD 100%		Box 5	
5728	19					
5718	20		NQ/NB ~½" x 3/4" ℄ STEEL			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT HOLE NO.

Hole No. L-1-80

DRILLING LOG	DIVISION N.P.	INSTALLATION Devils Lake Dam	SHEET 3 OF 6 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE — STARTED — COMPLETED
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING %
9. TOTAL DEPTH OF HOLE	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
5718	20		CONCRETE			
			TIGHT BOND	100%		
5708	21		RUN #5 BEDROCK		21.1	RUN #6 WL 11:55 Run 4.7' Began 11:23 Rec 4.7' End 12:32 Loss — Time 1:22 Gain — Drl time 66 min Hyd press 250# Water press — RPM/cc - 150 Drl Action Smooth Water ret White/Lt Brown Remarks RQD 28.5% 1.9'/10 sec Water
			NB			
5698	22		Dolomite LIMESTONE LMT NB			
			GREY IN COLOR, V FINE GRND, SUGARY TEXTURE, FOSSILIFEROUS, NB WITH SOLUTION CAVITIES 3 x 4 1/2 SHALE/CLAY STRINGERS ~~to~~			
5688	23		CLOSED MOUNDED AND ~~NB~~ GOVERN ~~BREAKS~~	100%		
			NB			
5678	24		NB		Box 6	
			NB CAVITY			
5668	25		NB — BREAKS ARE STAINED NB BLACK — [redacted] GROUND WATER ACTIVITY — NB CS — SOLUTION CAVITY			SEE NOTE
			NB RUN #6		25.8	RUN #7
5658	26		NB RUN #7	100%	Box 7	July 24 80 WL — Run 0.35 Began 1:31 Rec 0.35 End 1:57 Loss — Time 6 min Gain — Drl time 6 min Hyd press 400 Water press — RPM 150 Drl Action Smooth Water ret White/Lt Brown Remarks
			NB			
5648	27		Dolomite LIMESTONE LMT NB		Box #7	
5638	28			100%		RQD = 100%
			NB NA ZONE OF NUMEROUS CL/SH LAMINA			SEE NOTE
5628	29		CLOSED VERTICLE FRACTURE			
			BLACK STAINING AT BREAKS			
5618	30		HIGH WATER LOSS			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) — PROJECT — HOLE

Hole No. [illegible]

DRILLING LOG	DIVISION [illegible]	INSTALLATION	SHEET [illegible] OF 6 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING %	
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
5618	30		Dolomite Limestone			Run # 8; WL —; Began 1:55; End 2:42; Time 47min; Drl time 47min; Run 5.0'; Rec 5.0; Loss —; Gain —; Hyd press 300-400 PSI; Water press —; RPM 150±; Drl Action Smooth; Water ret Lt Brown/White; Remarks Water loss occured at 29.55' on Run; Core break at 29.55 with change of water - black staining
5608	31	MB, MB	Run # 8		31.15	
5598	32		Dolomite Limestone			
5588	33	MB		100%	Box 8	
5578	34					Run # 9; WL —; Began 4:22; End 5:07; Time 45min; Drl time 45min; Run 4.35; Rec 4.35; Loss —; Gain —; Hyd press 350 PSI; Water press —; RPM 150±; Drl Action Smooth; Water ret Zero; Remarks
5568	35	MB	Run # 9 RQD: 100%		35.5	
			Dolomite Limestone	100%	Box 9	
5558	36		Run # 10			
5548	37	MB, MB	Dolomite LIMESTONE RQD: 93%			Run # 10; WL; Began 11:20; End 12:[illegible]; Time [illegible]; Drl time 30min; Run 5.0'; Rec 0.5'; Loss —; Gain —; Hyd press —; Water press —; RPM 150±; Drl Action Smooth; Water ret Lt Brown/White; Remarks 4.5' of Run was green
5538	38					
5528	39	M				
5518	40	MB				

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) | PROJECT | HOLE NO.

Hole No.

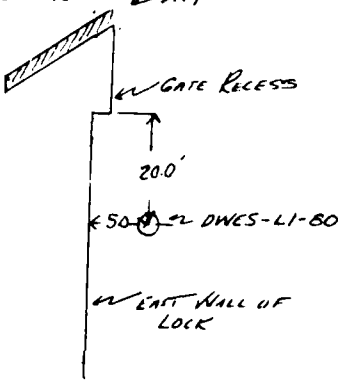
DRILLING LOG	DIVISION	INSTALLATION	SHEET / OF 1 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Stations)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc.; if separate sheet, so state) g
	40		MA Run # 11			Run # 11
			Dolomitic Limestone			WL Run 43'
			Run # 12 RQD = 100	100%		Began 12 47 Rec 4.15
	41					End 1 20 Loss 0.5
			END			Time 33 min Gain —
						Drl time 33 min
						Hyd press [illegible]
						Water press —
						RPM 150
						Drl Action Smooth
						Water ret
						Lt Brown / Milky w Lt
						Remarks
						Run 12
						WL Run 6.8'
						Began 1 30 Rec 0.95
						End 1 45 Loss —
						Time 15 min Gain 0.15
						Drl time 15 min
						Hyd press — psi
						Water press —
						RPM 150
						Drl Action Smooth
						Water ret
						Lt Brown / Milky
						Remarks

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT HOLE NO.

DEPERE LOCK 3 DAM



LOCATION

LEGEND

- Concrete
- Limestone dolomite
- N.B. Natural Break
- M.B. Machine/Mechanical Break

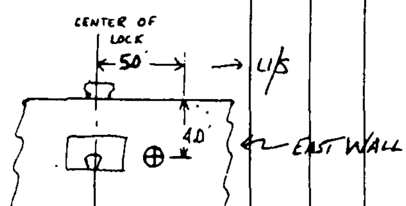
Hole No. DLCS L2-8C

DRILLING LOG	DIVISION Detroit	INSTALLATION Dresden Lock & Dam	SHEET 1 OF 1 SHEETS

1. PROJECT: Dresden Lock & Dam	10. SIZE AND TYPE OF BIT: 6 7/8 x 6" [illegible]
2. LOCATION (Coordinates or Station): See Sketch	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1935 MSL
3. DRILLING AGENCY: CELCS	12. MANUFACTURER'S DESIGNATION OF DRILL: ELECTRIC
4. HOLE NO. (As shown on drawing title and file number): DLCS-L2-8C	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED —
5. NAME OF DRILLER: Clyde Drake	14. TOTAL NUMBER CORE BOXES: ONE
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED Horiz DEG. FROM VERT.	15. ELEVATION GROUND WATER: —
	16. DATE HOLE: STARTED 24 July 80 COMPLETED 24 July 80
7. THICKNESS OF OVERBURDEN	17. ELEVATION TOP OF HOLE: 587.5'
8. DEPTH DRILLED INTO ROCK	18. TOTAL CORE RECOVERY FOR BORING: 100 %
9. TOTAL DEPTH OF HOLE: 3.5	19. SIGNATURE OF INSPECTOR: [signature]

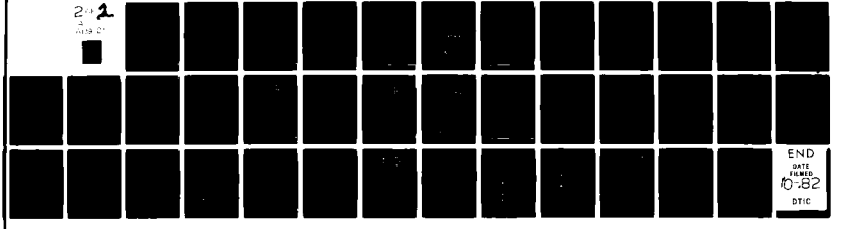
ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0.0 – 10 – 20 – 30	Δ	CONCRETE GREYISH BROWN, NATURAL AGG-FINE TO MED-SLIGHT REACTION PRODUCT ON SURFACE.	100	Box #1	WL; Run 3.15; Began 10:31; Rec 3.15; End 10:54; Loss —; Time 23 min; Gain —; Drl time 23 min; Hyd press —; Water press —; RPM 1500; Drl Action Smooth; Water ret Lt. Brown/White; Remarks
			Run RQD = 100%.			

