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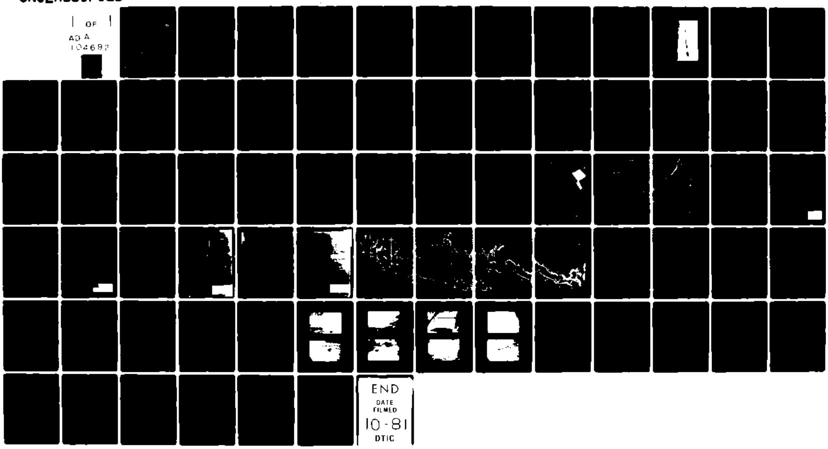

LEVEL II

MISSOURI - KANSAS CITY BASIN

LAKE POST COMMONS DAM

ST. LOUIS COUNTY, MISSOURI

MO 11278

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

OCTOBER 1980

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A104692	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Lake Post Commons Dam (MO 11278) St. Louis County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report.
		6. ~~PERFORMING ORG.~~ REPORT NUMBER
7. AUTHOR(s) Horner & Shifrin, Inc.		8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0063
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		12. REPORT DATE October 1980
		13. NUMBER OF PAGES Approximately 50
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) National Dam Safety Program. Lake Post Commons Dam (MO 11278), Missouri - Kansas City Basin, St. Louis County, Missouri. Phase I Inspection Report.		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION

Approved for release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

DTIC ELECTE SEP 2 1981

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

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

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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MISSOURI - KANSAS CITY BASIN

LAKE POST COMMONS DAM

ST. LOUIS COUNTY, MISSOURI

MO 11278

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

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PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

OCTOBER 1980

DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO
ATTENTION OF

LMSED-P

SUBJECT: Lake Post Commons Dam, MO 11278, Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Lake Post Commons Dam (MO 11278):

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood without overtopping the dam.

2) Overtopping of the dam could result in failure of the dam.

3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED — 30 OCT 1980
Chief, Engineering Division — Date

APPROVED BY: SIGNED — 30 OCT 1980
Colonel, CE, District Engineer — Date

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LAKE POST COMMONS DAM

MISSOURI INVENTORY NO. 11278

ST. LOUIS COUNTY, MISSOURI

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

PREPARED BY:

HORNER & SHIFRIN, INC.
5200 OAKLAND AVENUE
ST. LOUIS, MISSOURI 63110

FOR:

U. S. ARMY ENGINEER DISTRICT, ST. LOUIS
CORPS OF ENGINEERS

OCTOBER 1980

HS-8011

PHASE I REPORT

NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Lake Post Commons Dam
State Located:	Missouri
County Located:	St. Louis
Stream:	Unnamed Tributary of Bonhomme Creek
Date of Inspection:	10 July 1980

The Lake Post Commons Dam was visually inspected by engineering personnel of Horner & Shifrin, Inc., Consulting Engineers, St. Louis, Missouri. The purpose of this inspection was to assess the general condition of the dam with respect to safety and, based upon this inspection and available data, determine if the dam poses a hazard to human life or property.

The following summarizes the findings of the visual inspection and the results of certain hydrologic/hydraulic investigations performed under the direction of the inspection team. Based on the visual inspection and the results of the hydrologic/hydraulic investigations, the present general condition of the dam is considered to be satisfactory. However, the following deficiencies were noticed during the inspection and are considered to have an adverse effect on the overall safety and future operation of the dam:

1. Erosion has created several gullies up to about 3 feet in depth in the downstream face of the dam below the lower berm adjacent to the spillway discharge structure. Loss of embankment material by erosion can be detrimental to the stability of the dam.

2. Several small trees exist at the waterline on the upstream face of the dam. A few patches of brushy undergrowth were also found on the downstream slope. Tree roots can provide passageways for lake seepage which could lead to a piping condition (progressive internal erosion) resulting in failure of the dam. Brushy undergrowth may conceal animal burrows which could also provide passageways for lake seepage.

