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LEHIGH RIVER BASIN,
POHOPOCO CREEK, PENNSYLVANIA .

BELTZVILLE LAKE.

CONDITION REPORT.
DAM, OUTLET WORKS & SPILLWAY
PERIODIC INSPECTION REPORT, NO. 1,

JULY 1970.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The first periodical inspection of Beltzville Lake Dam, Pohopoco Creek, was undertaken by representatives of the Office of the Chief of Engineer, North Atlantic Division and the Philadelphia District. The overall condition of the dam was very good with no significant cracking on the outlet works and no structural effects observed on the spillways although some of the weepholes in the spillway stabs were clogged with debris and required cleaning. Bridge movement was not observed and piezometers showed only minute and insignificant		

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Pressures.

The inspection disclosed no serious problems but several minor deficiencies were noted in the embankment, particularly at contact with the abutments in the conduit and spillway. Repair measures were outlined to be undertaken to correct these deficiencies.

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CONDITION REPORT
BELTZVILLE LAKE
PCHOPOCO CREEK, PENNSYLVANIA
DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO. 1

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A-2		South Wall
A-3	31	North Wall
A-4	c 25	South Wall
A-5	Omitted - Poor Photograph	
A-6	5+53	North Wall
A-7	4+34	South Wall
A-8	3+73	South Wall
A-9	2+00 to 2+07	South Wall
A-10	2+00 to 2+07	South Wall
A-11	1+34	South Wall
A-12	0+94	North Wall
A-13	0+84	South Wall
A-14	0+67 to 0+69	Entrance to South Chamber
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B-1	0+31	South Chamber Ceiling
B-2	0+00	South Chamber Gate
B-3	0+67	North Chamber, Entrance Ceiling
B-4	0+58	North Chamber Ceiling
B-5	0+43	North Chamber, South Wall
B-6	0+38 to 0+43	North Chamber, North Wall
B-7	0+27	North Chamber, South Wall
B-8	0+27	North Chamber, North Wall
B-9	0+00	North Chamber Gate
B-10	Omitted - Poor Photograph	
B-11	0+68	Entrance - Chambers
B-12	4+47 to 4+50	South Wall - Conduit

CORRESPONDENCE

&

INSPECTION REPORTS

1	Official Correspondence
2	Inspection Report - District
3	Inspection Report - OCE

BELTZVILLE LAKE
POHOPOCO CREEK, PENNSYLVANIA
DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT

1. AUTHORITY AND SCOPE.

This report has been prepared as covered by Engineer Regulation 1110-2-100, "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures," to present the instrumentation, periodic inspection and continuing evaluation of the project during the operational phase. This report does not include analysis of instrumentation installed to measure hydraulic performance of the conduit during operation or instrumentation to be installed to monitor water quality releases since this type of instrumentation was considered outside the intended scope of ER 1110-2-100.

This report describes the project, sets the schedules for periodic inspection, discusses, in detail, the types of instrumentation, frequency of readings, the submission and evaluation of data, and presents the results of the periodic inspections.

2. DESCRIPTION OF PROJECT.

2.1 PROJECT LOCATION. The project is located in Carbon and Monroe Counties in Northeastern Pennsylvania 73 air miles northwest of Philadelphia, Pennsylvania. The dam site is located 5.2 miles above the mouth of Pohopoco Creek and 4 miles east of Lehigh, Pennsylvania as shown on plate 1.

2.2 BASIN DESCRIPTION. Pohopoco Creek is a tributary of the Lehigh River. The Lehigh River Basin is rural in character with only scattered communities upstream of the heavily populated Allentown-Bethlehem-Easton area. Upstream of the confluence of the Pohopoco Creek, the Lehigh River drainage area is 773 square miles. The Pohopoco Creek drainage area is 111 square miles and the portion above the dam site is 96.3 square miles.

2.3 PROJECT DESCRIPTION. The principal structures consist of an earth dam across the valley of Pohopoco Creek, an uncontrolled spillway located in the right abutment, and an outlet works located adjacent to the natural channel of the creek. The Beltzville Reservoir, when filled to the top of the water supply pool (elev. 628), will be approximately seven miles long, one-half mile wide at the point of maximum width, and will have a maximum depth of approximately 130 feet at the toe of dam. A number of deep, narrow gorges enter the reservoir from the right, or north bank. A high, steep ridge forms the left valley wall. The ridge is particularly steep in the vicinity of the dam site and the upstream portion of the reservoir. The reservoir will be cleared below elevation 631, three feet above the maximum water supply pool.

2.4 PROJECT FUNCTIONS.

a. Water Supply. The storage allocated to water supply, which is further subdivided into storage for municipal water supply (70%) and for low-flow augmentation (30%), is equal to 39,830 acre-feet. This volume, when combined with the volume allocated to sediment accumulation, would fill the reservoir to elevation 628. The total storage below elevation 628 is equivalent to about 8 inches of runoff.

b. Flood Control. A volume equal to 27,030 acre-feet has been allocated for flood-control storage. When added to the preceding storage allocations, the combined volume is equal to 66,860 acre-feet and the total controlled storage is equivalent to about 13 inches of runoff. The top of flood-control pool is elevation 651.

c. Recreation. Recreation will be provided at the project through the acquisition of land by the Corps of Engineers and development by both the Corps of Engineers and the Commonwealth of Pennsylvania. The initial development considered to be required for the first three years after the project is operational will be provided by the Corps of Engineers and will accomodate an average annual visitation of 250,000 recreation-days. Augmentation of that development, during the period from about three to ten years after the project is operational, will result in a total capacity of about 600,000 recreation-days. Both the Federal and the State developments will provide facilities for general day-and-overnight use.

2.5 PERTINENT DATA.

a. Drainage Areas.

Mouth	111 sq. mi.
Parryville Gage	109 sq. mi.
Beltzville Dam Site	96.3 sq. mi.
Wild Creek Dam	22.1 sq. mi.
Hatchery Gage	16.8 sq. mi.
Penn Forest Dam	16.1 sq. mi.

b. Reservoir.

	Elevation (ft/s.l.d.)	Surface Area (acres)	Storage	
			Capacity (acre-foot)	Runoff (inches)
Top of Sediment Reserve	537	113	1,390	0.27
Top of Water Supply Pool	628	947	41,220	8.05
Top of Flood Control Pool (Spillway Crest)	651	1,410	68,250	13.33
Maximum Spillway Design Surcharge	666.5	1,817	93,220	18.21
Top of Dam	672	1,976	103,630	20.24
Allocated to Sediment Reserve	495-537	--	1,390	0.27
Allocated to Supplies of Water	537-628	--	39,830	7.78
Allocated to Flood Control	628-651	--	27,030	5.28

c. Dam.

(1) Embankment

Type	Impervious core with random and rockfill zones
Top elevation, ft./s.l.d.	672.0
Maximum height, ft.	170
Slope on upstream side	
Above elevation 620	3 H to 1 V
Below elevation 620	5 H to 1 V
Slope on downstream side	
Above elevation 600	3 H to 1 V
Below elevation 600	3.5 H to 1 V
Length, feet	4,560

(2) Spillway

Type	Ungated, partially concrete lined channel in saddle through right abutment
Crest elevation, ft./s.l.d.	651.0
Crest control	100 ft. wide concrete sill
Base width of cut, ft.	275
Side slopes, rock-cut	1 H to 2 V
Side slopes, earth-cut	1.5 H to 1 V

(3) Flood Control Outlet Works *

Conduit dimensions	7'-0" Dia.
Length, feet	1,165.3
Discharge capacity, c.f.s.	
Maximum water-supply pool, elevation 628	1,680
Flood-control pool, elevation 651	1,840
Invert elevation at intake	503.39
Invert elevation at outlet	499.69
Service and emergency gates	
Type	Slide gate
Number	2
Size	2'-10" x 7'-4"
Stilling basin	
Width, feet	23.3
Length, feet	50.0
Apron elevation	486.5

* Type of conduit and dimensions of conduit and stilling basin changed by modification of construction contract April 1968 due to changed conditions encountered in the field.

(4) Water Quality Control Outlet Works

Discharge capacity at top of water supply pool, c.f.s.	300
Number of intake ports	8
Vertical spacing, feet	11'-8"
Size of intake port gates	2'-0" x 4'-0"
Passage dimensions of divided intake wet-well	4'-6" x 10'-10"
Passage dimensions of riser	4'-6" x 5'-0"
Size of control gate	2'-0" x 3'-0"

d. Spillway.

(1) Design Flood (all season storm)

Total precipitation in 48 hrs., inches	27.10
Total runoff, inches	25.58
Peak inflow	68,000
Total hydrograph, volume, acre-ft.	131,100

(2) Result of Routing

Elevation of pool at start of flood ft./s.l.d.	651.0
Total maximum discharge, c.f.s.	48,830
Maximum spillway discharge, c.f.s.	46,400
Maximum design pool elevation ft./s.l.d.	667.0
Adopted freeboard, ft.	5.0

3. CONSTRUCTION HISTORY.

The dam site facilities were constructed in two contracts. A contract for site preparation was awarded to Devault Contracting Company on 12 September 1966, and completed 22 February 1967 at a cost of \$165,899.76. A contract for construction of the embankment, outlet works and spillway was awarded to Green-Winston Construction Company on 14 June 1967. The contract was completed on 10 July 1970. The embankment was topped out in December 1969. A contract for Phase I clearing was awarded on 11 June 1969 to Casanave Tree Service Company and was completed 3 March 1970. A contract for Phase II clearing was awarded 18 July 1970 and scheduled for completion 2 April 1971. Filling of the Reservoir is to commence in February 1971.

4. INSTRUMENTATION.

4.1 GENERAL. Instrumentation installed to measure performance consist of piezometers in the embankment and foundation to measure seepage pressures, inclinometers through the embankment to measure horizontal movement and incremental vertical movement, surface settlement points along the embankment crest to measure post construction settlement and alignment and settlement points on the spillway and intake tower bridges to measure horizontal and vertical bridge movements.

a. Piezometers. A total of twenty piezometers were installed in the embankment. Purpose, type and location of these piezometers are described below. Two types were used. The Casagrande device was used at locations near centerline and upstream of centerline because the Casagrande device is one of the most reliable and is not difficult to install. The Warlam type air actuated pressure cell was used for the downstream devices, principally to provide some comparison and experience with this type device. The Warlam device offers a definite advantage during construction in that the tubes can be buried in a trench and subsequent construction can proceed without interference.

(1) Purpose

(a) To measure pore pressures within the foundation and embankment during construction.

(b) To measure hydrostatic pressures during impoundment, and to evaluate performance in comparison with design assumptions.

(2) Location

Piezometer installations are shown in plan view with typical cross sections and details appearing on plates 2 and 3. The installation consists of four lines (stations) of piezometers placed in planes perpendicular to the axis of the dam. At each location, piezometers extend into the foundation as well as to selected depths within the embankment at intervals between the upstream and downstream toe of dam. The piezometers installed at Stations 7+770 and 8+600 were placed primarily to determine the seepage thru the pervious foundation, and to study the effectiveness of the cutoff trench. The piezometers installed in the embankment on the other lines are set at low elevations where the load is maximum. In addition to the groups of piezometers at selected lines, piezometers were placed at two intermediate stations to provide a check on the uniformity of conditions between lines.

(3) Installation

In general, the Casagrande type piezometer was installed prior to placing in excess of 20 feet of fill at the device location, except those located in the cutoff trench which were installed after the cutoff trench was backfilled. Vertical extensions, with hand compacted backfilled protective mounds as shown by the drawings, was consistently kept ahead of the fill operations. The Warlam type piezometer was installed at all installations located downstream of the dam axis. The Warlam device uses air as its medium. This eliminates such effects as gravity corrections, freezing, and the construction problem of extending the pipes vertically through the fill. Maintenance is greatly reduced and instant response to pore pressure changes is provided. The pressure cells were installed when the embankment reached the elevations of the top of the monitoring boxes as shown on plates 4, 5 and 6. The Warlam piezometer lines extend along the faces of the dam in a shallow cut and cover trench and terminate in weatherproof monitoring boxes.

b. Slope and Settlement Indicators.

(1) Purpose

(a) To measure any embankment movement which may occur either parallel or perpendicular to the dam axis.

(b) To measure total and differential settlements within the embankment during and after construction.

(2) Location

Three indicators were installed at the specified embankment stations as shown by the plan view drawing on plate 2. Plate 3 illustrates the details of a typical indicator installation. Two of the devices were placed in the deepest sections of the embankment. One was installed in the pre-diversion embankment on the right side of the river near the temporary slope towards the river, the second was placed in the left abutment area in the embankment closure section and the third indicator was placed near the toe of the steep left abutment terrace because of the extreme elevation differential between the terrace and the valley section of the left abutment. This emplacement will serve to check for movement of the embankment away from the left abutment, and also check for differential settlement between the valley and terrace fill sections.

(3) Installation

The instruments installed were manufactured by Slope Indicator Company of Seattle, Washington. The instruments were installed prior to the placement of 10 feet of impervious fill at the device location. The aluminum casing was anchored into firm rock with one set of grooves aligned parallel to the dam axis while the other set is normal to the axis. The aluminum casing was extended consistently ahead of fill operations and guarded with a hand compacted protective mound.

c. Surface Settlement Pipes and Alignment Pipes.

(1) Purpose

(a) To determine the total settlement of the top of dam at various stations along its crest.

(b) To determine horizontal deflections normal to the centerline of the dam at these same stations.

(2) Location

Seven devices will be installed along the upstream edge of roadway on the top of the dam at the embankment stations shown on plate 3.

(3) Installation

The indicator is simply a No. 11 reinforcing bar set at a known alignment and elevation. A 6" diameter hole will be drilled to elevation 669. Then a protective 6" diameter piece of iron pipe will be placed in the hole and driven into the embankment at least 6 inches. A 6-foot length of No. 11 reinforcing bar will then be driven inside the casing to elevation 666. When the driving is completed, the bar will be cross-marked and its alignment and elevation checked with reference targets and benchmarks established on the abutments.

4.2 FREQUENCY OF READINGS.

a. Responsibility. Personnel of the Resident Engineers Office made all the instrument readings on devices installed until December 1969. At that time the data collection responsibility was transferred to operating personnel and consecutive monthly observations were maintained. It will be Operation Division's responsibility to oversee and maintain the reading schedule mentioned herein and to see that the data obtained is furnished to Engineering Division. Engineering Division has processed, reviewed and evaluated the data collected to date and will continue this function during project operation. Engineering Division will be specifically responsible for the establishment of procedures for promptly informing the Chief of Engineers, when evaluation of the condition of the structure or analyses of the instrumentation data indicate the stability of the structure is questionable.

b. During Construction.

(1) Piezometers

Since initial installation, monthly readings on eight Warlam type piezometers have indicated either no hydrostatic pressures at all or an occasional minute pressure which eventually disappears. Five other piezometers continue to read small hydrostatic pressures, but they are of little significance. Only PZE-95-1, a Casagrande type device measured significant excess hydrostatic pressure during construction. This installation is located 135 feet upstream in a random zoned material with the tip at elevation 506. Because of the unusually heavy rainfall in July 1969, a temporary flood pool to elevation 551+ was formed behind the upstream cofferdam. The seepage forces resulting from this pool caused the piezometric head in device PZE-95-1 to rise of 8.5 feet above the embankment surface elevation of 528, which existed at the device when the rainfall occurred. Subsequent readings showed this pressure to quickly dissipate with the lowering of the flood pool to elevation 507. The piezometers will continue to be read on a monthly basis until the first filling of the reservoir commences.

(2) Slope and Settlement Indicators

These devices were read generally on a monthly basis with particular emphasis on scheduling readings at various stages of increased height of embankment fill. The readings obtained during construction are of value in that settlement and movements, although small, have occurred in the magnitude and direction to be generally expected. Tabulated below is a summary of these results to date.

INSTAL- LATION	HT. OF FILL ABOVE BOTTOM OF CASING	MAXIMUM SETTLEMENT TO DATE	GENERAL MOVEMENT AND LARGEST DEFLECTION			
			North-South	Defl.	East-West	Defl.
VIF 92-2 (Rt. Abut)	151'	1.26'	South	1.6"	East	4.0"
VIF 95-2 (Closure)	169'	1.62'	North	0.85"	East	2.7"
VIF 98-5 (Lt. Abut)	115'	0.97'	North	0.75"	West *(East)	0.6" (0.7")

*Initial Readings

The installations VIF 92-2 and VIF 98-5 exhibit movements away from their abutments and in upstream and downstream directions respectively. Installation VIF 95-2 installed in the closure section of the embankment has a steadily decreasing rate of inclination toward the right abutment and a definite downstream progression. The movements of the embankment, in general, seem to be directed towards those areas of greatest height of embankment fill which lie on top of the old river bed. Total settlements have occurred in reasonable proportion to the height of embankment fill placed. Readings will continue for these installations on a monthly basis until results become relatively static, or until such time as the filling of the reservoir is initiated.

(3) Surface Settlement Pipes, Spillway and Service Bridge Alignment Plugs

These devices are scheduled to be installed during the fall of 1970. The Philadelphia District Survey Branch will make an immediate survey of the alignment and elevation of the devices when installations are completed. Thereafter, they will be surveyed every 3 months until such time as the filling of the reservoir commences and the post construction schedule takes precedence. The survey party will also check the elevations for the tops of the Casagrande type piezometers and the tops of the aluminum casing for the slope indicators at each inspection period.

c. Post Construction. Instrumentation readings will be obtained in accordance with the schedule given below for at least 2 years beyond the date at which the operating pool level elevation 628 is reached. At that time the schedule for observation readings will be reevaluated by Engineering Division and a reading schedule established on past performance.

(1) First Filling

Assuming conditions which produce average monthly mean flows prevail, the time required to fill the reservoir to elevation 628 (top of water supply pool) varies from 87 days to a maximum of 225 days. This time interval was calculated for a minimum release of 35 c.f.s. through the outlet works during the filling period and an initial pool elevation of 504 ft./s.l.d. Any inflow which is greater or below average after the initial start of filling would fill the reservoir at corresponding faster or slower rates.

(a) Piezometers: Readings will be taken weekly, or at every ten foot increase in water elevation above elevation 504, whichever occurs first. This observation schedule shall continue for a period of one month beyond the date that the top of water supply pool elevation 628 is reached.

(b) Slope and Settlement Indicators: These indicators will be read at every 20 foot increase in water elevation above elevation 504 or on a monthly basis whichever occurs first. Readings will continue for a period of one month beyond the date pool elevation 628 is reached.

(2) Post Filling. Static, drawdown and flood control pools.

(a) Piezometers: If a relatively static pool level is maintained at elevation 628 for more than 30 days, readings will be taken on a monthly basis. If conditions require drawdown or the pool elevation is lowered below operating pool elevation 628, readings will be taken at every 10 foot drop in elevation or at monthly intervals depending on whichever occurs first. When flooding occurs or temporary water storage for prototype testing of outlet works causes the pool elevation to exceed elevation 628 but remain less than elevation 651 (top of flood control pool), the piezometers will be read at every 5 foot increase in head above elevation 628 or on a weekly basis whichever occurs first.

(b) Slope and Settlement Indicators: During static pool conditions (pool elevation at 628), readings will be taken every 2 months on the indicators installed. For drawdown situations all indicators will be read at every 20 foot drop in elevation below elevation 628 or monthly depending on which condition happens first. For flood stages or prototype testing where pool elevations exceed elevation 628 all indicators will be read for each 10 foot increase in head above elevation 628, or every 2 weeks depending on which condition occurs first.

(3) Surface Settlement Pipes, Spillway and Service Bridge
Alignment Plugs

The Philadelphia District Survey Branch will conduct a monthly survey to check the elevation and alignment of the above mentioned devices. At the same time the survey party will check the elevations for the tops of the Casagrande type peizometers and the tops of the aluminum casing for the Slope Indicator installations. This survey schedule will commence one month before the initial start of the filling of the reservoir and continue for a period of one month beyond the date pool elevation 628 is reached. Thereafter, these devices will be surveyed every three months for the remaining 2 year inspection schedule.

d. Summary of Frequency of Readings.

INSTRUMENT	DURING CONSTRUCTION	POST CONSTRUCTION	
		FIRST FILLING	AFTER INITIAL FILLING
1. Piezometers	Monthly	Every 10' above El. 504 to El. 628, or monthly*	<u>STATIC POOL</u> - Monthly readings <u>Drawdown</u> - Every 10' below 628, or monthly* <u>FLOOD CONTROL</u> - Every 5' above 628, or weekly*
2. Slope and Settlement Indicators	Monthly, or until results become relatively static	Every 20' above El. 504 to El. 628, or monthly*	<u>STATIC POOL</u> - Every 2 months <u>Drawdown</u> - Every 20' below 628, or monthly* <u>FLOOD CONTROL</u> - Every 10' above 628, or every 2 weeks*
3. Surface Settlement Pipes	** Surveyed when installed, every 3 months thereafter	** Monthly Survey	Survey every 3 months **
4. Spillway and Service Bridge Alignment Plugs	** Surveyed when installed, every 3 months thereafter	** Monthly Survey	Survey every 3 months **

*Indicates whichever condition occurs first

**Performed by Survey Branch, Operations Division

5. INSPECTION AND EVALUATION.

Under the provisions of ER 1110-2-100, "Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures", instrumentation is to be incorporated in major structures to assure their safety and stability. As part of this safety evaluation program a system of scheduled inspections is planned to detect problem areas and to form a basis for remedial treatment when necessary. In the subparagraphs that follow, the schedule of these inspections, the detailed checklist to be used, and the personnel involved is discussed in detail.

5.1 SCHEDULE OF INSPECTIONS. Periodic inspections for the Beltzville Dam and Reservoir have tentatively been scheduled for the following sequence.

Initial Inspection		July 1970
Subsequent Inspections	Time Interval	
2nd	1 year	July 1971
3rd	1 year	July 1972
4th	1 year	July 1973
5th	1 year	July 1974
6th	1 year	July 1975
7th	2 year	July 1977
8th	2 year	July 1979
9th*		

*Inspections following the two-year interval will be increased to a 5 year frequency if justified by the results of the previous inspections.

5.2 CHECKLIST. A detailed checklist should be carried by the inspection team and visual inspections should be made of following items:

a. Embankment.

- (1) Surface cracks
- (2) Abutment and embankment junctions
- (3) Vertical and horizontal alignment
- (4) Unusual movement or cracking at or beyond the toe
- (5) Unusual through embankment or downstream seepage
- (6) Sloughing or erosion of embankment and abutment slopes
- (7) Movement of structural features in embankment
(conduit and intake tower)
- (8) Rip-rap failure (major displacement)

b. Outlet Works. Conduit, Tower and Stilling Basin

- (1) Concrete surfaces
- (2) Structural details of the bridge decks, roadways, parapets, building walls and floors, bridge piers and tower
- (3) Structural cracking
- (4) Joints and joint materials including relative movement at joints between structures or portions of structures
- (5) Water passages including drains
- (6) Leakage at joints or cracks
- (7) Condition of weepholes and other drainage systems
- (8) Bridge movement

c. Spillway.

- (1) Concrete surfaces
- (2) Structural details of chute and gravity walls
- (3) Joint displacement and joint material
- (4) Weepholes and drainage system
- (5) Bridge movement

5.3 PERSONNEL. The minimum inspection teams generally consist of District personnel having knowledge of design and construction problems at Beltzville with particular emphasis on soils, embankment design and construction, structural design, concrete materials, and concrete construction. Where possible, it is desirable to have representatives of OCE accompany Division personnel on the inspection.

As provided in paragraph 5.1 above, the first periodic inspection was performed in July 1970. The report on the results of that inspection follows in paragraph 6.

6.0 RESULTS OF FIRST PERIODIC INSPECTION. On 22 July 1970 the first "Periodic Inspection" was performed at Beltzville Lake. Correspondence applicable to implementation of the inspection is listed in the Appendix.

6.1 INSPECTION REPORTS. The inspection was attended by representatives of the Office of the Chief of Engineers, North Atlantic Division, and the Philadelphia District. On arrival at the site a short briefing was held covering the pertinent features of design and construction. Following the briefing the inspection party proceeded to the outlet works for a walk-thru the conduit then a thorough inspection of the embankment, tower and spillway. Following the inspection a critique was held. The discussion followed, point-by-point, the checklist for the inspection shown in paragraph 5.2 on

pages 12 and 13. At the end of the critique all the comments made by the various members of the inspection party were recorded and are summarized below:

a. Embankment.

(1) Surface cracks: None.

(2) Abutment and embankment junctions: Erosion noted along contact of embankment with the right abutment. Some large boulders were placed by the contractor to reduce erosion but were not successful and erosion is continuing. Engineering Division will design a drainage system to correct this problem.

(3) Vertical and horizontal alignment: No problem noted.

(4) Unusual movement or cracking at or beyond toe: None.

(5) Unusual thru embankment or downstream seepage: None.

(6) Sloughing or erosion of embankment and abutment slopes: The resistance of the material on the downstream slope to weathering with subsequent sloughing and eventual clogging of the horizontal drainage blanket with migrating fines was questioned. A close watch will be made of the slope for sloughing, and the piezometers for any build-up in pressure that might indicate possible ineffectiveness of the horizontal drain.

(7) Movement of structural features in embankment: None.

(8) Rip rap failure (major displacement): None.

b. Outlet Works. Conduit, Tower and Stilling Basin

(1) Concrete surfaces: One hairline crack appears in the outlet works wall near the end of the conduit.

(2) Structural details of bridge decks, roadways, walls, floors, bridge piers and tower: No deficiencies noted.

(3) Structural cracking: None

(4) Joints and joint material: No deficiencies noted.

(5) Water passages including drains: Some minor cracking was noted in the transition zone and, although leakage was noted following completion of construction, they are now sealed with calcium deposits.

(6) Leakage at joints and cracks: See (5).

(7) Condition of weepholes and other drainage systems:
No problem noted.

(8) Bridge movement: None noted.

c. Spillway.

(1) Concrete surface: Surface of spillway slab is rough with poor finish, has appearance of over-sanded mix or coarse grout covering. Many hairline cracks appear in surface of slabs. One working crack will progressively become worse after several freeze-thaw cycles and should be sealed.

(2) Structural details of apron and gravity walls:
Gravity walls show similar texture to finish. No structural defects noted.

(3) Joint displacement and joint material: Extrusion of pre-moulded joint filler was noted between the right spillway bridge pier at contact with the spillway slab.

(4) Weepholes and drainage system: Many of the weepholes in the spillway slab were clogged with dirt and require cleaning. A special cylinder or sleeve with screens on both ends should be designed to be inserted in the slab weepholes. Drainage fill will be prevented from getting out and animals and debris will be kept from getting in and clogging the hole.

(5) Bridge movement: None noted.

Copies of inspection reports by the District and the OCE representatives covering the above items are included in the Appendix with other correspondence. The results of surveys, mapping of cracks, and verifying photographs have been taken to establish control and are discussed in paragraph 6.4, "Technical Assessment and Recommendations."

6.2 RESULTS OF INSTRUMENTATION OBSERVATIONS. The results of the readings on the existing instrumentation is shown on plates 17 thru 29 and discussed in detail in paragraph 4.2 b, pages 7 thru 10. Briefly summarized, the results are as follows:

a. Piezometers.

Since initial installation the piezometers have shown only minute and insignificant pressures with the exception of PZE-95-1 which showed a temporary significant increase in pore pressure due to an unusually heavy rainfall occurring in July 1969. The rain

caused a temporary pool to elevation 551'. The piezometric surface indicated was 533.5' which rapidly dissipated when the pool dropped. Plate No. 29 shows the summaries to date of all piezometer readings.

b. Slope and Settlement Indicators.

The results of readings on the three slope indicators are shown on plates 17 thru 28 and summarized on page 8. In general, the movements of the embankment seem to be directed toward those areas of the greatest height of fill lying on top of the old river bed, which is as expected. Total settlements have occurred in reasonable proportion to the height of embankment but will be watched more closely during filling of the reservoir which is scheduled to commence in February 1971.

c. Surface Settlement Pipes.

Seven surface settlement pipes of the type shown on plate no. 3 were installed as part of the embankment contract. However, OCE in reviewing the Design Memorandum No. 17, "Instrumentation," suggested the placing of an additional ten reference points at 50 foot intervals between Stations 9+580 and 10+030. These additional settlement points will be installed in the fall of 1970 and the first set of elevations taken as soon thereafter to establish control.

6.3 TECHNICAL ASSESSMENT AND RECOMMENDATIONS. The inspection disclosed no serious problems, but several minor deficiencies were noted. They appear in the embankment, particularly at contact with the abutments, in the conduit, and the spillway. Photographs have been taken of these minor deficiencies for control purposes in order to make comparison with later inspections. The photographs appear in the Appendix and are designated as 1 thru 17 and A-1 thru B-10. They are keyed by locations shown on the plates for the various structures. The minor deficiencies are:

a. Embankment.

(1) Ponding of water: Photograph No. 1 is taken looking downstream. Ponding at contact of left abutment and downstream toe of dam has occurred as a result of poor grading. Dam Tender has been instructed to regrade area and provide a drainage ditch to extend downstream to prevent further accumulation of water against the toe.

(2) Erosion: The erosion along the contact zone of the embankment with the right abutment, as noted in paragraph 6.1 a, is shown in photographs 2 and 3. The expedient of placing the large boulders shown as a means of reducing erosion by the contractor was not successful and the problem will be corrected as funds become available.

b. Outlet Works.

(1) Conduit: A crack survey was made in the conduit to determine the extent and seriousness of cracking and spalling and to provide a basis of control for comparison with subsequent inspections. In addition, the first set of elevations were taken thru the conduit to determine if settlement or deformation has taken place in the interval between periodic inspections. An isometric view of the gate chambers and the barrel of the conduit, showing the relative position and extent of cracks and spalls, is shown on plates 12 thru 16 and in photographs A-1 thru B-10. Cracking was minor and leaks were sealed with calcium deposits. The profile of the conduit, plate 11, showing elevation taken at both crown and invert reveal no irregularities with the exception of two minor depressions occurring at Stations 5+00 and 8+50. The depressions appear to be a result of a deficiency in the formwork at those locations.

(2) Stilling basin walls: Photographs 4 and 5 show a minor crack and a joint spall in the left basin wall. No repair needed.

(3) Outlet works area: Photographs 6, 7 and 8 show areas of possible future erosion problems and were taken for comparison purposes only. Captions identify the area.

c. Spillway.

(1) Drainage: Photograph No. 9 was taken in the spillway area looking upstream and shows some shallow ponding which will be corrected by resident personnel.

(2) Bridge piers: Some minor extrusion of joint filler has occurred between the right spillway bridge pier and the spillway slab but does not present a problem at this time. No repair is contemplated. Extent of displacement can be seen on photographs 10 and 11.

(3) Cracks: Many hairline cracks have appeared in the surface of the spillway slab. The majority, however, are minor in nature. One crack is a working crack and will be sealed. Photographs 12, 13 and 14 show, in general, the surface cracks. Photographs 15 and 16 show the working crack.

6.4 SUMMARY. In general, the overall condition of the dam, outlet works and spillway is very good with only minor deficiencies. Repair work, as recommended above, will be accomplished as funds become available. The next recommended inspection is as scheduled, July 1971.

CONDITION REPORT

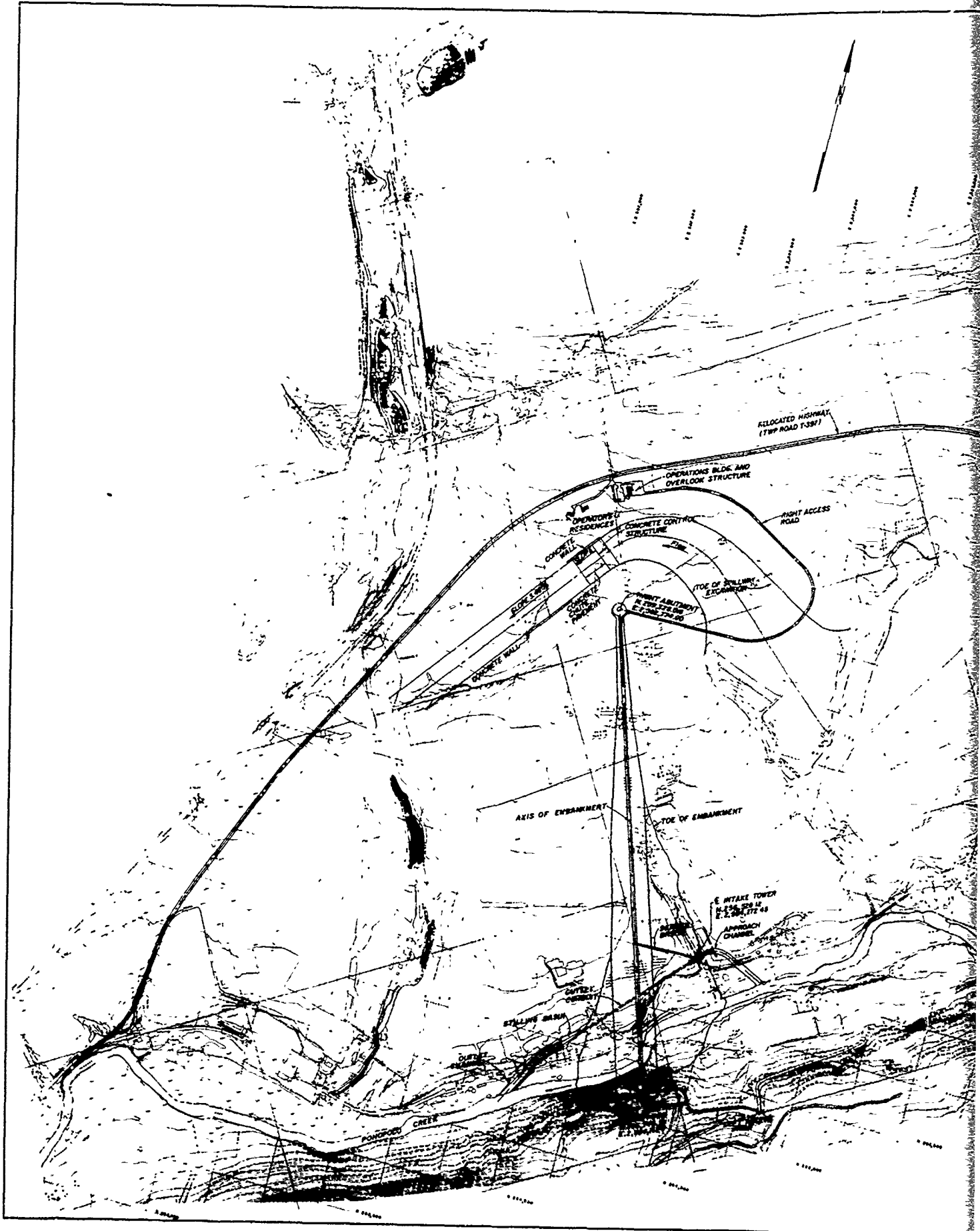
BELTZVILLE LAKE

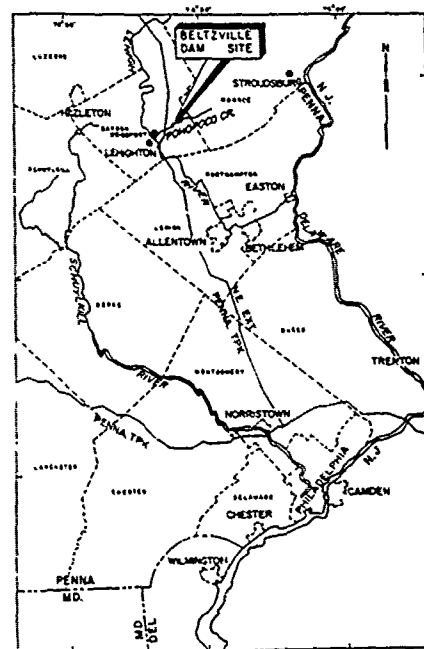
POHOPOCO CREEK, PENNSYLVANIA

DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO. 1

PLATES





LOCATION MAP

SCALE IN MILES
0 1 2 3 4

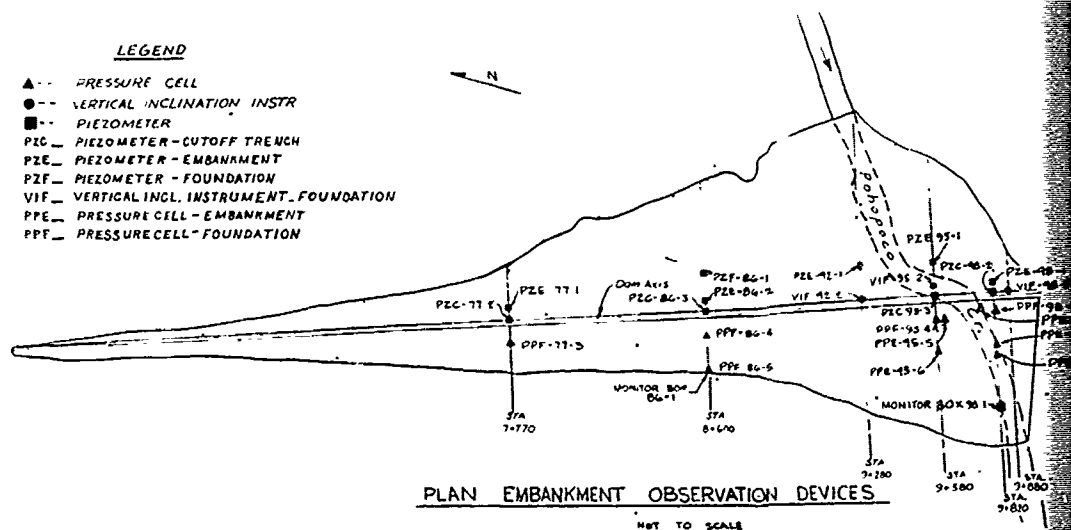


SCALE IN FEET
0 400 800

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
GENERAL PROJECT PLAN

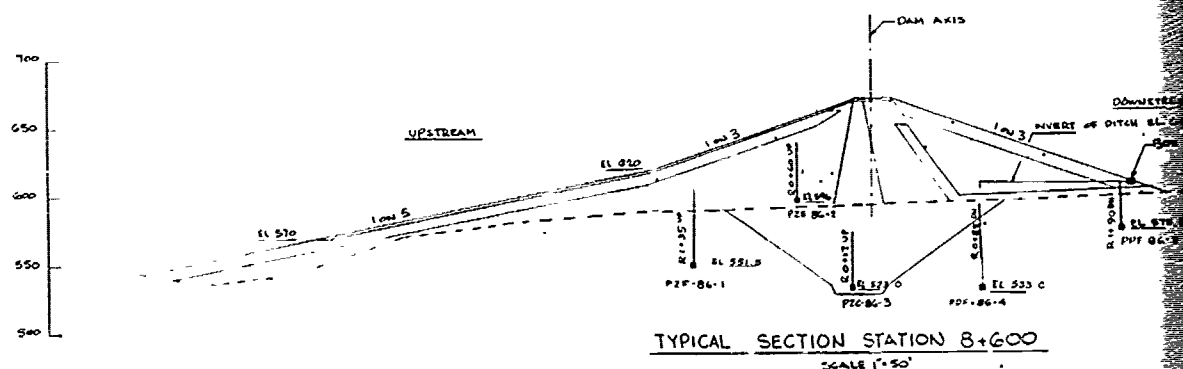
LEGEND

- ▲ -- PRESSURE CELL
 ● -- VERTICAL INCLINATION INSTR
 ■ -- PIEZOMETER
 PTC -- PIEZOMETER - CUTOFF TRENCH
 PZE -- PIEZOMETER - EMBANKMENT
 PZF -- PIEZOMETER - FOUNDATION
 VIF -- VERTICAL INCL. INSTRUMENT - FOUNDATION
 PPE -- PRESSURE CELL - EMBANKMENT
 PPF -- PRESSURE CELL - FOUNDATION



PLAN EMBANKMENT OBSERVATION DEVICES

NOT TO SCALE

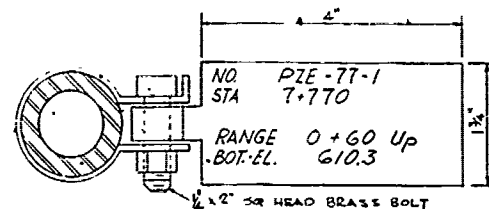


TYPICAL SECTION STATION 8+600

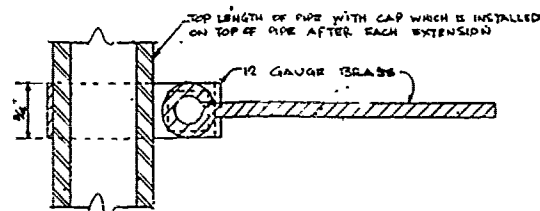
SCALE 1"=50'

GAGE NO.	STATION	RANGE	ELEVATION	MATERIAL	TYPE OF INSTALLATION
PZE-77-1	7+770	0+60 UP	610.3	EMBANKMENT	PIEZOMETER
PZE-77-2	7+770	0+17 UP	578.3	CUTOFF TRENCH	"
PPF-77-3	7+770	0+68 DN	583.9	FOUNDATION	PRESSURE CELL
PZE-86-1	8+600	1+35 UP	551.5	"	PIEZOMETER
PZE-86-2	8+600	0+60 UP	596.6	EMBANKMENT	"
PZE-86-3	8+600	0+17 UP	523.0	CUTOFF TRENCH	"
PPF-86-4	8+600	0+85 DN	532.5	FOUNDATION	PRESSURE CELL
PZE-92-1	8+600	1+90 DN	575.5	"	"
PZE-92-2	9+280	1+35 UP	613.1	EMBANKMENT	PIEZOMETER
VIF-92-2	9+280	0+17 UP	575.5	FOUNDATION	VERT. INSTR.
PZE-95-1	9+580	1+35 UP	506.5	EMBANKMENT	PIEZOMETER
VIF-95-2	9+580	0+30 UP	498.5	FOUNDATION	VERT. INSTR.
PZE-95-3	9+580	0+17 UP	501.0	CUTOFF TRENCH	PIEZOMETER
PPF-95-4	9+580	0+80 DN	482.2	FOUNDATION	PRESSURE CELL
PZE-95-5	9+580	0+60 UP	565.5	EMBANKMENT	PIEZOMETER
PZE-95-6	9+580	0+17 UP	552.0	CUTOFF TRENCH	"
PZE-95-7	9+580	0+80 DN	520.2	FOUNDATION	PRESSURE CELL
PPF-95-8	9+580	0+25 DN	494.0	"	"
VIF-95-9	9+580	0+17 UP	550.0	"	VERT. INSTR.
PPF-95-10	9+580	0+80 DN	520.2	FOUNDATION	PRESSURE CELL
PZE-95-11	9+580	1+80 DN	523.8	"	"
PZE-95-12	9+580	0+80 DN	510.2	"	"
PZE-95-13	9+580	1+90 DN	510.2	"	"

MONITOR BOX NO.	STATION	RANGE	ELEVATION	EL TOP OF BOX
BOX 86-1	8+600	1+96 DN	611.5	
BOX 95-1	9+580	4+82 DN	536.5	

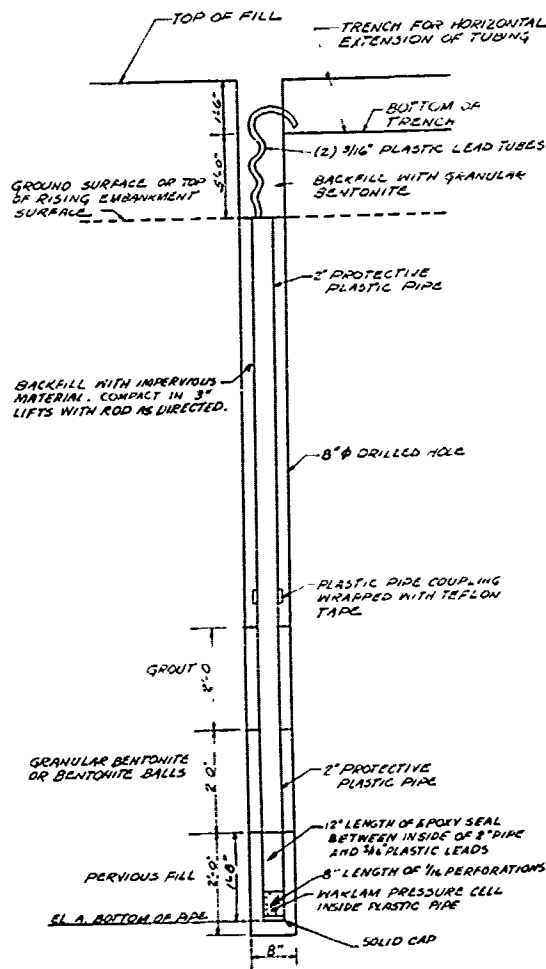


NOTE: IDENTIFICATION TAGS WILL BE PLACED ON ALL PIEZOMETER & VERTICAL INCLINATION INSTALLATIONS.