LOCATION L2 U/M



ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE (TRANSLUCENT) PROJECT

AD-A119 121 ARMY ENGINEER WATERWAYS EXPERIMENT STATION VICKSBURG--ETC F/G 13/2
CONDITION SURVEY OF DEPERE LOCK AND DAM LOWER FOX RIVER, WISCON--ETC(U)
JUN 82 R L STOWE, J C AHLVIN
UNCLASSIFIED WES/MP/SL-82-3 CTIAC-51 NL



Hole No. D WES E1-80

DRILLING LOG	DIVISION NCD	INSTALLATION DePere Lock & Dam	SHEET 1 OF 5 SHEETS
1. PROJECT DePere Lock & Dam		10. SIZE AND TYPE OF BIT 5" Rotary, 4" core	
2. LOCATION (Coordinates or Station) 18' D/S of Upper Gate River Side, 20' from chamber face.		11. DATUM FOR ELEVATION SHOWN (TBM or MSL) IGLD 1955	
3. DRILLING AGENCY WES		12. MANUFACTURER'S DESIGNATION OF DRILL 52H	
4. HOLE NO. (As shown on drawing title and file number) D WES E1-80		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED —	
5. NAME OF DRILLER Drake		14. TOTAL NUMBER CORE BOXES 7	
6. DIRECTION OF HOLE ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN 13.8'		16. DATE HOLE STARTED 1 July 1980 COMPLETED	
8. DEPTH DRILLED INTO ROCK 30.7'		17. ELEVATION TOP OF HOLE 591.8	
9. TOTAL DEPTH OF HOLE 44.5		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR Hasmann/Stone Logged 7/19/80	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc.; if significant) g
			0 - 13.8' Overburden see Hasmann's soil boring sheets; see attached sheets			

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PROJECT

HOLE NO. E1-80

Hole No.

DRILLING LOG | DIVISION | INSTALLATION | SHEET 2 OF SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE — ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. ETC e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10					
	11					
	12					
	13		Soil Overburden			
	14		Blk organic material (silty) Weathered pieces of bed rk, Dolomitic Ls. Pieces are coated (50%) w/ red clay. Pieces are sub rounded to angular & greenish gry sh small amount of iron & illumite staining.	silty) 100	1/7	
	15		14.1 – 14.4 frac.			
	16		Dolomitic Ls, lt gray, fine to med grain, fossiliferous (slightly). Contains sty planes that are sh filled, sh is greenish gry			chip missing
	17		Yellow brn sty plane. Reddish brn sandy silty clay 1/32" to 1/16" thick, along sty plane 1/16" to 1/8" peak to valley.			
	18				2/7	
	19		Denser appearing, more if brown color. More fossiliferous			
	20					

DD FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO. E1-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		BP			
			BP			
			BP			
			Chip missing	100		
	21		BP			
			high ∠ jt, clean, fresh 3/8" asperities w/ ∠ ~25°			
			BP			
	22		BP			
			blk green sh filled sty			
			BP			
			BP		3/4	
	23		BP			
			BP			
			healed frac, vert.			
	24		BP			
			BP			
			BP			
	25		BP			
			½" sh sty plane			
			fossil band			
			BP			
	26		BP			
			BP			
			fossile outlined shell fossil			
	27					
			BP		4/4	
			Dol/lt brownish gry			
	28		BP			
	29		BP			
	30					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT

HOLE NO. E1-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 4 OF SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	a. CORE RECOVERY RATE e	DEPTH OF SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc.; if applicable) g
	30		BP			
	31		BP fossil band	100		
	32		BP fossil band		S/1	
	33		BP fossils			
	34		BP			
	35					
	36		BP		G/1	
	37					
	38		BP			
	39		BP			
	40		BP			

DD FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT

HOLE NO. E1-80

Hole No.

DRILLING LOG | DIVISION | INSTALLATION | SHEET 5 OF SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE — ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40				7/7	
			BP			
	41					
			BP			
	42					
	43					
			BP			
	44		Rk same as above			
			End of core			
	45		Hole depth to 46.1			

Comments:
Bedrock in excellent condition
One thin sandy silty clay seam < 1/16" thick present near surface of bedrock, the clay is along a sty plane that is interlocked. Thin sh filled sty planes (paper thin to 1/16") are tight, interlocked. Shearing resistance along these sty planes should approach the shearing resistance of the intact rock at the low normal loads used in direct shear testing (to 3 tsf) and also in normal loads expected of the structure.

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PROJECT

HOLE NO. E1-80

BORING LOG
FIELD DATA

Project: DePere Lock & Dam Site: L[illegible]k Backfill - Riverside of [illegible] wall ([illegible] u/s upper gate) Date: 1 July 80
Location: Fox River - Wis Job No. ______
Drill Rig: Acker Failing Inspector: Hoseman Operator: Drake Surface El ______ Boring No. DWES E1-80

SAMPLE NUMBER	DATE TAKEN (July)	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	[illegible]	[illegible]	CLASSIFICATION AND REMARKS
1A	1			0.0	0.5	0.0	0.3	Shelby Tube Pushed	JTK	50	Silty clay (CL) (Brown)
1				0.5	1.0	0.3	0.85		[illegible]	250	Firm w/ TR rootlets
2A				1.0	1.5	0.85	1.20			3[illegible]	
2				1.5	2.0	1.2	2.1			340	
				2.0	2.5					280	
	Cleaned	out	hole	to	3.0	with	6" fish	tail	bit + water		
3A				3.0	3.5	3.0	3.2	Shelby Tube	JTK	200	Silty clay (CL) brown with
3				3.5	4.0	3.2	4.0		[illegible]	350	few gravel up to 1/2"
				4.0	4.5					990	
				4.5	5.0			5" drive [illegible]			No spl recovery
4A				5.0	5.5	5.0	5.1	Shelby Tube	JTK	360	Clay (CL) w/ gravel (Brown)
4				5.5	6.0	5.1	5.9		[illegible]	400	1/2 size max. Gravel in spl
5A				6.0	6.5	5.9	6.0			480	(Gravel ≤ 1") by gravel
5				6.5	7.0	6.0	6.75			880	TR fi. sand, change color
											Reddish brown

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED Sheet 1 of 4 Sheets

Boring No. ______
Location ______
Job No. ______

LABORATORY DATA

Date ______ Classified by ______

CLASSIFICATION	SYMBOL	NAT WC %

BORING LOG
FIELD DATA

Project: Dredge Lock & Dam · Site: Riverside of Lock Wall 15' D/S Upper Gate · Date: 1 July 80
Location: [illegible], Wis · Job No.:
Drill Rig: Acker [illegible] · Inspector: Hesselman · Operator: Drake · Surface El: · Boring No.: D WES L1-80

SAMPLE NUMBER	DATE TAKEN July	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
6A	1			5½	Drive Barrel to 7½'						
				7.5	7.7	7.5	7.7	Shelby Tube 3"			~~Sand~~ Limestone w/clay
											Binder - Gray - Brown
				7.7	8.0		5½'	Drive Barrel			Not Recovered
											Lost water at 9.7'
7				8.0	10.0	8.1	8.7	4"x5½" Core Barrel			Limestone - Gravel with
2A											clay binder - boulder size
											Grayish - clay br brown
				10.0	12.6			4"x5½" Core Barrel			12.6' Bedrock Limestone
											Above gravel large & med
											loose + broken.
8				12.6	15.4	12.6	13.8	"			Waxed 1.2' in cardboard
											Tube. Limestone gray
											Above loose gravel bed

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of 4 Sheets

Boring No.
Location
Job No.