According to the criteria set forth in the recommended guidelines, the magnitude of the spillway design flood for the Lake Post Commons Dam, which is classified as intermediate in size and of high hazard potential, is specified to be the Probable Maximum Flood (PMF). The Probable Maximum Flood (PMF) is the flood that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region.

Results of a hydrologic/hydraulic analysis indicated that the spillway is inadequate to pass lake outflow resulting from a storm of PMF magnitude without overtopping the dam. The spillway is capable of passing lake outflow resulting from the one percent probability (100-year frequency) flood and the outflow corresponding to about 35 percent of the PMF. According to the St. Louis District, Corps of Engineers, the length of the downstream damage zone, should failure of the dam occur, is estimated to be two miles. Accordingly, within the possible damage zone are three dwellings, several buildings, a concrete ready-mix plant and a facility for bulk storage of gasoline and oil.

A review of available data did not disclose that seepage or stability analyses of this dam were performed. This is considered a deficiency and should be rectified.

It is recommended that the Owner take the necessary action within a reasonable time to correct or control the deficiencies and safety defects reported herein. The provision of additional spillway capacity should be pursued on a high priority basis.

Ralph E. Sauthoff
Ralph E. Sauthoff
P. E. Missouri E-19090

Albert B. Becker, Jr.
Albert B. Becker, Jr.
P. E. Missouri E-9168

OVERVIEW LAKE POST COMMONS DAM

PHASE 1 INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

LAKE POST COMMONS DAM - MO 11278

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** Prepared by Reitz & Jens, Inc., 1974.

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APPENDIX B - HYDROLOGIC AND HYDRAULIC ANALYSES

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

LAKE POST COMMONS DAM - MO 11278

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

a. Authority. The National Dam Inspection Act, Public Law 92-367, dated 8 August 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, directed that a safety inspection of the Lake Post Commons Dam be made.

b. Purpose of Inspection. The purpose of this visual inspection was to make an assessment of the general condition of the dam with respect to safety and, based upon available data and this inspection, determine if the dam poses a hazard to human life or property.

c. Evaluation Criteria. This evaluation was performed in accordance with the "Phase I" investigation procedures as prescribed in "Recommended Guidelines for Safety Inspection of Dams", Appendix D to "Report to the Chief of Engineers on the National Program of Inspection of Non-Federal Dams", dated May 1975.

1.2 DESCRIPTION OF PROJECT

a. Description of Dam and Appurtenances. The Lake Post Commons Dam is an earthfill type embankment rising approximately 40 feet above the natural streambed at the downstream toe of the barrier. The embankment has an upstream slope above the waterline of approximately 1v on 2.5h, a crest width of about 17 feet, and a downstream slope that varies from 1v on 2.8h to 1v on 2.1h. There are two berms in the downstream face of the dam; the upper berm is approximately 8 feet wide and the lower berm is about 23 feet wide. The length of the dam is approximately 400 feet. A plan and a profile of the dam are shown on the construction plans prepared by Reitz & Jens, Inc., and are included as Plates 3 and 4, respectively. A cross-section of the dam as surveyed during the inspection is shown on Plate 8. At normal pool elevation the reservoir impounded by the dam occupies approximately 5 acres.

The spillway, a 4-foot square reinforced concrete drop inlet structure with a 30-inch diameter reinforced concrete outlet pipe, is located within the lake to the right of the center of the dam. A concrete, energy dissipating structure is located at the downstream end of the spillway outlet pipe. Flow passing the energy dissipator discharges to the original stream channel at the toe of the dam. According to the construction plans, a 12-inch lake drawdown pipe enters the drop inlet about 21 feet below the top of the inlet. The 12-inch pipe is controlled by a gate valve located within the structure. Details of the spillway, energy dissipator and drawdown pipe are shown on the construction plans and are included as Plates 6 and 7. A 12-inch concrete pipe storm drainage sewer, which appears to serve the area southeast of the dam, also discharges flow to the channel at the toe of the dam. A concrete headwall protects the bank at the sewer outlet.

b. Location. The dam is located on an unnamed tributary of Bonhomme Creek, about 0.8 mile southwest of the intersection of Clarkson Road and U.S. Highway 40 and approximately 1.4 mile south of Chesterfield, Missouri, as shown on the Regional Vicinity Map, Plate 1. The lake and dam are located within the residential development known as Chesterfield Village. The dam is located in U.S. Survey 2002, approximately 100 feet east and 1,700 feet south of the northwest corner.