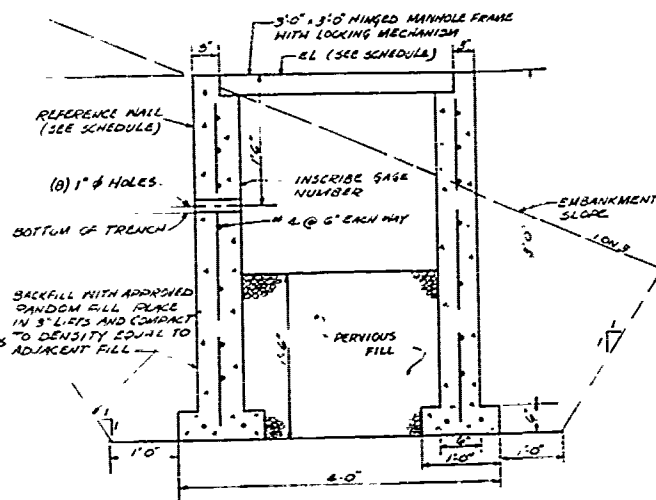
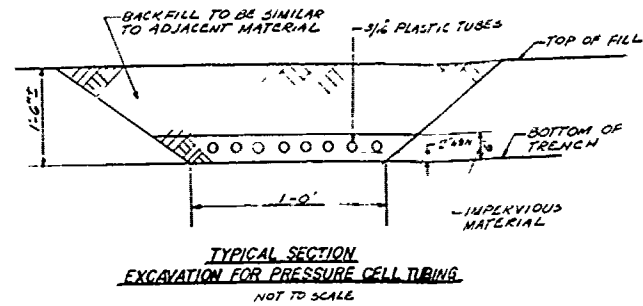
DETAIL OF IDENTIFICATION TAG

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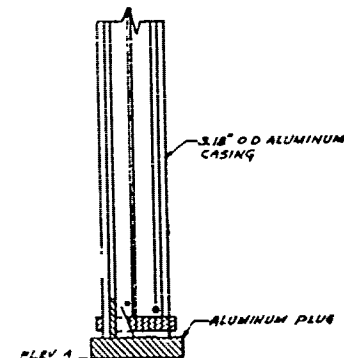


PRESSURE CELLS-INSTALLATION
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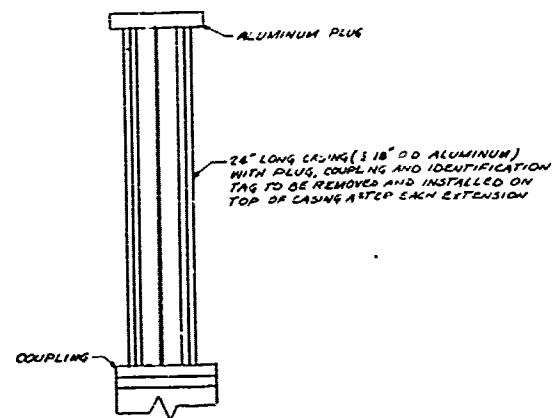
NOTE
TEMPORARY 6" CASING WILL
BE REQUIRED DURING INSTALLATION



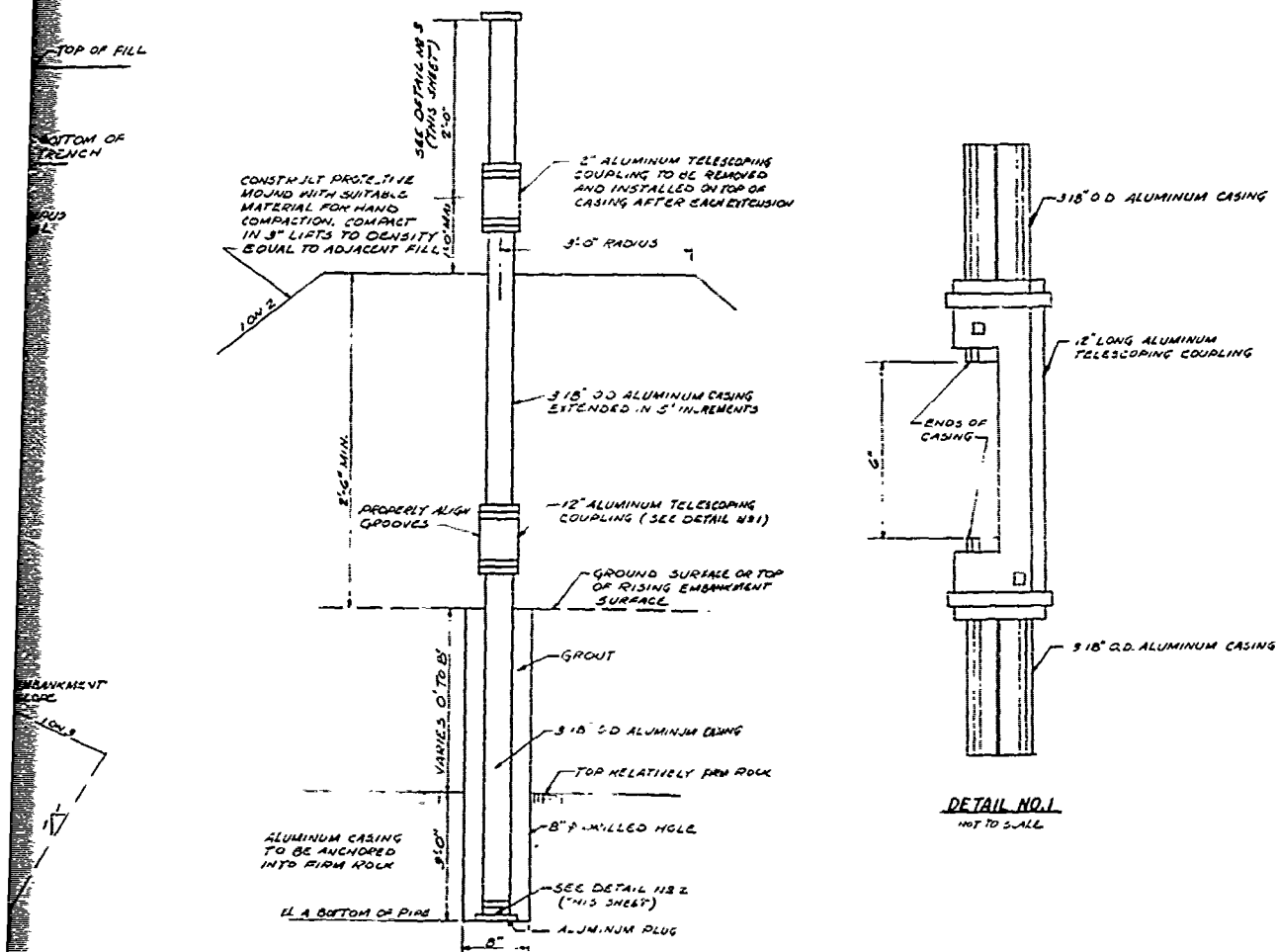
CONCRETE MONITORING BOXES
NOT TO SCALE



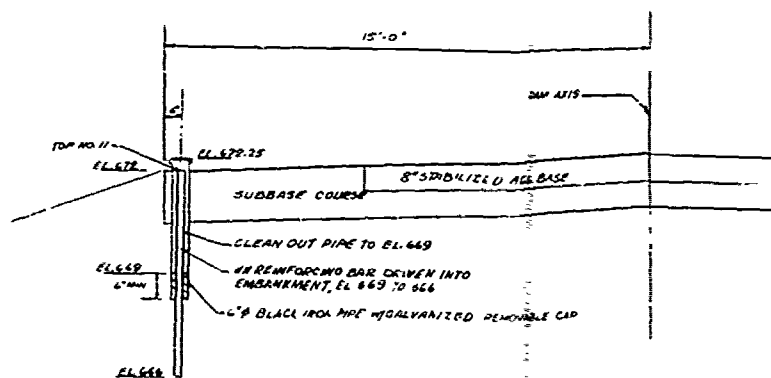
DETAIL NO. 2
NOT TO SCALE



DETAIL NO. 3
NOT TO SCALE



**VERTICAL INCLINATION INSTRUMENT
INSTALLATION.**
NOT TO SCALE

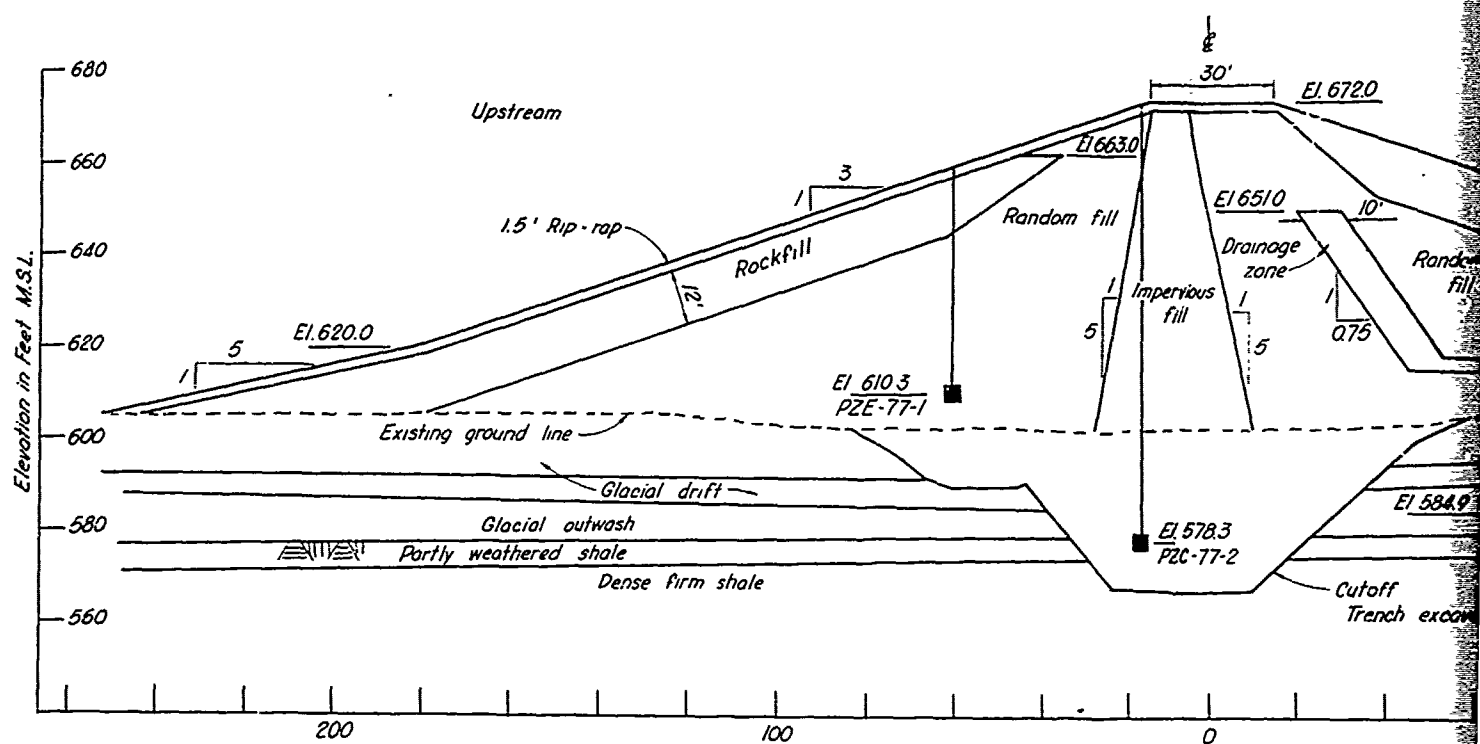


SURFACE SETTLEMENT PIPES.

SCALE 1" = 2'
2 1 0 2 4 FT

SURFACE SETTLEMENT PIPE INSTALLATIONS		
PIPE NO.	STARTING	RANGE
SP-1	61900	019500
SP-2	71400	019500
SP-3	71500	019500
SP-4	81400	019500
SP-5	81500	019500
SP-6	81600	019500
SP-7	91300	019500

U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER LEAHY BARR BUILDING ENGINEER DISTRICT HEADQUARTERS BATTLEFIELD LINE	
INSTRUMENTATION DETAILS	
PROJECT NO.	35497
SCALE	SHEET



AXIS STATION 7+770

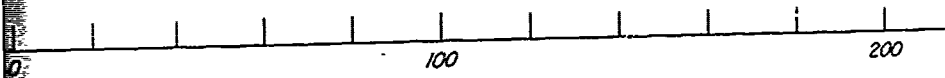
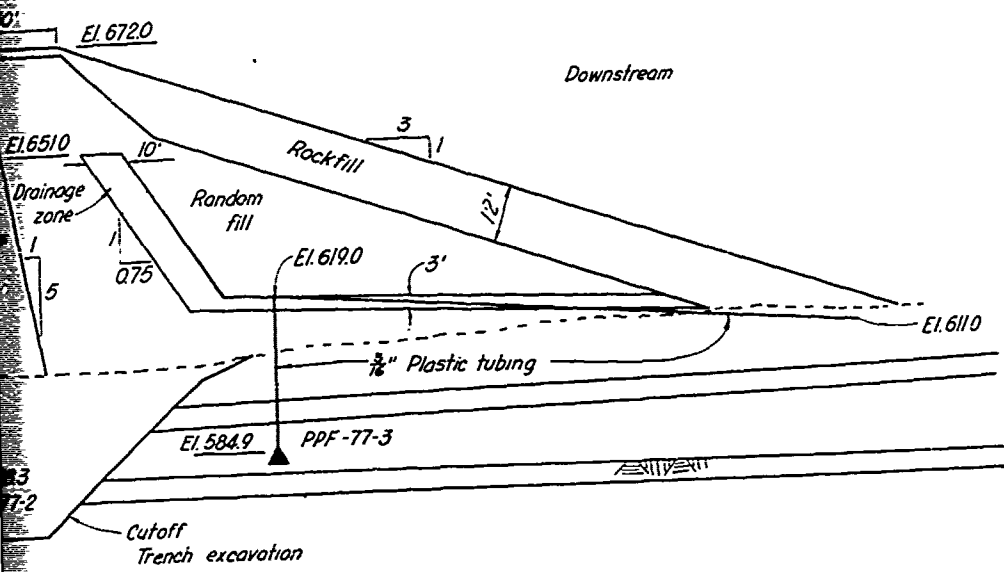
Scale in Feet



LEGEND

- ▲ Pressure cell
- Vertical inclination inst
- Piezometer
- PZC Piezometer - Cutoff trench
- PZE Piezometer - Embankment
- PZF Piezometer - Foundation
- VIF Vertical incl. instrument - Foundation
- PPE Pressure cell - Embankment
- PPF Pressure cell - Foundation

STA.	



N. 7+770
 Feet
 20 40

Trench
 and
 Foundation
 element
 location

POHON
 INST

REVISIONS			
NO.	DESCRIPTION	DATE	APP.

El. 5110

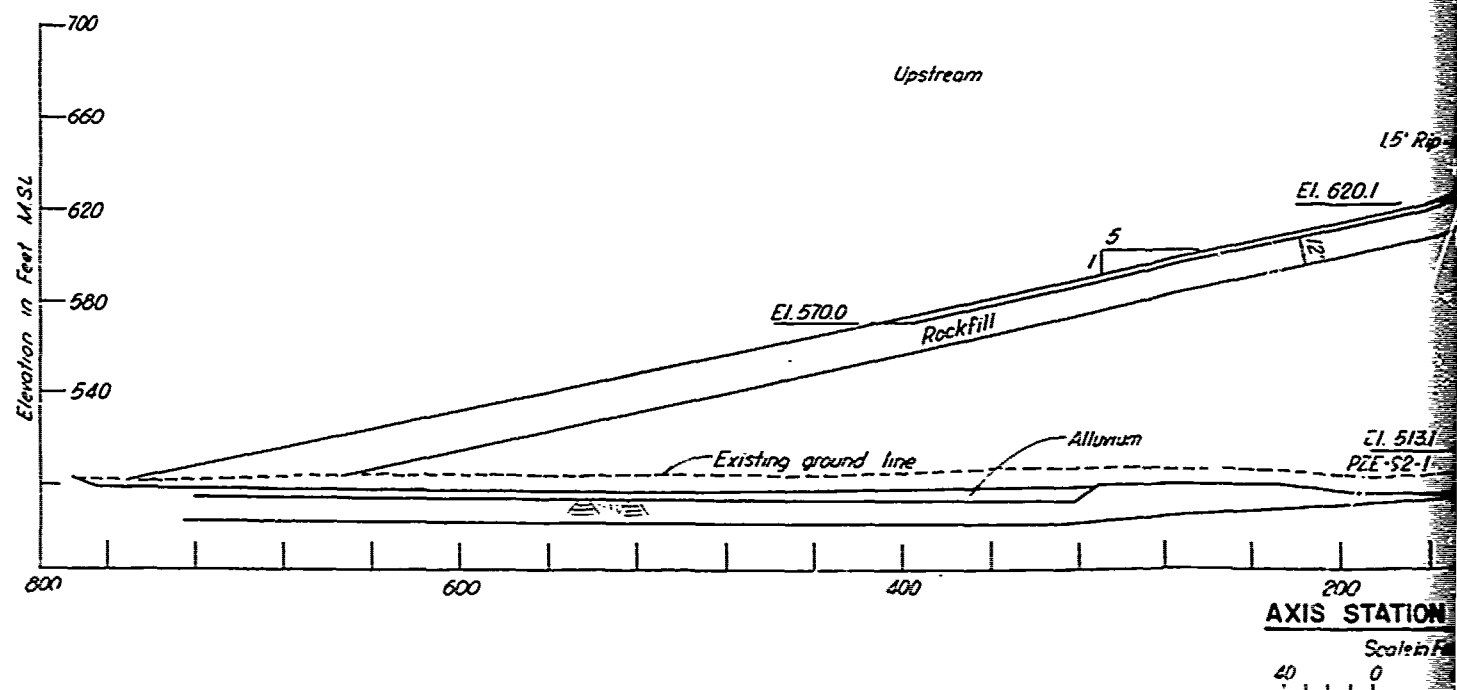
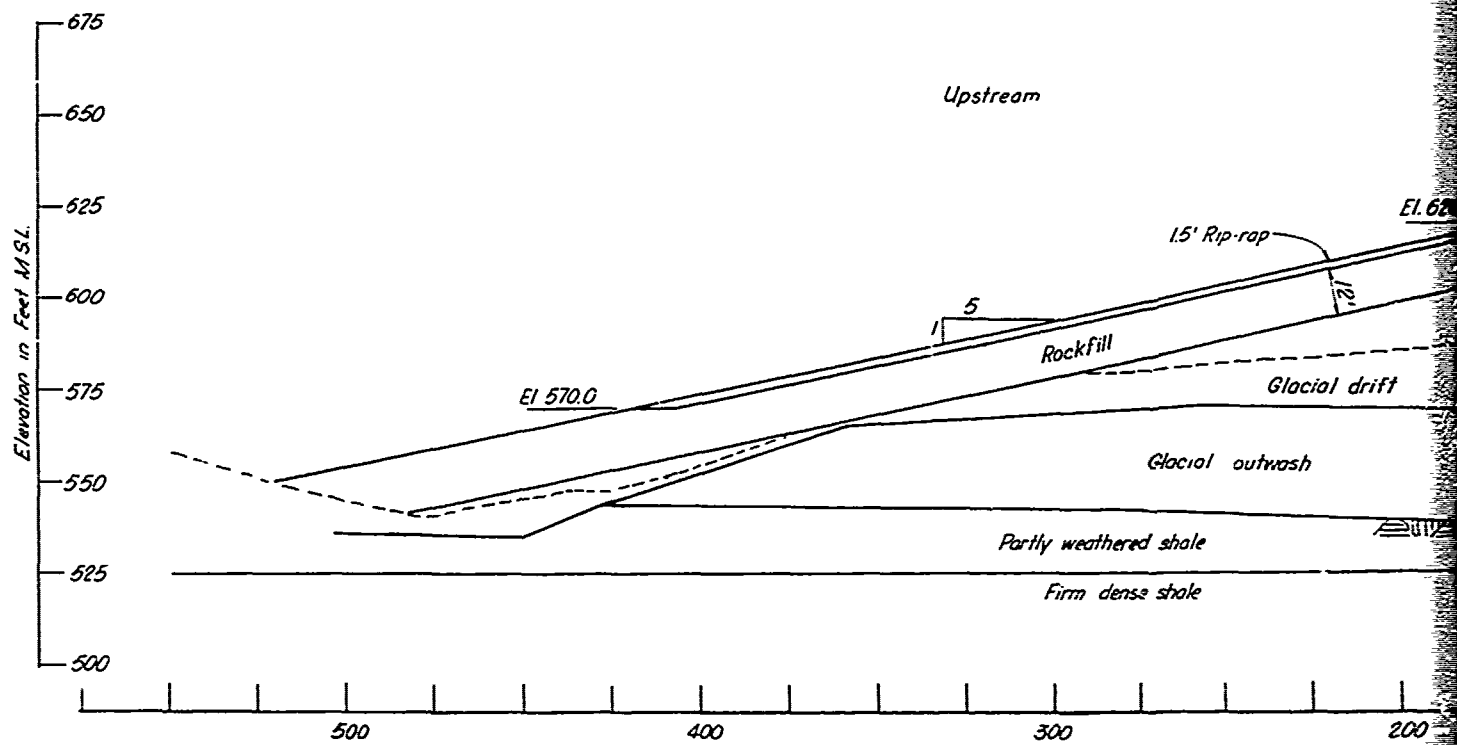
200

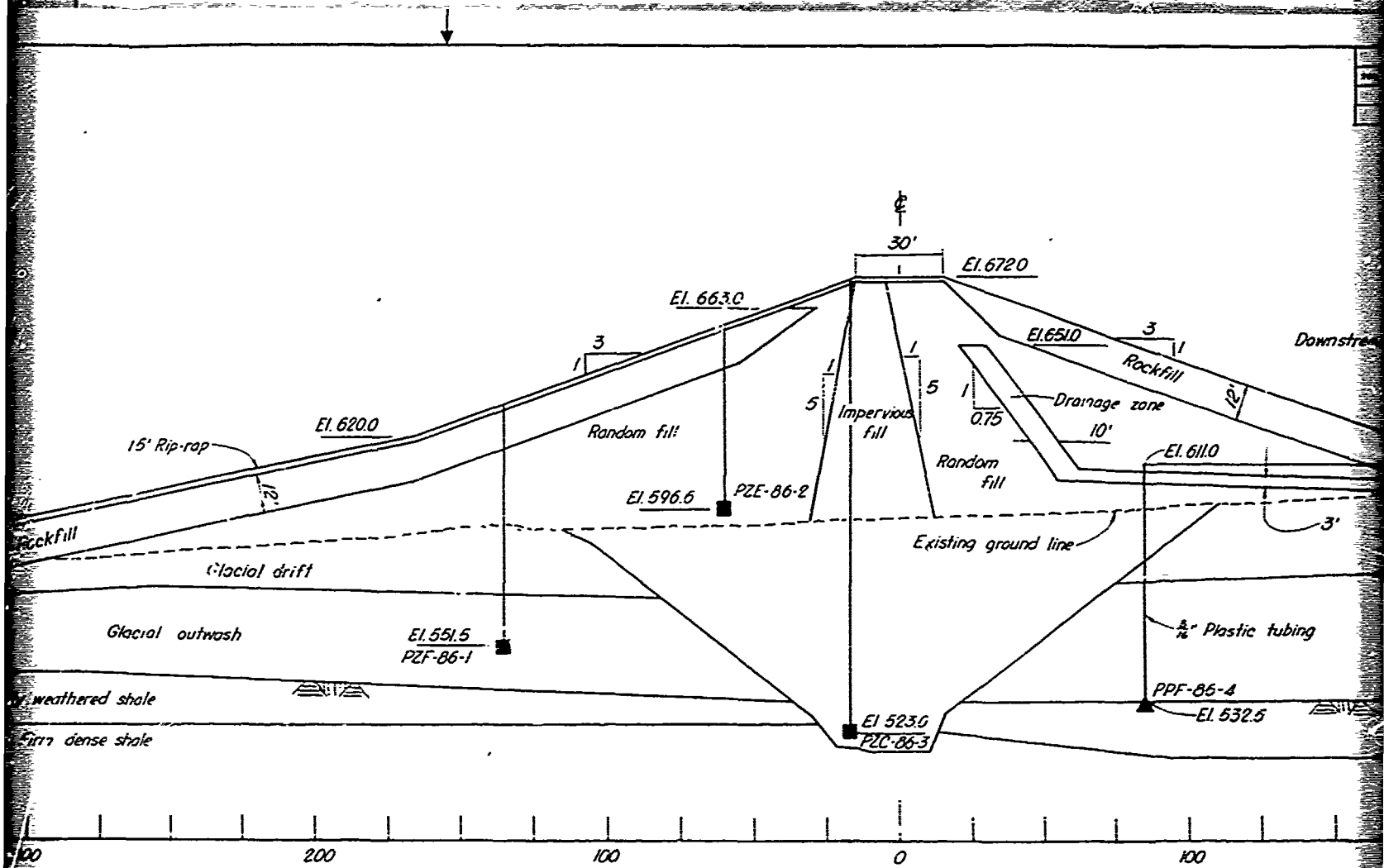
LEHIGH RIVER BASIN
BELTZVILLE LAKE
POHOPOCO CREEK, PENNSYLVANIA

INSTRUMENTATION LINE
STATION 7+770

3

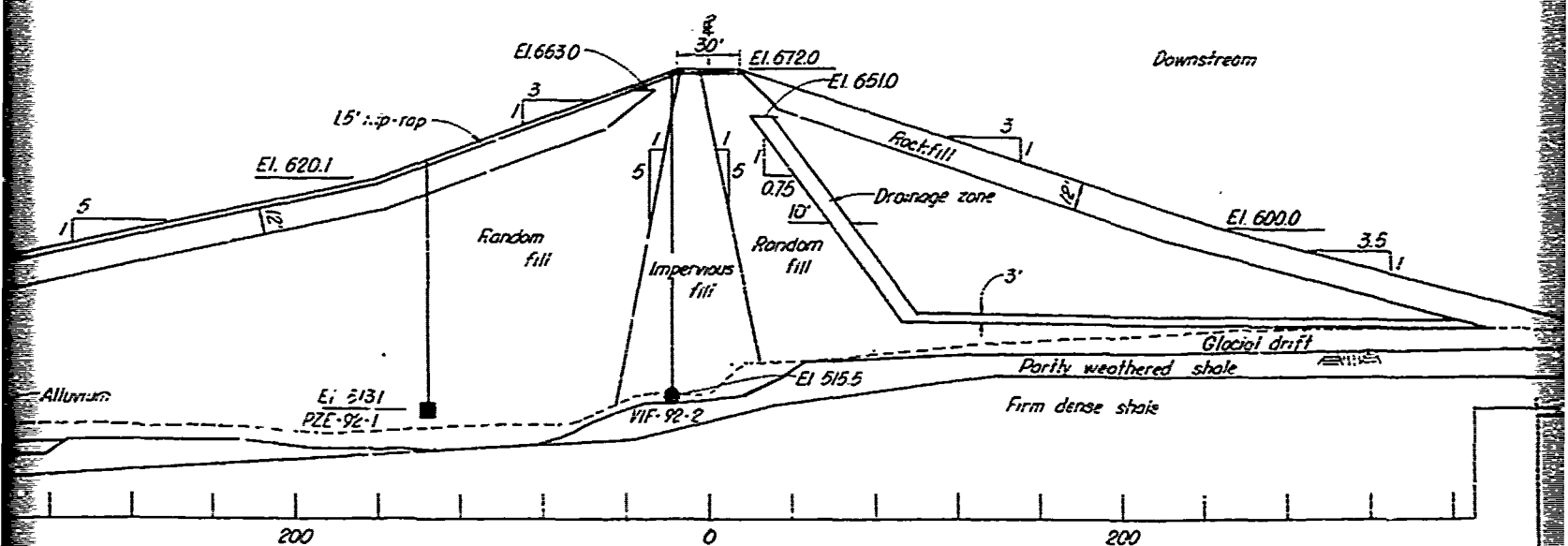
PLATE 4





AXIS STATION 8 + 600

Scale in Feet
25 0 25 50

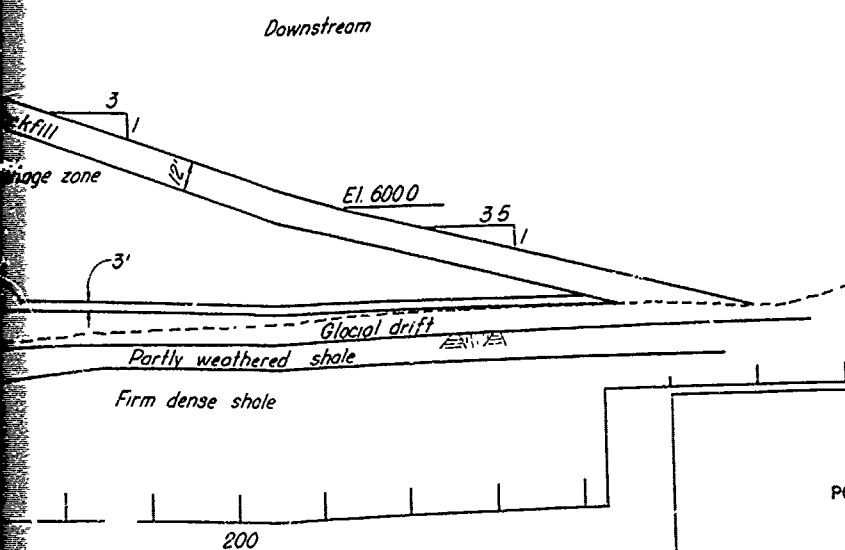
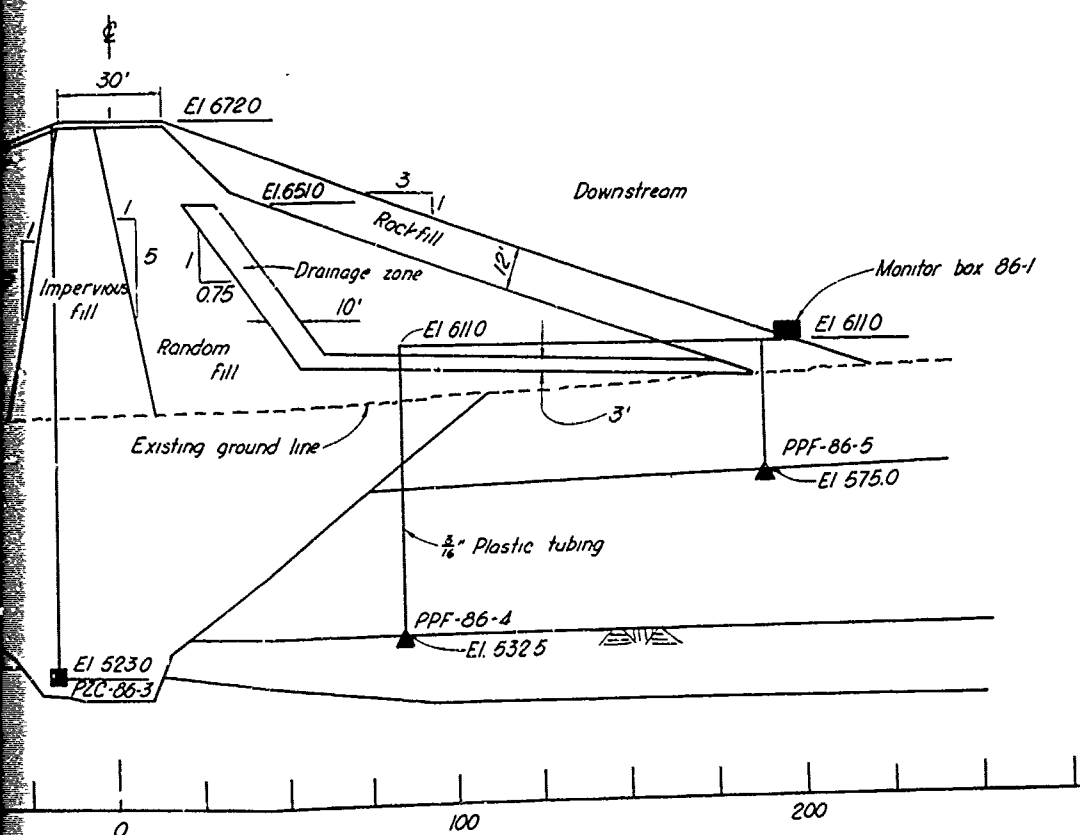


AXIS STATION 9 + 280

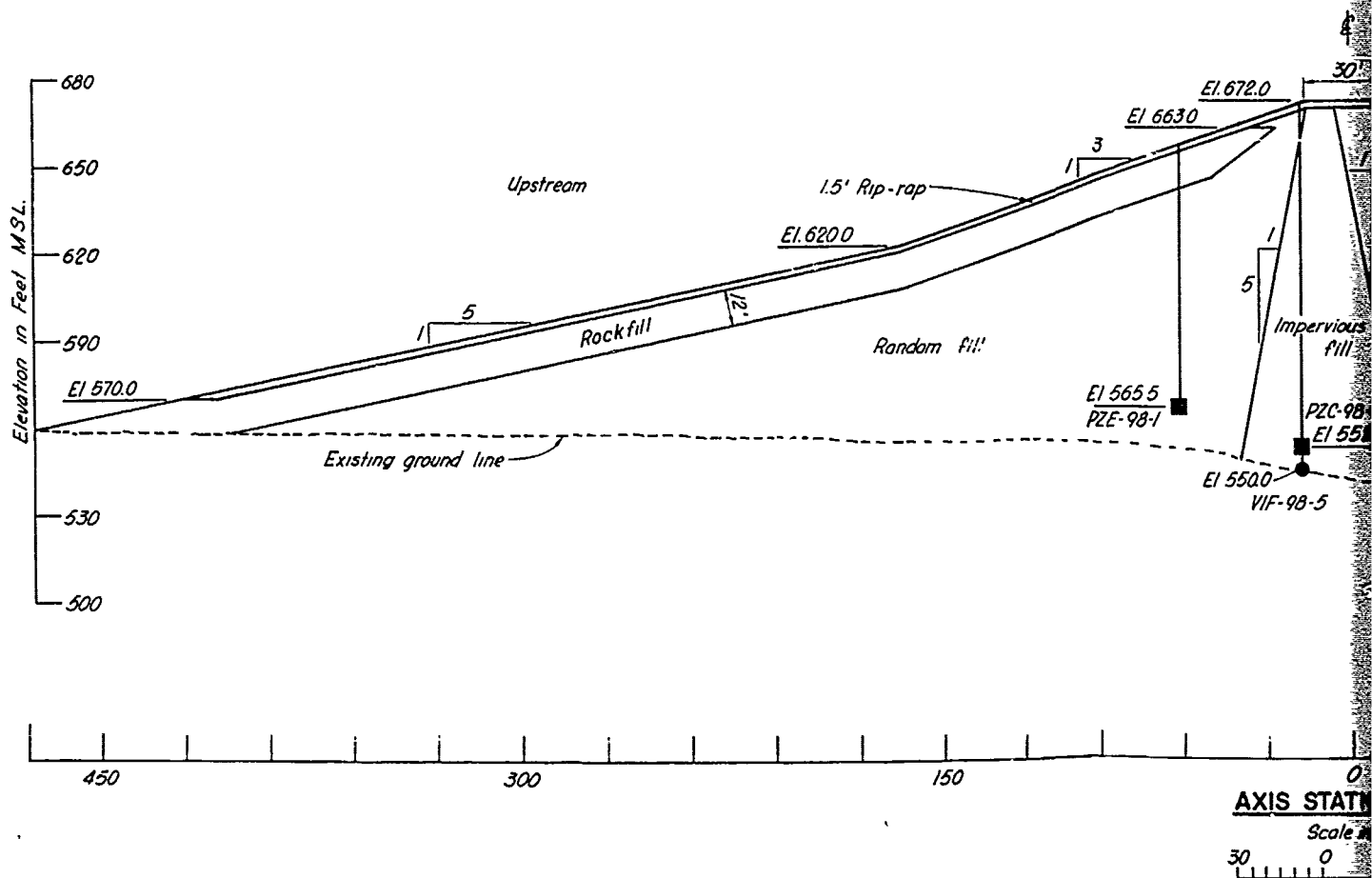
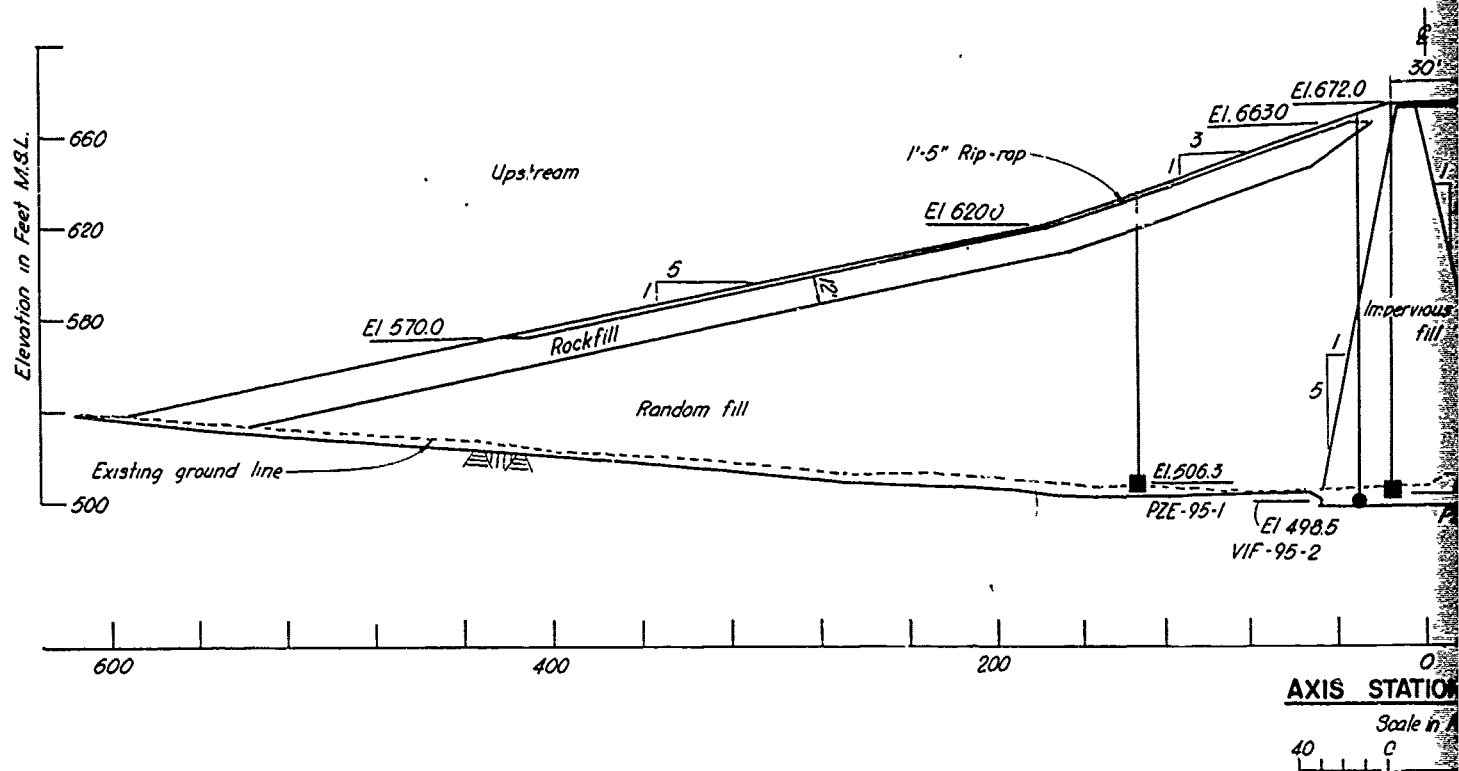
Scale in Feet
40 0 40 80