LABORATORY DATA

Date ______ Classified by ______

CLASSIFICATION	SYMBOL	NAT WC %

BORING LOG
FIELD DATA

Project Dike Lock & Dam   Site Riverside of lock wall [illegible] upper gate   Date 2 JULY 80
Location [illegible]   Job No.
Drill Rig [illegible]   Inspector [illegible]   Operator DRAKE   Surface El   Boring No. DIKES E1-[illegible]

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER				CLASSIFICATION AND REMARKS
	2	Reamed hole to					13.8	8¾" rock bit				
	Drove 8" casing 14' with 7" stick up -											casing in bedrock
	2	reamed [illegible] to 14.1'-15.4'										cleaned out hole
9	14		.7	15.4	16.4			4x5½ core barrel				Limestone with brown clay binder
10	"		1.8	16.4	21.2			"	"	"		same
11	"	[illegible]	.23	21.2	26.2			"	"	"		Limestone (gray [illegible])
12	15	[illegible]		26.2	30.4			"	"	"		same

WES FORM JAN 74 819   EDITION OF NOV 1971 MAY BE USED   Sheet 3 of 4 Sheets

Boring No.
Location
Job No.

LABORATORY DATA

Date   Classified by

CLASSIFICATION	SYMBOL	NAT WC %

BORING LOG
FIELD DATA

Project [illegible] Site [illegible] Date 14 JULY 80
Location [illegible] 15' [illegible] GATE Job No. ____
Drill Rig [illegible] Inspector [illegible] Operator DRAKE Surface El ____ Boring No. [illegible] EL-80

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
13	14	[illegible] .80 .77 1.25		30.4	35.7			4" x 5 1/2" CORE BARREL			LIMESTONE FIRM Gray
14	15	1.97 1.98		35.7	41.6			"			SAME
15		1.73		41.6	43.35			"			SAME
16		1.5 .57 .6		43.35	46.1			"			

WES Form Jan 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 4 of 4 Sheets

Boring No. ____
Location ____
Job No. ____

LABORATORY DATA

Date ____ Classified by ____

CLASSIFICATION	SYMBOL	NAT WC %

RODED 42.65

RODED to 43.8

BORING LOG
FIELD DATA

Project: DEERE LOCK 3 DAM — Site: DEERE LOCK 3 DAM — Date: 25 JUNE 1980
Location: SEE PLATE 1 — Job No. 441-S163-306822
Drill Rig: BH — Inspector: D. [illegible] — Operator: CIVIL DRAFT — Surface El. ____ — Boring No. DWCS-ER-1980

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER	PEN	REC	CLASSIFICATION AND REMARKS
1A	25 JUNE	0.0	0.5	0.0	2.5	0.0	0.85	5" SHELBY TUBE	/	TUBE	ORGANIC MATTER & CLAY
1B		0.5				0.85	0.90			JAR	CLAY IS BROWN IN COLOR
2A						0.90	1.85			TUBE	SOFT & LOW TO MED PLAST. (TF)
2B						1.85	1.90			JAR	PUSH: 2.5 COMP. 0.60 SPL. 1.9
3A	25 JUNE			0.0	0.5	0.0	0.45	5" SHELBY TUBE		TUBE	ORGANIC MATTER & CLAY
3B				0.5	1.0	0.45	0.50		200	JAR	SAME AS ABOVE
4A				1.0	1.5	0.50	1.55		240	TUBE	
4B				1.5	2.0	1.50	1.55		300	JAR	
				2.0	2.5				340		PUSH: 2.5' COMP. 0.95' SPL. 1.55'
				0.0	2.5			6" FISHTAIL	—		CLEANOUT
5A											
5B	25 JUNE			2.5	3.0	2.5	2.7	HOLLOW	180	JAR	CLAY - SAME: TRACE AMOUNT OF
5C				3.0	3.5	2.7	4.0		210	TUBE	MED. GRAVEL PRESENT.
				3.5	4.0	4.0	4.2		280	JAR	PUSH: 2.0
				4.0	4.5				340		COMP: 0.15 SPL. 1.3

WES FORM JAN 70 819 EDITION OF NOV 1971 MAY BE USED — Sheet 1 of ____ Sheets

Boring No. ____
Location ____
Job No. ____

LABORATORY DATA

Date ____ Classified by ____

CLASSIFICATION	SYMBOL	NAT WC %

B18

B19

BORING LOG
FIELD DATA

Project _____ Site _____ Date 26 July 60
Location _____ Job No. _____
Drill Rig _____ Inspector _____ Operator _____ Surface El _____ Boring No. DWES-EZ-60

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
				2.5	4.5	——		6" Fishtail	——		CLEANOUT
6	25 July			4.5	4.85	4.5	4.85	Hvorslov	420	Jar	Gravelly Clay – Sampler stopped on Boulder
7A	25 July			4.85	6.9	4.85	6.90	4½" x 4" Core Bbl	✓	Tube	Gravelly Clay & Lms Boulder
7B						4.85	6.90			Jar	Rec. 2 pieces of Lms – one foot of core.
	25 July			6.9	12.2	6.9	12.2	4½" x 4" Bbl	✓	Box	Gravelly Clay
	26 July			12.2	15.1	14.15	15.10	4½" x 4" Bbl	✓	Box	Gravelly Clay & Lms. Boulder
											Rec. 0.65' of Lms from Boulder
											Concrete starts at 14.15' &
											Rec. 0.95' – Grey Basalt, Not Acc.
											Blocked Off.
	26 July			15.1	15.5	——		4½" x 4" Bbl	✓	Box	Wood – 2" x 4" Form – Blocked
											off / Concrete Below Wood.

WES FORM JAN 70 819 EDITION OF NOV 1971 MAY BE USED

Sheet 2 of _____ Sheets

Boring No. _____
Location _____
Job No. _____

LABORATORY DATA

Date _____ Classified by _____

CLASSIFICATION	SYMBOL	NAT WC %

BORING LOG

FIELD DATA

Project ______ Site ______ Date 26 July 80

Location ______ Job No. ______

Drill Rig ______ Inspector ______ Operator ______ Surface El ______ Boring No. DWS-E-2-80

SAMPLE NUMBER	DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER		Cont	CLASSIFICATION AND REMARKS
	26 July			15.5	18.15	15.2	18.15	4¼" x 1" BBL	/	Box	CONCRETE FROM 15.2 FT TO
											17.4' WITH A LOOSE LIME/CONCRETE
											CONTACT. LIMESTONE IS BROKEN
											IN BOTH HORIZ. AND VERT DIRECTIONS.
											WITH [illegible] DISCOLORATION ON
											BREAK SURFACES. LIMESTONE IS
											SAME AS ENCOUNTERED IN
											PREVIOUS BORINGS.

WES FORM JAN 74 B19 EDITION OF NOV 1971 MAY BE USED

Sheet 3 of ______ Sheets

Boring No. ______

Location ______

Job No. ______

LABORATORY DATA

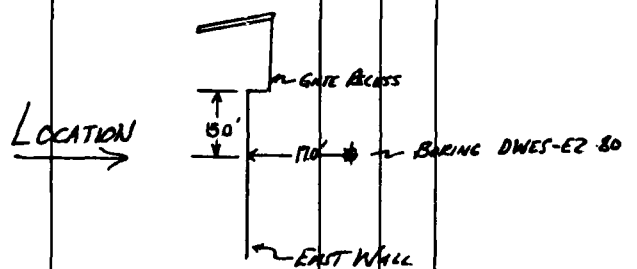
Date ______ Classified by ______

CLASSIFICATION	SYMBOL	NAT WC %

Hole No. DWES-EZ-80

DRILLING LOG	DIVISION NCD	INSTALLATION	SHEET 1 OF 4 SHEETS
1. PROJECT: Bonfire Look & Dam		10. SIZE AND TYPE OF BIT: Bit 7878102 & 7478162	
2. LOCATION (Coordinates or Station): See below		11. DATUM FOR ELEVATION SHOWN (USGS or MSL): IGLO	
3. DRILLING AGENCY: WES		12. MANUFACTURER'S DESIGNATION OF DRILL: 54H	
4. HOLE NO. (As shown on drawing title and file number): DWES EZ-80		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER: C Drake		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN: 14.1'; 3.5' Concrete		16. DATE HOLE: STARTED 25 July 1980 / COMPLETED	
8. DEPTH DRILLED INTO ROCK: 3.9'		17. ELEVATION TOP OF HOLE: 590.4	
9. TOTAL DEPTH OF HOLE: 18.1'		18. TOTAL CORE RECOVERY FOR BORING: %	
		19. SIGNATURE OF INSPECTOR: J. Dunbar	

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	00		Gravelly Clay & Limestone Boulders			
	14.6		Concrete			
	15.0		4-Wood Form - 2"x4"			
	16					
	17		LIMESTONE			
	18		N.A. N.B. Closed Breaks			
			End at 18.1			



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PROJECT

HOLE NO. EZ-80

Hole No. D WES 01-80

DRILLING LOG	DIVISION NCD	INSTALLATION	SHEET 1 OF 6 SHEETS
1. PROJECT: Bellefonte Lock & Dam		10. SIZE AND TYPE OF BIT 4 1/2 B
2. LOCATION (Coordinates or Station): Sluiceway pier #7		11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 1955
3. DRILLING AGENCY: WES		12. MANUFACTURER'S DESIGNATION OF DRILL: 34H
4. HOLE NO. (As shown on drawing title and file number): D WES 01-80		13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER: C Drake		14. TOTAL NUMBER CORE BOXES: 9
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN: 19.05'		16. DATE HOLE: STARTED 11 July 1980 / COMPLETED
8. DEPTH DRILLED INTO ROCK: 21.98'		17. ELEVATION TOP OF HOLE: 593.97
9. TOTAL DEPTH OF HOLE: 41.0'		18. TOTAL CORE RECOVERY FOR BORING: 100 %
		19. SIGNATURE OF INSPECTOR: Logged R.L Stowe 7/10/80

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	RQD OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	1		Concrete, gray, agg size to 1" crushed calcite agg, sand is rounded no determination. lot of coarse agg. same as Dam Look at cor... in lab. all breaks fresh			
	2					
	3					
	4					
	5					
	6					
	7					
	8					
	9					
	10					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO. 01-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 5 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)	D1-80	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	SIZE OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc.; if applicable) (g)
10						
11						
12						
13						
14						
15						
16						
17						
18			BP		5/9	
19			Concrete at interface excellent bond; Tight no Break			
5/1			Dolomitic ls, H. gray, med grained fossiliferous fossils to ½" dia, No fract or BP breaks. Thin sty, tight thin to Med.		5/9	

DD FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT

HOLE NO. D1-80

Hole No.

DRILLING LOG | DIVISION | INSTALLATION | SHEET 3 OF 6 SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	SAMPLE NO.	REMARKS
	20				S/9	
4/1			BP 10° BP partly sealed w/ Sh, reddish in color			
			BP Broken along it at high angle, dk gray no water staining.			
	21					
3/1			few tight sty...			
	22		BP			
7/1			coarsely x'gal, dolomitic			
	23		BP It same as above H gry, fine to med grained		6/9	
4/1			BP			
	24		coarsely grained fossil...			
2/1						
	25		BP filler in sty BP, grnish gray filler in dty age grnish gry to brownish (mostly brownish)			
4/1						
	26		It is excellent shape hard sound, tight sty planes			
1/1						
	27		BP Dol is as above, more med to coarse grained vug, calcite x'gal. Mn blk filled sty		7/9	
4/1			vug, cal filled			
	28		BP			
4/1			sh grn gry vug, x'gal			
	29					
1/1			few sty BP			
	30					

DD FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. B1-60

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 4 OF 4 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (GS or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and title number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION	DEPTH	LOGGING	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	SAMPLE OR CORE BOX NO.	REMARKS (Drilling rate, water loss, depth of weathering, etc., if significant)
	30		BP			
2/1			BP			
	31		coarsely x'gnd			
4/1			few c/y BP			
			coarsely x'gnd some pieces of longer.			
	32		limited frac		B/9	
0/1						
	33		grn ish gry			
2/1			BP			
	34					
3/1			Soft same a above fine to med grained.			
	35					
2/1			BP fossils			
	36		BP gryish grn sh c/y		9/9	
7/1						
	37		BP coarsely x'gnd			
3/1						
	38		coarsely x'gnd			
9/1			BP coarsely x'gnd			
	39		BP coarsely x'gnd			
1/1						
	40					

DHS FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO. B1-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 6 OF 6 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	g. CORE RECOVERY (%) e	RQD (%) (Sum of Lengths of Pieces 4 in. or More in Length) f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
2/1			↑			
			6D. coarsely vijat			
			↓			
	41		End boring			
			Comments: Excellent bedrock no weak zones, thin style... bedding paper thin to 1/16", 1/2" peak & valley no weakness along sty planes.			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT NO. 81-80

Hole No. D WES D2-80

DRILLING LOG | DIVISION: NCD | INSTALLATION: | SHEET 1 OF 3 SHEETS

1. PROJECT	DePere Lock & Dam
2. LOCATION (Coordinates or Station)	75' US of Sluiceway pier #7
3. DRILLING AGENCY	WES
4. HOLE NO. (As shown on drawing title and file number)	D WES D2-80
5. NAME OF DRILLER	C. Drake
6. DIRECTION OF HOLE	[X] VERTICAL [ ] INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN	—
8. DEPTH DRILLED INTO ROCK	20.9'
9. TOTAL DEPTH OF HOLE	20.9'
10. SIZE AND TYPE OF BIT	4 x 5½"
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	IGLD 1955
12. MANUFACTURER'S DESIGNATION OF DRILL	S & H
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN	DISTURBED: UNDISTURBED:
14. TOTAL NUMBER CORE BOXES	5
15. ELEVATION GROUND WATER	
16. DATE HOLE	STARTED: 7 July 1980 COMPLETED:
17. ELEVATION TOP OF HOLE	579.47'
18. TOTAL CORE RECOVERY FOR BORING	100 %
19. SIGNATURE OF INSPECTOR	Stowe 7/10/80