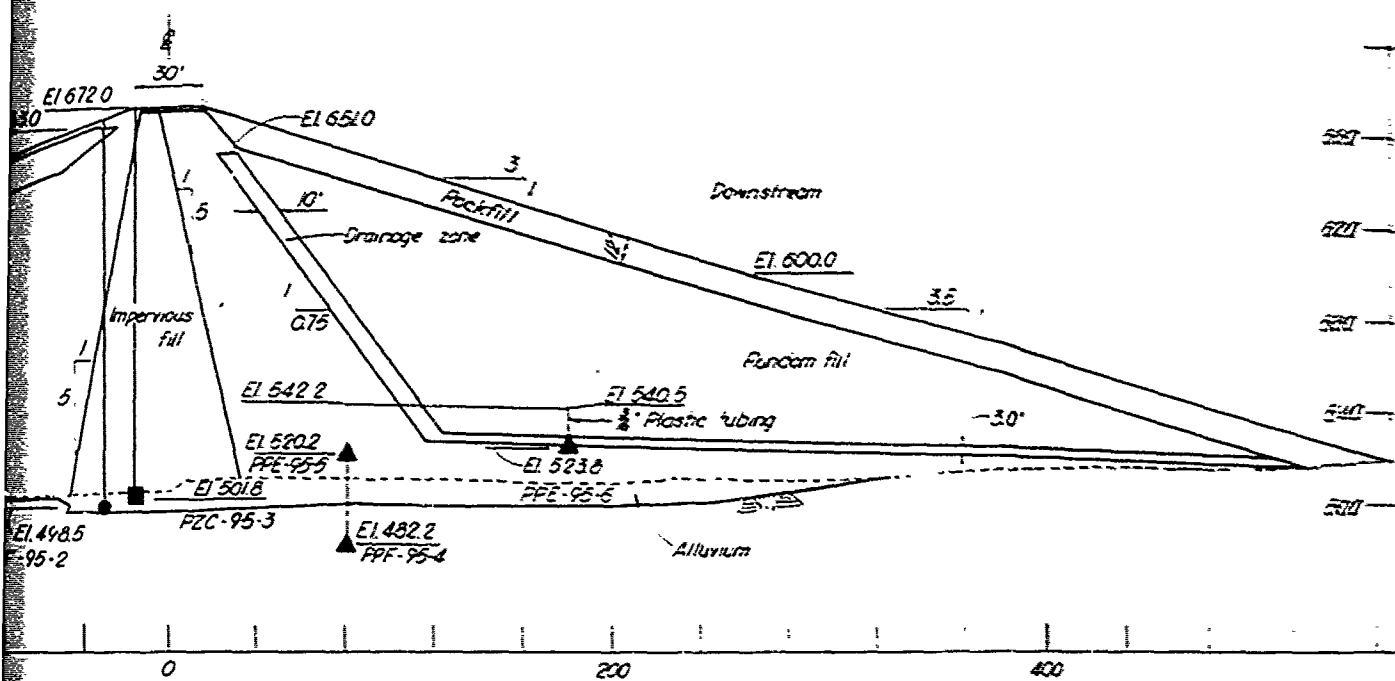
2

REVISIONS			
SYM.	DESCRIPTION	DATE	APP.



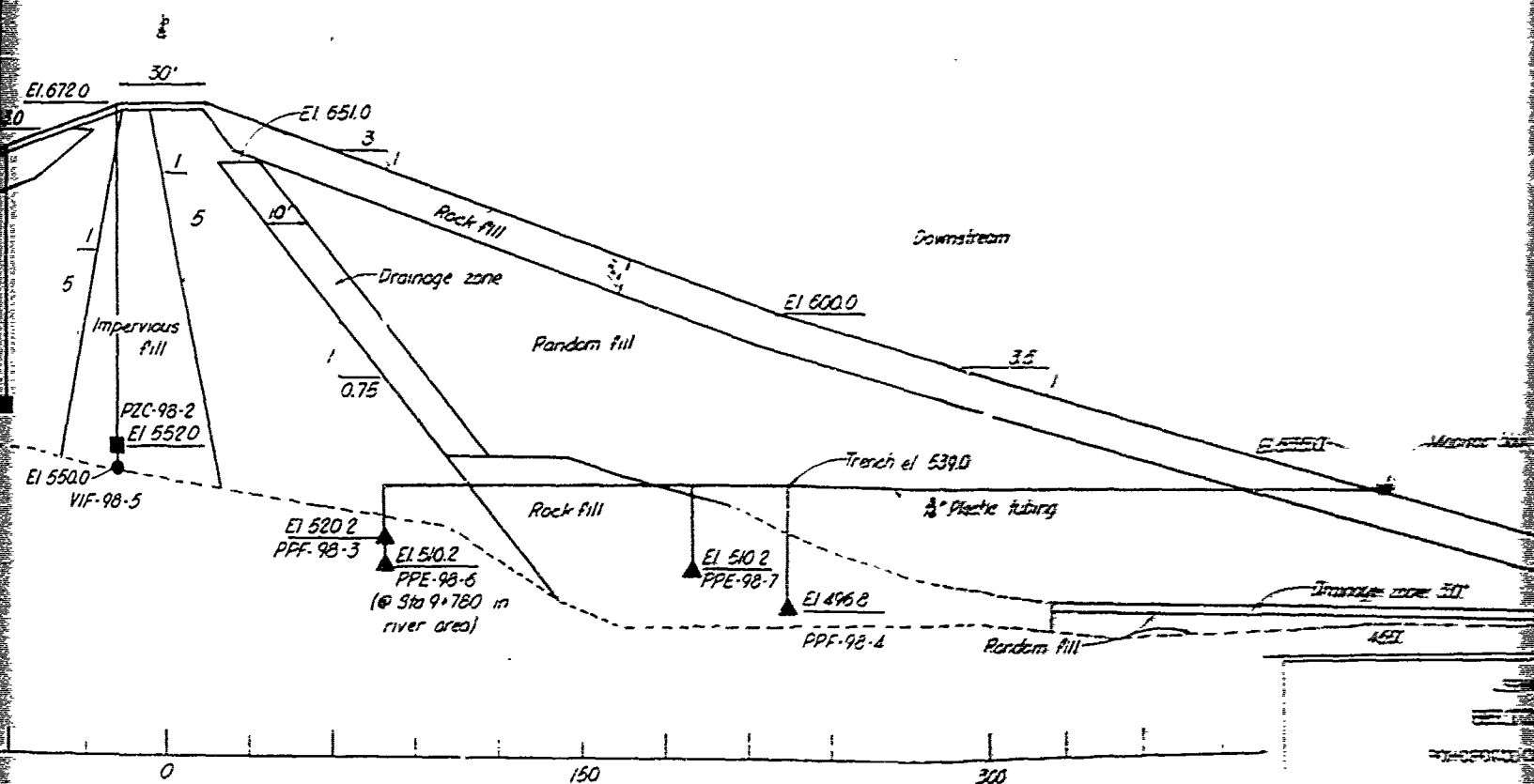
LEHIGH RIVER BASIN
BELTZVILLE LAKE
POHOPOCO CREEK, PENNSYLVANIA
INSTRUMENTATION LINE
STATION 8+600 & STATION 9+280





AXIS STATION 9+580

Scale in Feet
0 40 80

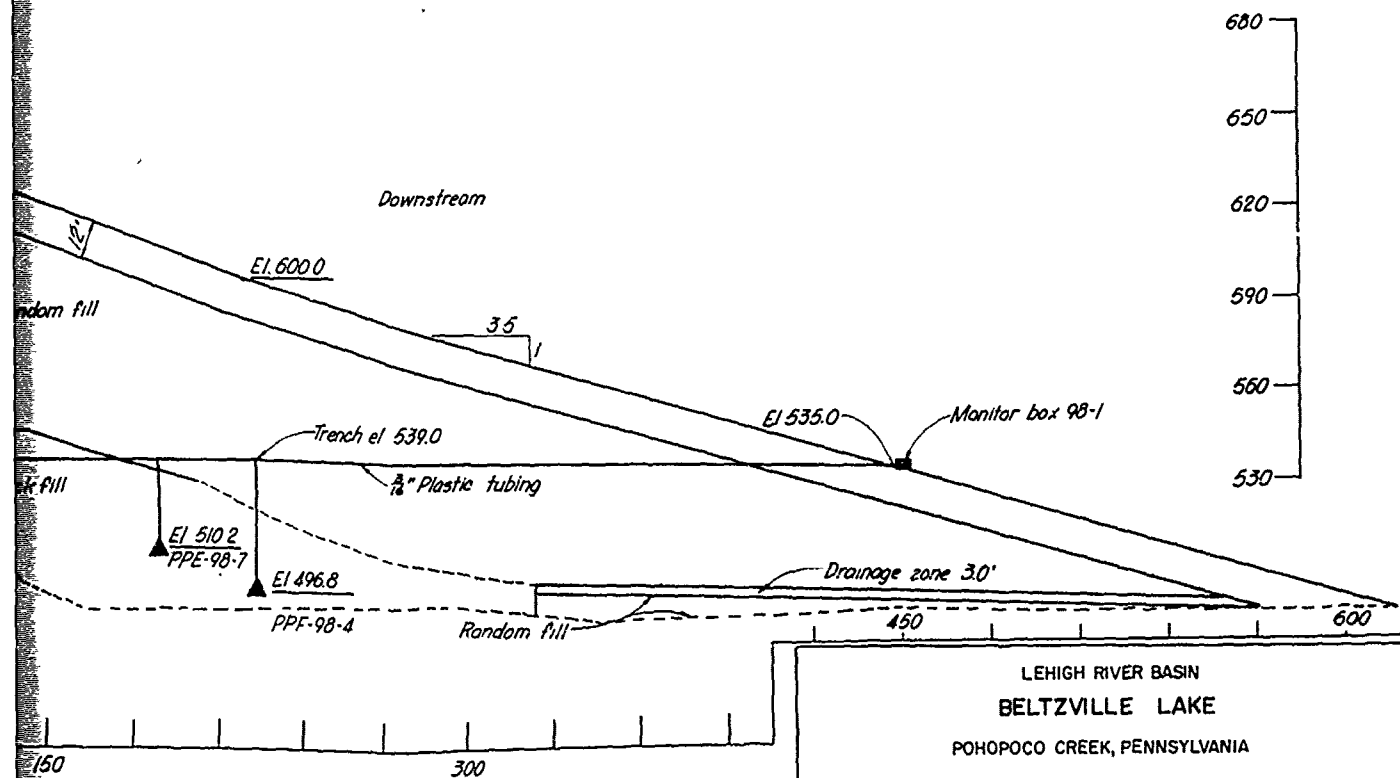
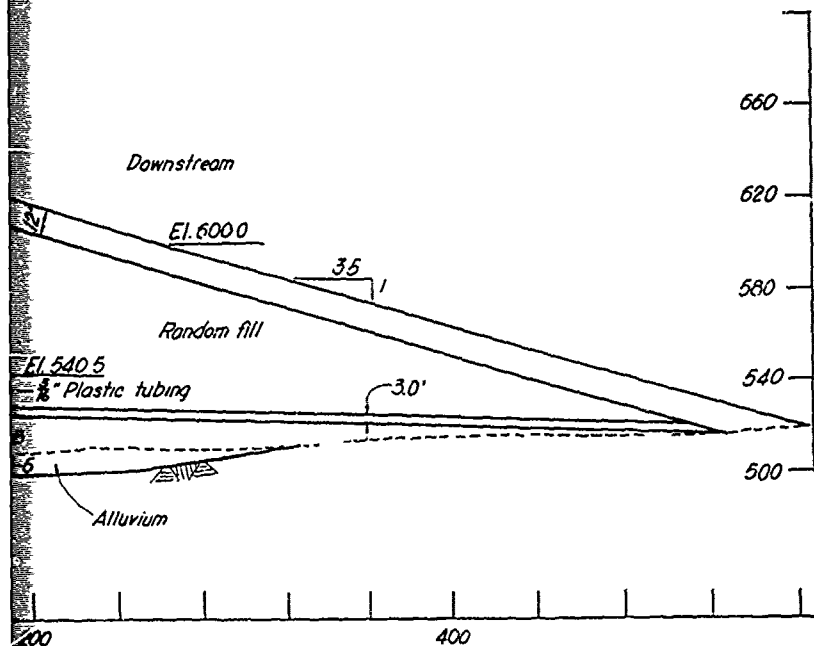


AXIS STATION 9+820

Scale in Feet
0 30 60

INSTRUMENT

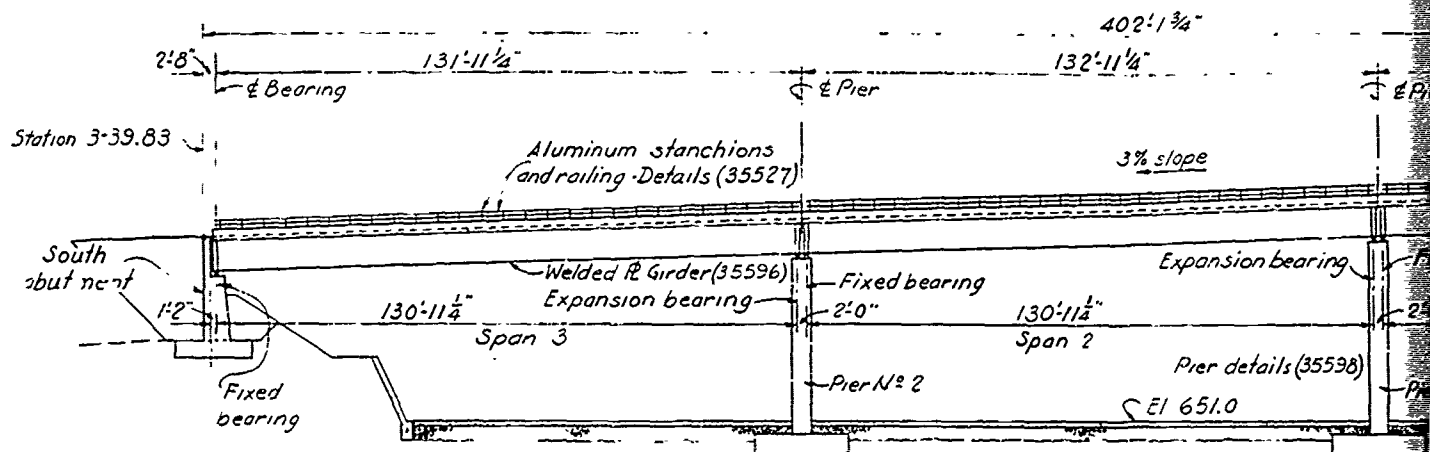
STATION: 94300



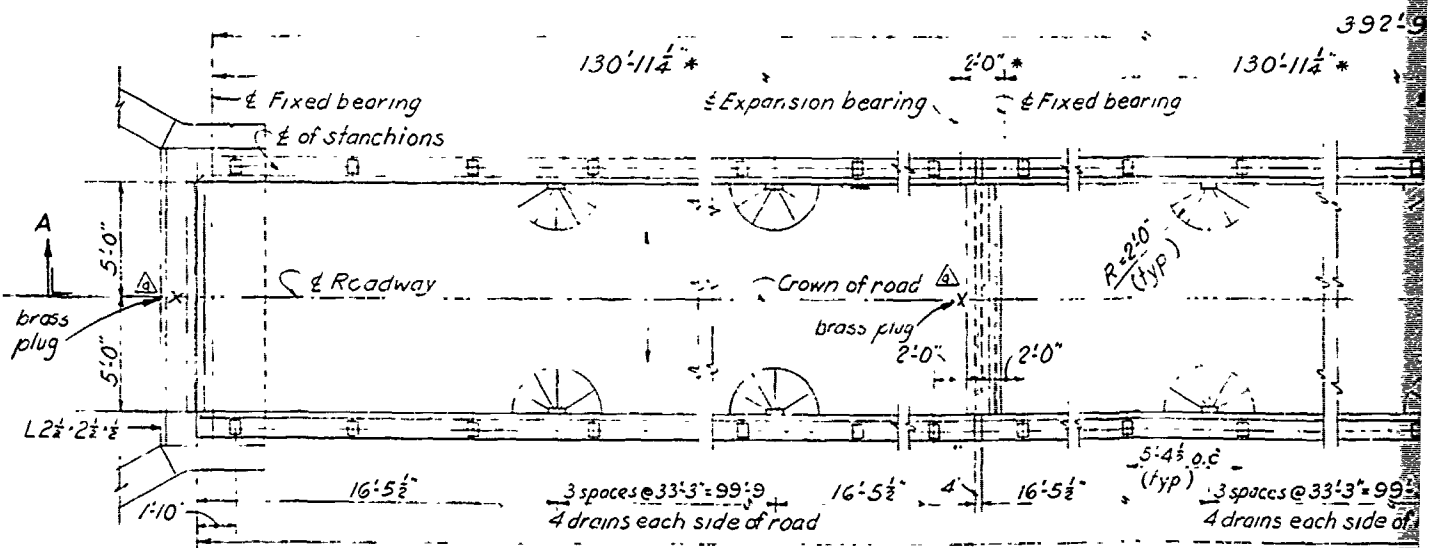
LEHIGH RIVER BASIN
BELTZVILLE LAKE
POHOPOCO CREEK, PENNSYLVANIA

INSTRUMENTATION LINE
STATION 9+580 & STATION 9+820

PLATE 6



ELEVATION OF BRIDGE
Scale 1" = 20'-0"



PLAN
Scale 1/4" = 1'-0"

Location	Top of Pier or Abut.	Top of Leveling R.
North Abutment	694.74 *	694.95
Pier No. 1, Span No. 1	690.78	691.02
Pier No. 1, Span No. 2	690.78	690.96
Pier No. 2, Span No. 2	686.79	687.03
Pier No. 2, Span No. 3	686.79	686.97
South Abutment	682.83 *	683.04

* On ϵ of bearing

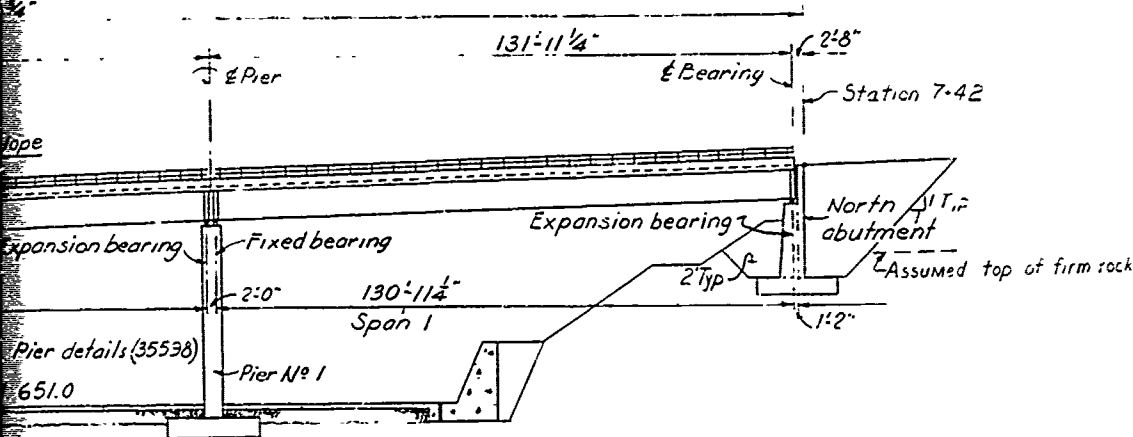
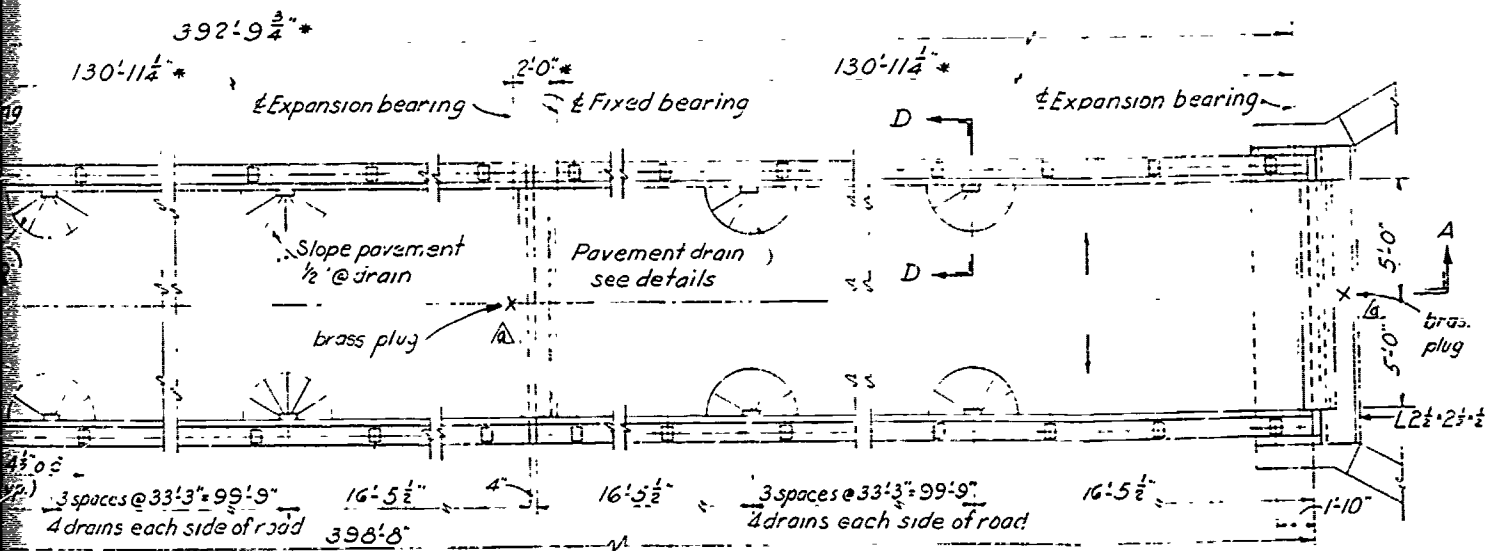


Fig. R-16"
Stiff. R-4 1/2"
Web R-84"
Stiff. Rs-7"
Stiff. Rs-7 1/2"

BRIDGE



PLAN * Indicates horiz dim.
Scale 1/4" = 1'-0"

Set 1 ϕ 1/2" brass plug in non-shrink grout at elevation of deck. Scribe center line of bridge in plug after plugs are in place

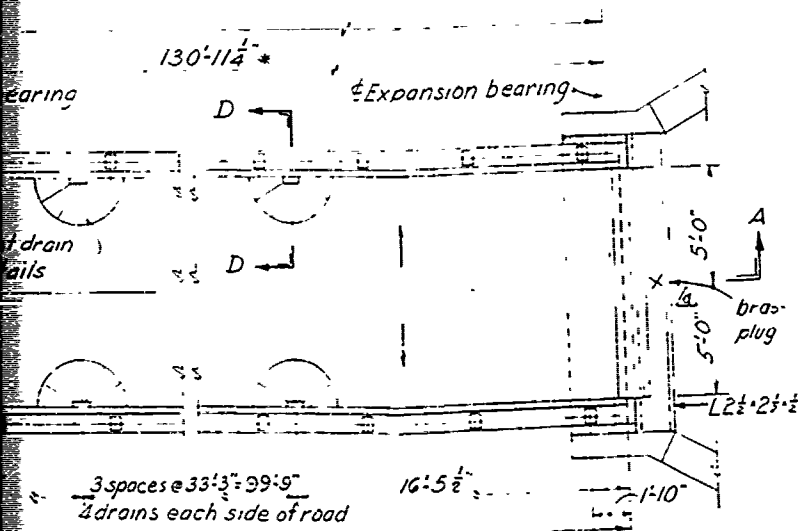
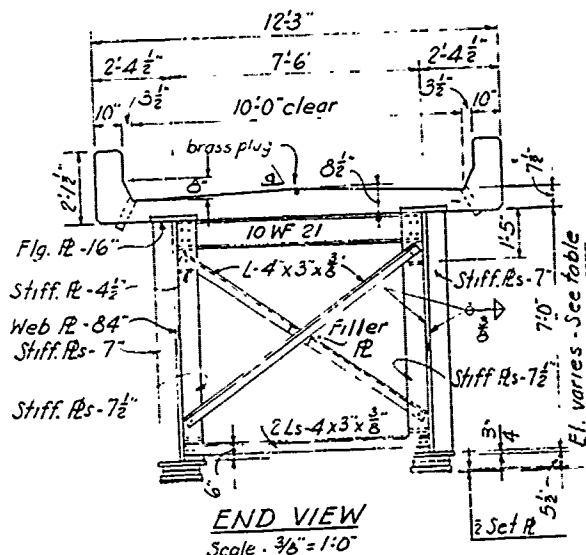
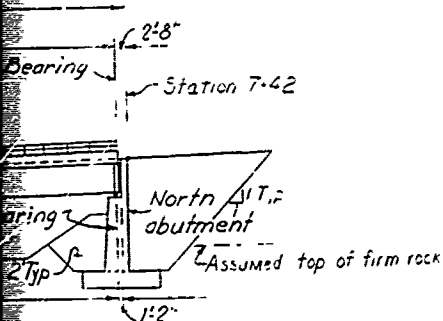
2

U. S. ARMY

Location	Top of Pier or Abut.	Top of Leveling R.
North Abutment	694.74 *	694.95
Pier No. 1, Span No. 1	690.78	691.02
Pier No. 1, Span No. 2	690.78	690.91
Pier No. 2, Span No. 2	686.79	687.01
Pier No. 2, Span No. 3	686.79	686.97
South Abutment	682.83 *	683.04

* On $\frac{1}{2}$ of bearing

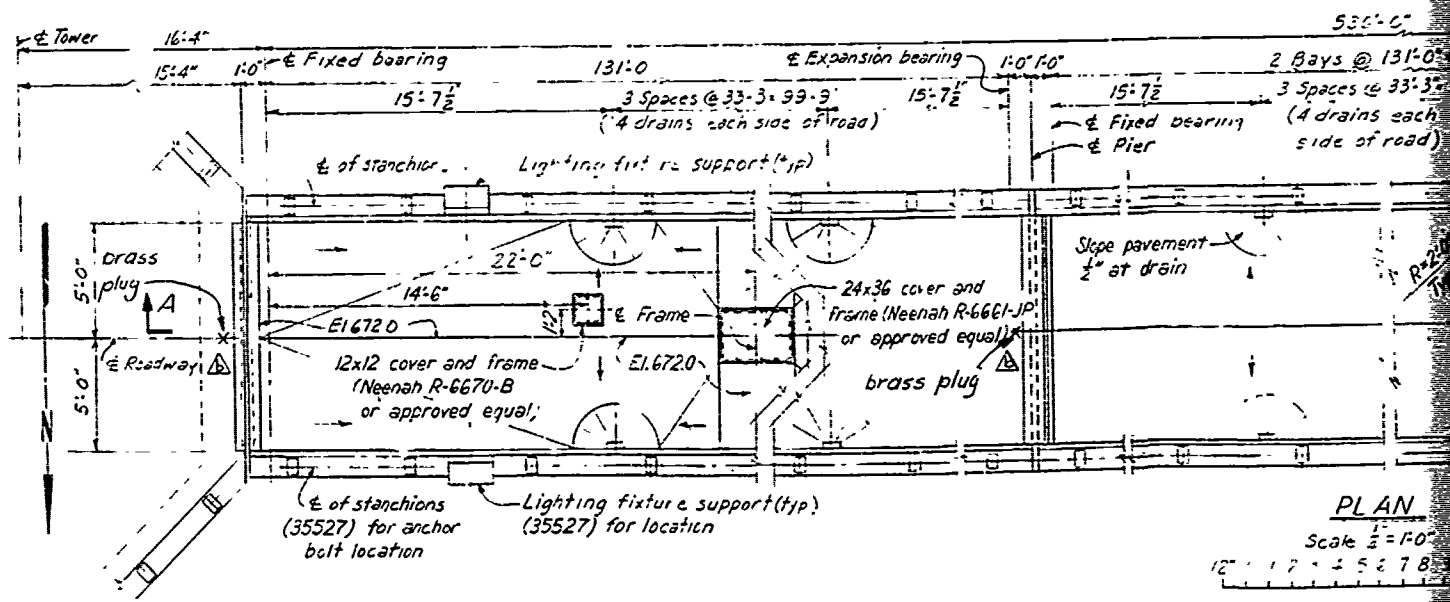
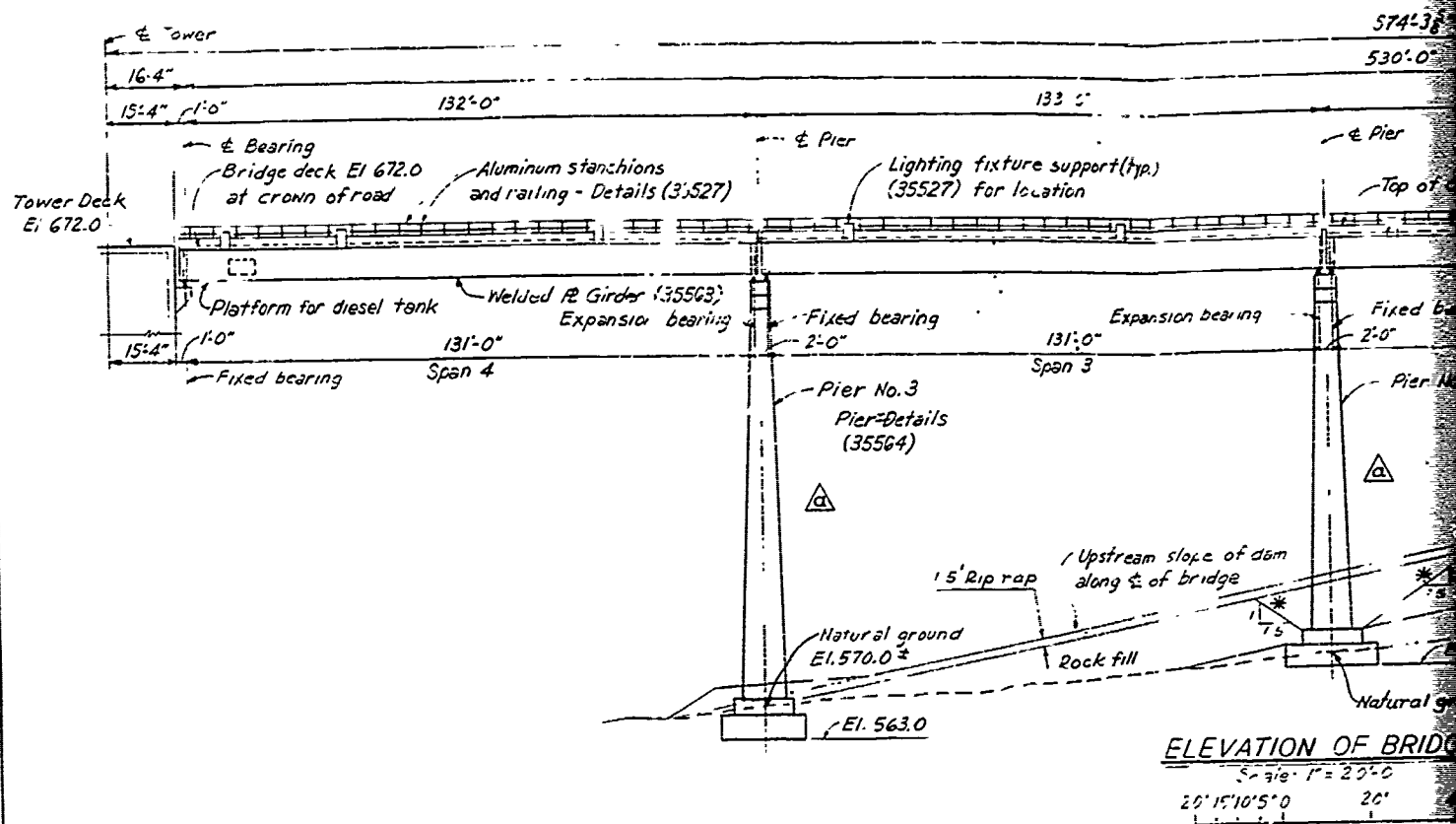
REVISIONS		
SYM	ZONE	DESCRIPTION
△		Added brass plugs for instrumentation



△ Set 19 1/2" brass plug non-shrink grout at elevation of deck. Scribe center line of bridge in plug after plugs are in place.

U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER		
LEHIGH RIVER BASIN POCONO CREEK, PENNSYLVANIA BELTZVILLE LAKE		
SPILLWAY BRIDGE ELEVATION AND STRUCTURAL DETAILS SHEET 1		
SIZE F	INV. NO.	DRAWING NO. 35596
SCALE AS NOTED		SHEET 121

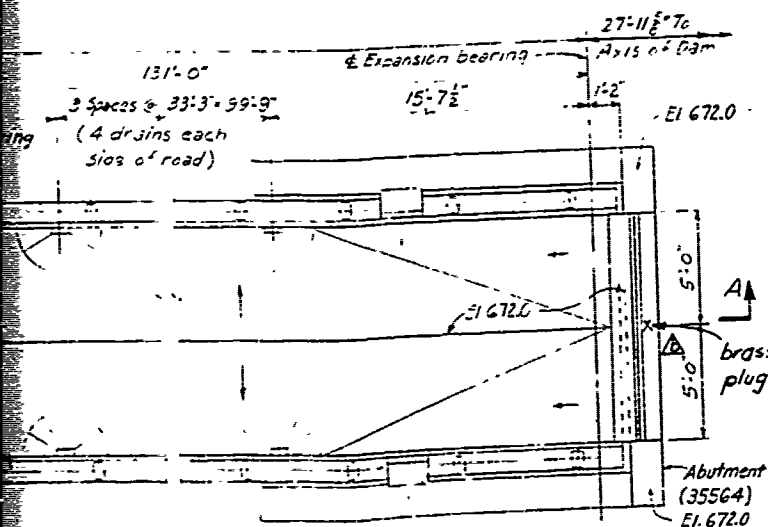
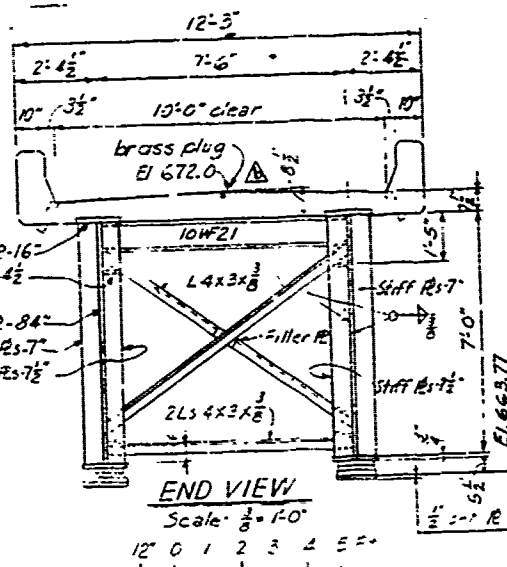
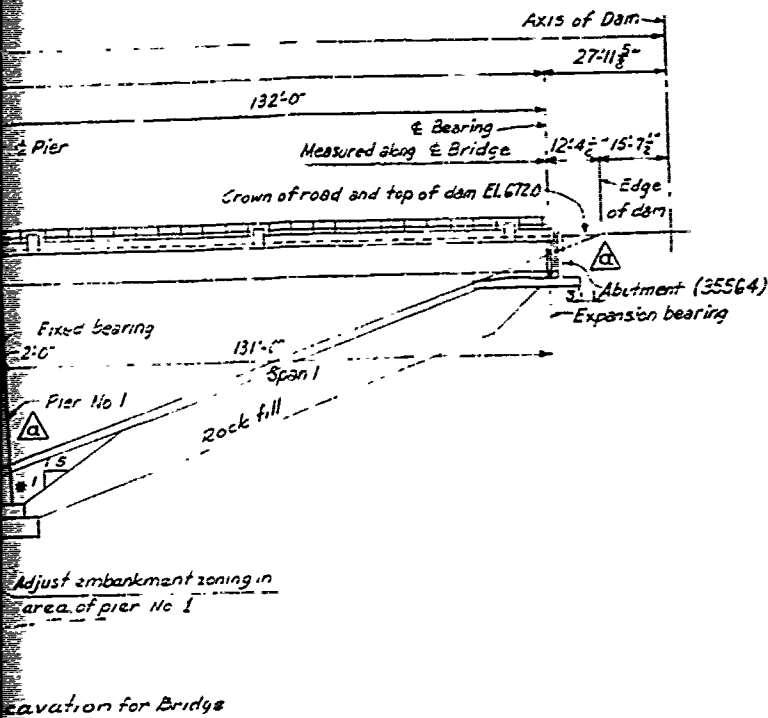
PLATE 7



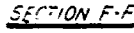
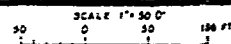
U. S. ARMY

REVISIONS

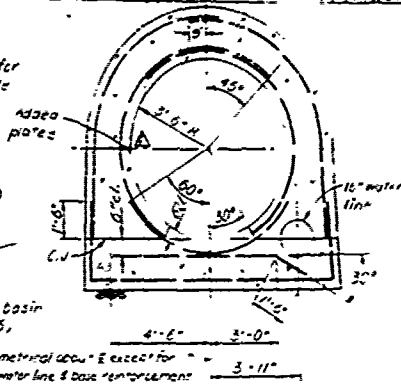
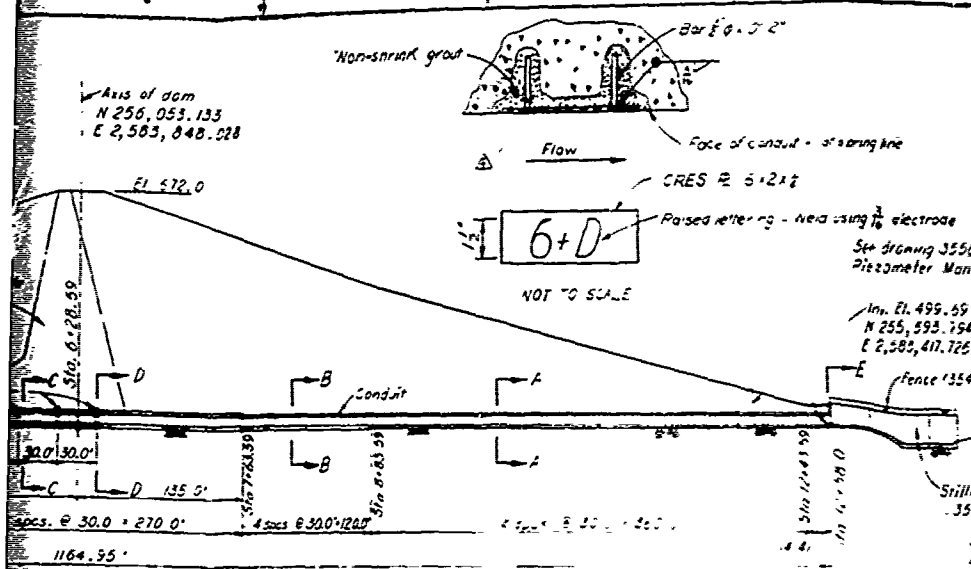
NO.	DATE	DESCRIPTION
1		Revised piers and temporary excavation
2		Added brass plugs for instrumentation



ERIK FLOOR & ASSOCIATES, INC. CONSULTING ENGINEERS CHICAGO		U.S. ARMY ENGINEER DISTRICT PHILADELPHIA CORPS OF ENGINEERS OFFICE OF THE DISTRICT ENGINEER	
LEHIGH RIVER BASIN POCONO, PENNSYLVANIA BELTZVILLE LAKE			
SERVICE BRIDGE ELEVATION AND STRUCTURAL DETAILS SHEET 1			
DESIGNED BY E. FLOOR	CHECKED BY F. FLOOR	DRAWING NO. 35562	SHEET 87
SCALE: AS NOTED		PLATE 8	



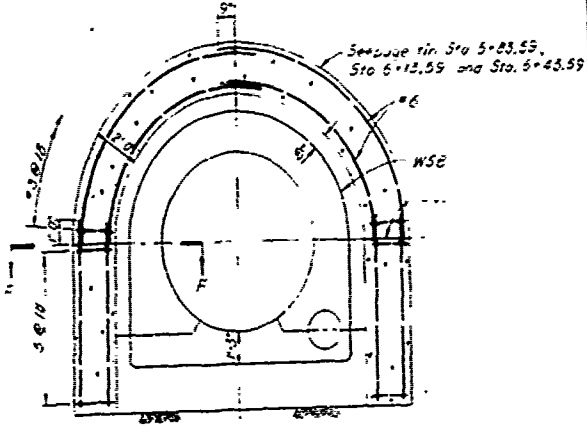
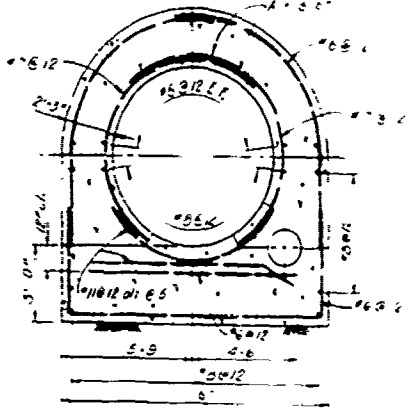
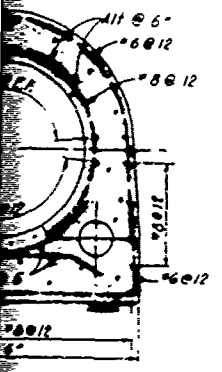
REV	DATE	DESCRIPTION	BY	CHK
1		Revised reinforcing steel pipe & added...		
2		Added 16" water line, deleted details & C...		
3		Added 8" water line...		
4		Added 8" water line...		
5		Added 8" water line...		
6		Added 8" water line...		
7		Added 8" water line...		
8		Added 8" water line...		
9		Added 8" water line...		
10		Added 8" water line...		



ON ALONG E CONDUIT

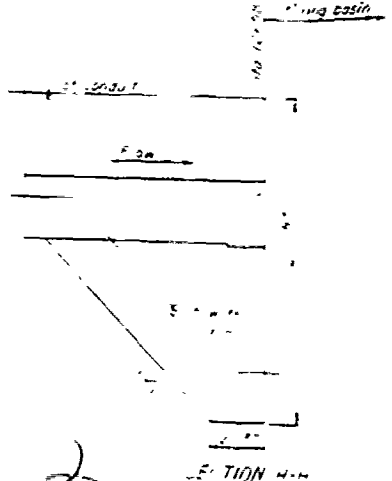
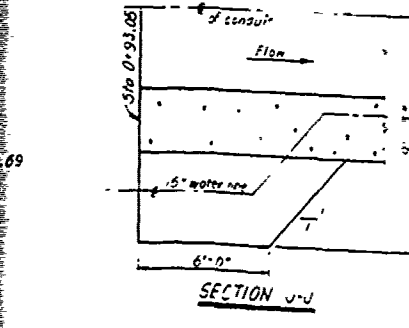
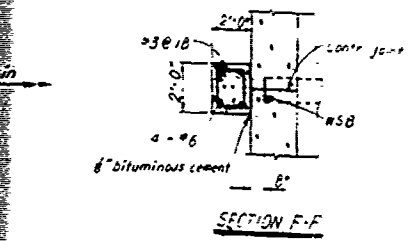
SCALE 1" = 50.0'

0 50 100 FT



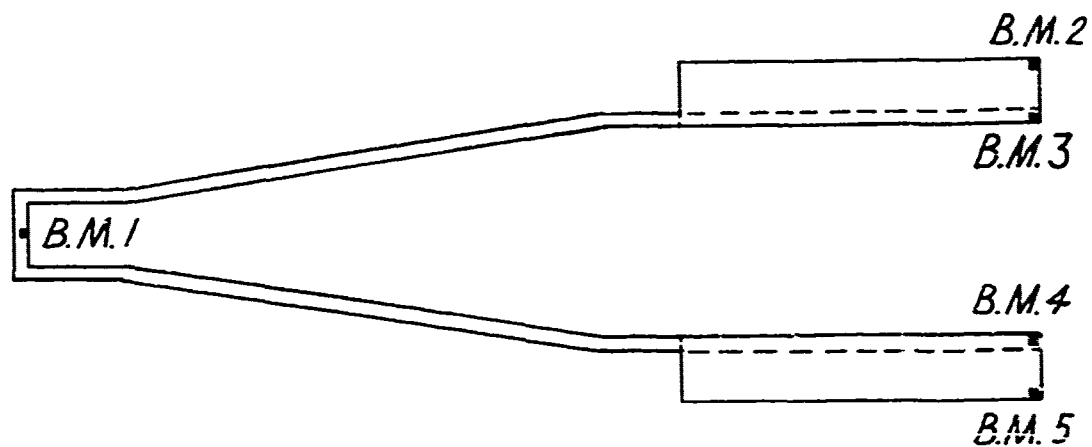
SECTION D-D

Note: Lines shown to
NSB are typical of
all construction joints



NOTES

1. Install 12 plates at 100-foot stations. Place plate marked
Sta 0+0 at the axis of the dam (Sta 5+26.55).
Install 6 plates downstream and 5 plates
upstream of the axis. Letter plates with
station number and direction, e.g., 3+00,
3+U, 4+D.
2. Coat contraction joints with 8" bituminous
cement.
3. Reinforcing steel 306. - at continue to
contraction joints.
4. For standard details see 314-1
5. For 1:10, 1:20, 1:40, 1:60, 1:80, 1:100, 1:125, 1:150, 1:175, 1:200, 1:225, 1:250, 1:275, 1:300, 1:325, 1:350, 1:375, 1:400, 1:425, 1:450, 1:475, 1:500, 1:525, 1:550, 1:575, 1:600, 1:625, 1:650, 1:675, 1:700, 1:725, 1:750, 1:775, 1:800, 1:825, 1:850, 1:875, 1:900, 1:925, 1:950, 1:975, 1:1000, 1:1025, 1:1050, 1:1075, 1:1100, 1:1125, 1:1150, 1:1175, 1:1200, 1:1225, 1:1250, 1:1275, 1:1300, 1:1325, 1:1350, 1:1375, 1:1400, 1:1425, 1:1450, 1:1475, 1:1500, 1:1525, 1:1550, 1:1575, 1:1600, 1:1625, 1:1650, 1:1675, 1:1700, 1:1725, 1:1750, 1:1775, 1:1800, 1:1825, 1:1850, 1:1875, 1:1900, 1:1925, 1:1950, 1:1975, 1:2000, 1:2025, 1:2050, 1:2075, 1:2100, 1:2125, 1:2150, 1:2175, 1:2200, 1:2225, 1:2250, 1:2275, 1:2300, 1:2325, 1:2350, 1:2375, 1:2400, 1:2425, 1:2450, 1:2475, 1:2500, 1:2525, 1:2550, 1:2575, 1:2600, 1:2625, 1:2650, 1:2675, 1:2700, 1:2725, 1:2750, 1:2775, 1:2800, 1:2825, 1:2850, 1:2875, 1:2900, 1:2925, 1:2950, 1:2975, 1:3000, 1:3025, 1:3050, 1:3075, 1:3100, 1:3125, 1:3150, 1:3175, 1:3200, 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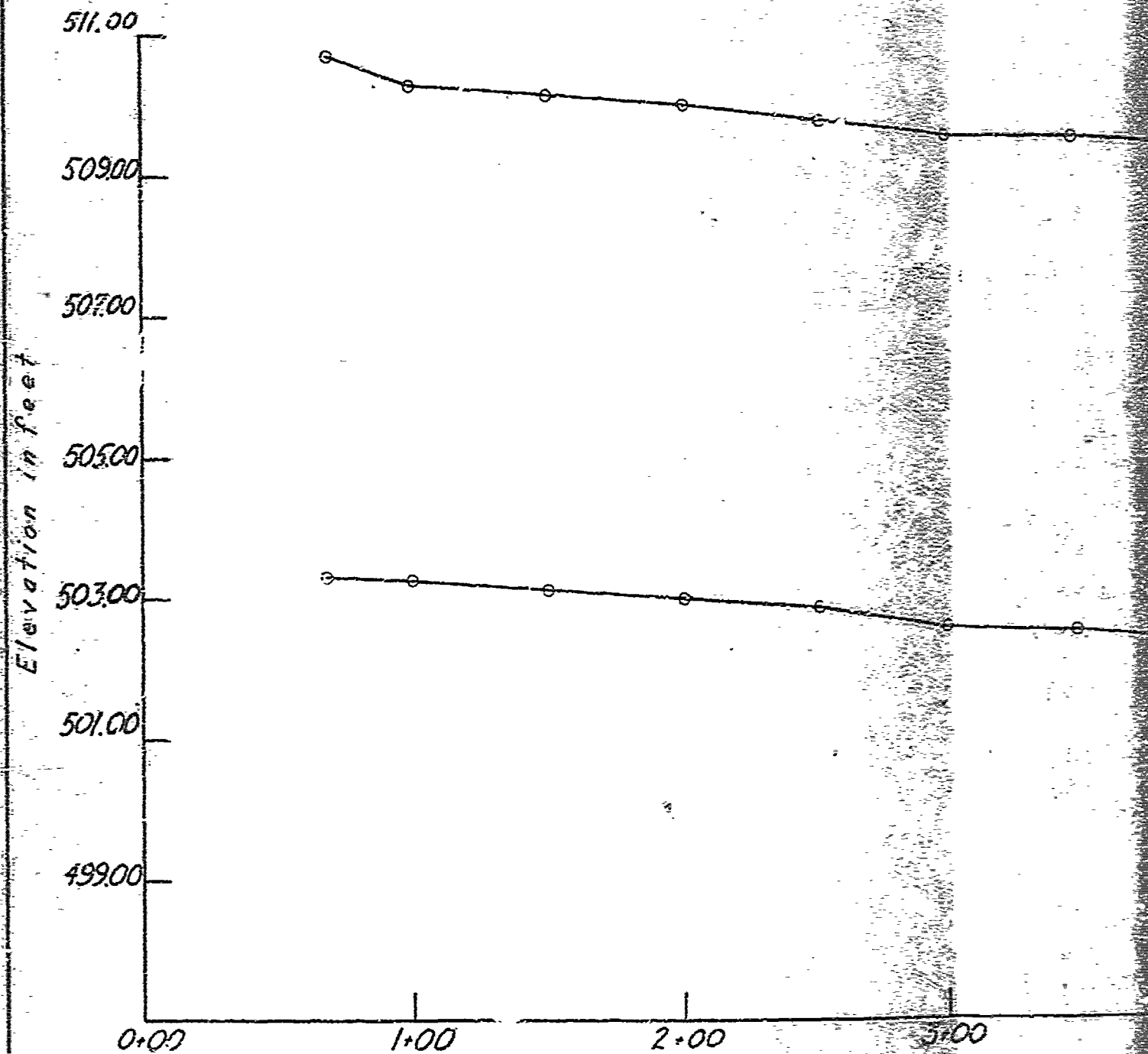


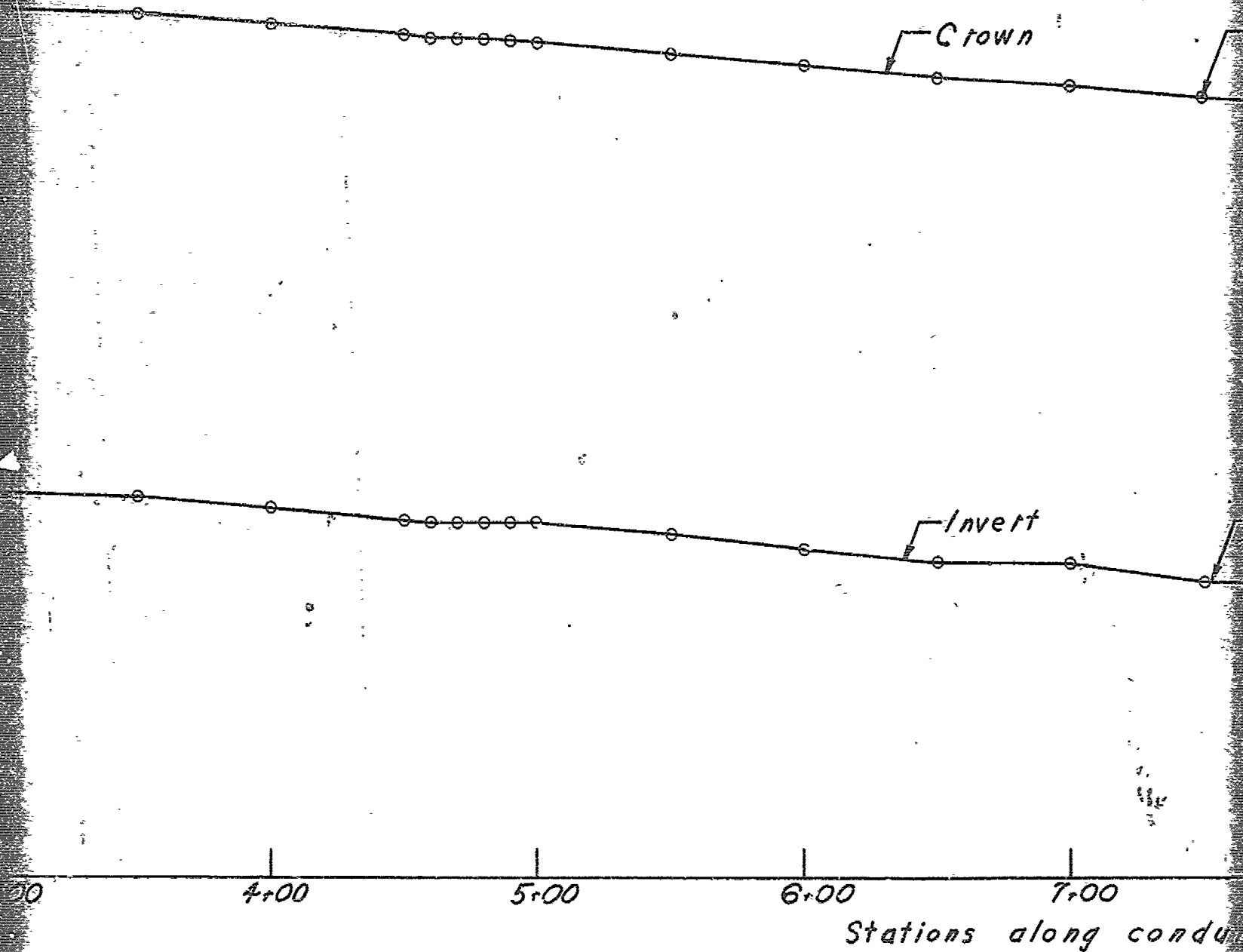
PLAN OF STILLING BASIN STRUCTURE
LOCATION OF BENCH MARKS

ELEVATIONS					
Date	B.M. 1	B.M. 2	B.M. 3	B.M. 4	B.M. 5
13 Aug. '70	515.14	508.10	508.10	508.08	508.12

BELTZVILLE LAKE
CONDUIT SETTLEMENT STUDY

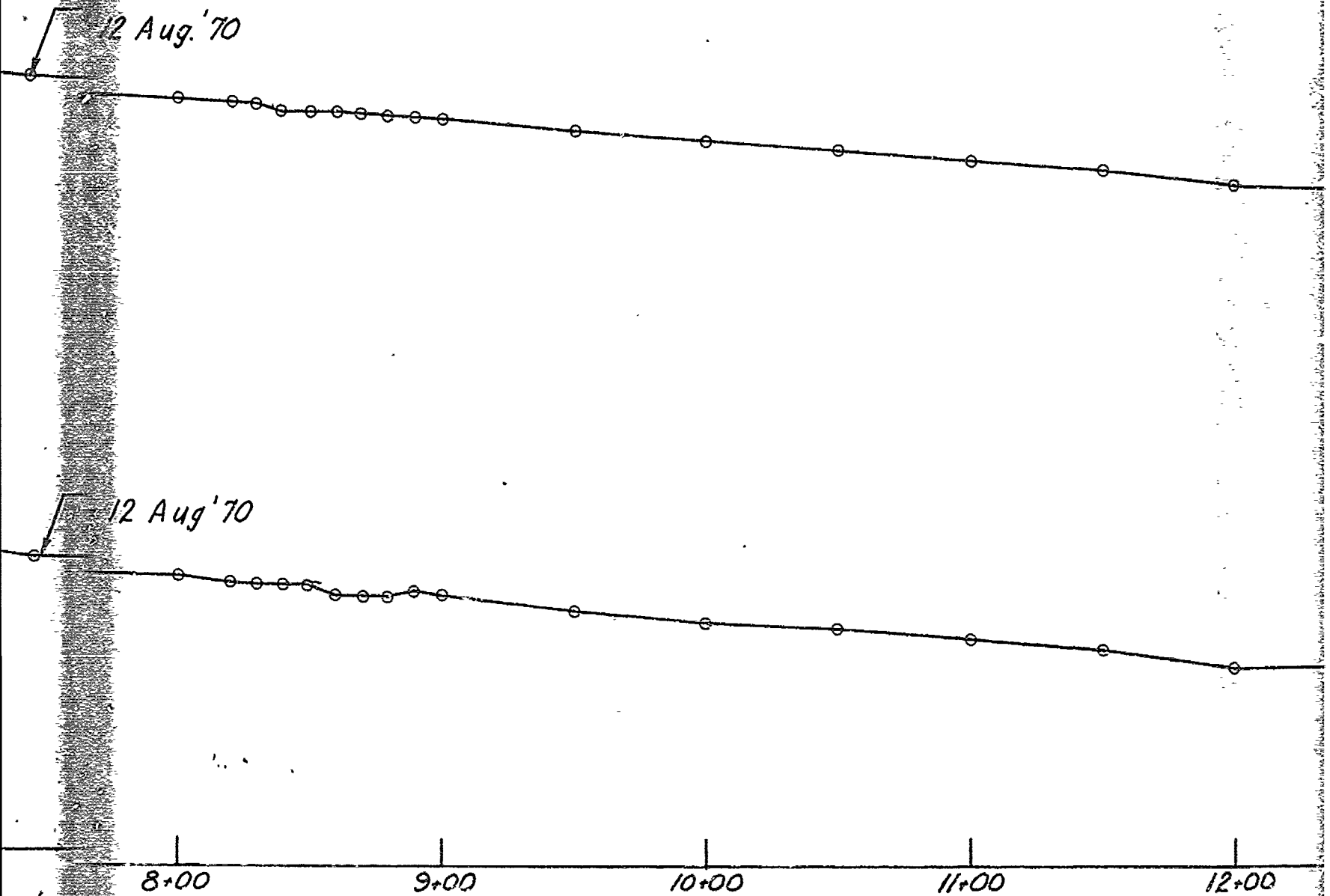
CORPS OF ENGINEERS





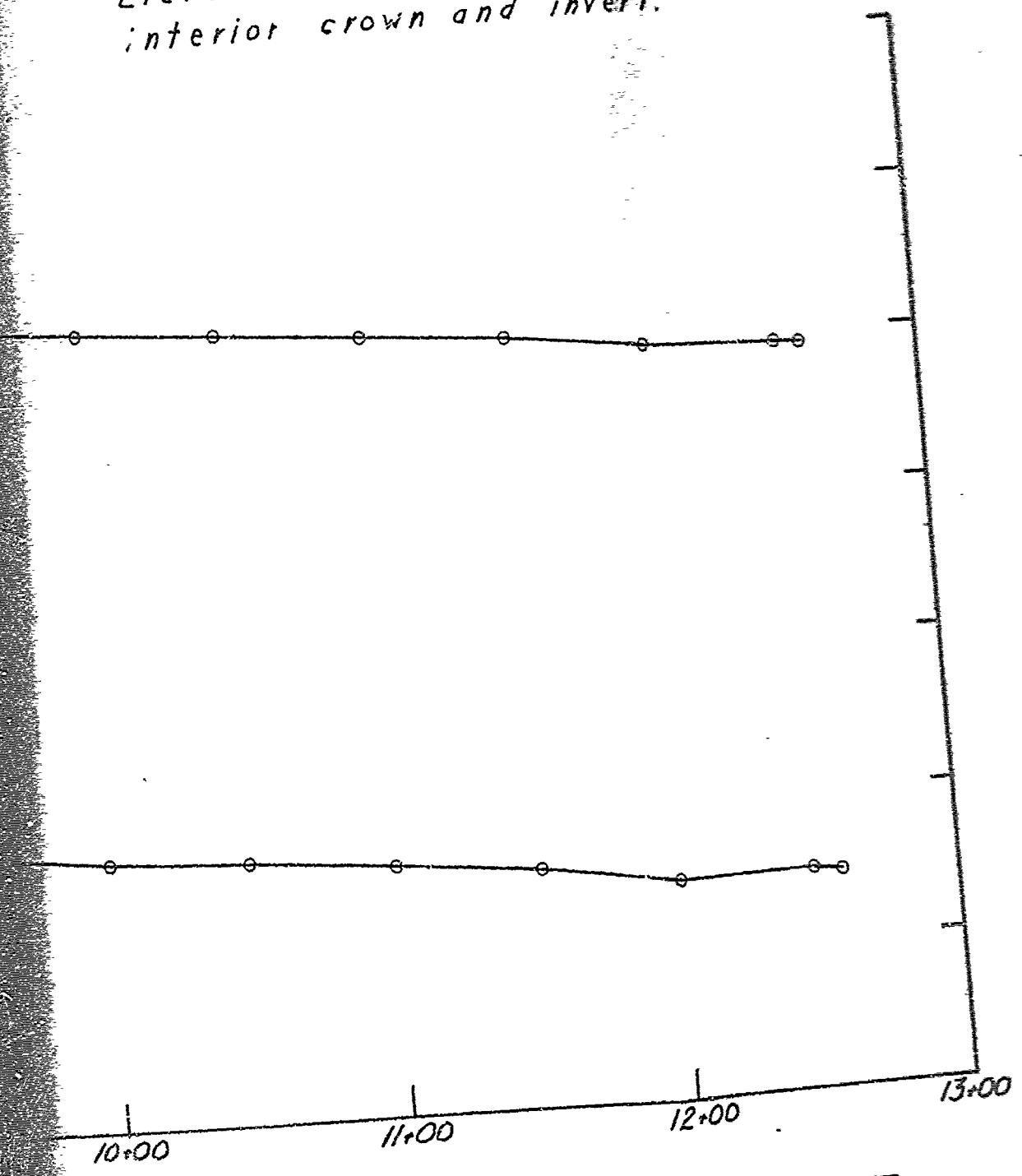
NOTE:

Elevations taken at
interior crown and invert.



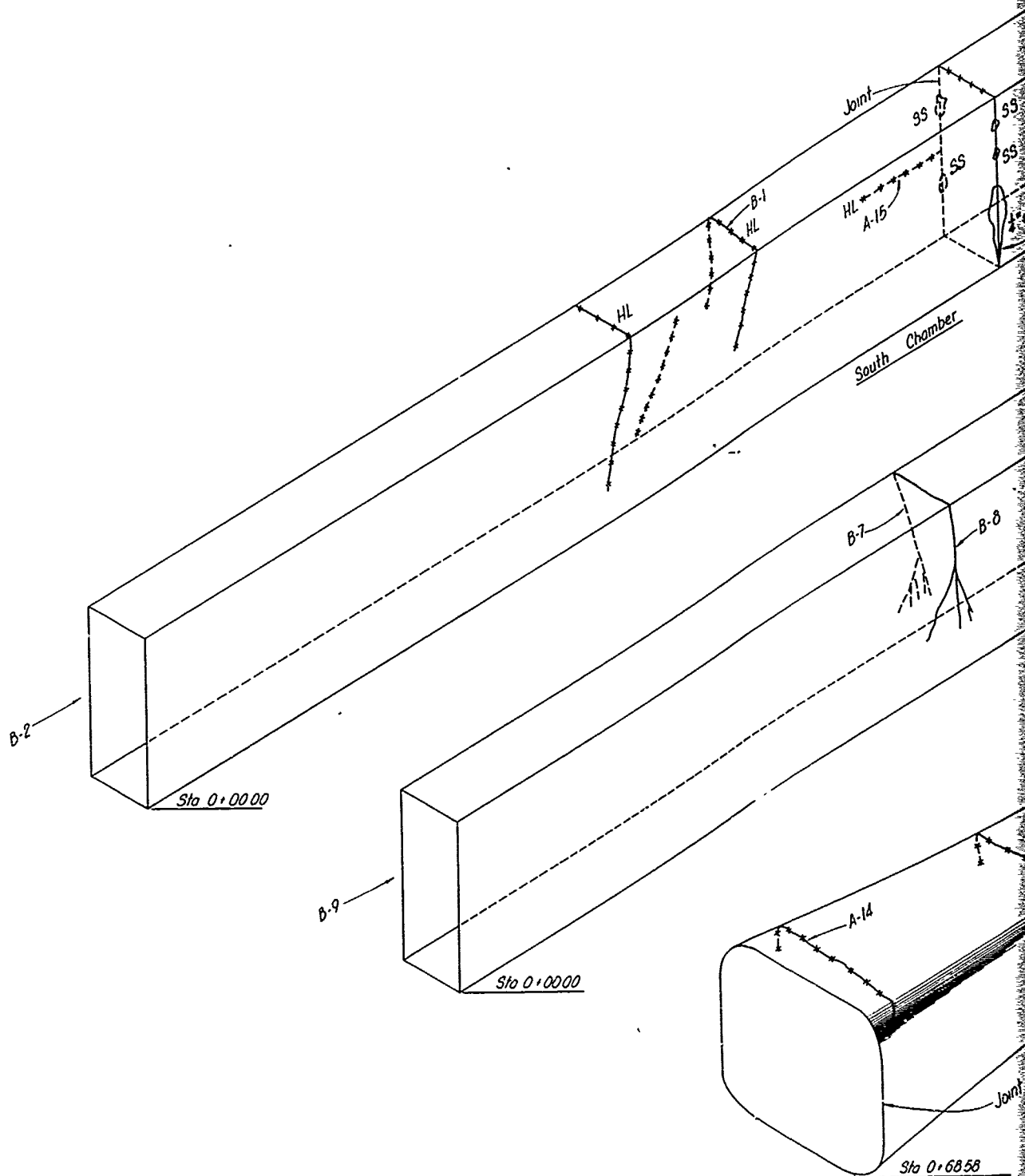
BELTZVILLE
CONDUIT SETTLEMENT

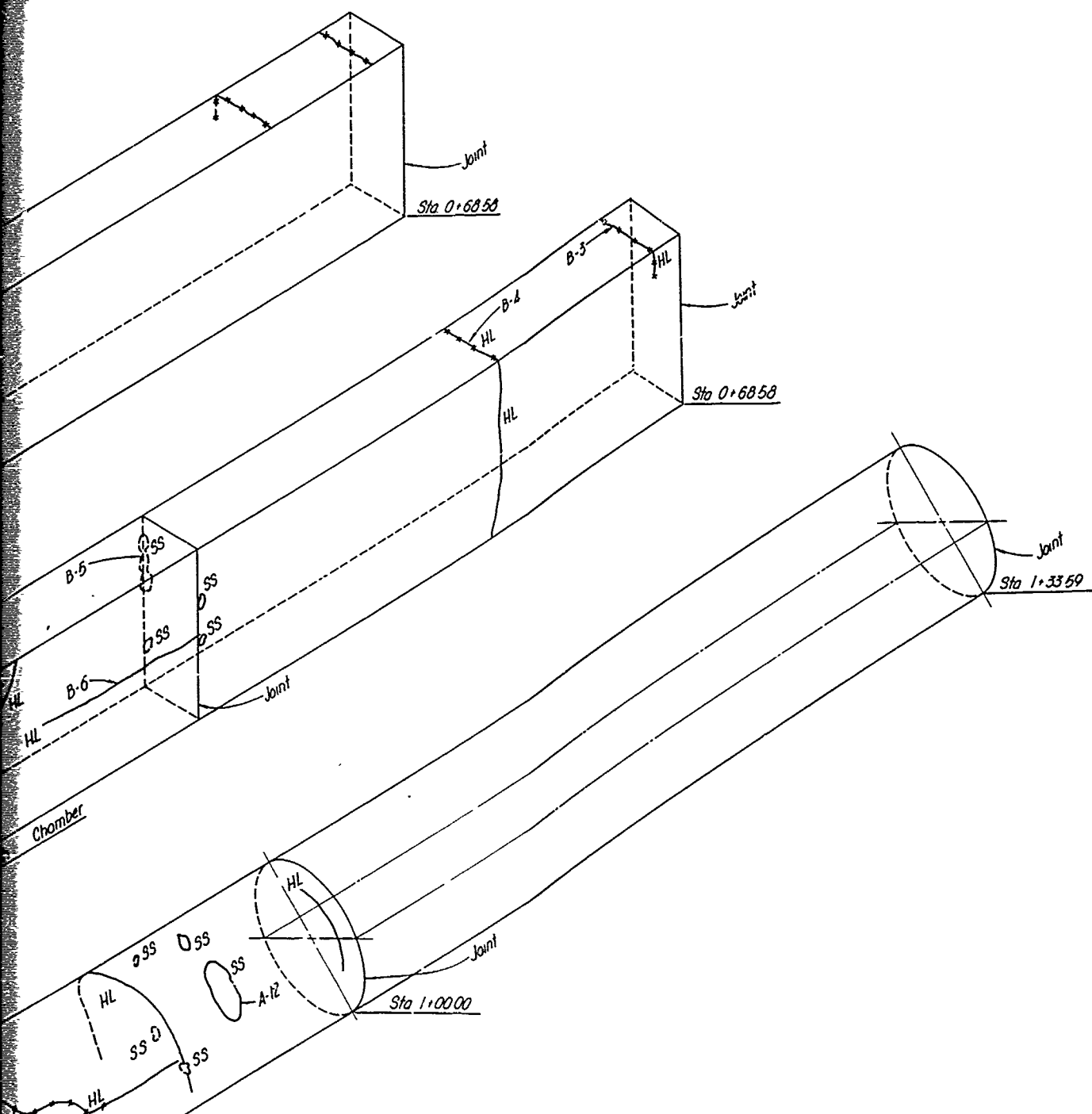
NOTE:
Elevations taken at
interior crown and invert.



BELTZVILLE LAKE
CONDUIT SETTLEMENT STUDY

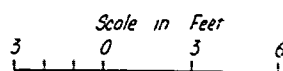
4
PLATE NO. 11





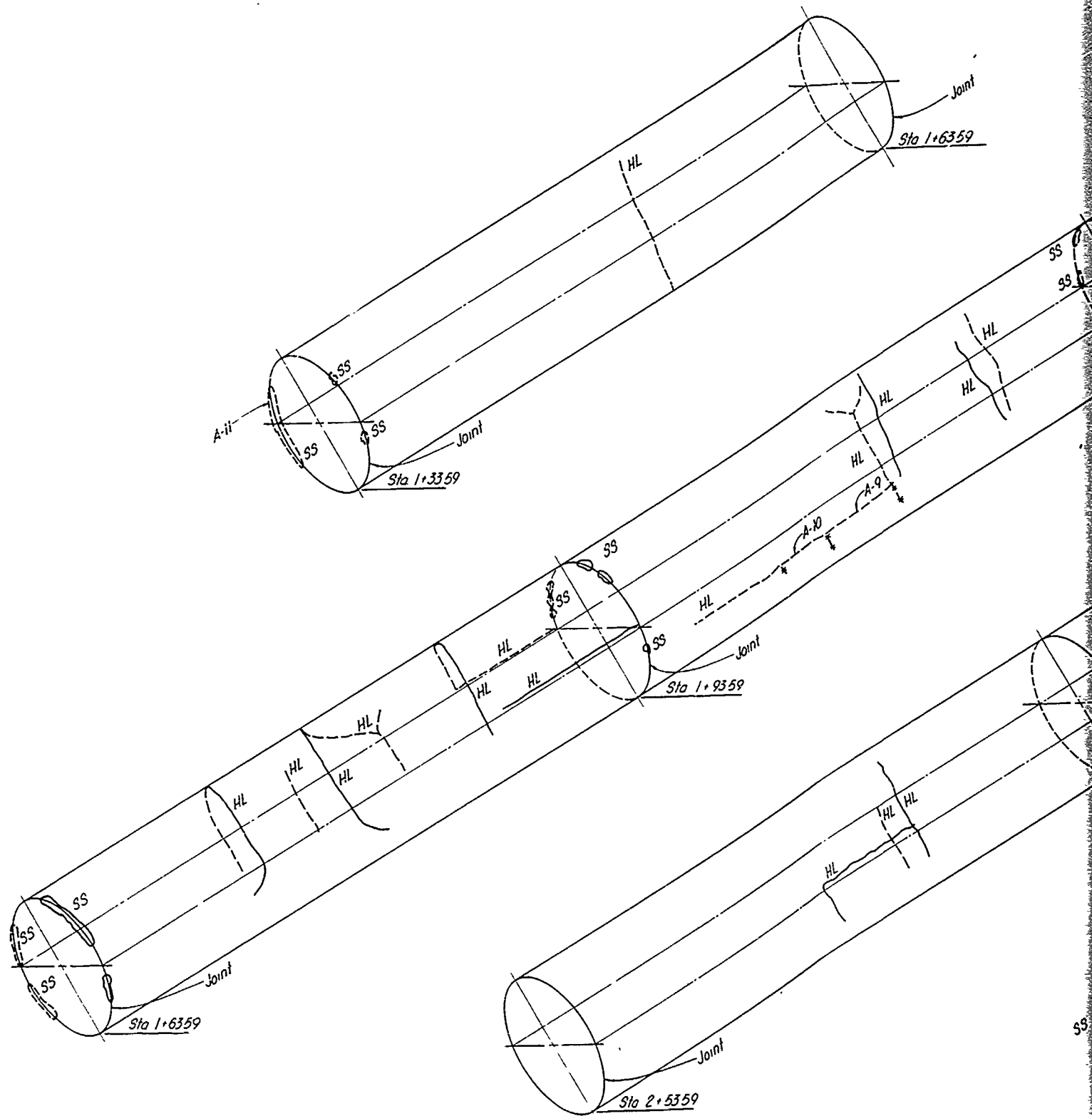
LEGEND

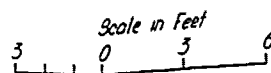
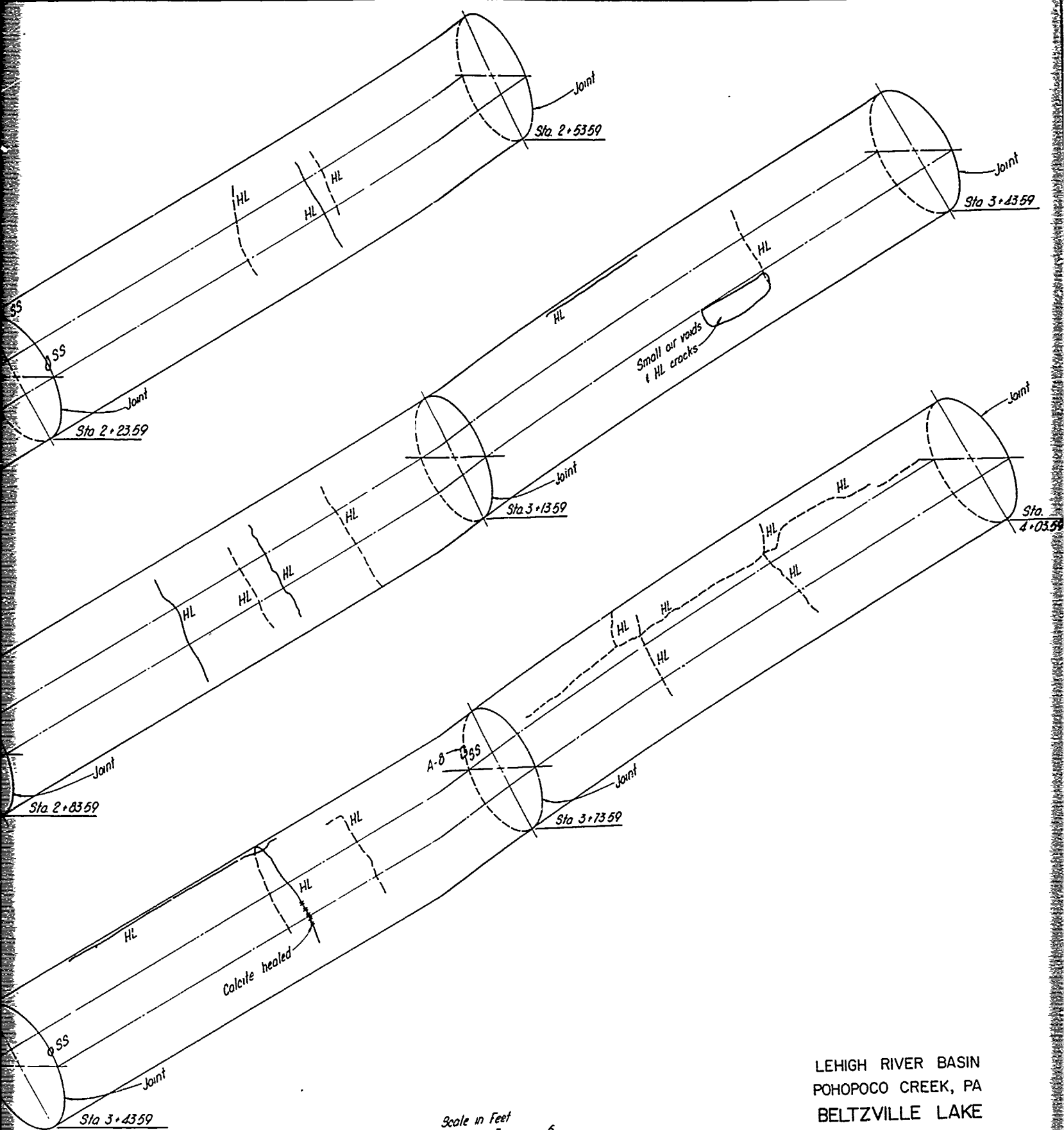
- Quadrant limits
- HL Hairline cracks
- SS Small spall
- ** Calcite deposits
- A-12 Photographs