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
1/1			Dolomitic Ls, lt gry, dense, fine to med. slightly grain, cryst'l rk. ~ 1/32" fossils, few [illegible] BP, bedding plane; smooth [illegible] valleys.		1/5	6-in core size. Sound bedrock. ¼ to ½"
	1		Open jt, dark gry stain coating jt, reddish brn clay (20% coating)			BP nearly horizontal
1/1			BP open, no coating, stained; high angle jt, lt staining; BP			Jt's are smooth, not rough at all. ~ 1/16 to ⅛" peak to valley w/ 6" period.
3/1	2		1-1.6 sheet thin (<1/16") sh stringers, grayish gry. Some not continuous through core. Sh stringer; Jt; BP			BP are wavy ([illegible]) than sh stringers stylolitic. ⅛ to ½" peak to valley, well bonded, not weakness in rock, most continuous through core. Paper thin to [illegible] 1/16" [illegible] in thickness [illegible] thin to 1/16".
	3		sh styl, freq 6/ft.			
5/2			fossils; BP; sh styl	100%		Bedding is along sty planes. Rock very similar to BR Joliet formation
7/1	4		BP healed frac. stained styl surface. Dol as above, sh stringers more freq		2/5	BP are stylo planes where rk breaks along.
4/1	5		BP opening, calcified hard crusty surface, like a waterworn surface			BP breaks are along sty bedding planes
5/1	6		BP. Dol same as above but color is lt brownish gray (more gry as above); voids w/ cal cryst (vugs); BP rk in this box is less fossiliferous; BP			
2/1	7		BP; vug; no sh sty			10.75 / 2.3 / 8.4
3/1	8		BP; BP; BP		3/5	
2/1	9		BP; vugs; BP. Dol lt gry - same as above, sty BP not as freq as above			9'
	10					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. D2-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 of 3 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN — DISTURBED — UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
	15. ELEVATION GROUND WATER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.	16. DATE HOLE — STARTED — COMPLETED
	17. ELEVATION TOP OF HOLE
7. THICKNESS OF OVERBURDEN	18. TOTAL CORE RECOVERY FOR BORING %
8. DEPTH DRILLED INTO ROCK	19. SIGNATURE OF INSPECTOR
9. TOTAL DEPTH OF HOLE	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			BP		3/5	
2/1			BP jt smooth			
11			BP			
3/1			BP			
12			BP			
2/1			BP oly BP Dol as above, same // bluish gry			
13			BP few fossils break bedding		4/5	
ok 9/1			BP dolomitic, med to coarse grained, cryst... fossils			
ok 14			BP sh stringer mng aal cryst			
ok 2/1			BP			
15 ok			BP			
3/1			BP sh stringers med & coarse, cryst			
16 ok			BP			
3/1			Bedding becomes thicker evidenced by BP breaks (on core lengths) from 16.6' down to 18.9			
17			1.15			
ok 2/1			BP		5/5	
18			1.35			1.35
3/1			peak to valley 1/16"			
19			BP fossils			[illegible] dolomitic
			.6			
7/1			BP coarsely cryst.			
20			BP			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. B2-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 3 OF 3 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE		15. ELEVATION GROUND WATER	
☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
20						
41			Soil Fill BP		S/S	
			BR End of scheduled boring. Comment Good sound bedrock, no weak zones, no clay			

DD FORM 1836 MAR 77 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLEVISION?)

PROJECT

HOLE NO. BR-80

Hole No. D WES D3-80

DRILLING LOG	DIVISION NCD	INSTALLATION	SHEET 1 OF 3 SHEETS

1. PROJECT: DeDore Lock & Dam	10. SIZE AND TYPE OF BIT: 4x5½"
2. LOCATION (Coordinates or Station): 75' DS of Sluiceway pier #7	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): IGLD 1955
3. DRILLING AGENCY: WES	12. MANUFACTURER'S DESIGNATION OF DRILL: S&H
4. HOLE NO. (As shown on drawing title and file number): D WES D3-80	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER: C Drake	14. TOTAL NUMBER CORE BOXES: 5
6. DIRECTION OF HOLE: [X] VERTICAL [ ] INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
	16. DATE HOLE: STARTED 4 July 1980; COMPLETED
7. THICKNESS OF OVERBURDEN: —	17. ELEVATION TOP OF HOLE: 575.33
8. DEPTH DRILLED INTO ROCK: 21.4'	18. TOTAL CORE RECOVERY FOR BORING: 100 %
9. TOTAL DEPTH OF HOLE: 21.4'	19. SIGNATURE OF INSPECTOR: RL Stone 7/10/80

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		Dolomitic ls, lt gry dense, fine to med grained cryst bands, slightly fossiliferous		1/5	
3/1		BP	Top of rk is stained & water worn as no gravel or river deposit was detected. Clean bedrock for river bottom			
	1	BP	Bedding planes same as in D3-80 boring. smoother lt smooth and flatter surfaces			
3/1						
	2	BP	vug fossils			All ~~ lines are sty bedding planes
3/1			sty not as frey as D2-80 thickness the same			
	3	BP	filling the same, greenish gry, paper thin to 1/16" Thickness varies from paper thin to 1/16" on most all sty.			
4/1		BP				
	4	BP	dolomitic band			
3/1						.75
	5	BP	open BP sty			
3/1			Dol. same as above		2/5	.9
	6	BP	calcite xtal.. in vug			
4/1						1.5
	7					
3/1		BP	Blk filled sty			
	8		Blk filled sty			
3/1		BP				1.6
	9					
3/1						length out

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. D3-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 3 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Stration)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING	%
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
4/0			BP			.55
			coarsely x'ysl .55		3/5	
4/1			BP			
	11		coarsely x'ysl 1.25			can't tell where or if dol is pres & brittish gry
5/1			coarsely x'ysl			
	12		BP coarsely x'ysl			
5/1			.8			
			BP			
	13		coarsely x'ysl			
2/1			1.75			
	14		coarsely x'ysl			
1/1			BP coarsely x'ysl			
	15					
5/1						
			BP ↓			
	16		Pinkish, fine & med grained. not solid pink color, mixed w/ grey color.			
			BP ↑			
6/1			open bedding plane, appears as water channel			
	17		BP along BP Bedding ~ 10°, first occurrence			
3/1						
	18		BP sty plane open, during drilling			
			↓ coarsely x'ysl			
1/1			BP ↑			
	19					
0/1						
			coarsely x'ysl			

DNG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT

HOLE NO. B3-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 OF 3 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. (RQD) e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
			80			
1/1						
	21					
3/1			Bott of Boring			

Comment. Strong, hard sound bedrock no weak zones seen. Sty bedding is tight, thin (paper thin to 1/16". 1/4 to 1/2 peak & valley, well bonded. Sty bedding will be strong in direct shear.

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT)

PROJECT

HOLE NO. 83-80

B33

BORING LOG
FIELD DATA

Project DeSoto Lock & Dam — Site DAM-CONCRETE APRON 1'U/S — Date 10 JULY 80
Location FOX RIVER- WIS. — VERTICAL FACE OF APRON Job No.
Drill Rig ACKER 500 — Inspector HASEMANN — Operator DRAKE — Surface El DIS PROJ Boring No. DWES D4-80

SAMPLE NUMBER	1980 DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
	JULY	PIECES									
1	10	1.17		0.0	5.17			Concrete			CONCRETE (TOP OF)
		.57						Rock			NOT WELL SEATED TO
		.65									BEDROCK
		.83									
		.93									
		.24									LIMESTONE (GRAY) HARD
		.72						Rock			WITH ½ to 1 SMALLER SHALE
											SEAMS.
				GROUTED HOLE WITH 10 gal GROUT.							

WES FORM JAN 76 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 1 Sheets

Boring No.
Location
Job No.

LABORATORY DATA

Date Classified by

CLASSIFICATION	SYMBOL	NAT WC %

BORING LOG
FIELD DATA

Project DE PERE LOCK + DAM Site DAM, 1015' D/S VERTICAL FACE Date 9 JULY 80
Location FOX RIVER - WIS. OF APRON SLUICEWAY Job No.
Drill Rig ACKER SKID Inspector HOSEMANN Operator DRAKE Surface El Gate 2' Boring No. DWES DS-80

SAMPLE NUMBER	DATE TAKEN 1980 JULY	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
1	9	PIECES	.68	0.0	5.38	0.0	5.43	NXM CORE			LIMESTONE HARD (GRAY) Bottom 5.38
			1.20		5.46			BARREL			
			.25								
			.57								
			.69								
			.94								
			.33								
			.34								
			.43								
											GROUTED HOLE WITH Sand GROUT

WES FORM JAN 74 819 EDITION OF NOV 1971 MAY BE USED

Sheet 1 of 1 Sheets

Boring No.
Location
Job No.

LABORATORY DATA

Date Classified by

CLASSIFICATION	SYMBOL	NAT WC %

B34

BORING LOG
FIELD DATA

Project: DE PERE Locks & DAM — Site: DAM 25' DS INLINE CENTER OF NEXT TO LAST SPILLWAY — Date: 9 JULY 80
Location: FOX RIVER - WIS. — Job No.:
Drill Rig: ACKER SKID — Inspector: HUSEMANN — Operator: DRAKE — Surface El.: — Boring No.: DWES D6-80

SAMPLE NUMBER	SAMPLE DATE TAKEN	STRATUM FROM	STRATUM TO	DRIVE FROM	DRIVE TO	SAMPLE FROM	SAMPLE TO	TYPE OF SAMPLER			CLASSIFICATION AND REMARKS
1	9 JULY		PIECES .18	0.0	4.8	0.0	4.65	4" x 5½ CORE BARREL			LIMESTONE (GRAY)
			.17								HARD WITH VERY SMALL
			.21								SEAMS (VERY) BRITTLE
			.35								
			.36								
			.29								
			.32								
			.32								
			.49								
			.57								
			.28								
			.37								
			.42								
			.40								
2				4.8	5.6	4.65	5.49	"			SAME
					GROUTED with 8 gal.						

ROCK TO 5.25'

WES FORM 819 EDITION OF NOV 1971 MAY BE USED — Sheet 1 of 1 Sheets

Boring No.:
Location:
Job No.:

LABORATORY DATA

Date: Classified by:

CLASSIFICATION	SYMBOL	MAT WC S

B35

Hole No. DWES D7-80

DRILLING LOG | DIVISION NCD | INSTALLATION | SHEET 1 OF 5 SHEETS

1. PROJECT: DeSoto Lock & Dam
2. LOCATION (Coordinates or Station): R Spillway Pier #1
3. DRILLING AGENCY: WES
4. HOLE NO. (As shown on drawing title and file number): DWES D7-80
5. NAME OF DRILLER: C Drake
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN: 15.2'
8. DEPTH DRILLED INTO ROCK: 25.4'
9. TOTAL DEPTH OF HOLE: 40.6'
10. SIZE AND TYPE OF BIT: 6" & 4"
11. DATUM FOR ELEVATION SHOWN (GS or MSL): IGLD 1955
12. MANUFACTURER'S DESIGNATION OF DRILL:
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED ____ UNDISTURBED ____
14. TOTAL NUMBER CORE BOXES: 9
15. ELEVATION GROUND WATER:
16. DATE HOLE: STARTED 16 July 1980 COMPLETED
17. ELEVATION TOP OF HOLE: 591.8
18. TOTAL CORE RECOVERY FOR BORING: 100 %
19. SIGNATURE OF INSPECTOR: R.L. Stowe 7/18/80

ELEVATION	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	% CORE RECOVERY	RUN OR SAMPLE NO.	REMARKS
	0		Concrete 0-1.3' is 6" core.		1	
			0-0.9' 1" max size agg which is carbonate & crushed			
	1		four ignegous rounded agg. Cm has entrapped air voids 1/4 max size.			
			MB This should be newer con from patch or resurface work.			
	2		0.9' down is older con ... w/ a 1" angular carbonate coarse and rounded fine agg.			
			Matrix is lt gry.			
	3		MB High percentage of coarse agg.		2	
	4					
	5		Probable construction jt ~ 10° angle.			
	6					
	7					
	8		MP ↓ bg in lab		3	
	9					MB normal or machine break

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. D7-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 2 of 5 SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	10					
	11					
	12					
					4	
	13					
	14					
	15		Concrete Rk contact loose.			
*	?		Dol ls or Con.? examine in lab.			
*			15.2 to 15.7 appears to be concrete loosely cemented with a gritty green matrix. The matrix could be SHALE.			
	16		open			
5/1		BP	15.7' down is Dolomitic ls, lt grey, fine to med grain.			
	17		Sty planes w/ greenish gray filler, paper thin to 1/16" thick, thickness varies in each sty plane from paper thin to 1/16" thick.			
3/1 { open / open, not stained			broken along sty bedding, highlighted in core stained, no staining		5	
	18	BP				
		BP				
	19		fossils common, small, not in bands			
		BP				
	20					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. 67-80

Hole No.

DRILLING LOG	DIVISION		SHEET 3 OF 5 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE	STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING	100 %
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	20		BP			
6/1			BP			
	21					
5/1			fossil band			
	22					
4/1			BP BP fossils		6	grouted hole from 23.8' up attempt to stop water loss in hole, water loss was 90% before grouting and was 10% loss after grouting. Loss is in 1st 8 ft of hole.
	23		BP sh filled sty, gry green in color to brown, transition zone			
8/1						
	24		BP high angle jt ~ 80° BP jt surface smooth, no staining or coating			
8/1			calcite filled vug, [illegible] grained sty plane filled w/ stratified brown shale. BP peak to valley is 1/4" coarsely x'ysl			24.25' to 24.65'
	25					
3/1			BP smooth (appears water worn) surface, carbonate crust coating on all surface, probable in a fossil sty plane.			
	26		BP sty plane, peak to valley ~ 3/8", peaks sub-rounded but interlocked. coarsely x'ysl			
13/1						
	27					
5/1			coarsely x'ysl BP			37.10 / 15 / 22.10
	28		sty plane filler is greenish gray			
8/1						
	29		fossil zone, fine grained [illegible] appearance			
4/1			vug w/ calcite x'ysl			
	30					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. D7-80

Hole No.

DRILLING LOG | DIVISION | INSTALLATION | SHEET 4 of 5 SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE — ☐ VERTICAL ☐ INCLINED ______ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN | DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE | STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	30		BP Dol Ls as above fossil e coarsely x'yd Dol is more fossiliferous		8	25.3' 7¾" hole 1.35' 40 sec 1.35' 35 sec 1.35' 47 sec
7/1						
	31					
7/1			on dk brownish green sty planes			0 – 1.35' is 6×7⅞ hole, 1.35'–25.3 4×5½" hole.
	32		BP			
6/1			BP fossil band			
	33					
6/1						
	34		BP — heavy w/ fossils — greenish gray sty filled		9	
7/1						
	35					
7/1			BP — heavy fossil concentration — w/ stylo (small < ⅛") fossil band			
	36		BP fossil band			
8/1						
	37					
5/1						
	38		BP fossil band			
8/1			heavy fossil band			
	39		brownish tint to rk BP dense appearance			
4/1			fossil band			
	40					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO. D7-80

Hole No.