2

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
CONDUIT SETTLEMENT STUDY



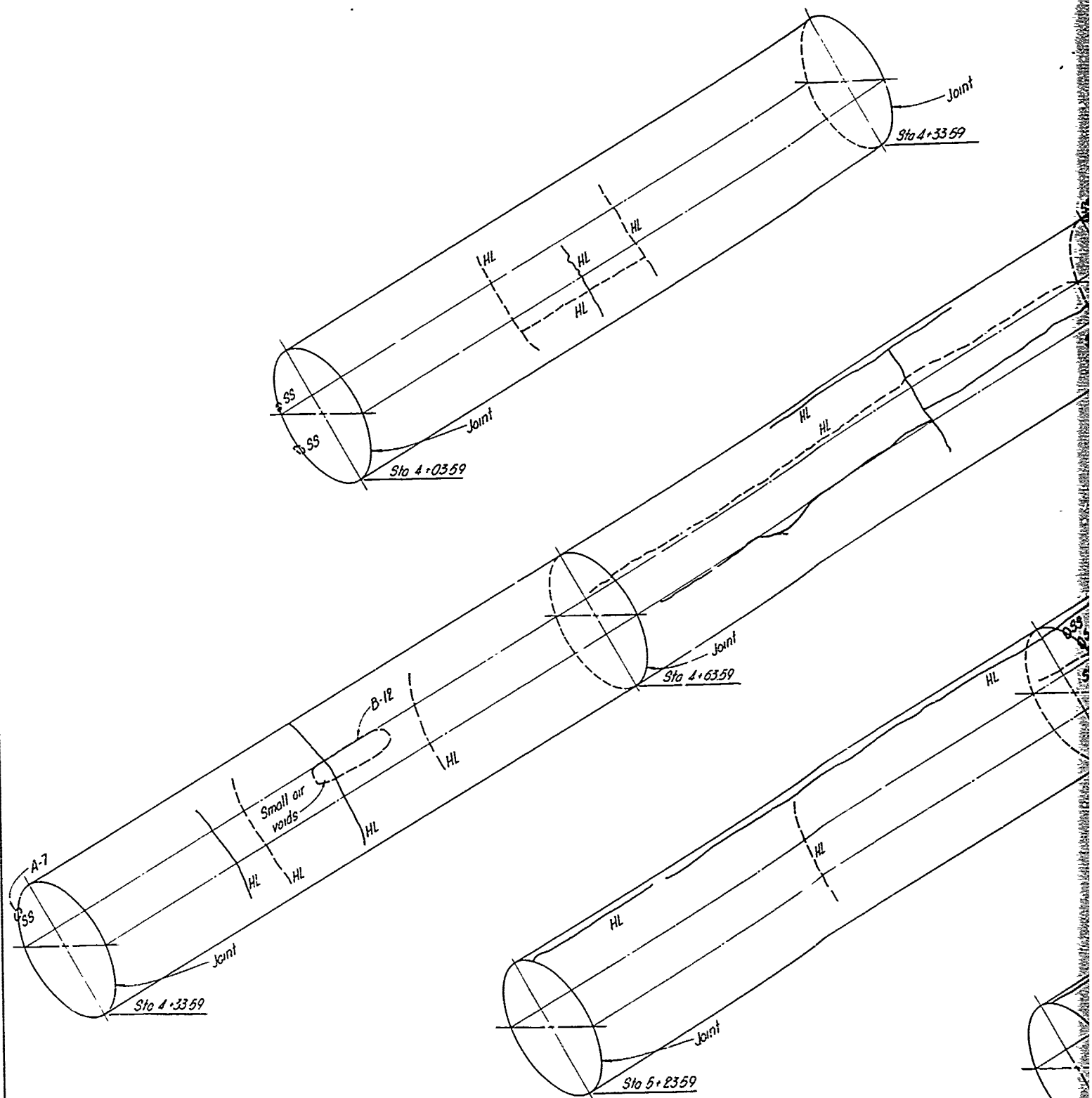


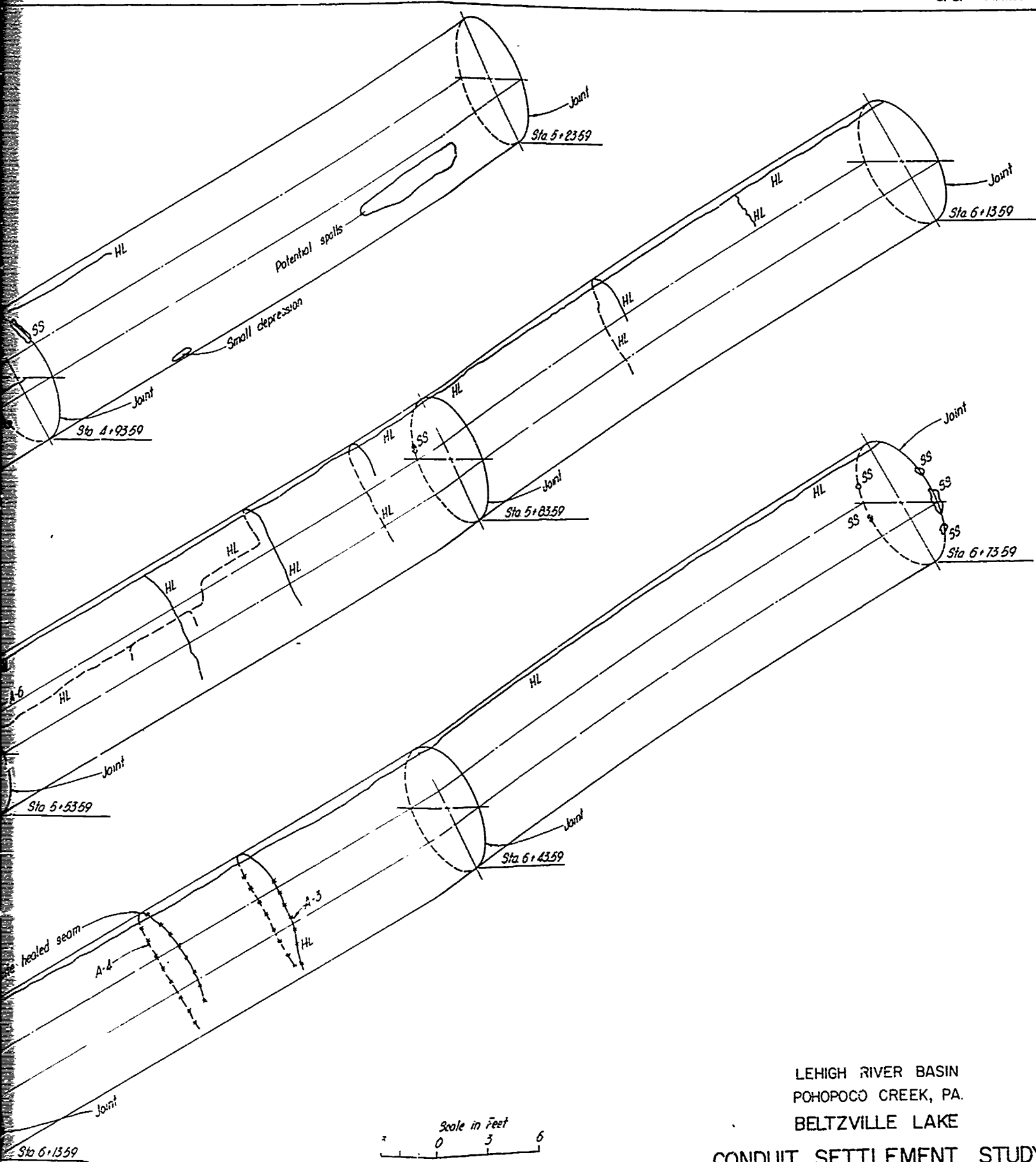
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE

CONDUIT SETTLEMENT STUDY

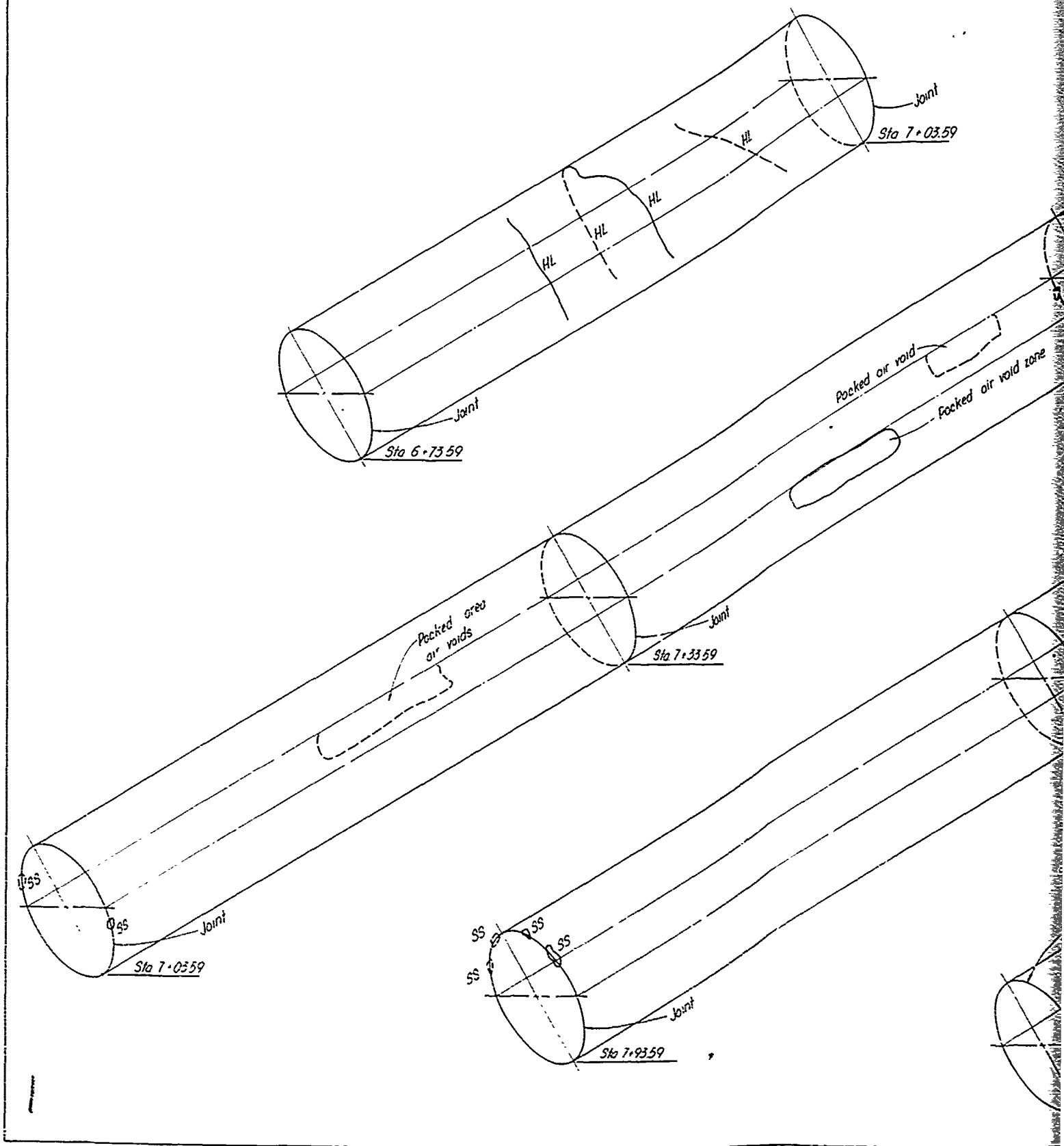
PLATE I

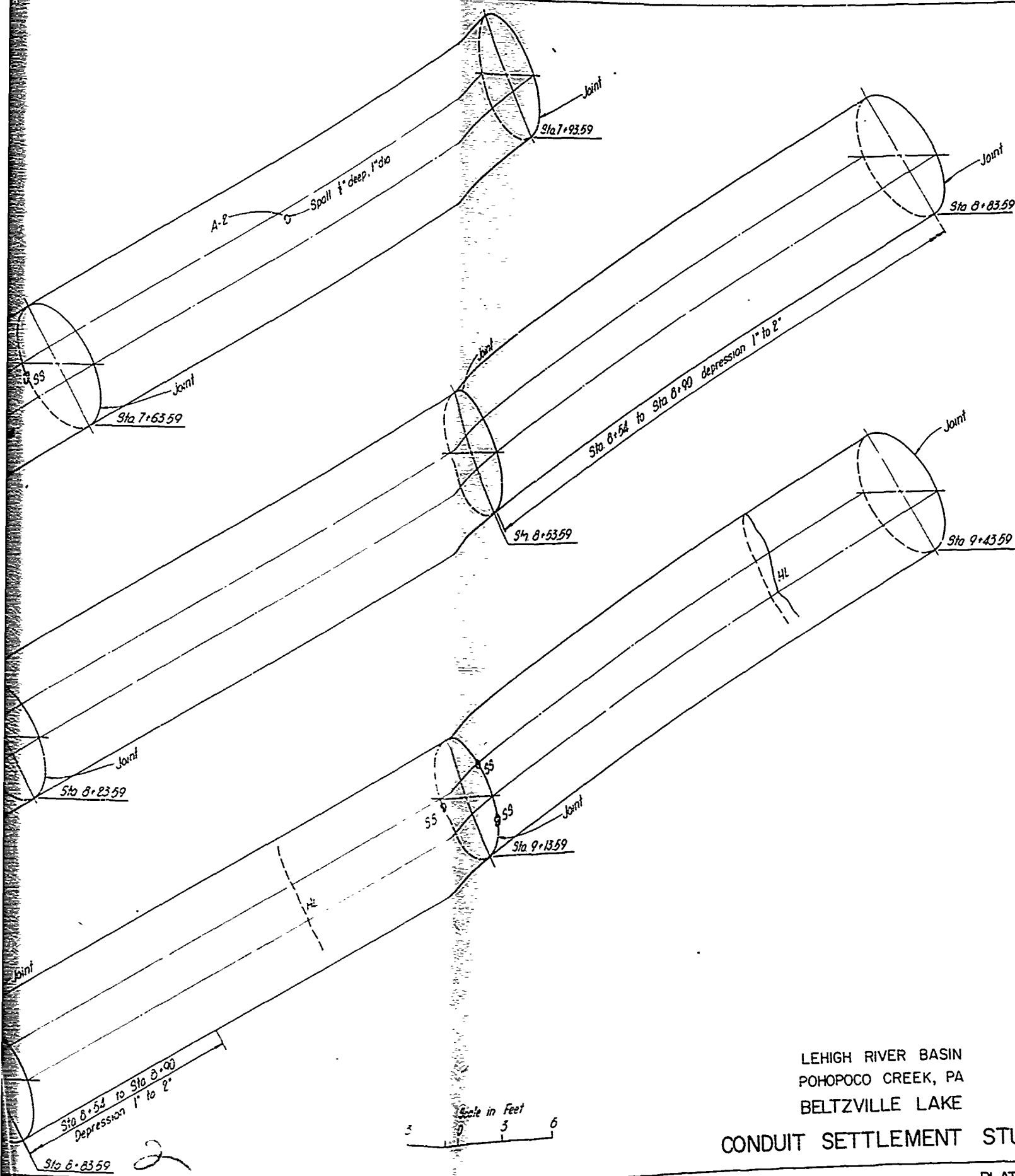
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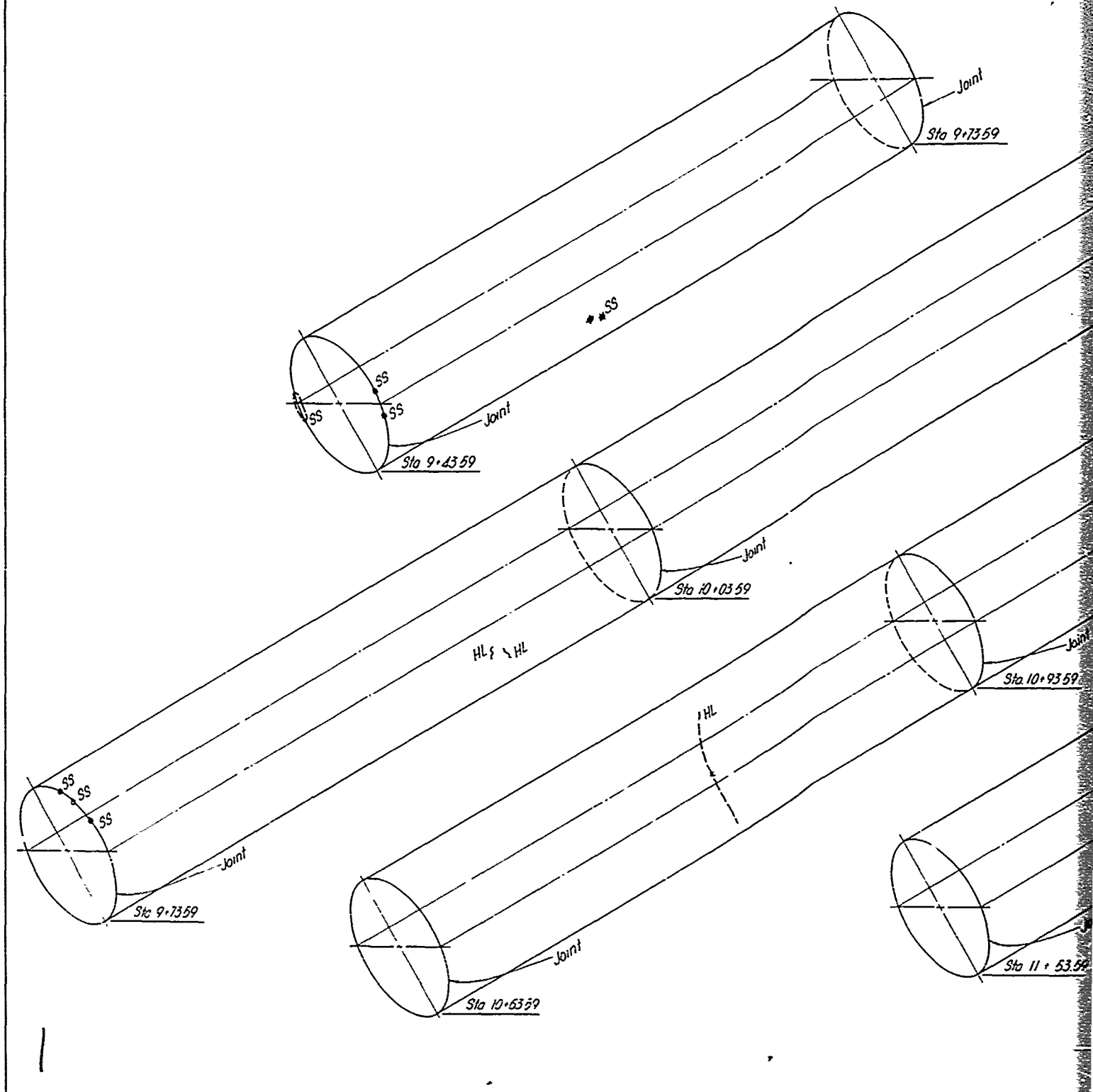
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
CONDUIT SETTLEMENT STUDY

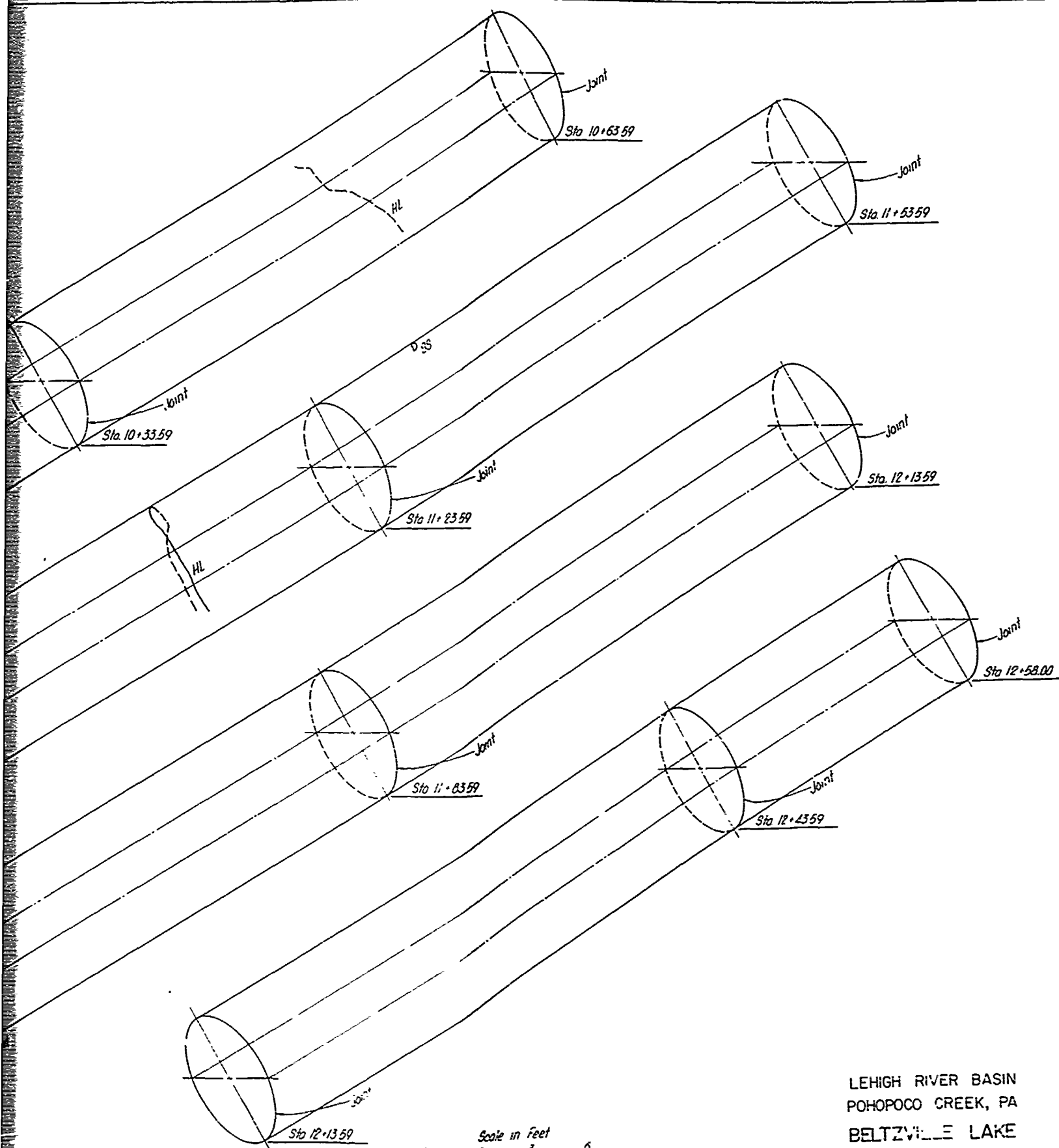




LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE

CONDUIT SETTLEMENT STUDY





LEHIGH RIVER BASIN
 POHOPOCO CREEK, PA
 BELTZVILLE LAKE
 CONDUIT SETTLEMENT STU

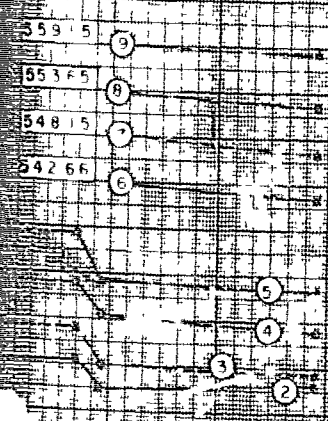
1968

NOTE 521

STU
PLATE

1969
 DECEMBER JANUARY FEBRUARY MARCH APRIL MAY JUNE JULY AUGUST SEPTEMBER OCTOBER NOVEMBER DECEMBER

FILL EL 560



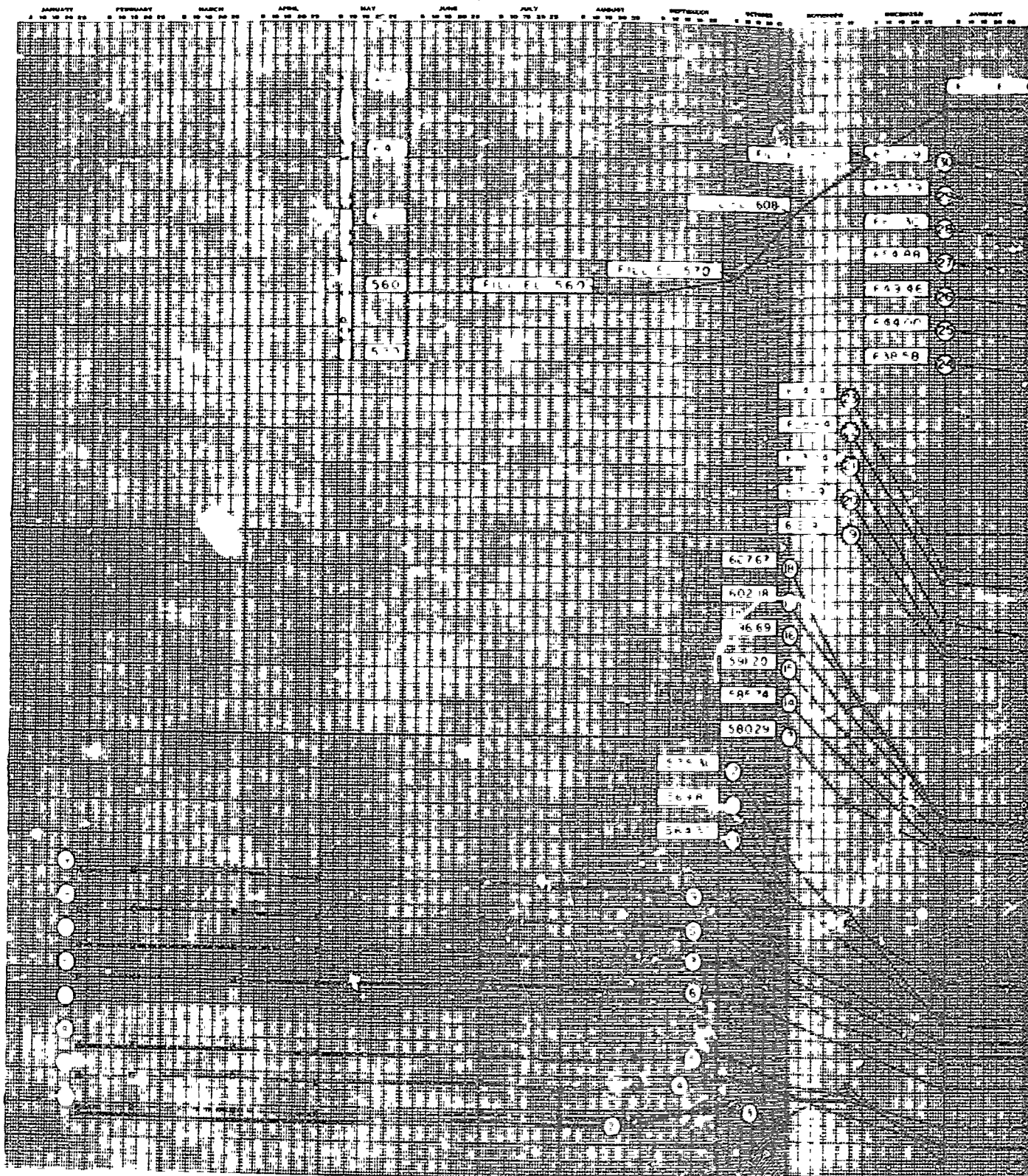
NOTE
 521.00 ② INITIALLY INSTALLED BOTTOM
 ELEVATION FOR CASING # 2

Readings are continued on plate 18

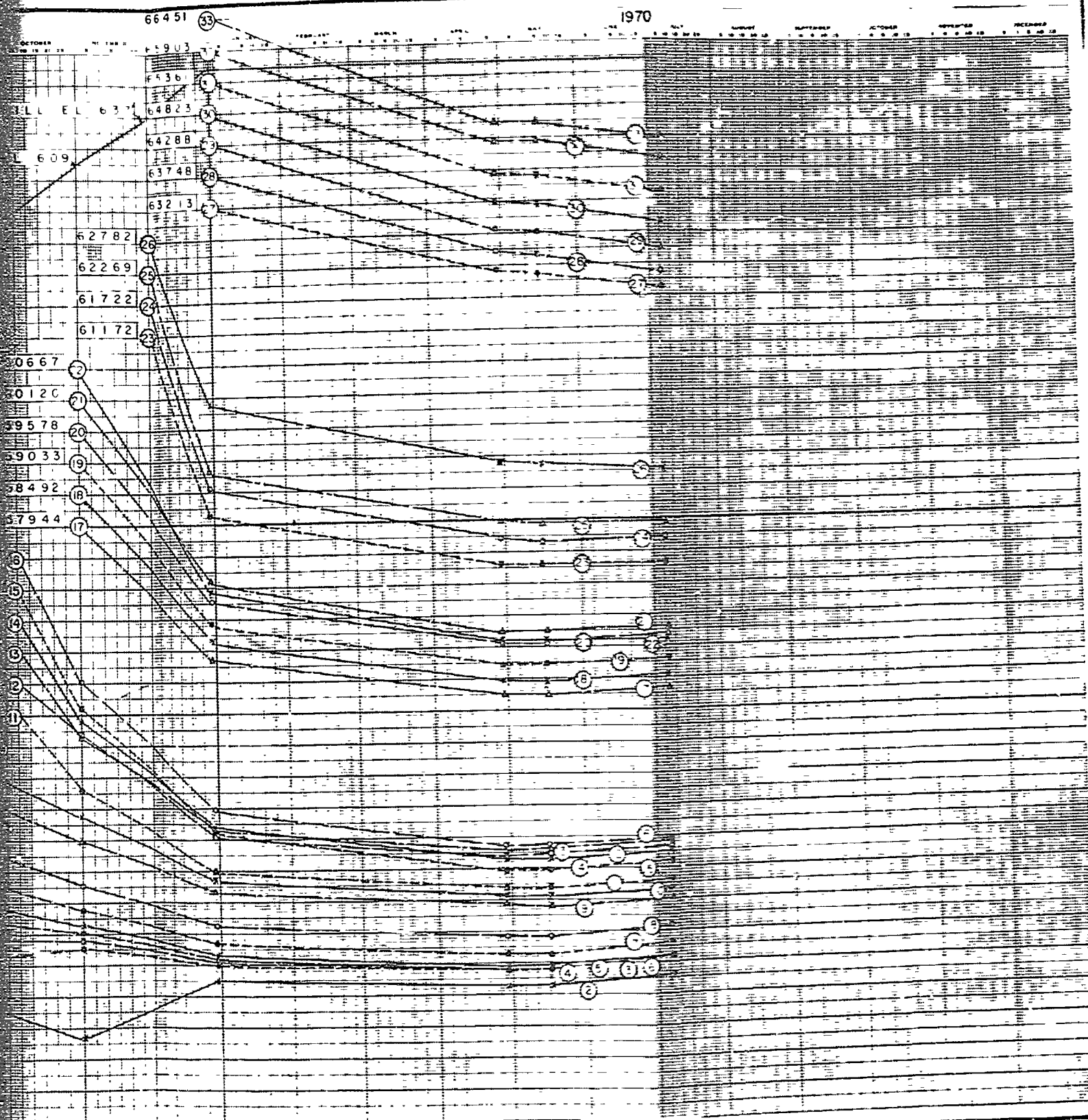
LEHIGH RIVER BASIN
 POHOPOCO CREEK, PA.
 BELTZVILLE LAKE
 SUBSURFACE SETTLEMENT DATA
 VIF-92-2

1969

SETLEMENT

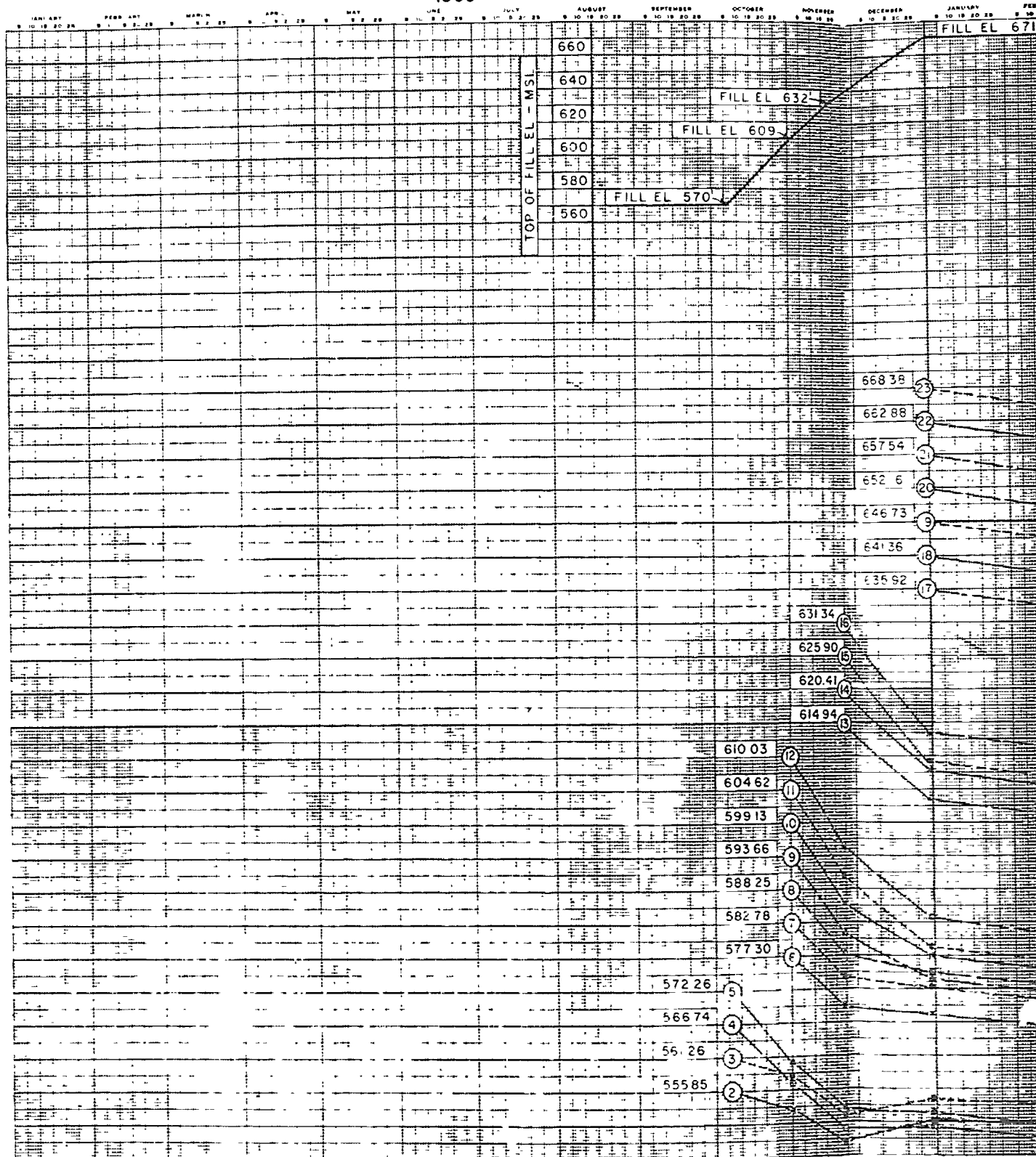


NOTE:
564.3
ELEV

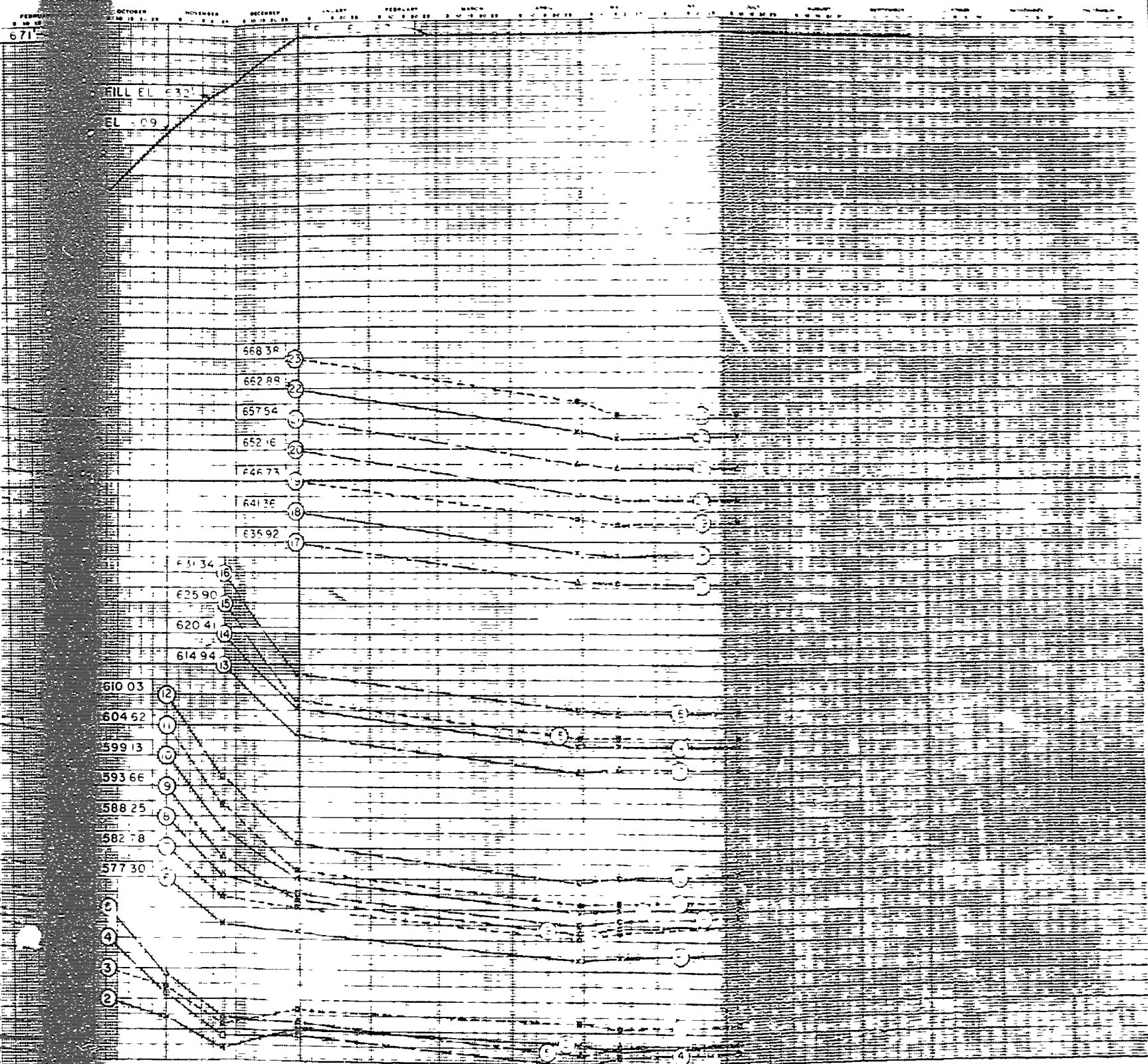


1969

SETTLEMENT
1 INCH = 0.4'