DRILLING LOG	DIVISION	INSTALLATION	SHEET 5 OF 5 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or MSL)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and file number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED	
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.		15. ELEVATION GROUND WATER	
7. THICKNESS OF OVERBURDEN		16. DATE HOLE: STARTED / COMPLETED	
8. DEPTH DRILLED INTO ROCK		17. ELEVATION TOP OF HOLE	
9. TOTAL DEPTH OF HOLE		18. TOTAL CORE RECOVERY FOR BORING %	
		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOV. (RQD) e	RUN OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	40		Sand bed at bottom of boring 40.52' of core Hole was rodded at 40.52'			
	41					
	42					

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) PROJECT HOLE NO. 07 80

Hole No. 0 WES 08-80

DRILLING LOG	DIVISION: NCD	INSTALLATION:	SHEET 1 OF 5 SHEETS

1. PROJECT: FOX RIVER - DEPERE L+D	10. SIZE AND TYPE OF BIT: 6 2 3/8"
2. LOCATION (Coordinates or Station): NEXT TO LAST PIER LEFT SPILLWAY, DEPERE, WISCONSIN	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): ('OLD 1935)
3. DRILLING AGENCY:	12. MANUFACTURER'S DESIGNATION OF DRILL: S+A
4. HOLE NO. (As shown on drawing title and file number): DWESD8-80	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER: C. DRAKE	14. TOTAL NUMBER CORE BOXES: 5
6. DIRECTION OF HOLE: ■ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER:
	16. DATE HOLE: STARTED 18 July 1980; COMPLETED
7. THICKNESS OF OVERBURDEN: 13.15'	17. ELEVATION TOP OF HOLE: 591.8
8. DEPTH DRILLED INTO ROCK: 23.45'	18. TOTAL CORE RECOVERY FOR BORING: 96 %
9. TOTAL DEPTH OF HOLE: 36.6'	19. SIGNATURE OF INSPECTOR: J. Mkin

ELEVATION (a)	DEPTH (b)	LEGEND (c)	CLASSIFICATION OF MATERIALS (Description) (d)	% CORE RECOVERY (e)	BOX OR SAMPLE NO. (f)	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) (g)
	0.0	△			1/5	Box 1 total 5.8' Concrete
590.8	1.0	△	NB			
589.8	2.0	△				
588.8	3.0	△				2.3' piece Concrete
		△	LT GRAY - BROWN CONCRETE SOME AIR VOIDS (SMALL) MAX AGG (LS + Q) .07' NAT + CRUSHED AGGR.		2/5	
587.8	4.0	△	LT GRAY - BROWN CONCRETE MAX AGG .1' NAT + CRUSHED LS + Q MANY SMALL AIR VOIDS NO VISIBLE CRACKS NO VISIBLE RXN MAT.			
586.8	5.0	△				
585.8	6.0	△				
584.8	7.0	△				
		△	NAT. + CRUSHED AGG. LS + QUARTZ NO VISIBLE RXN MAT NO VISIBLE CRACKS SOME AIR VOIDS MAX AGG. .1'	3/5		
583.8	8.0	△				
582.8	9.0	△	NO VISIBLE RXN MAT NO VISIBLE CRACKS SOME AIR VOIDS (SMALL) MAX AGGR. .1-			
581.8	10.0	△				

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. PROJECT HOLE NO.
MAR 71 (TRANSLUCENT)

Hole No. DWES 08-80

DRILLING LOG | DIVISION | INSTALLATION | SHEET 1 OF 4 SHEETS

1. PROJECT	10. SIZE AND TYPE OF BIT
2. LOCATION (Coordinates or Station)	11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
3. DRILLING AGENCY	12. MANUFACTURER'S DESIGNATION OF DRILL
4. HOLE NO. (As shown on drawing title and file number)	13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN: DISTURBED / UNDISTURBED
5. NAME OF DRILLER	14. TOTAL NUMBER CORE BOXES
6. DIRECTION OF HOLE ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.	15. ELEVATION GROUND WATER
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED / COMPLETED
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING %
	19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
580.8	11.0		LT GRAY CONCRETE MAX AGGR. .08' NAT + CRUSHED LS. AGGR. NO VISIBLE CRACKS NO VISIBLE RXN MAT			
579.8	12.0		NAT. + CRUSHED AGG. (L.S.) MAX AGGR .1' FEW AIR VOIDS NO VISIBLE CRACKS NO VISIBLE RXN MAT		1/9	
578.8	13.0		LT GREY CEMENT			
577.8	14.4		CONCRETE NATURAL + CRUSHED AGGR. (LIMESTONE) MAX. AGGR. .08'			
576.8	15.0		LOOSE SAND (SEPARATION)			
			FINE-GRAINED L.S.			
575.8	16.0		FINE-GRAINED L.S. SHALE			
574.8	17.0		STY. SHALE SEAMS		4/9	
			FLUIDS FOSSILS			
573.8 SAMPLE FOR TEST	18.0		571.90 FINE-GRAINED LS			
572.8	19.0					
571.8	20.0		568.60			

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO.

Hole No. 3 WES DB-80

DRILLING LOG | DIVISION | INSTALLATION | SHEET 3 OF 4 SHEETS

1. PROJECT
2. LOCATION (Coordinates or Station)
3. DRILLING AGENCY
4. HOLE NO. (As shown on drawing title and file number)
5. NAME OF DRILLER
6. DIRECTION OF HOLE — ☐ VERTICAL ☐ INCLINED ____ DEG. FROM VERT.
7. THICKNESS OF OVERBURDEN
8. DEPTH DRILLED INTO ROCK
9. TOTAL DEPTH OF HOLE
10. SIZE AND TYPE OF BIT
11. DATUM FOR ELEVATION SHOWN (TBM or MSL)
12. MANUFACTURER'S DESIGNATION OF DRILL
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN — DISTURBED | UNDISTURBED
14. TOTAL NUMBER CORE BOXES
15. ELEVATION GROUND WATER
16. DATE HOLE — STARTED | COMPLETED
17. ELEVATION TOP OF HOLE
18. TOTAL CORE RECOVERY FOR BORING %
19. SIGNATURE OF INSPECTOR

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	a. CORE RUN NO. e	b. CORE RECOVERY No. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
(Estimated)						
	21.0		- BLACK STAINING ON SHALE SEAMS COARSELY CRYSTALLINE			
	22.0		NO RECOVERY			1.7
568.8	23.0		FINE-GRAINED LS		6/9	
567.8	24.0		FINE-GRAINED LS			
566.8	25.0		FINE-GRAINED LS			
565.8	26.0		FINE-GRAINED LS			
	27.0		INTERBEDDED SHALE SEAM		7/9	
	28.0		BP			
			VOIDS - CALCITE LS			
	29.0		COARSELY CRYSTALLINE LS			
			BP			
	34.0					

DNG FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) — PROJECT — HOLE NO.