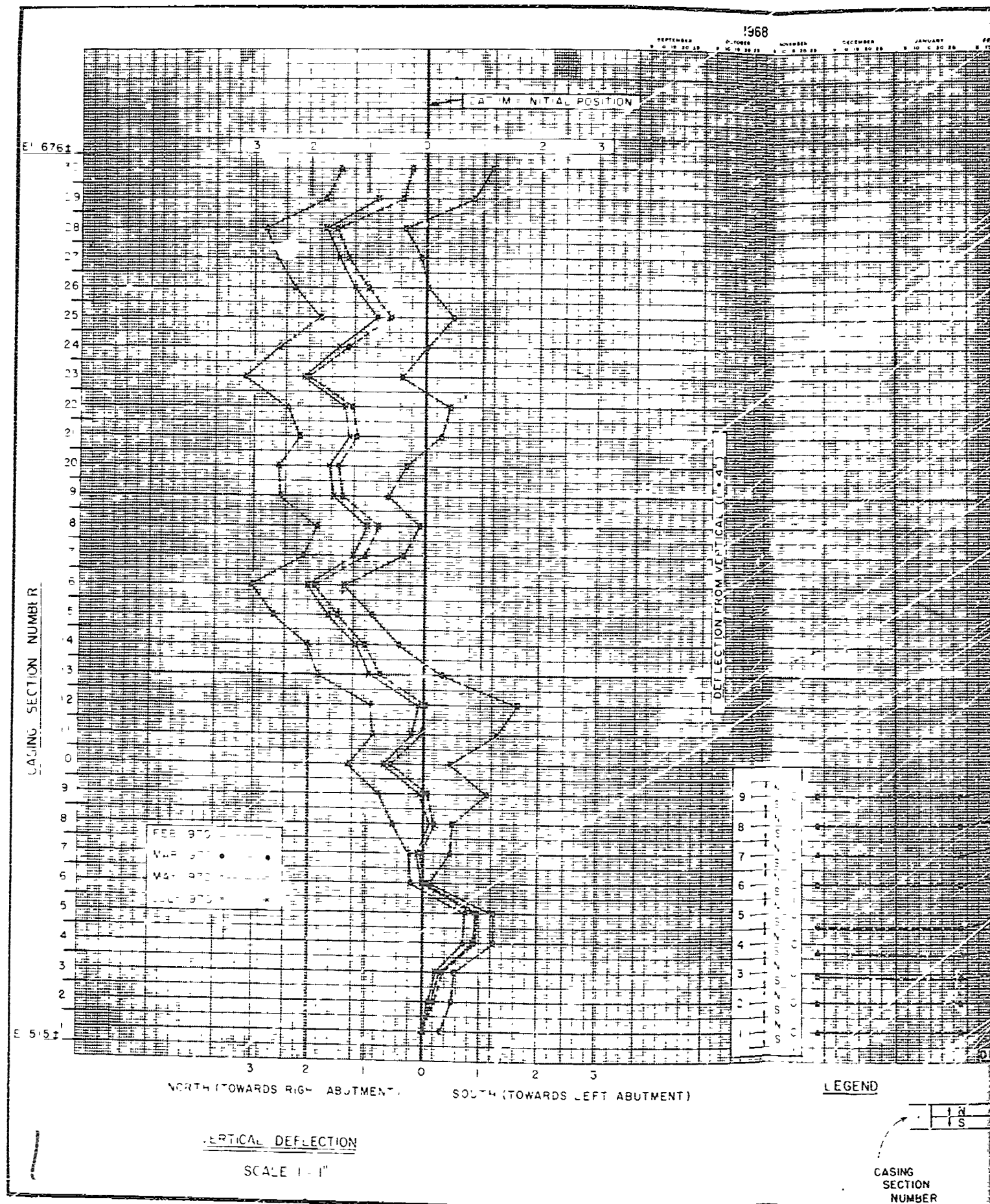


NOTE
555.85



NOTE
555.85 (2) - INITIALLY INSTALLED BOTTOM
ELEVATION FOR CASIN #2

LEHIGH RIVER BASIN
POHOPOGOC CREEK, PA
BELTZVILLE LAKE
SUBSURFACE SETTLEMENT DATA
VIF-98-5



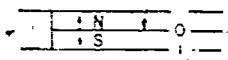
1968

363

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LEGEND

DATUM FOR NBS DEFLECTION



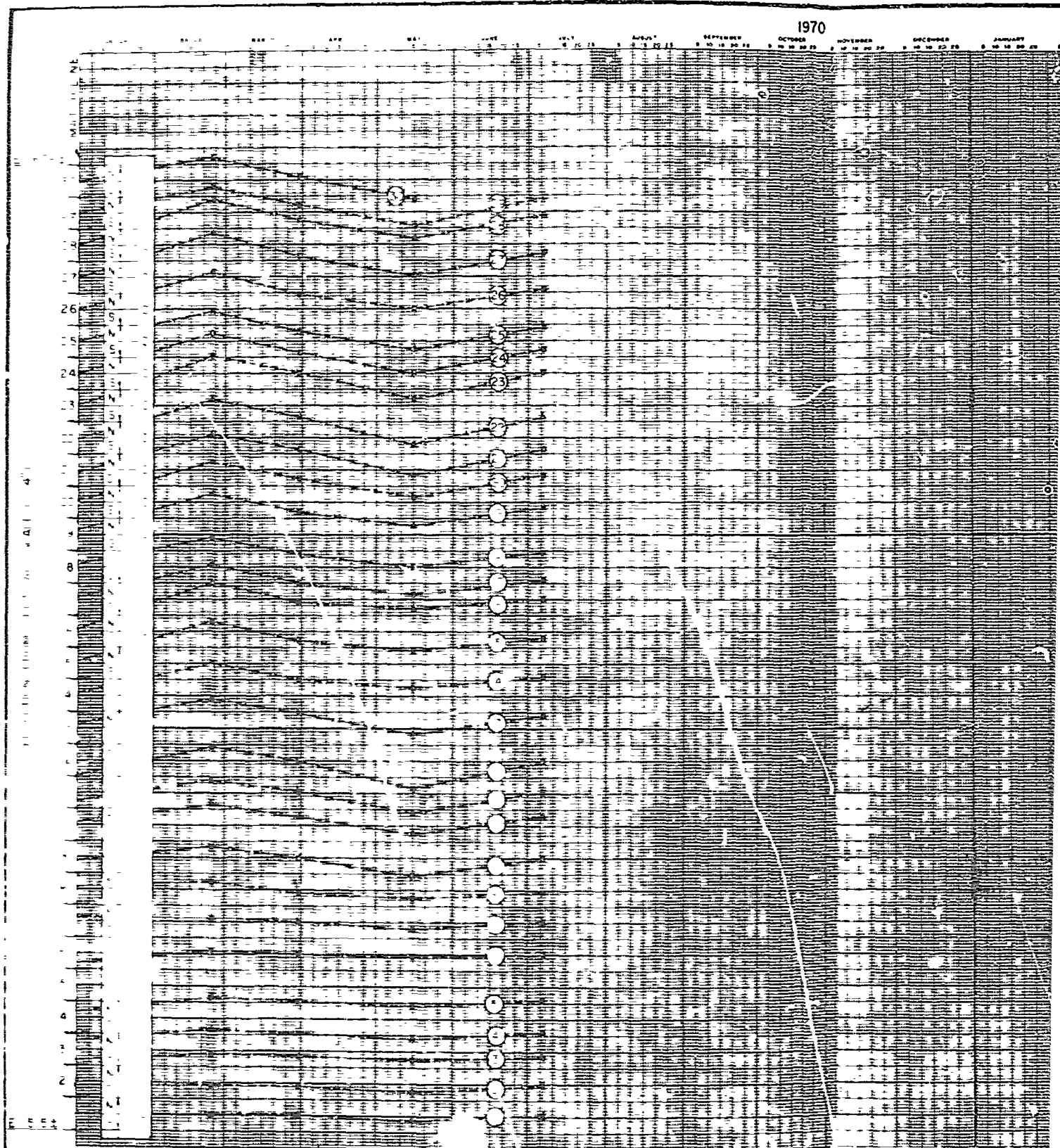
CASING
SECTION
NUMBER

LINE INDICATING DIRECTIONAL
MOVEMENT WITH TIME

MINOR VERTICAL DEFLECTION IN SOUTHERLY
DIRECTION FROM INITIAL POSITION

LEHIGH RIVER BASIN
POCONO CREEK PA
BELLEVILLE LAKE
VERTICAL DEFLECTION DATA-NBS
VF-92-2

PLATE 2



LEGEND

CASING
SECTION
NUMBER

1970

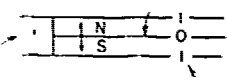
1970

OCTOBER	NOVEMBER	DECEMBER	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
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7	7	7	7	7	7	7	7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
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30	30	30	30	30	30	30	30	30	30	30	30	30	30	30
31	31	31	31	31	31	31	31	31	31	31	31	31	31	31

DEFLECT ON - TIME STUDY

LEGEND

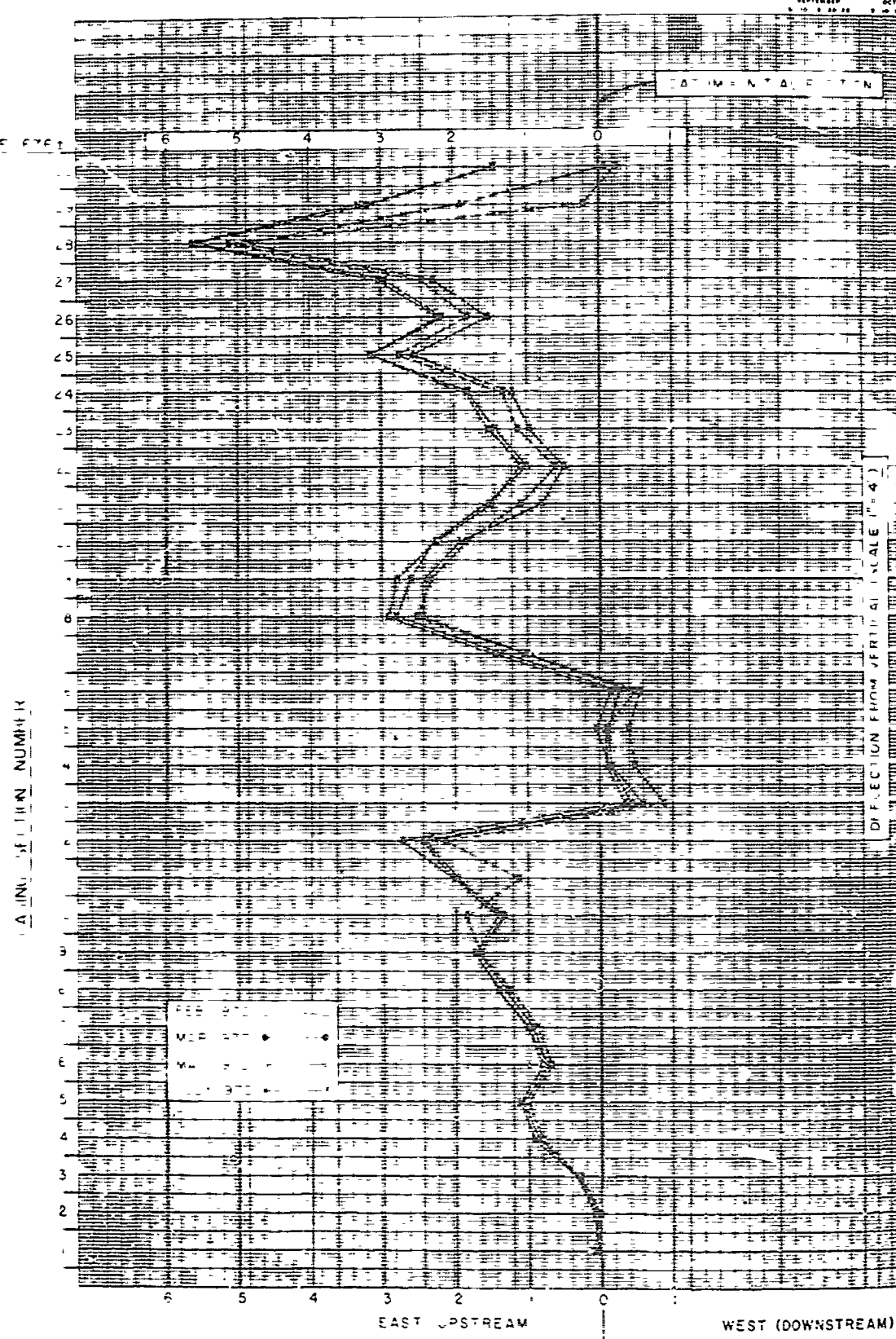
DATUM FOR N & S DEFLECTION

LINE INDICATING DIRECTIONAL
MOVEMENT WITH TIMECASING
SECTION
NUMBER- INCH VERTICAL DEFLECTION IN SOUTHERLY
DIRECTION FROM INITIAL POSITION

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF-92-2

1968

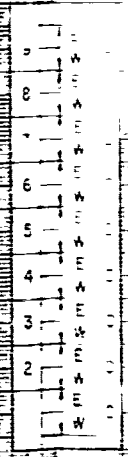
SEPTEMBER 1 10 20 30
OCTOBER 1 10 20 30
NOVEMBER 1 10 20 30
DECEMBER 1 10 20 30
JANUARY 1 10 20 30



CASING SECTION NUMBER

DEFLECTION FROM VERTICAL (INCHES)

LEGEND
 M.C.P. 1000
 M.C.P. 1000



EAST UPSTREAM

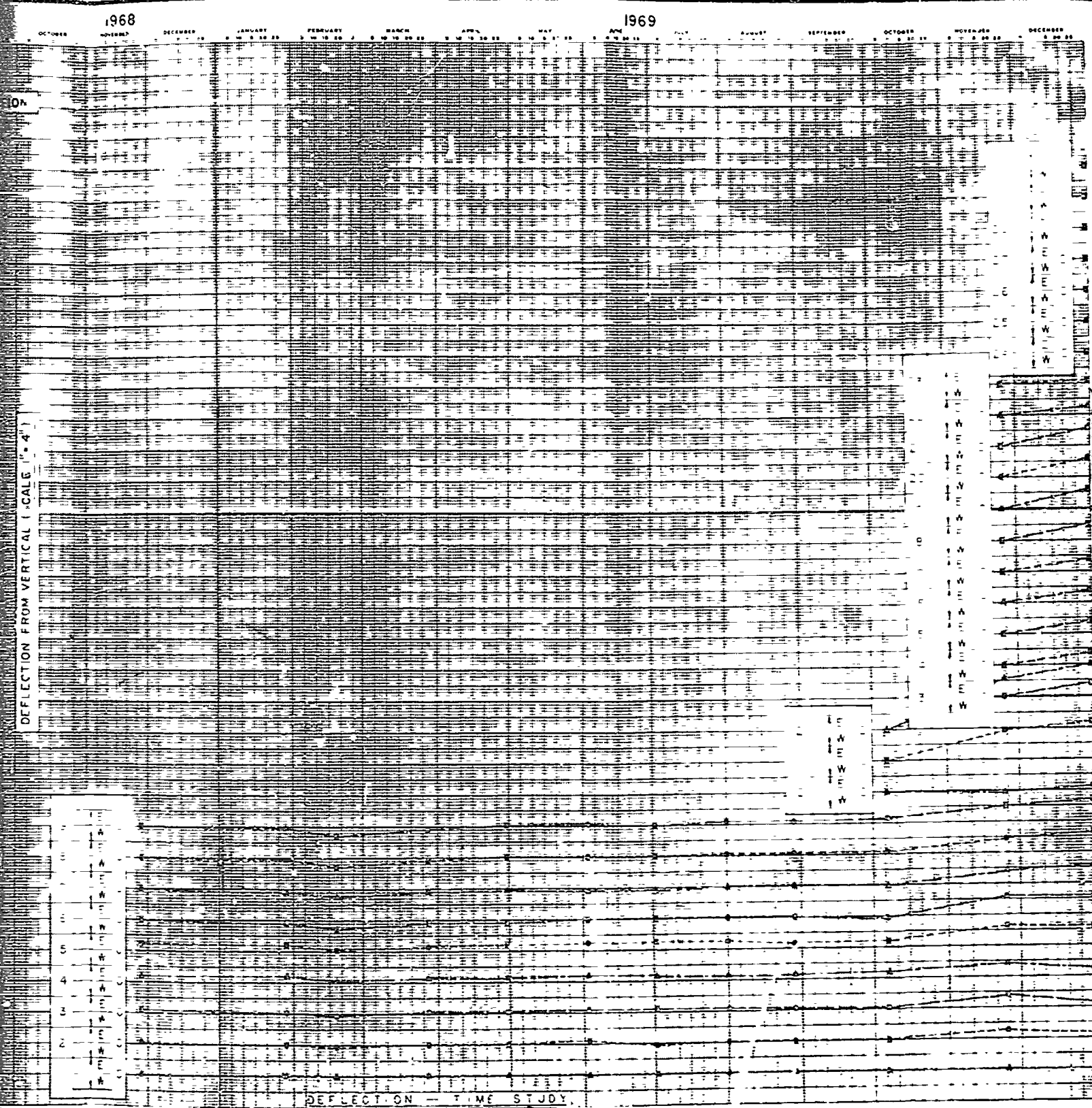
WEST (DOWNSTREAM)

LEGEND

VERTICAL DEFLECTION

SCALE 1" = 1'

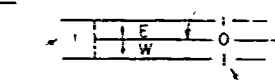
CASING SECTION NUMBER



TEAM)

LEGEND

DATUM FOR E & W DEFLECTION



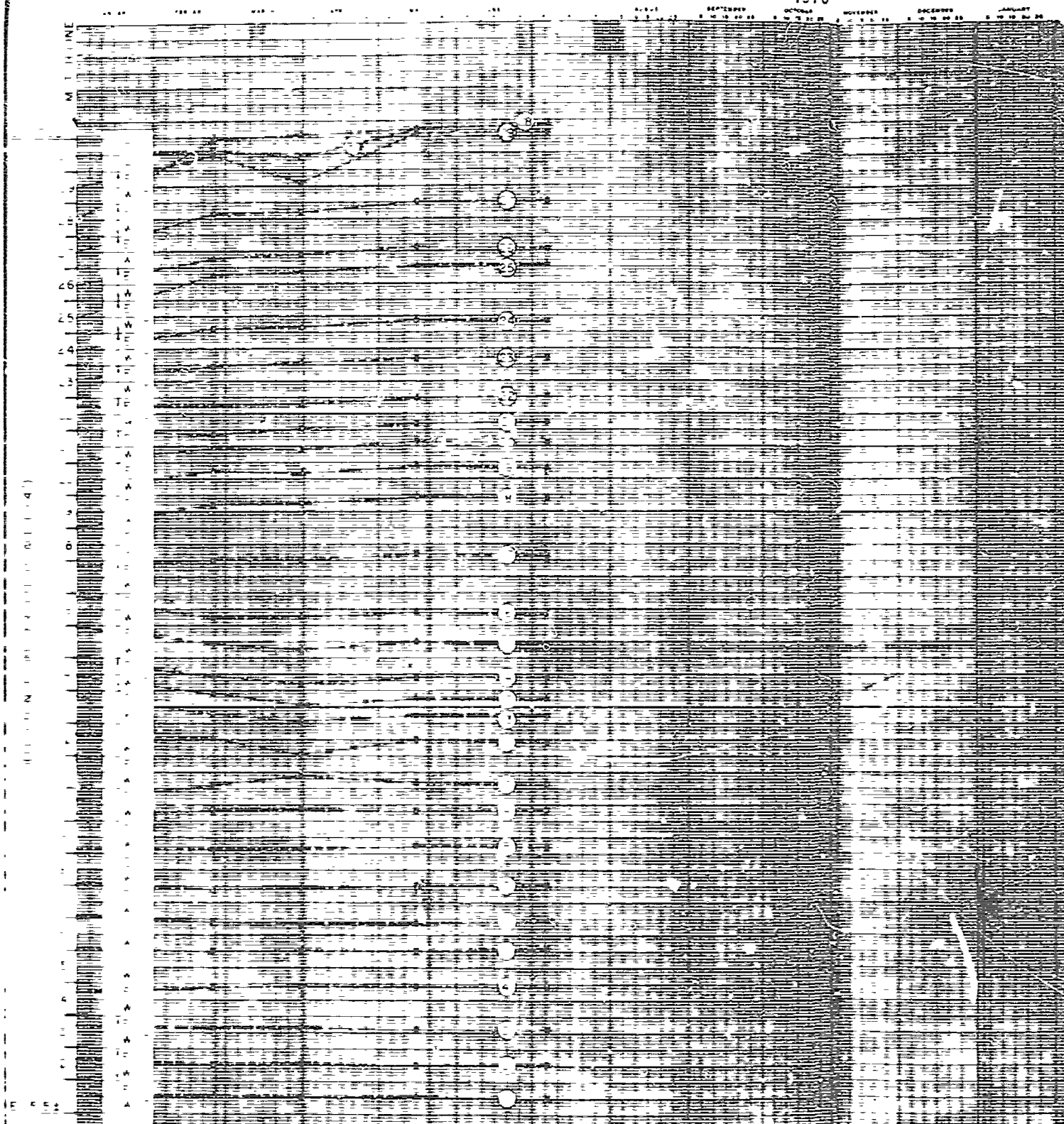
LINE INDICATING DIRECTIONAL
MOVEMENT WITH TIME

CASING
SECTION
NUMBER

1/4-INCH VERTICAL DEFLECTION IN WESTERLY
DIRECTION FROM INITIAL POSITION

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF - 92-2

1970



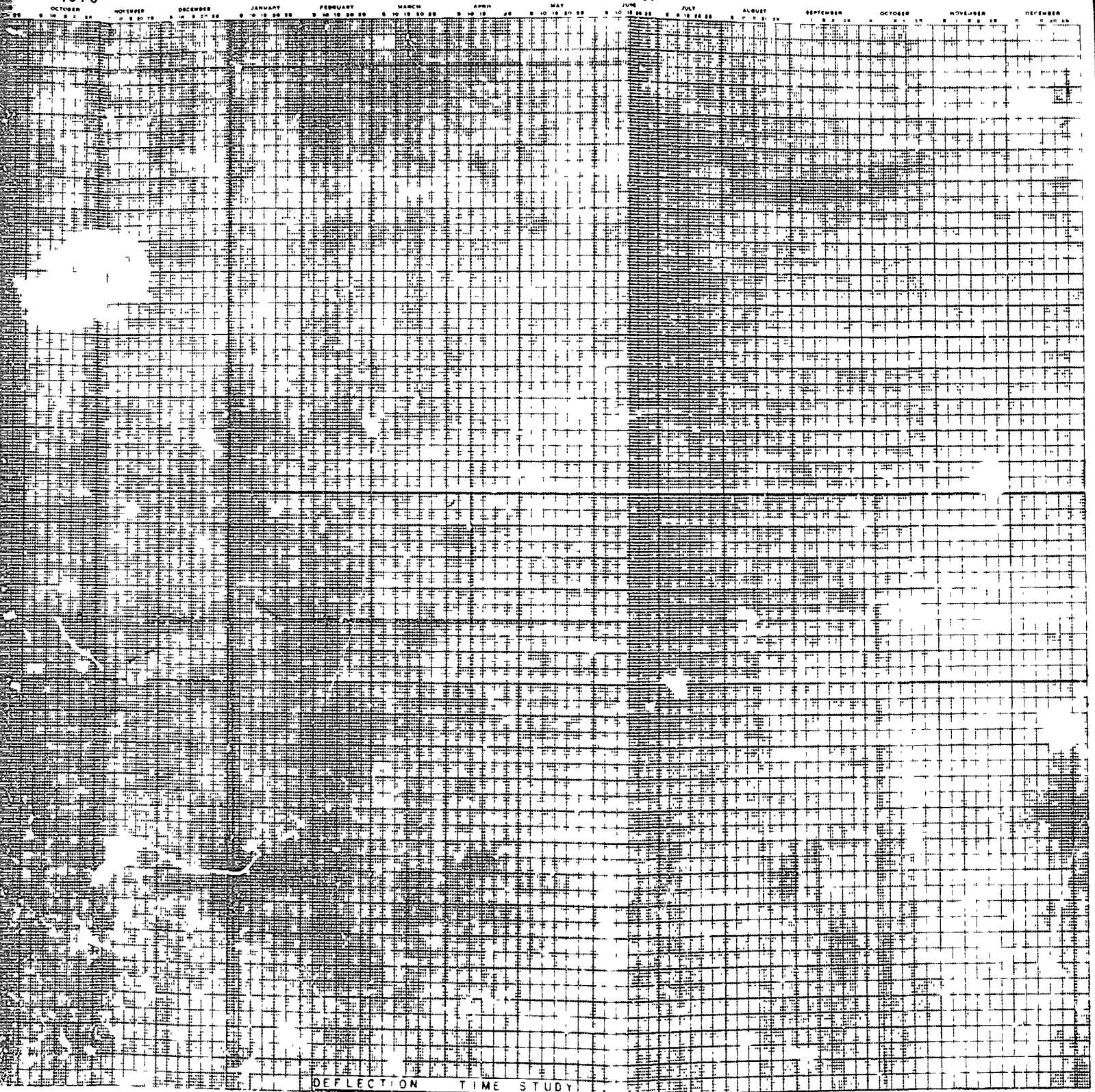
LEGEND

E
W

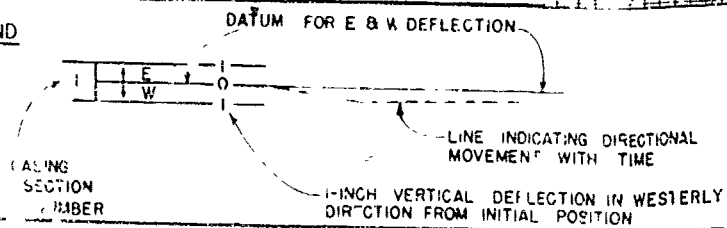
CASING
SECTION
NUMBER

1970

197

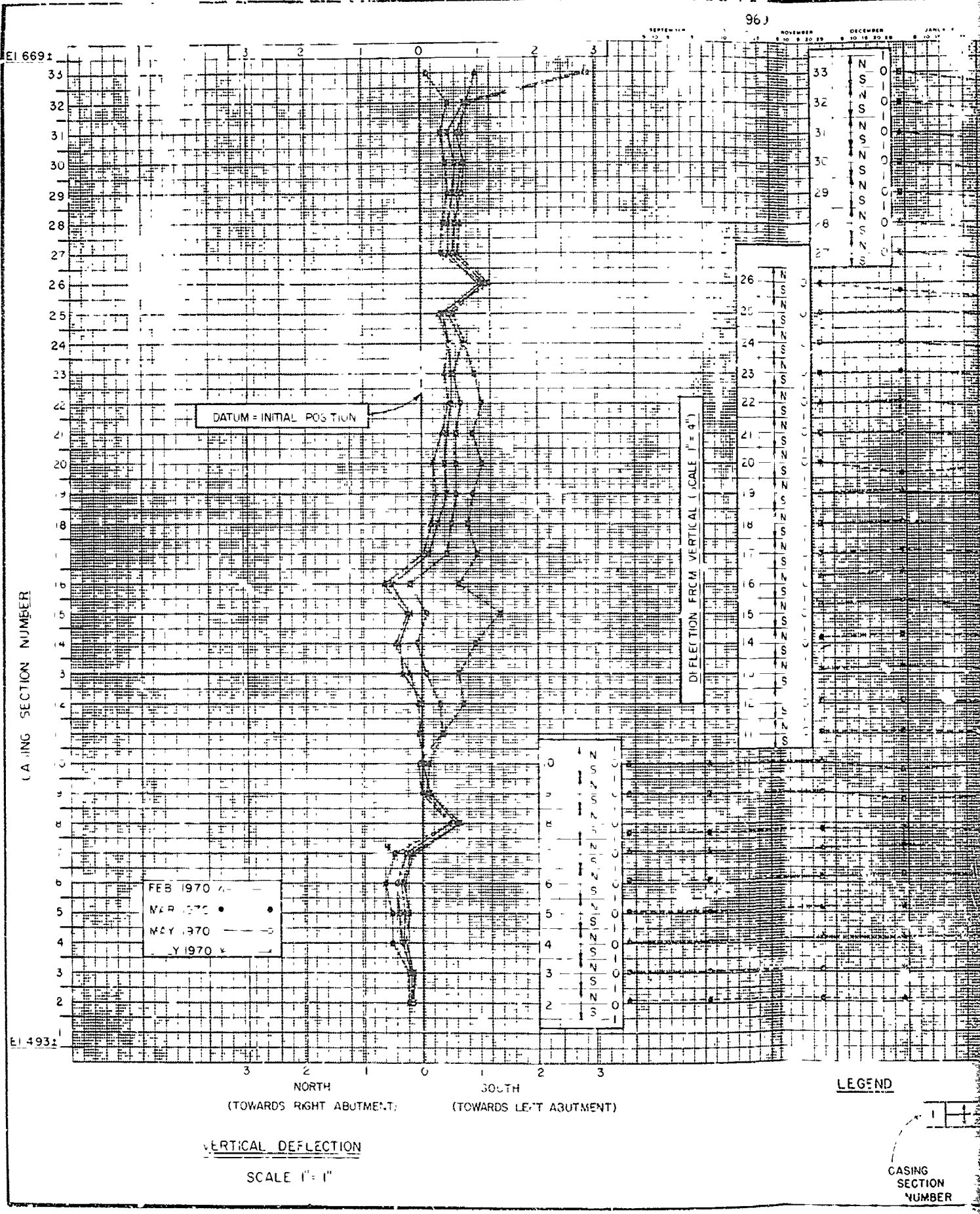


LEGEND



LEHIGH RIVER BASIN
POHOPOCO CREEK PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA E & W
VIF-92-2

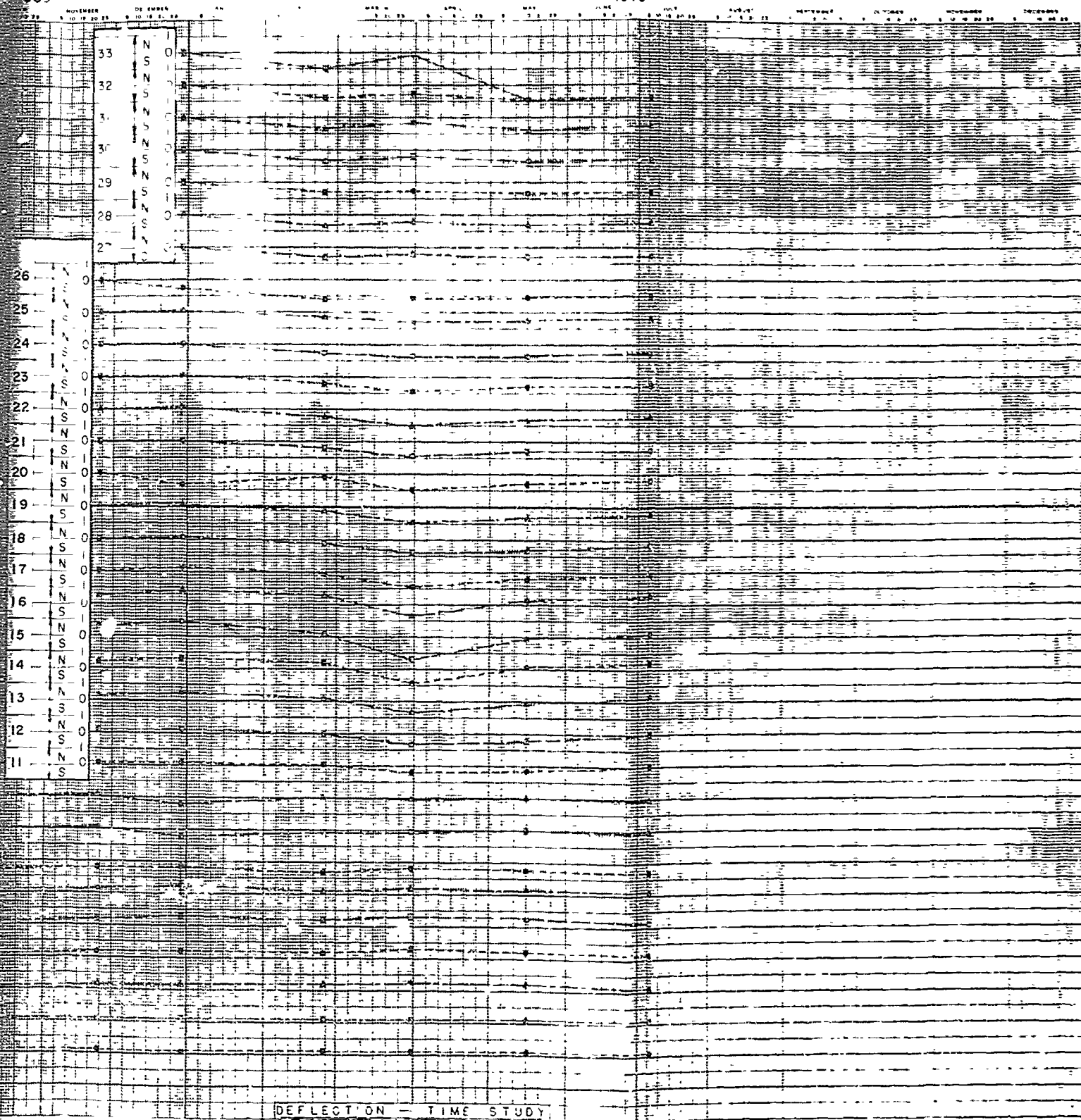
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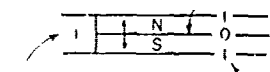
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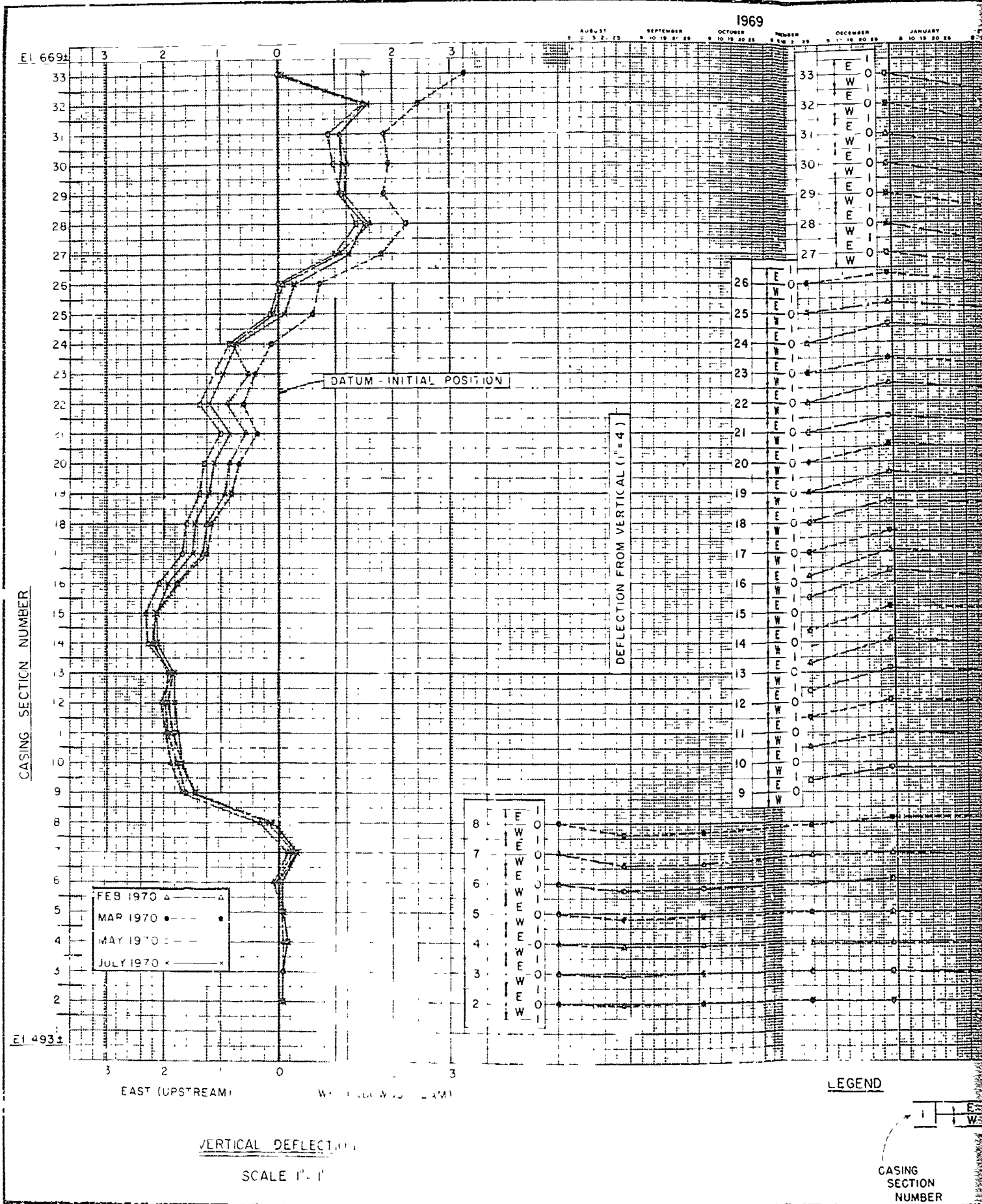
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DATUM FOR N & S DEFLECTION.