Hole No. D WES 08-80

DRILLING LOG	DIVISION	INSTALLATION	SHEET 1 OF 1 SHEETS
1. PROJECT		10. SIZE AND TYPE OF BIT	
2. LOCATION (Coordinates or Station)		11. DATUM FOR ELEVATION SHOWN (TBM or Mean)	
3. DRILLING AGENCY		12. MANUFACTURER'S DESIGNATION OF DRILL	
4. HOLE NO. (As shown on drawing title and title number)		13. TOTAL NO. OF OVER-BURDEN SAMPLES TAKEN	DISTURBED / UNDISTURBED
5. NAME OF DRILLER		14. TOTAL NUMBER CORE BOXES	
6. DIRECTION OF HOLE		15. ELEVATION GROUND WATER	
☐ VERTICAL ☐ INCLINED _____ DEG. FROM VERT.		16. DATE HOLE	STARTED / COMPLETED
7. THICKNESS OF OVERBURDEN		17. ELEVATION TOP OF HOLE	
8. DEPTH DRILLED INTO ROCK		18. TOTAL CORE RECOVERY FOR BORING	%
9. TOTAL DEPTH OF HOLE		19. SIGNATURE OF INSPECTOR	

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	TYPE OF SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	34.0		31.0			
	82.0		COARSELY CRYSTALLINE		4/9	
	93.0		COARSELY CRYSTALLINE			
	94.0		34.0			
	344		INTERBEDDED CLAY & SHALE VOID - CALCITE KLS			
	364		dense, gray, Limestone, Hard Sandy in seams		9/9	
	382		38.0			
	390		NO CORE			
	398					

DD FORM 1836 MAR 71 — PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLOGGIT) — PROJECT — HOLE NO.

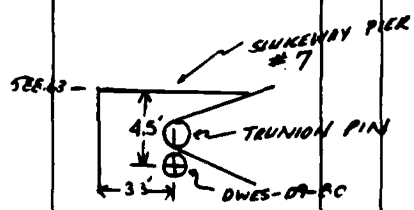
Hole No. D-WES-09-SC

DRILLING LOG	DIVISION: Detroit	INSTALLATION: Detroit Lock & Dam	SHEET 1 OF 1 SHEETS

1. PROJECT: Detroit Lock & Dam	10. SIZE AND TYPE OF BIT: [illegible] [redacted]
2. LOCATION (Coordinates or Station): [illegible]	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 455 MSL [illegible]
3. DRILLING AGENCY: [illegible]	12. MANUFACTURER'S DESIGNATION OF DRILL: Electric
4. HOLE NO. (As shown on drawing title and file number): DWES-09-SC	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED —
5. NAME OF DRILLER: C. Drake	14. TOTAL NUMBER CORE BOXES: ONE
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED Horiz DEG. FROM VERT.	15. ELEVATION GROUND WATER: —
	16. DATE HOLE: STARTED 23 July 60; COMPLETED 23 July 60
7. THICKNESS OF OVERBURDEN: —	17. ELEVATION TOP OF HOLE: 584 B
8. DEPTH DRILLED INTO ROCK: —	18. TOTAL CORE RECOVERY FOR BORING: 100 %
9. TOTAL DEPTH OF HOLE: —	19. SIGNATURE OF INSPECTOR: [signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0–30		Resteel - 1/4"-1/2" Concrete Grey in color. Crushed Agg.-Coarse 1/4" to 1 1/2" with avg at 3/4". H.B. Run. RQD=100%.	100%	Box 1	EL Began 1:47 Run 2.85' End 2:45 Rec 2.85' Time 58 min Loss — Drl time 24 min Gain — Hyd press — Water press — RPM 1505 Drl Action Smooth Water ret Lt. Brown/White

LOCATION



588.63
4.5
584.23

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO.

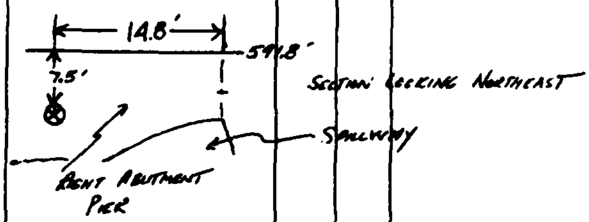
Hole No. DWES-D10-80

DRILLING LOG	DIVISION: Detroit	INSTALLATION: De Pere Lock & Dam	SHEET 1 OF 1 SHEETS

1. PROJECT: De Pere Lock & Dam	10. SIZE AND TYPE OF BIT: 6 1/2 x 6" #77Pu043
2. LOCATION (Coordinates or Station): See Bottom of Page	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): 1935 MSL
3. DRILLING AGENCY: CEWES	12. MANUFACTURER'S DESIGNATION OF DRILL: Electric
4. HOLE NO. (As shown on drawing title and file number): DWES-D-10-80	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: DISTURBED — UNDISTURBED —
5. NAME OF DRILLER: C. Drake	14. TOTAL NUMBER CORE BOXES: One
6. DIRECTION OF HOLE: ☐ VERTICAL ☐ INCLINED Horiz. DEG. FROM VERT.	15. ELEVATION GROUND WATER: Lake Pool
7. THICKNESS OF OVERBURDEN	16. DATE HOLE: STARTED 23 July 80; COMPLETED 23 July 80
8. DEPTH DRILLED INTO ROCK	17. ELEVATION TOP OF HOLE: 584.3 ft
9. TOTAL DEPTH OF HOLE	18. TOTAL CORE RECOVERY FOR BORING: 94 %
	19. SIGNATURE OF INSPECTOR: [signature]

ELEVATION a	DEPTH b	LEGEND c	CLASSIFICATION OF MATERIALS (Description) d	% CORE RECOVERY e	BOX OR SAMPLE NO. f	REMARKS (Drilling time, water loss, depth of weathering, etc., if significant) g
	0		NB 2-closed cracks			
	1		NB			WL — Began 11:14 End 11:40 Time 26 min Drl time 26 min Hyd press — Water press — RPM 1502 Drill Action Smooth Water ret Lt. Brown/white Remarks Run 3.07 Rec 2.9 Loss 0.17 Gain —
	2		Concrete Grey Brown color, Natural Agg-size range from 1/8" to 3/4" with avg at approx 3/8" RQD = 94% Run	94%	Box 1	
	3.0					

Location



ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE. (TRANSLUCENT) | PROJECT | HOLE NO.

In accordance with letter from DAEN-RDC, DAEN-ASI dated 22 July 1977, Subject: Facsimile Catalog Cards for Laboratory Technical Publications, a facsimile catalog card in Library of Congress MARC format is reproduced below.

Stowe, Richard L.
Condition survey of Depere Lock and Dam Lower Fox River, Wisconsin / by Richard L. Stowe, Joyce C. Ahlvin (Structures Laboratory, U.S. Army Engineer Waterways Experiment Station). -- Vicksburg, Miss. : The Station ; Springfield, Va. : available from NTIS, 1982.
96 p. in various pagings, 26 p. of plates ; ill. ; 27 cm. -- (Miscellaneous paper ; SL-82-3)
Cover title.
"June 1982."
Final report.
"Prepared for U.S. Army Engineer District, Chicago."
Bibliography: p. 29.

1. Concrete dams. 2. Dams--Inspection. 3. DePere Lock and Dam (Wis.) 4. Lower Fox River (Wis.) I. Ahlvin, Joyce C. II. United States. Army. Corps of Engineers. Chicago District. III. U.S. Army Engineer Waterways

Stowe, Richard L.
Condition survey of Depere Lock and Dam Lower Fox : ... 1982.
(Card 2)

Experiment Station. Structures Laboratory. IV. Title V. Series: Miscellaneous paper (U.S. Army Engineer Waterways Experiment Station) ; SL-82-3.
TA7.W34m no.SL-82-3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8