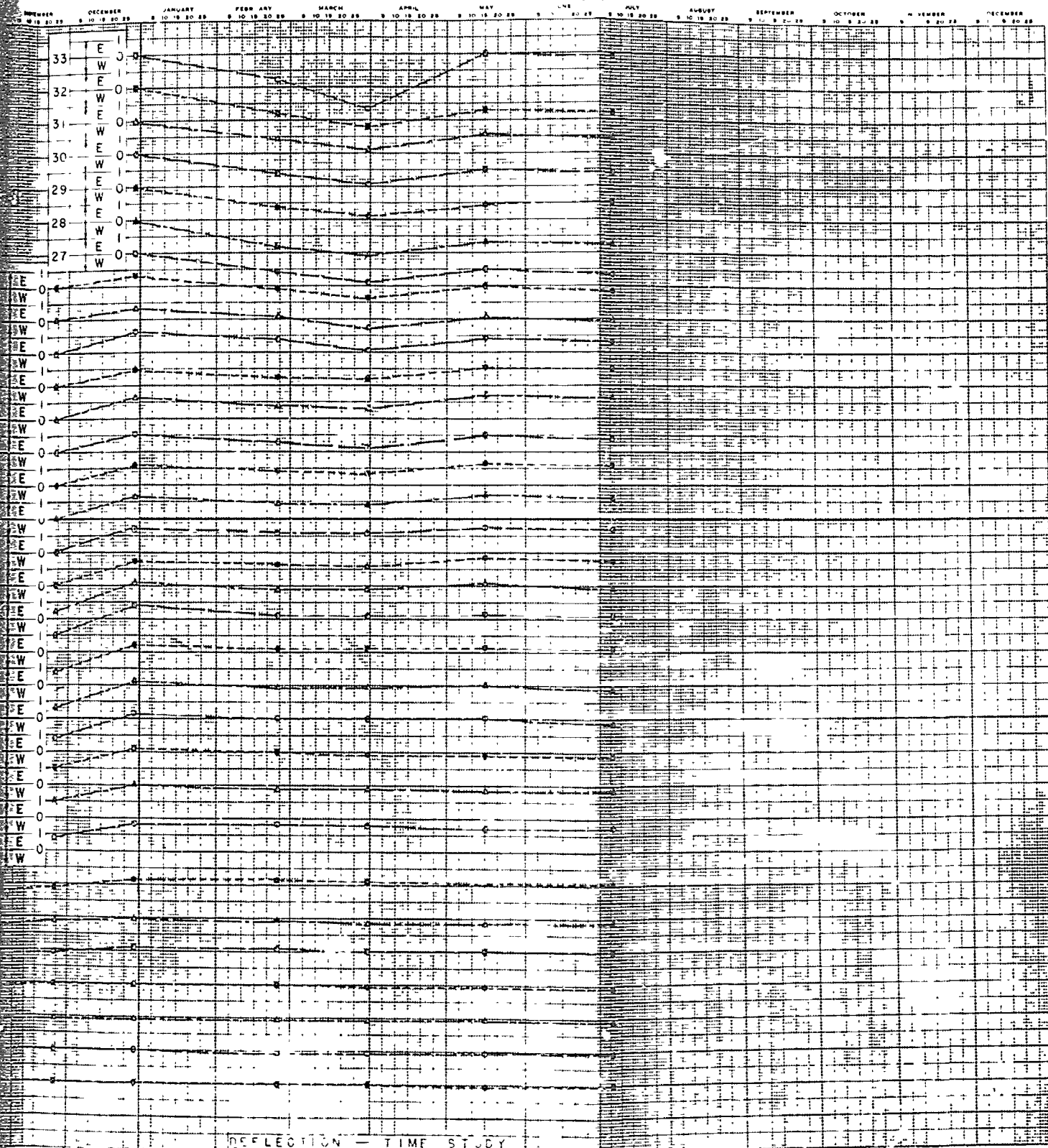
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NUMBERLINE INDICATING DIRECTIONAL
MOVEMENT WITH TIME- INCH VERTICAL DEFLECTION IN SOUTHERLY
DIRECTION FROM INITIAL POSITION

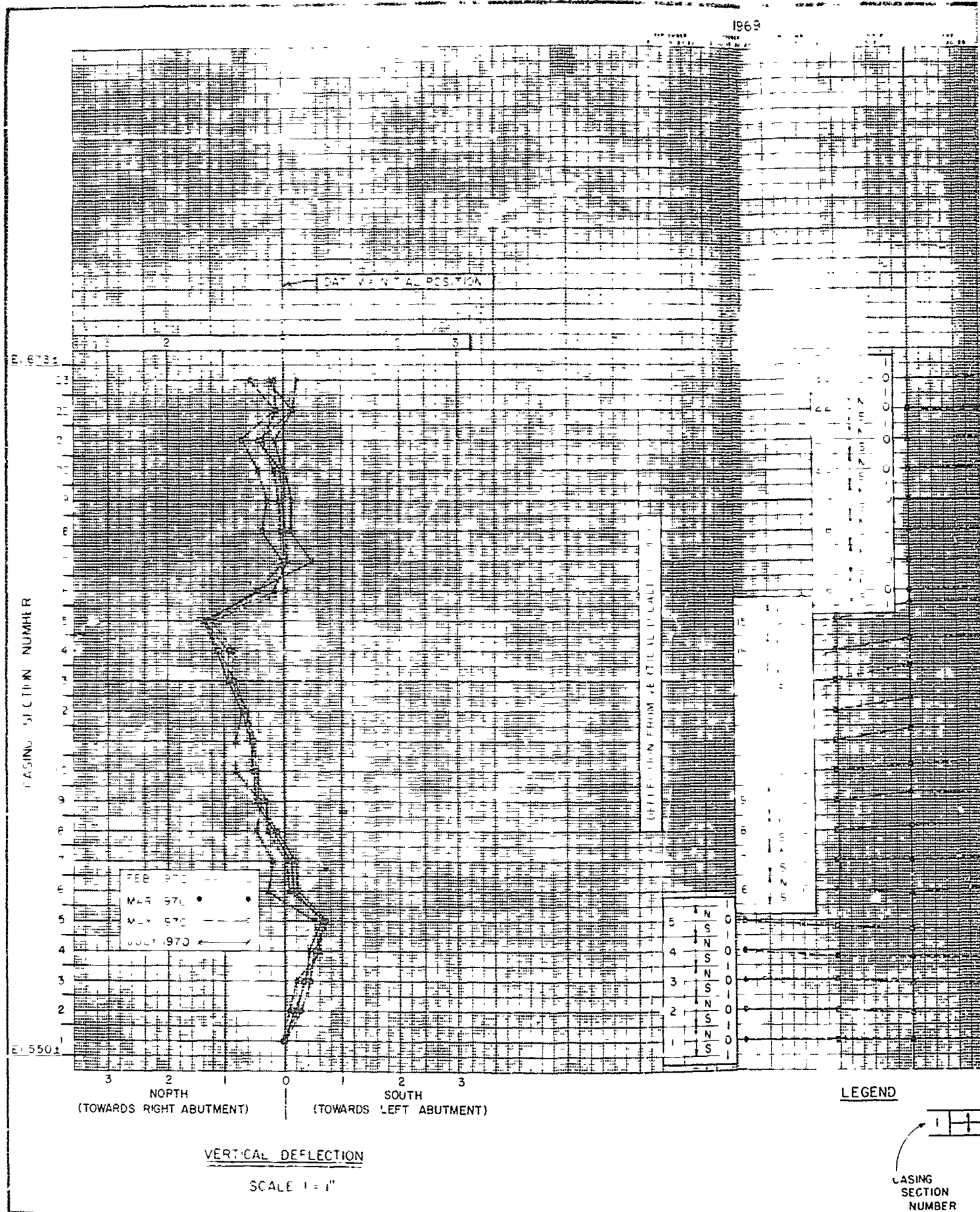
LEHIGH RIVER BASIN
POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA N & S
VIF - 95-2

PLATE 25



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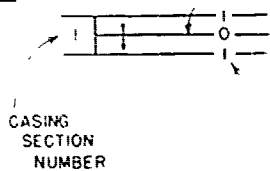
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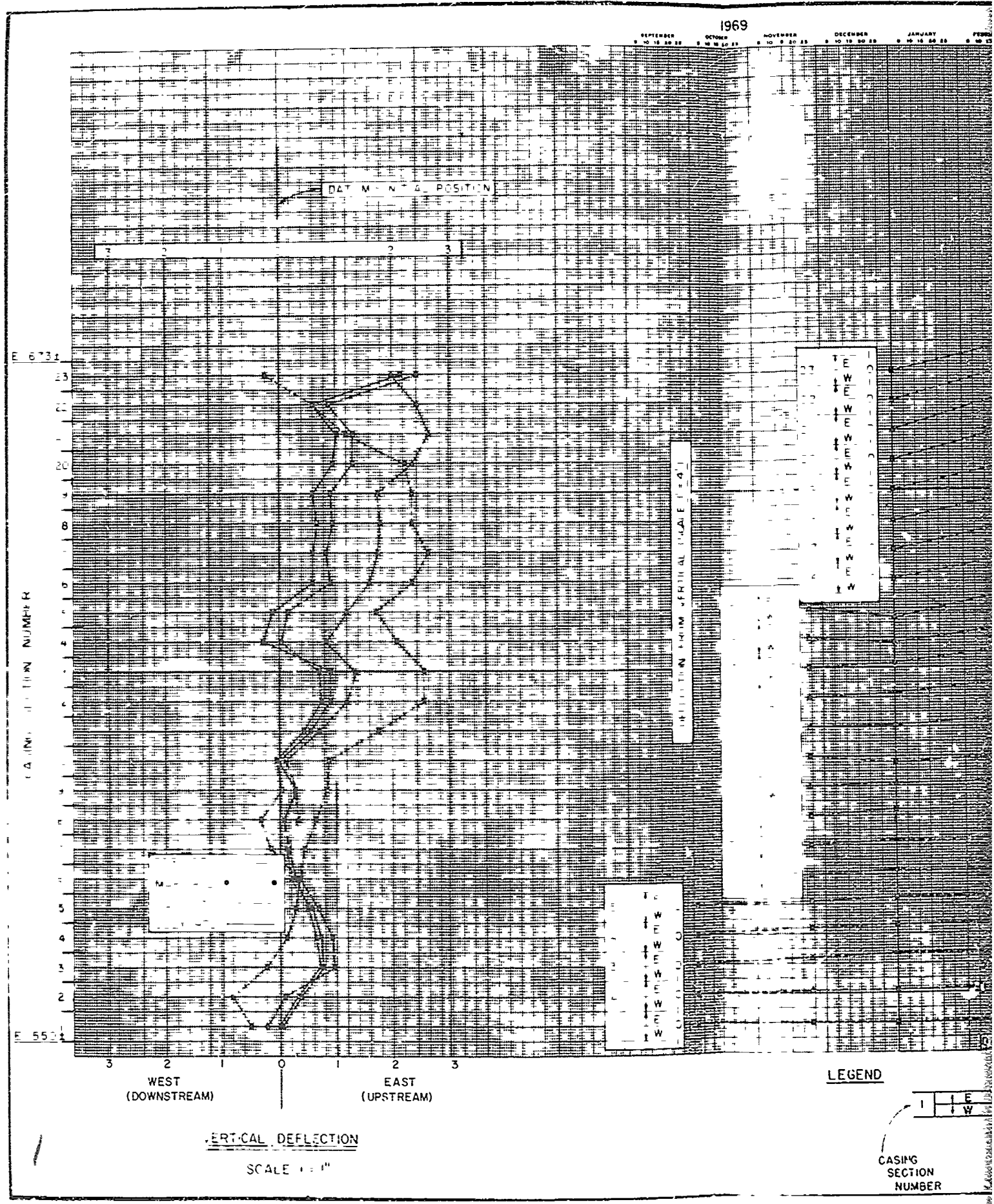


DATUM FOR N & S DEFLECTION

LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

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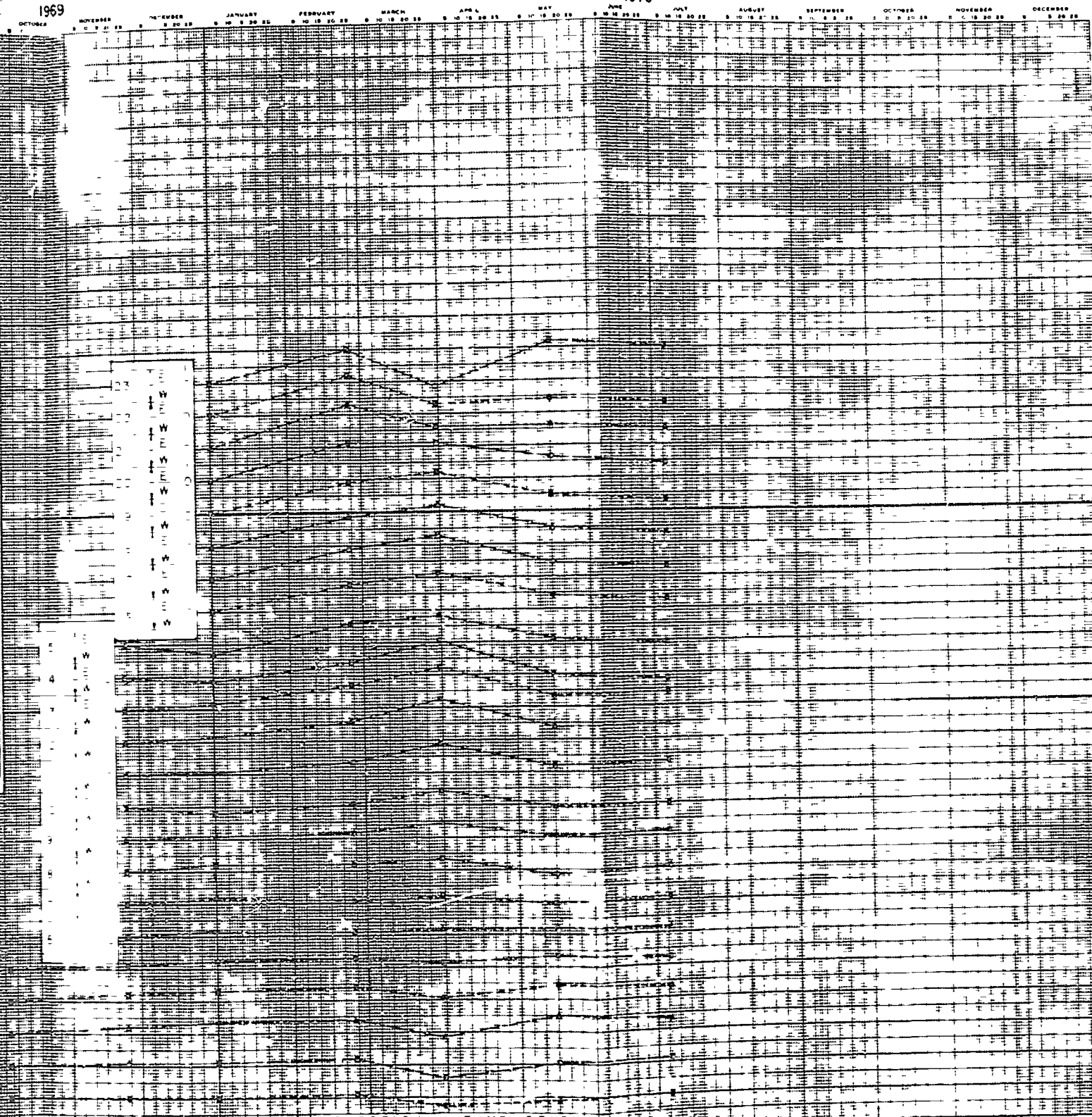
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POHOPOCO CREEK, PA
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA-N&S
VIF-98-5



1969

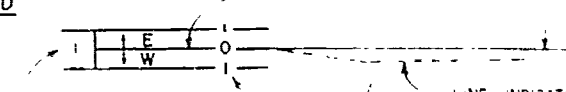
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DEFLECTION FROM VERTICAL (SCALE IN INCHES)



LEGEND

DATUM FOR E & W DEFLECTION



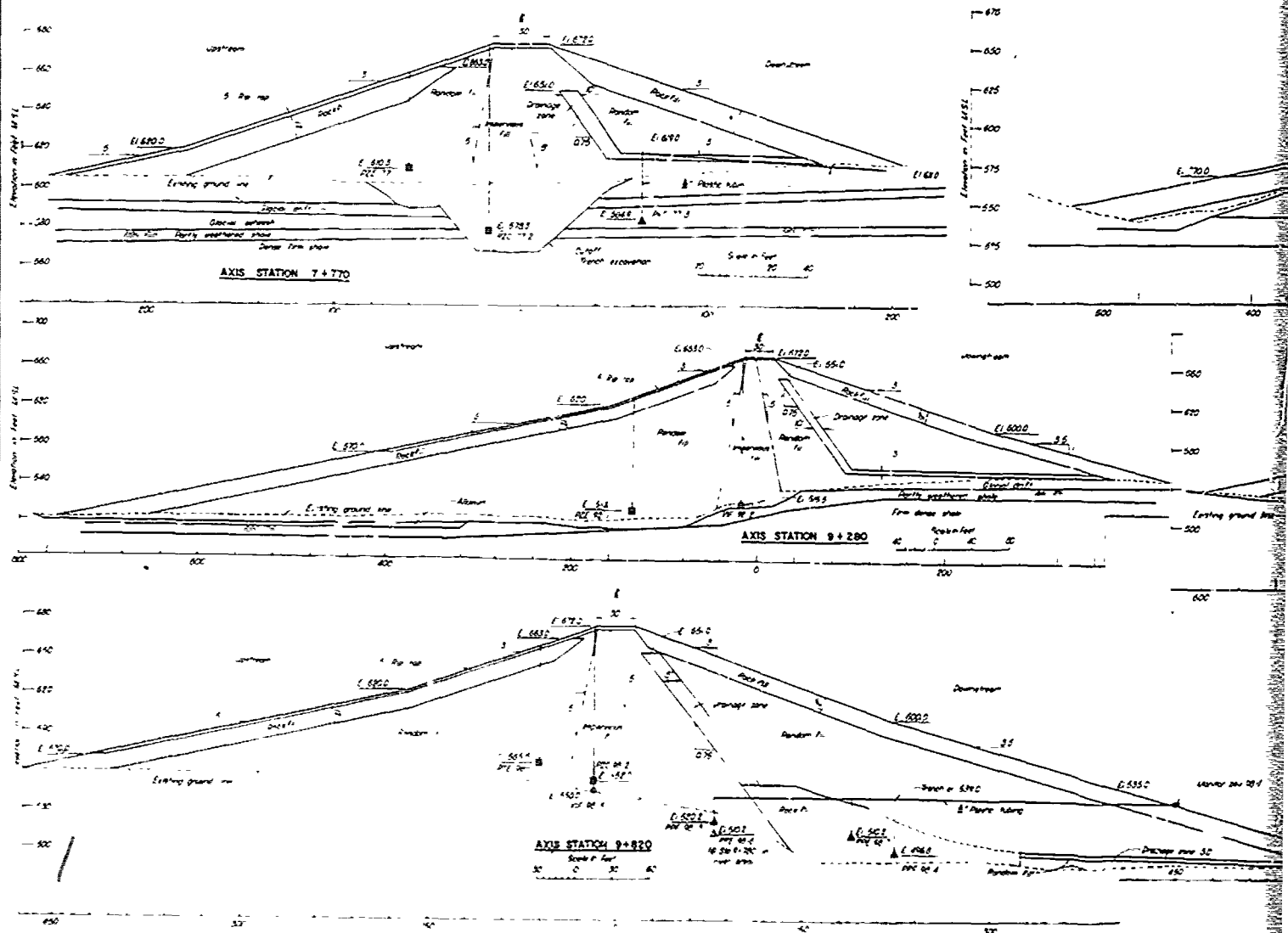
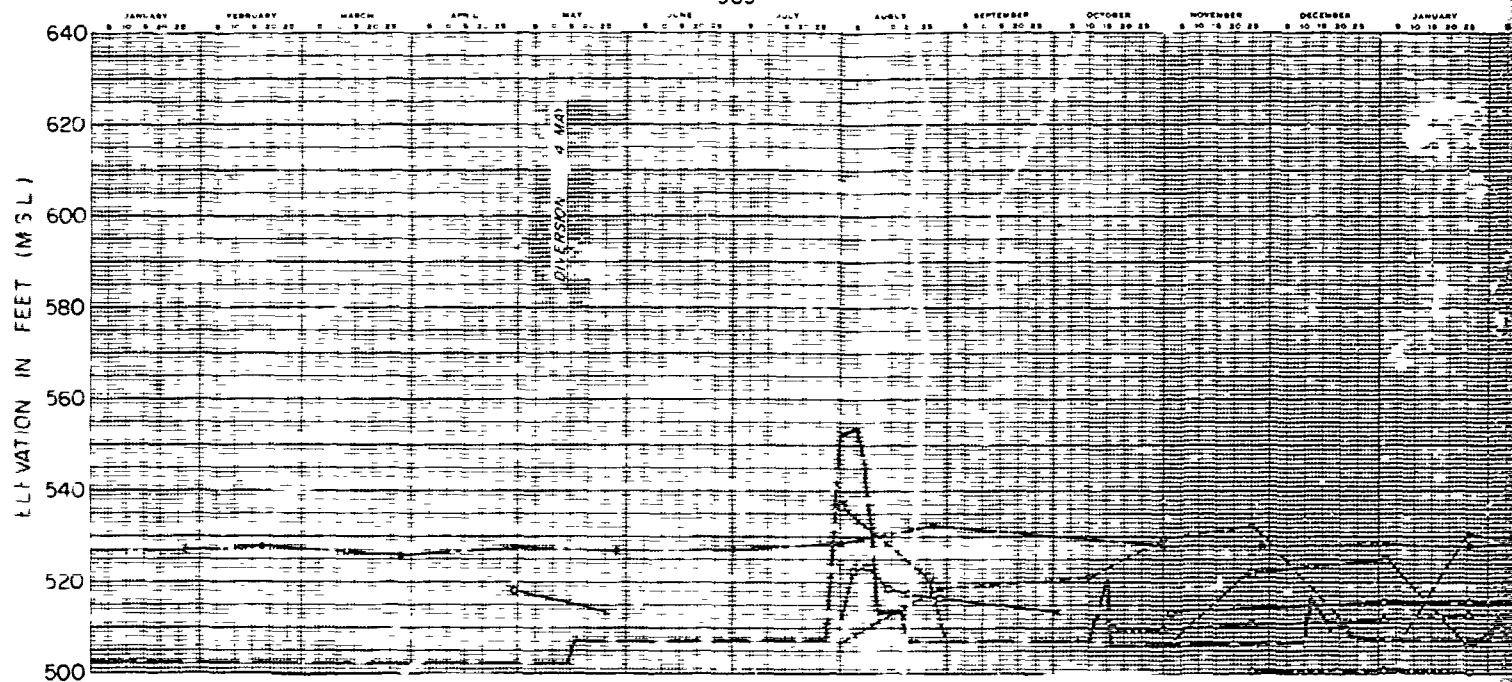
LINE INDICATING DIRECTIONAL MOVEMENT WITH TIME

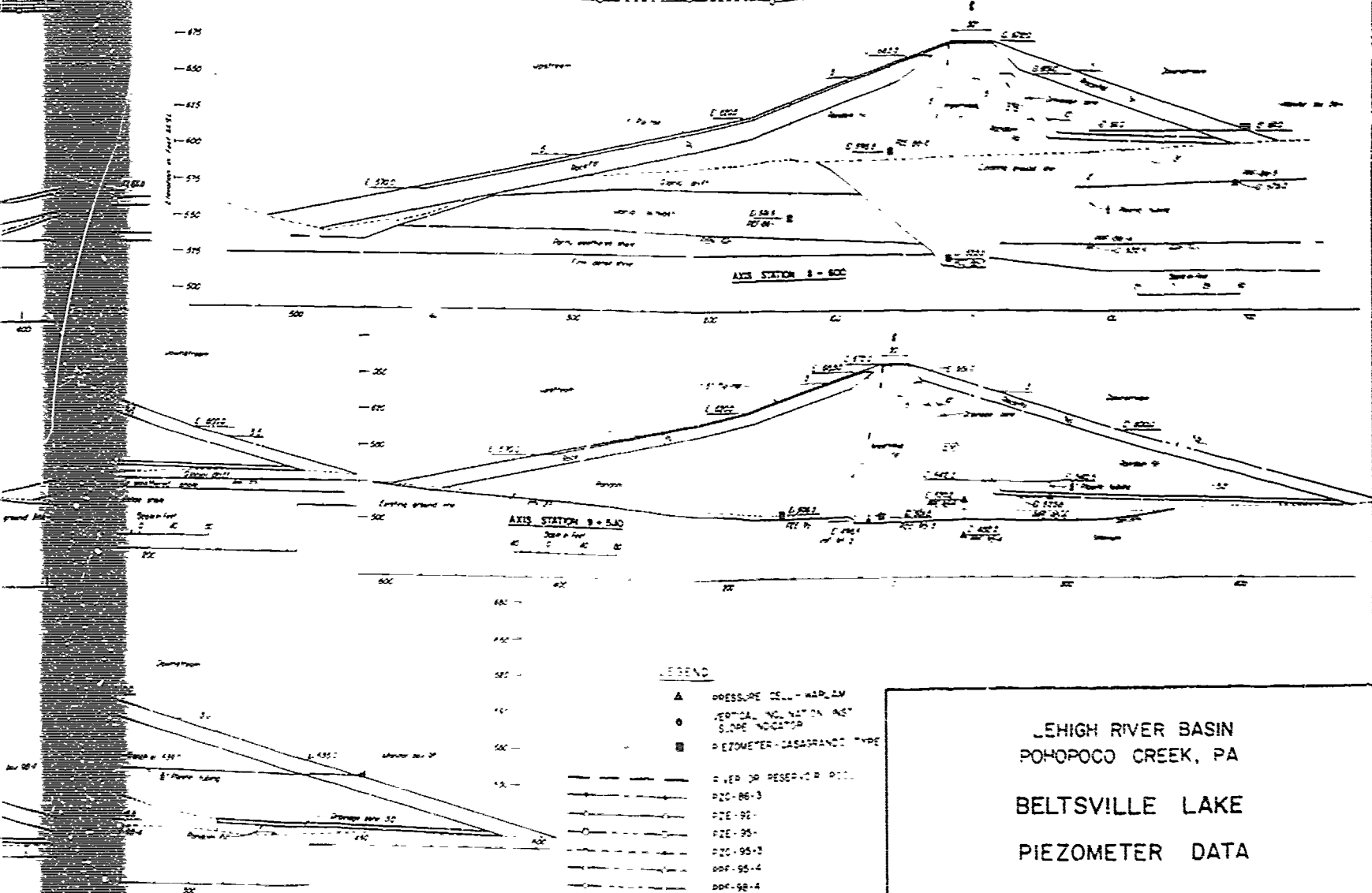
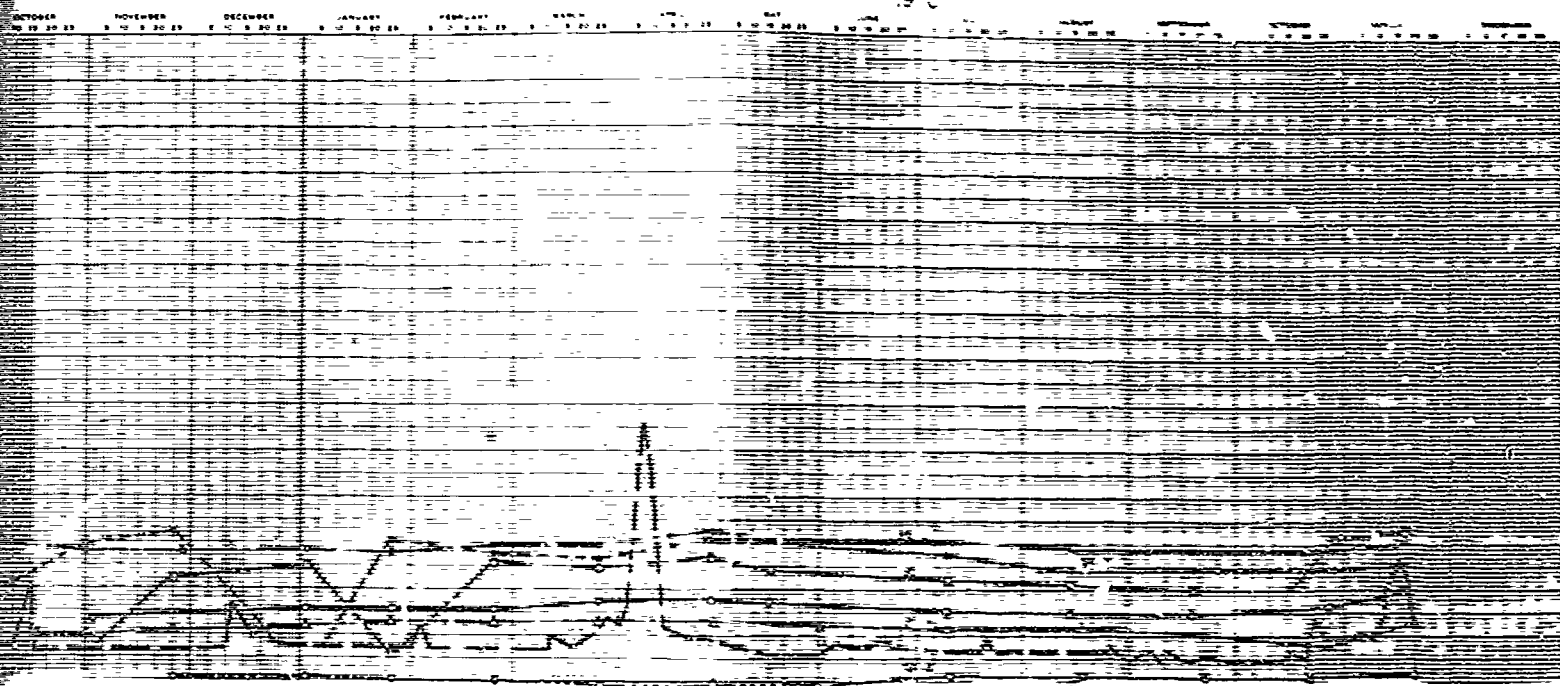
CASING
SECTION
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1/4 INCH VERTICAL DEFLECTION IN EITHERLY
DIRECTION FROM INITIAL POSITION

LEHIGH RIVER BASIN
POHOPOCO CREEK, PA.
BELTZVILLE LAKE
VERTICAL DEFLECTION DATA-E & W
VIF - 98-5

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LEHIGH RIVER BASIN
 POHOPOCO CREEK, PA
 BELTSVILLE LAKE
 PIEZOMETER DATA

CONDITION REPORT

BELTZVILLE LAKE

POHOPOCO CREEK, PENNSYLVANIA

DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO. 1

APPENDIX

CONDITION REPORT

BELTZVILLE LAKE

POHOPOCO CREEK, PENNSYLVANIA

DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO. 1

PHOTOGRAPHS



Photo No. 1 Ponding of water - left abutment and toe of embankment.



Photo No. 2 Attempt to prevent erosion at contact between right abutment and embankment by placing large boulders.

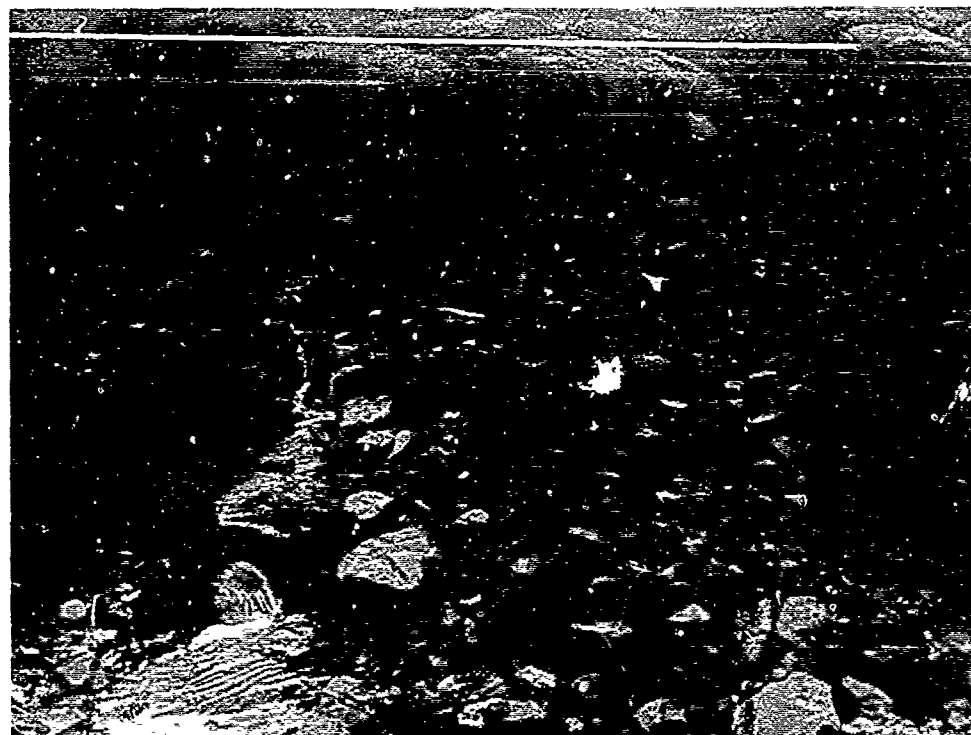


Photo No. 3 Erosion continuing beneath
large boulders.

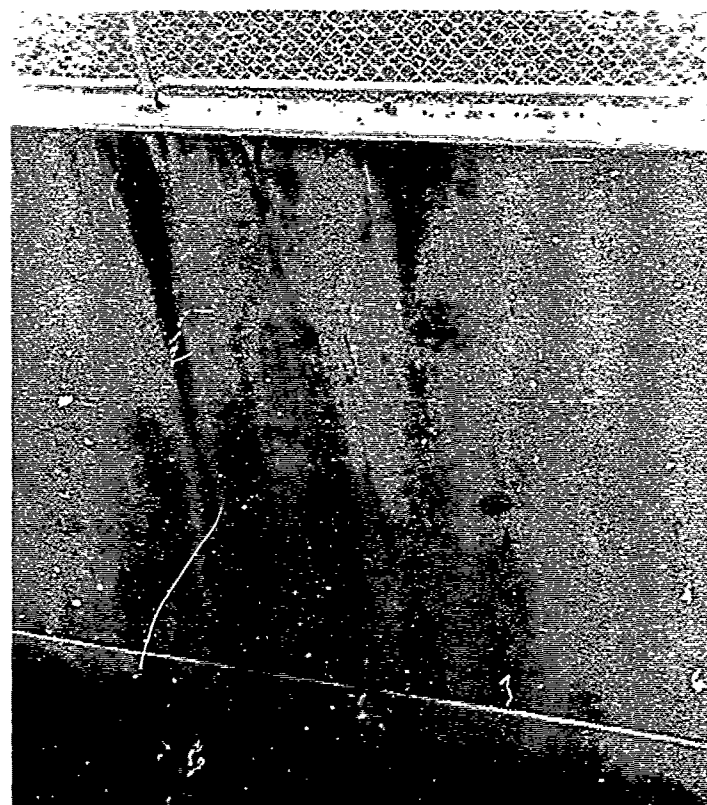


Photo No. 4 Minor crack in left wing wall -
outlet works.

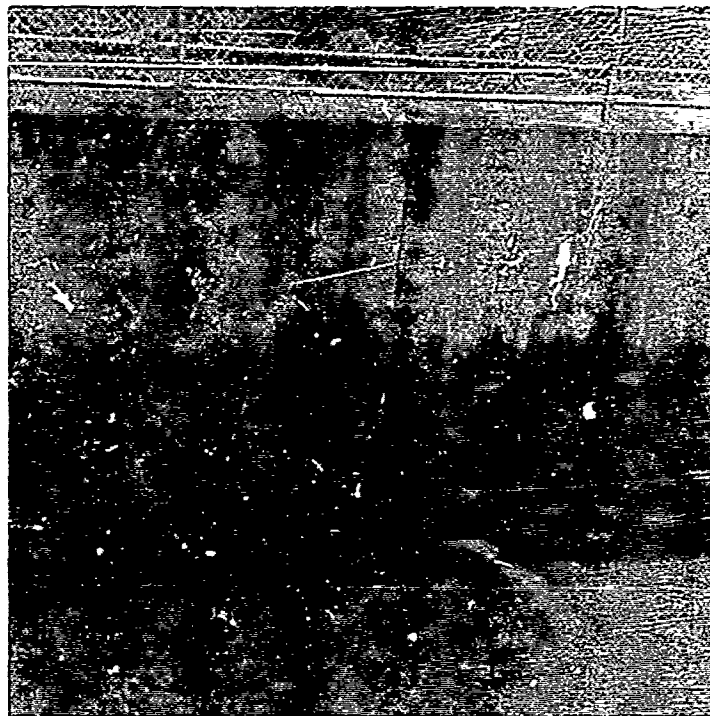


Photo No. 5 Minor joint spall in left wing
wall - outlet works.

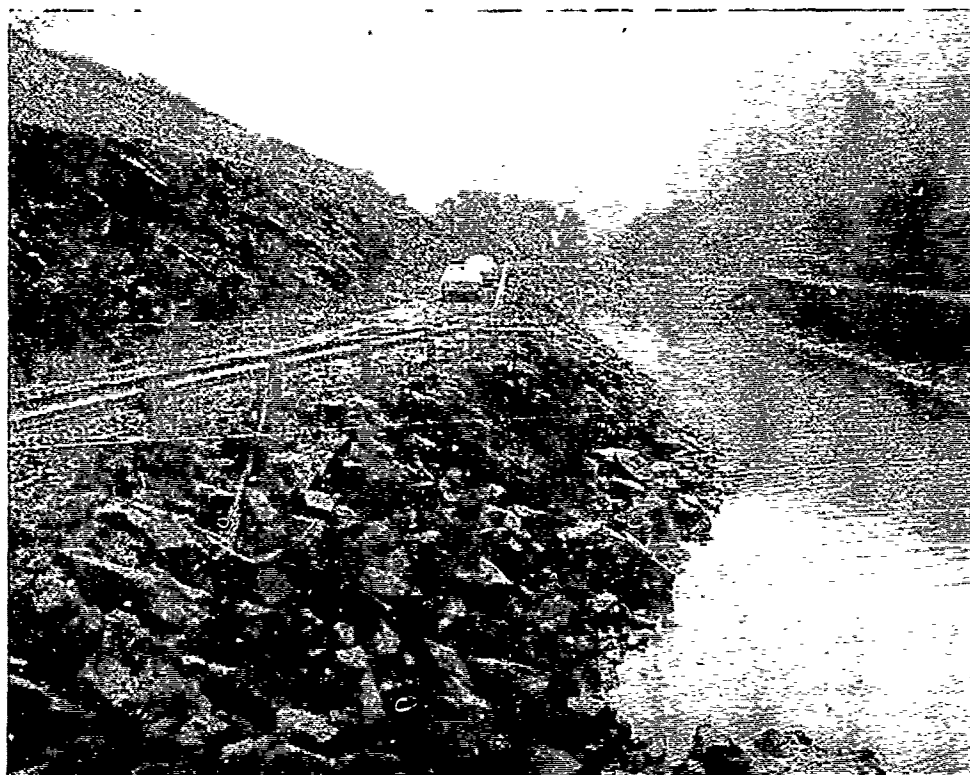


Photo No. 6 Potential undermining of guard
rail downstream of outlet works.

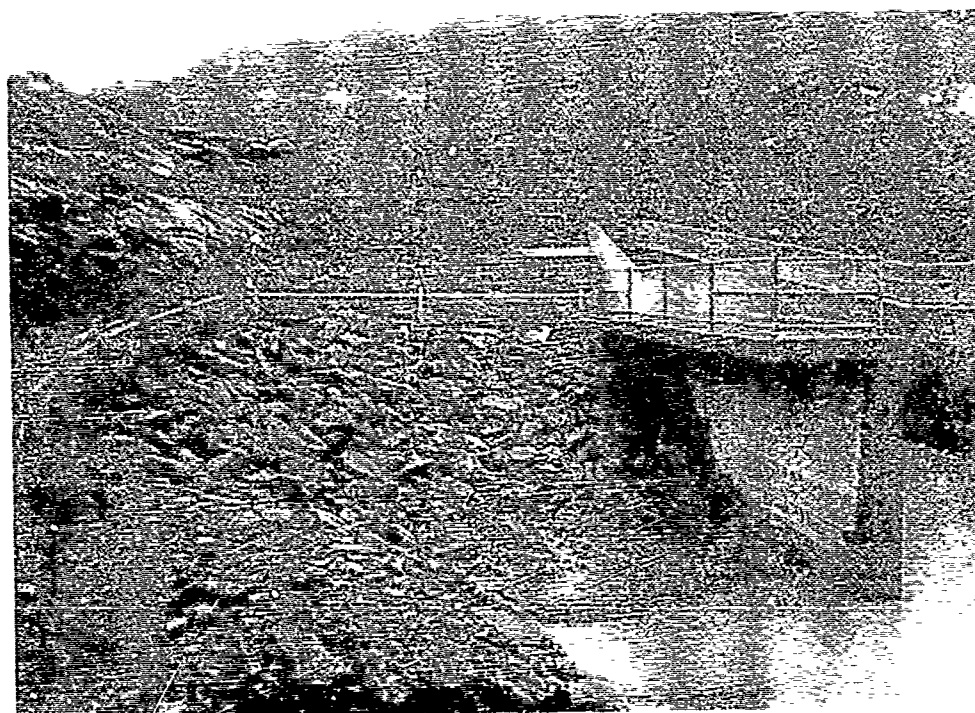


Photo No. 7 General view of right abutment
and outlet works - looking
upstream.



Photo No. 8 Eroding of overburden down to
bedrock - right bank above
outlet works.

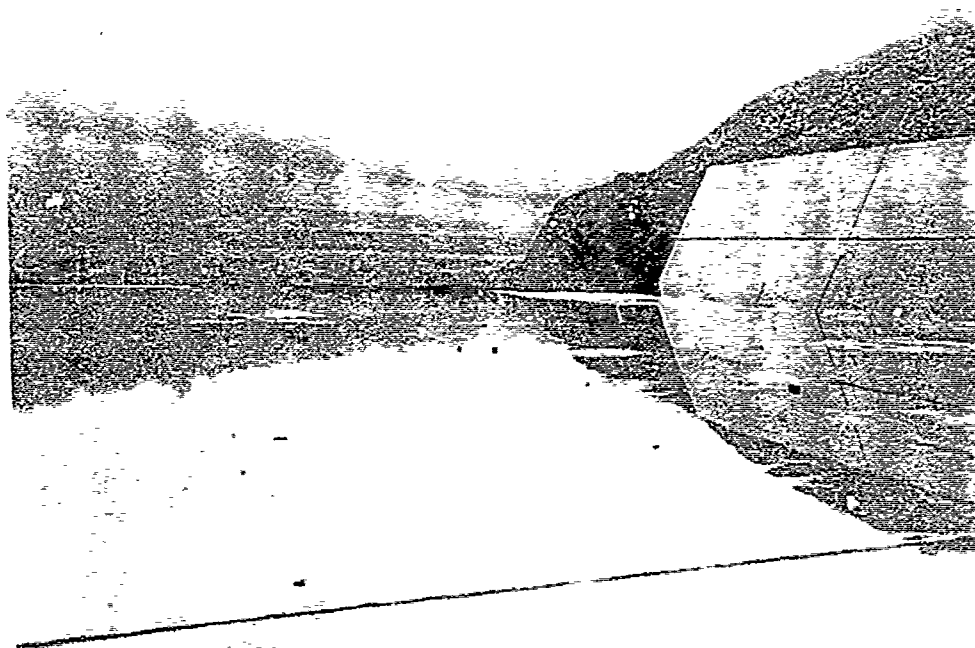


Photo No. 9 Upstream view of ponding -
spillway slab.

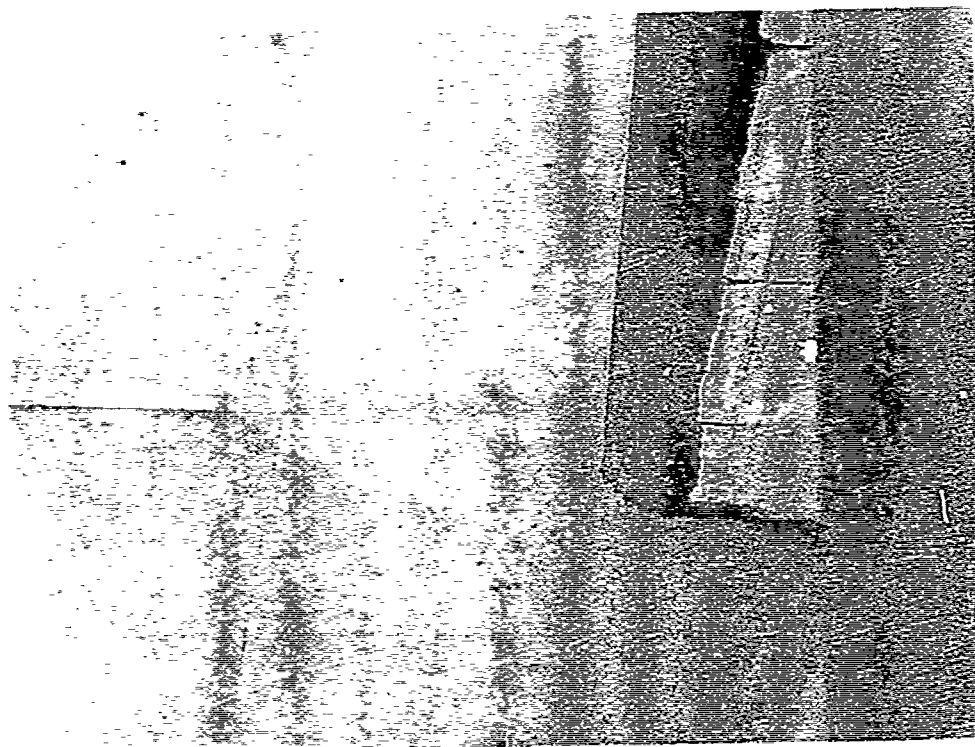


Photo No. 10 Extrusion of joint sealing
compound between spillway
bridge pier and spillway slab.



Photo No. 11 Extrusion of joint sealing
compound between spillway
bridge pier and spillway slab -
closeup view.



Photo No. 12 Cracks in spillway slab.

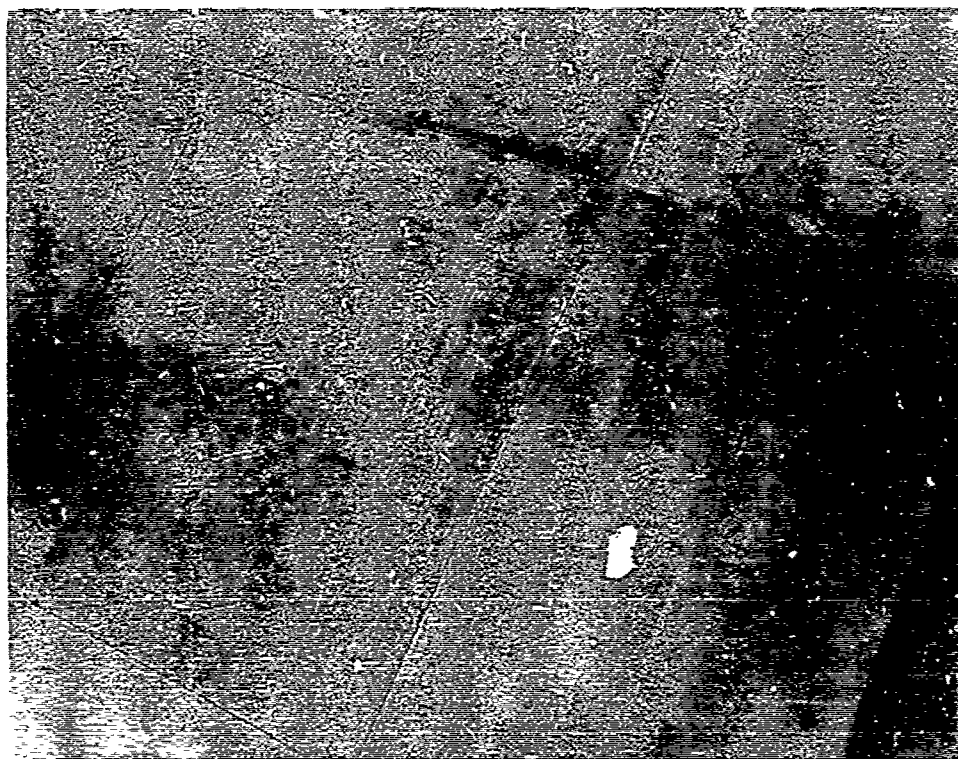


Photo No. 13 Cracks in spillway slab.

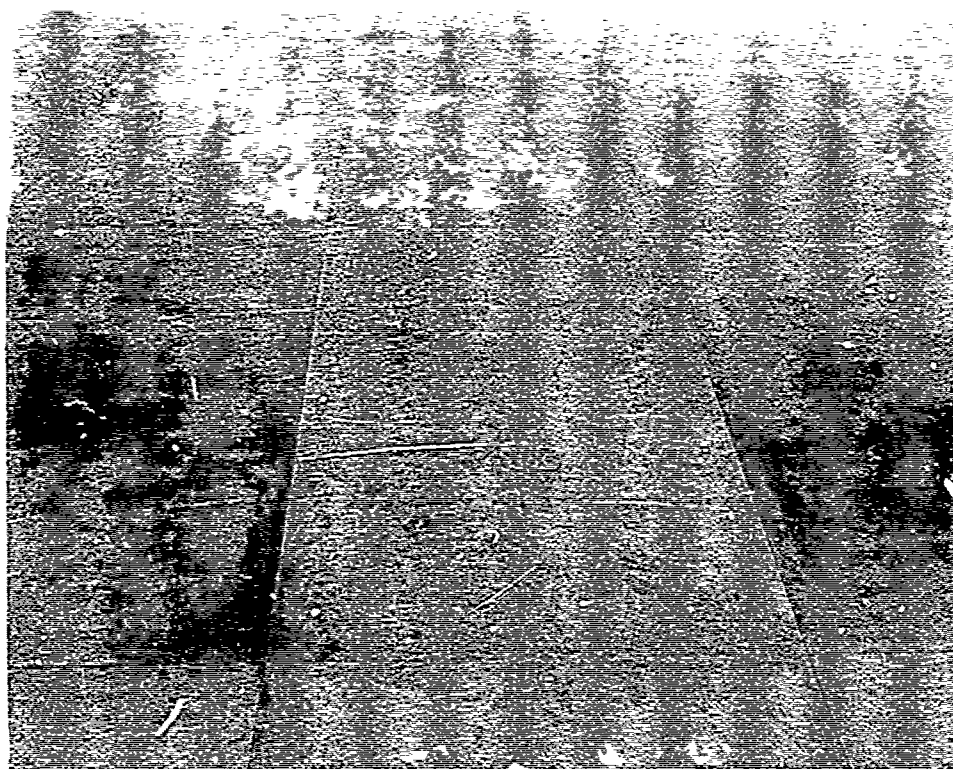


Photo No. 14 Cracks in spillway slab.

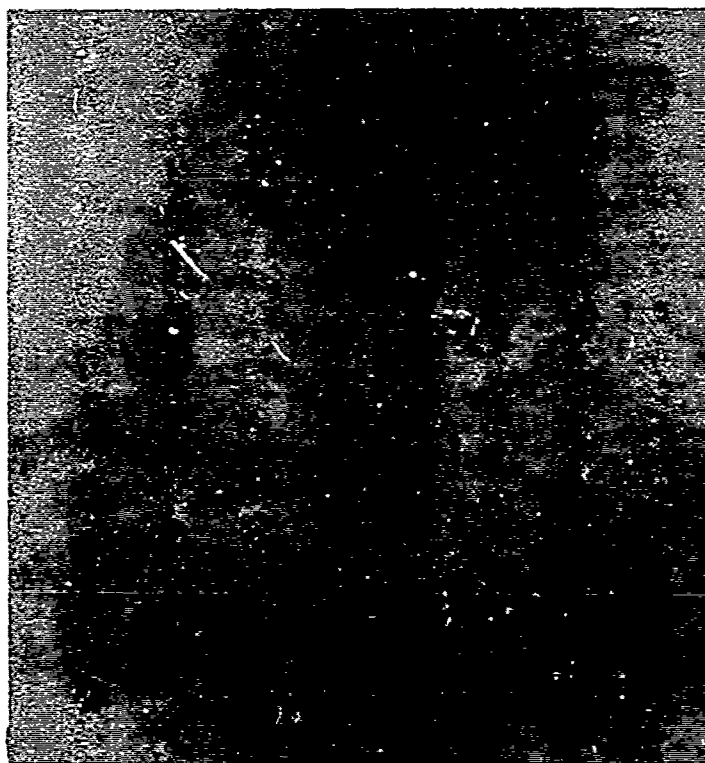


Photo No. 15 Working crack, spillway slab.



Photo No. 16 Working crack, spillway slab.



Photo No. A-1 Minor joint spall at
Sta. 9+44.



Photo No. A-2 Small air void at Sta. 7+76.

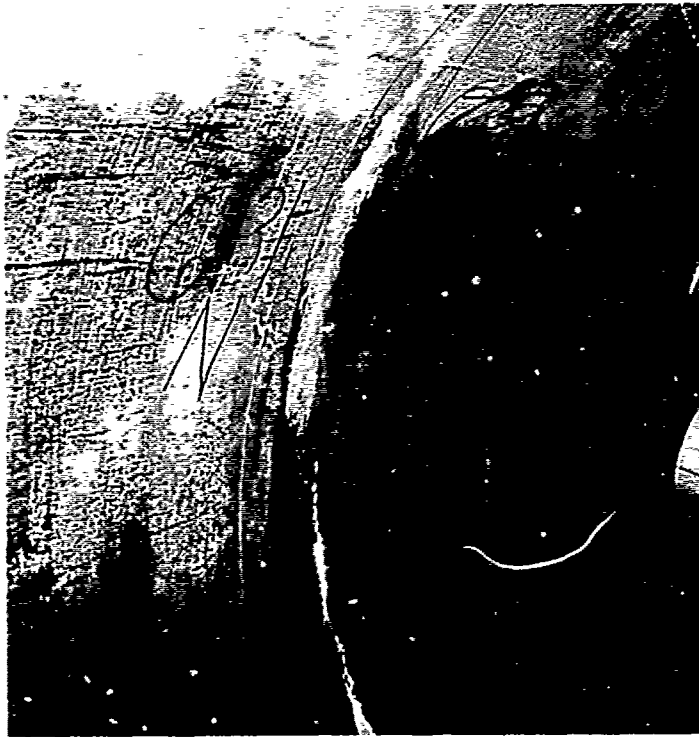


Photo No. A-3 Crack sealed by calcium
deposits at Sta. 6+31.



Photo No. A-4 Crack sealed by calcium
deposits at Sta. 6+25.

Photo No. A-5 (Not included).



Photo No. A-6 Minor joint spall at
Sta. 5+53.

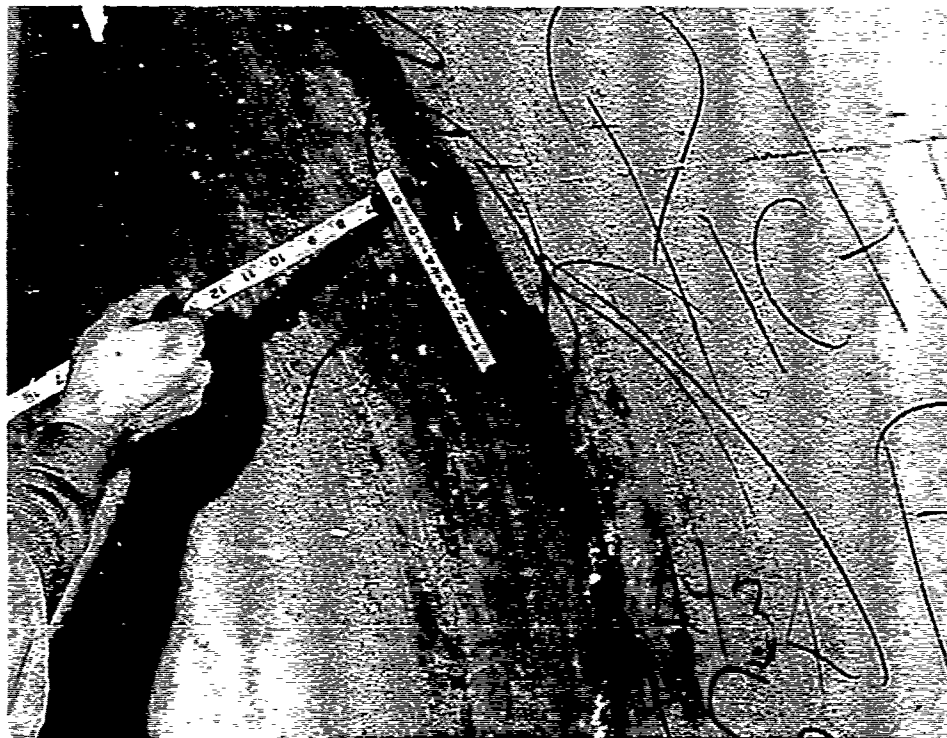


Photo No. A-7 Minor joint spall at
Sta. 4+43.

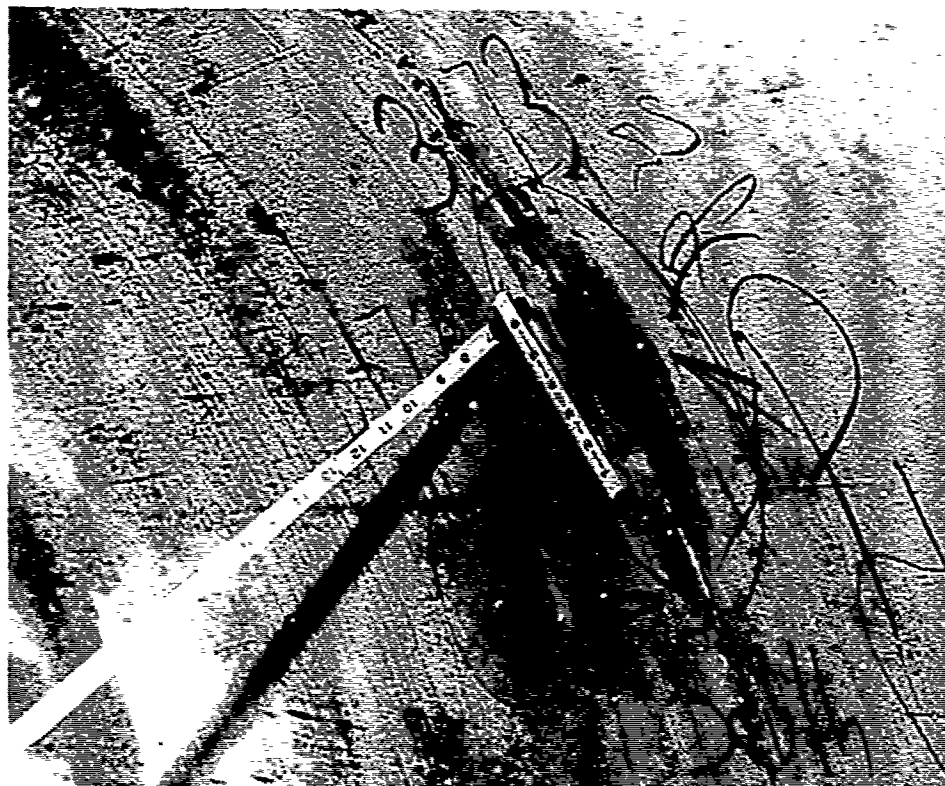


Photo No. A-8 Minor joint spall at
Sta. 3+73.

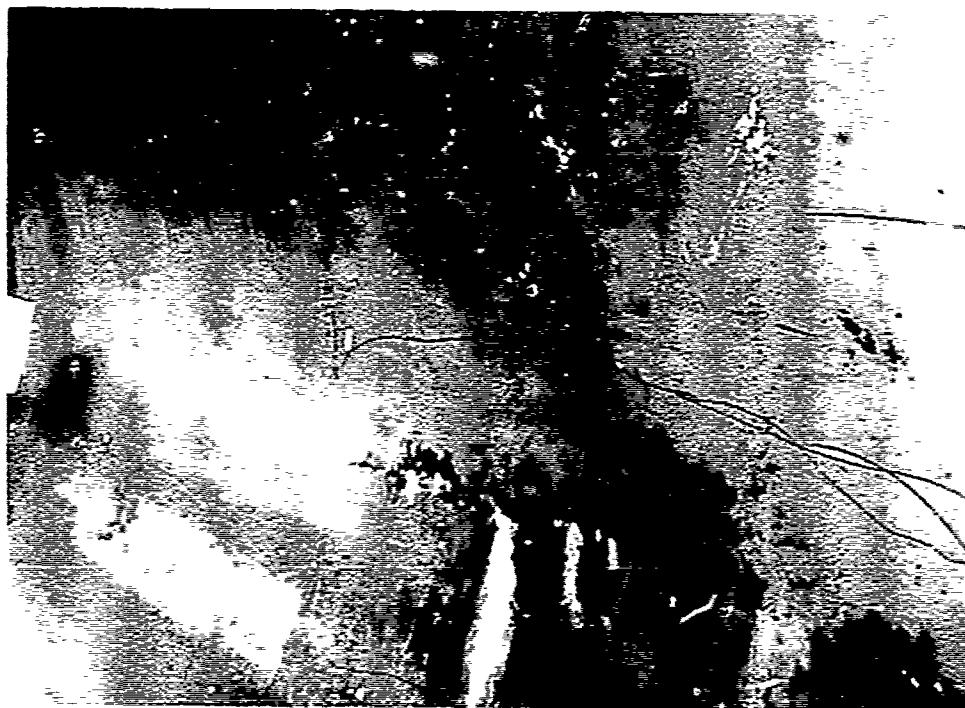


Photo No. A-9 Horizontal crack sealed by
calcium deposits at
Sta. 2+00 to 2+07.



Photo No. A-10 Horizontal crack sealed by
calcium deposits at
Sta. 2+00 to 2+07.



Photo No. A-11 Minor joint spall at
Sta. 1+34.



Photo No. A-12 Minor joint spall at
Sta. 0+94.



Photo No. A-13 Minor crack sealed by calcium
deposits at Sta. 0+84.



Photo No. A-14 Ceiling cracks in South Chamber
sealed by calcium deposits at
Sta. 0+67 to 0+69.



Photo No. A-15 Minor cracks in South Chamber
sealed by calcium deposits at
Sta. 0+39 to 0+43.



Photo No. A-16 Minor crack in South Chamber
with light seepage at
Sta. 0+43.



Photo No. B-1 Peripheral crack in South Chamber at Sta. 0+31. Ceiling completely sealed by calcium deposits.

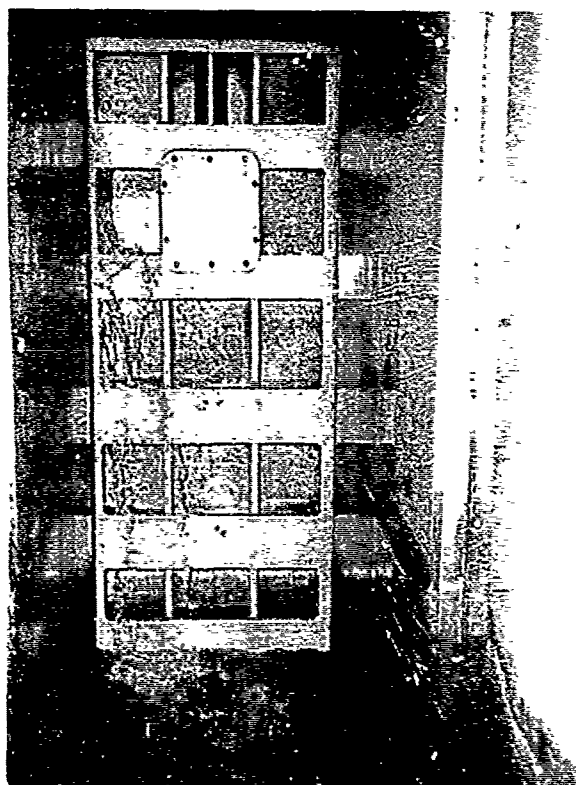


Photo No. B-2 View of gate in South Chamber.



Photo No. B-3 Ceiling crack in North
Chamber at Sta. 0+67 sealed
by calcium deposits.



Photo No. B-4 Ceiling crack in North
Chamber at Sta. 0+58 sealed
by calcium deposits.

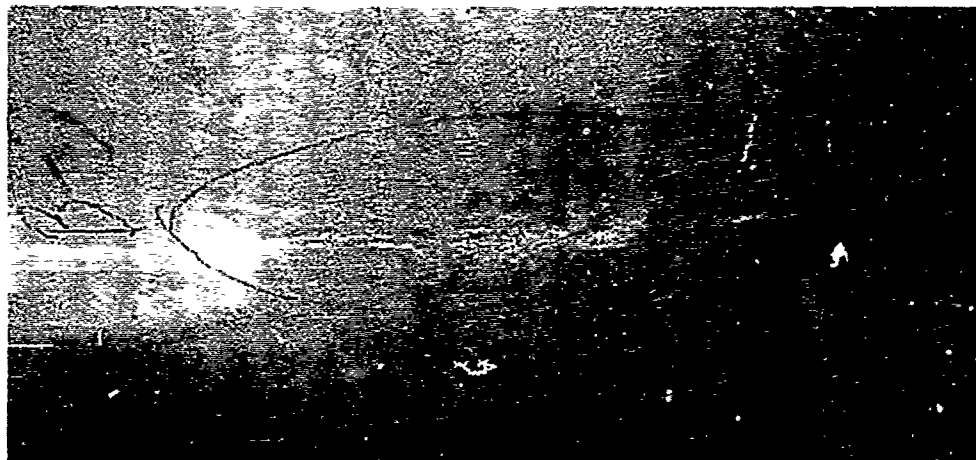


Photo No. B-5 Minor joint spall in wall of
North Chamber at Sta. 0+43.

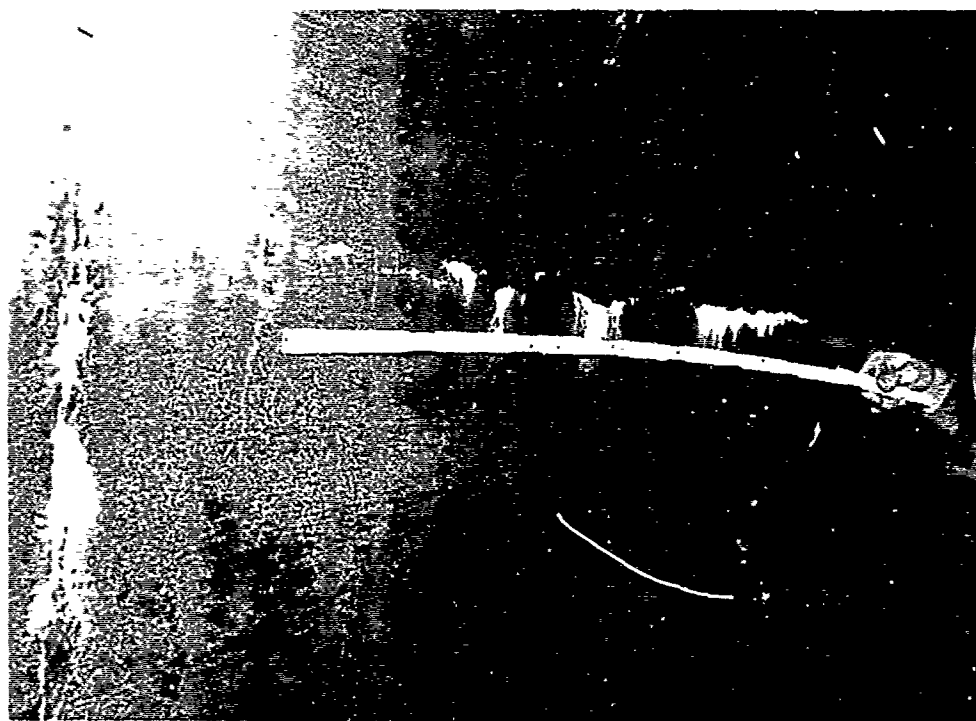


Photo No. B-6 Horizontal crack in North
Chamber between Sta. 0+38 and
0+43 sealed by calcium
deposits.

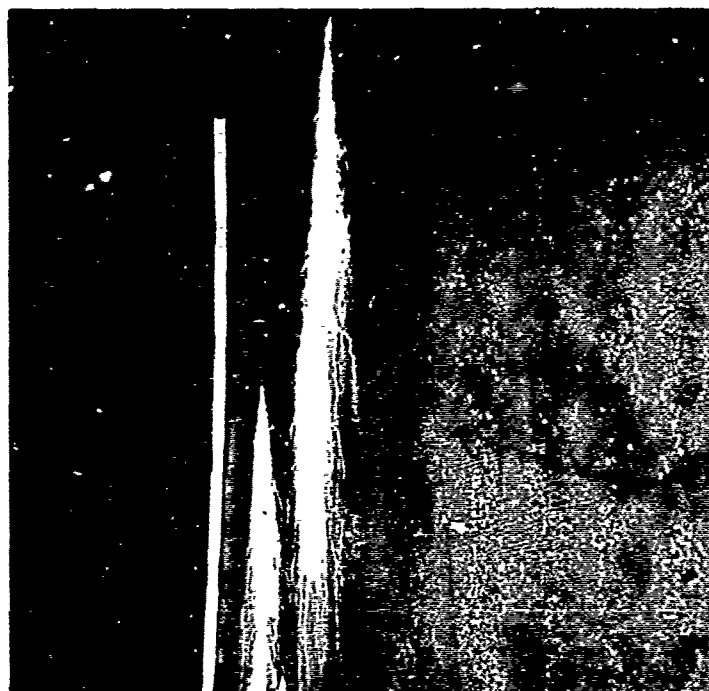


Photo No. B-7 Horizontal crack in North
Chamber at Sta. 0+27 sealed
by calcium deposits.



Photo No. B-8 Vertical cracks in North
Chamber at Sta. 0+27 sealed by
calcium deposits.

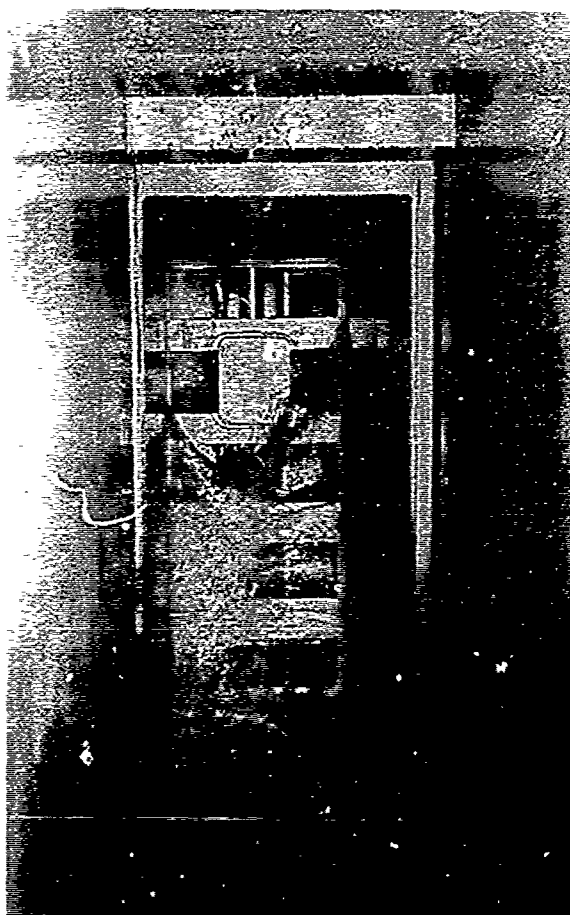


Photo No. B-9 View of gate in North Chamber.

Photo No. B-10 (Not included).



Photo No. B-11 View of Chambers. Note mud
deposit in center chamber
(water quality control outlet).



Photo No. B-12 Air voids zone in south wall
conduit between Sta. 4+47 and
4+50.

C

CONDITION REPORT

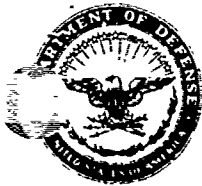
BELTZVILLE LAKE

POHOPOCO CREEK, PENNSYLVANIA

DAM, OUTLET WORKS & SPILLWAY

PERIODIC INSPECTION REPORT NO. 1

CORRESPONDENCE



DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE-2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO

NAPEN-F

5 JUN 1970

SUBJECT: Periodic Inspection of Beltzville Dam and Reservoir

Division Engineer
U. S. Army Engineer Division, North Atlantic
ATTN: NADEN-T
New York, New York 10007

1. Reference is made to the following:

a. ER 1110-2-100, Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures.

b. DM No. 17, Instrumentation, Beltzville Dam and Reservoir, 27 April 1970.

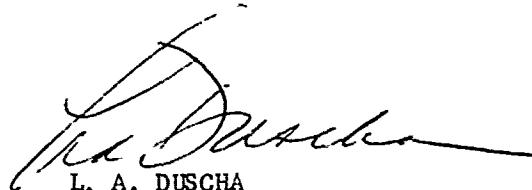
2. Reference 1a requires the establishment of a schedule for the Periodic Inspection of Completed Civil Works Structures. The Instrumentation DM, reference 1b, sent to NAD 27 April 1970 establishes a schedule of inspections for Beltzville Dam and recommends July 1970 for the first of the periodic inspections.

Based on informal discussion with NAD personnel, a convenient date for the first inspection appears to be Wednesday, 22 July 1970.

Please advise of the suitability of this date for NAD and OCE personnel, furnish names of representatives who will attend and hotel accommodations desired. It is anticipated that the inspection party will depart Philadelphia District Office in the morning and return to Philadelphia in the evening after the inspection.

It is planned to use the Instrumentation DM as a pre-inspection brochure.

FOR THE DISTRICT ENGINEER:


L. A. DUSCHA
Chief, Engineering Division

67-1-2

NADEN-T (5 June 1970) 1st Ind.
SUBJECT: Periodic Inspection of Beltzville Dam and Reservoir

DA, North Atlantic Division, Corps of Engineers, 90 Church Street,
New York, N.Y. 10007 10 June 1970

TO: Chief of Engineers, ATTN: ENGCV-E

1. Proposed date for inspection is satisfactory to this office.
2. In order to complete the inspection in one day it is considered desirable for NAD and OCE representatives to secure hotel reservations for the night of 21 July 1970 to facilitate an early start on 22 July 1970.
3. Names of representatives from your office are requested.
4. Division representation will be named on return of correspondence to District.

FOR THE DIVISION ENGINEER:



CF:
DE Philadelphia, ATTN: NAPEN-F

M. SCHECHET
Acting Chief, Engineering Division

ENGW-EZ (NAPEN-F, 5 Jun 70) 2d Ind
SUBJECT: Periodic Inspection of Beltzville Dam and Reservoir

DA, Office of the Chief of Engineers, Washington, D.C. 20314 18 June 1970

TO: Division Engineer, North Atlantic, ATTN: NADEN-T

1. Mr. Ralph R. W. Beene, Soils Branch, will represent OCE at the proposed periodic inspection of Beltzville Dam.
2. One, late arrival, single room, overnight lodging beginning the night of 21 July 1970 is required and confirmation to OCE is requested.
3. A completed DA Form 2544 should be submitted to OCE as soon as possible.

FOR THE CHIEF OF ENGINEERS:

W. E. Johnson
WENDELL E. JOHNSON
Chief, Engineering Division
Civil Works

NADEN-T (5 June 1970) 3rd Ind.
SUBJECT: Periodic Inspection of Beltzville Dam and Reservoir

DA, North Atlantic Division, Corps of Engineers, 90 Church Street,
New York, N.Y. 10007 24 June 1970

TO: District Engineer, Philadelphia ATTN: NAPEN-F

1. Messrs. M.A. Sylvester, E.A. Alcott and T.H. Riddle will represent NAD at the proposed periodic inspection of Beltzville Dam.
2. Single room reservation for the night of 21 July 1970 is required for Mr. Riddle. Mr. Alcott will meet the inspection party at the hotel for departure to the site at 0800 hours 22 July 1970. Mr. Sylvester will drive directly to the site on 22 July 1970.

FOR THE DIVISION ENGINEER:

CF: OCE-ENG CW-EZ

M. Schechet

M. SCHECHET
Acting Chief, Engineering Division

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

INCE OR OFFICE SYMBOL

NAPEN-F

SUBJECT

First Periodic Inspection and Continuing
Evaluation of Completed Civil Works Structures,
22 July 1970

TO Chief, F & M Branch

FROM

E. P. Hartzell
Chief, Mtrls & Sty Section

DATE

21 Aug 70

CMT 1

HARTZELL/ram/4846

1. Reference is made to the following:

a. ER 1110-2-100, dated 15 November 68, subject as above. The regulation sets policy and determines the scope and frequency of the inspections.

b. DM #17, Instrumentation, dated 27 April 70. The DM contains the checklist for the inspection and was used as a pre-inspection brochure.

c. Letter, NAPEN-F, "Periodic Inspection of Beltzville Dam and Reservoir", dated 5 June 70, with Indorsements, set up inspection date and names of personnel attending from higher authority.

2. On 22 July 70 the first periodic inspection was held for the Beltzville Dam and Reservoir. Attending the inspection were the following:

R. Beene	OCE - Soils Branch
A. Iarrobino	NAD - Engineering Division
T. Riddle	NAD - Engineering Division
M. Sylvester	NAD - Operations Division
E. Dodson	NAP - Engineering Division
J. Lewis	NAP - Engineering Division
W. Hampton	NAP - Engineering Division
J. Kane	NAP - Engineering Division
P. Hartzell	NAP - Engineering Division
G. Stout	NAP - Operations Division
R. Greene	NAP - Operations Division

At the Site:

B. Schwartz	Resident Engineer
J. Borchik	Dam Tender

3. On arrival at the site a short briefing was held covering the pertinent features of design and construction. Following the briefing the inspection party proceeded to the outlet works for a walk-thru the conduit then a thorough inspection of the embankment, tower and spillway.

4. Following the inspection a critique was held. The discussion followed, point by point, the checklist for the inspection which was furnished in the Instrumentation,

DA FORM 2496
1 FEB 62

REPLACES DD FORM 96, EXISTING SUPPLIES OF WHICH WILL BE
ISSUED AND USED UNTIL 1 FEB 63 UNLESS SOONER EXHAUSTED.

GPO : 1962 O - 322-400

NAPEN-F

SUBJECT: First Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures, 22 July 1970

DM #17, (reference 1b). At the end of the critique all the comments made by the various members of the inspection party were recorded and are summarized below:

a. Embankment.

(1) Surface cracks: None.

(2) Abutment and embankment junctions: Erosion noted along contact of embankment with the right abutment. Some large boulders were placed by the contractor to reduce erosion but were not successful and erosion is continuing. Engineering Division will design a drainage system to correct this problem.

(3) Vertical and horizontal alignment: No problem noted.

(4) Unusual movement or cracking at or beyond toe: None.

(5) Unusual thru embankment or downstream seepage: None.

(6) Sloughing or erosion of embankment and abutment slopes: The resistance of the material on the downstream slope to weathering with subsequent sloughing and eventual clogging of the horizontal drainage blanket with migrating fines was questioned. A close watch will be made of the slope for sloughing, and the piezometers for any build-up in pressure that might indicate possible ineffectiveness of the horizontal drain.

(7) Movement of structural features in embankment: None.

(8) Rip rap failure (major displacement): None.

b. Outlet Works. Conduit, Tower and Stilling Basin

(1) Concrete surfaces: One hairline crack appears in the outlet works wall near the end of the conduit.

(2) Structural details of bridge decks, roadways, walls, floors, bridge piers and tower: No deficiencies noted.

(3) Structural cracking: None.

(4) Joints and joint material: No deficiencies noted.

(5) Water passages including drains: Some minor cracking was noted in the transition zone of the conduit and, although leakage was noted following completion

NAPEN-F

SUBJECT: First Periodic Inspection and Continuing Evaluation of Completed Civil Works Structures, 22 July 1970

of construction, they are now sealed with calcium deposits. Also, some minor cracking noted at crown of conduit near centerline of dam.

(6) Leakage at joints and cracks: See (5), page 2.

(7) Condition of weepholes and other drainage systems: No problem noted.

(8) Bridge movement: None noted.

c. Spillway.

(1) Concrete surface: Surface of spillway slab is rough with poor finish, has appearance of over-sanded mix or coarse grout covering. Many hairline cracks appear in surface of slabs. One working crack will progressively become worse after several freeze-thaw cycles and should be sealed.

(2) Structural details of apron and gravity walls: Gravity walls show surface texture similar to finish of the apron slabs. No structural defects noted.

(3) Joint displacement and joint material: Extrusion of pre-moulded joint filler was noted between the right spillway bridge pier at contact with the spillway slab.

(4) Weepholes and drainage system: Many of the weepholes in the spillway slab were clogged with dirt and require cleaning. A special cylinder or sleeve with screens on both ends will be designed to be inserted in the slab weepholes. Drainage fill will be prevented from getting out and animals and debris will be kept from getting in and clogging the hole.

(5) Bridge movement: None noted.

5. Conclusions and Recommendations:

Surveys, mapping of cracks and deficiencies, along with verifying photographs, have been initiated and the results will be included in the final report to higher authority. Remedial work, where necessary, will be completed in FY 72.



E. P. HARTZELL

Chief, Materials & Special Studies Section
Foundations & Materials Branch

DISPOSITION FORM

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

AGENCY OR OFFICE SYMBOL ENGW-ES		SUBJECT Trip Report - Periodic Inspection of Beltzville Dam, Pa.			
TO	1. Actg C/Engr Div, CW 2. Asst Dir/CW for Atlantic Divs 3. Exec Dir/CW 4. Dir/CW	FROM Soil Mech Br	DATE 26 Aug 70 BEENE/36824/mh CMT 1		
1. SUMMARY: The first periodic inspection of Beltzville Dam, with no water in the reservoir, showed that the embankment is in excellent condition. The next inspection will be held in July 1971, after the conservation pool has been filled. 2. PLACE AND DATE: Beltzville Dam, Pohopoco Creek, near Lehighton, Pa., 22 July 1970. 3. PURPOSE: First Periodic Inspection under the provisions of ER 1110-2-100. 4. ATTENDANCE: <table><tr><td><u>OCE</u> Ralph R.W. Beene <u>NAD</u> A. V. Iarrobino Todd Riddle M. Sylvester <u>Res. Office</u> B. W. Swartz</td><td><u>Philadelphia District</u> E. I. Dodson A. Depman J. Kane E. P. Hartzell J. Lewis W. Hampton Robert Green G. Stout</td></tr></table> 5. NARRATIVE: a. The Beltzville project includes an earth dam with a maximum height of 170 feet and a length of 4,560 feet, an ungated, paved spillway with a crest length of 275 feet, and a seven-foot diameter outlet conduit. The structures were essentially completed in December 1969. Deliberate impoundment is planned for February 1971 and it is anticipated that the reservoir will reach conservation pool level in May 1971. No water is impounded at present, but in August 1969 and April 1970, the reservoir temporarily reached elevations 553 and 555 respectively as a result of heavy rainstorms,				<u>OCE</u> Ralph R.W. Beene <u>NAD</u> A. V. Iarrobino Todd Riddle M. Sylvester <u>Res. Office</u> B. W. Swartz	<u>Philadelphia District</u> E. I. Dodson A. Depman J. Kane E. P. Hartzell J. Lewis W. Hampton Robert Green G. Stout
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b. The appearance of the structures is excellent. There is no evidence of unusual deformation or pore pressures. Instrumentation in the embankment and foundation includes slope indicators, tubes, piezometers and surface reference points. The 18-inch thick riprap layer on the upstream slope of the embankment has been well-placed and appears to be suitably sound rock. A few small trees are growing in the rock. The downstream face of the dam consists of shale fill taken from excavation for the spillway cut. The shale broke down more than anticipated and may be less pervious than planned, which might block seepage emerging from the sand drainage blanket. This can be observed by measuring the pressure in piezometers which are in the drainage blanket. Under the influence of repeated heavy rainfall, the downstream slope may develop gullies, requiring future maintenance.

c. A number of large hard shale boulders have been piled in the surface drain at the downstream toe of the dam where the terrace begins. This was intended to stop erosion of the toe, but is not effective, because of the large voids in the mass.

d. The left abutment was inspected to see if there are any springs existing prior to filling of the reservoir. None were found.

6. RECOMMENDATIONS:

- a. The trees growing in the riprap should be removed.
- b. The piezometers in the drainage blanket should be observed closely after impoundment of the reservoir has begun to determine if the blanket is blocked by the rockfill on the downstream slope.
- c. The Philadelphia District plans to have the next periodic inspection in July 1971. This will be two months after the anticipated time of attainment of conservation pool level, and should be a good time to examine the dam and abutments for seepage.

RALPH R. W. BEENE

CF: NAD
Philadelphia District

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