c. Size Classification. The size classification based on the height of the dam and storage capacity, is categorized as intermediate (per Table 1, Recommended Guidelines for Safety Inspection of Dams).

d. Hazard Classification. The Lake Post Commons Dam, according to the St. Louis District, Corps of Engineers, has a high hazard potential, meaning that if the dam should fail, there may be loss of life, serious damage to homes, or extensive damage to agricultural, industrial and commercial facilities, important public utilities, main highways, or railroads. The estimated flood damage zone, should failure of the dam occur, as determined by the St. Louis District, extends two miles downstream of the dam. Within the possible flood damage zone are three dwellings, several buildings, a concrete ready-mix plant and a facility for bulk storage of gasoline and oil. Those features lying within the downstream damage zone reported by the Corps of Engineers, St. Louis District, were verified by the inspection team.

e. Ownership. The lake and dam are owned by the Chesterfield Village Association, a Division of Sachs Properties, Inc., Post Office Box 7104, St. Louis, Missouri 63177. Mr. David B. Rosenberg, Development Manager for Sachs Properties, Inc., is the Owner's representative.

f. Purpose of Dam. The dam impounds water for stormwater retention and for recreational use.

g. Design and Construction History. Lake Post Commons is located within Chesterfield Village, a development which includes a large shopping center and numerous condominiums. A comprehensive study of the civil engineering aspects of the development of Chesterfield Village was prepared by Consoer Townsend & Associates, Consulting Engineers, St. Louis, Missouri, for Sachs Properties, the area developers. The study suggested the use of several lakes, including Lake Post Commons, to provide stormwater retention and to reduce erosion resulting from the increased runoff caused by the proposed development within Chesterfield Village.

In 1974 the developers retained Reitz & Jens, Inc., Consulting Engineers, St. Louis, Missouri, to prepare the Chesterfield Village Master Drainage plan for the area, which included Lake Post Commons.

Subsequently, plans for the construction of the dam for Lake Post Commons were prepared in 1975 by Reitz & Jens, Inc. Vic Koepke Excavating and Grading Company of Villa Ridge, Missouri constructed the dam, also during 1975.

h. Normal Operational Procedure. The lake level is unregulated. Lake outflow is governed by the capacity of a drop inlet type spillway.

1.3 PERTINENT DATA

a. Drainage Area. The area tributary to the lake is in various stages of commerical and residential development although most of the residential type development has been completed. Office buildings and two and three story townhouse style condominiums have been constructed in the area south and east of the outer road, Chesterfield Village Parkway, for the Chesterfield Mall Shopping Center. North of the outer road the area is being developed as part of the shopping center with commerical type buildings and parking lots occupying approximately 54 percent of the drainage area. There is some ground without improvements that lies adjacent to the north side of the lake; however this area is relatively small. For the hydrologic/hydraulic investigations performed under the direction of the inspection team and based on existing conditions, the following classes of land use and their respective percents of imperviousness were assumed:

Description	Percent Impervious
Commercial (65.4 Ac.)	55
Residential (42.5 Ac.)	40
Lake (4.5 Acres)	100
Unimproved (8.1 Ac.)	10

Of the total watershed, approximately 121 acres, and based on the above land use and percents of imperviousness, 49 percent of the total area was assumed to be impervious. The watershed area is outlined on Plate 2.

b. Discharge at Damsite.

(1) Estimated known maximum flood at damsite ... No data available

(2) Spillway capacity ... 129 cfs.

c. Elevation (Ft. above MSL). The following elevations were determined by survey and are based on the elevation of the top of the drop inlet spillway structure as shown on Sheet 3 (Plate 5) of the construction plans prepared by Reitz & Jens, Inc.

(1) Observed pool ... 553.0

(2) Normal pool ... 553.0

(3) Spillway crest ... 553.0

(4) Maximum experienced pool ... No data available

(5) Top of dam ... 559.9 (min.)

(6) Streambed at centerline of dam ... 519± (per construction plans)

(7) Maximum tailwater ... Unknown

(8) Observed tailwater ... None

d. Reservoir.

(1) Length at normal pool (Elev. 553.0) ... 1,100 ft.

(2) Length at maximum pool (Elev. 559.9) ... 1,300 ft.

e. Storage.

(1) Normal pool ... 48 ac. ft.

(2) Top of dam (incremental) ... 39 ac. ft.

f. Reservoir Surface.

(1) Normal pool ... 5 acres

(2) Top of dam (incremental) ... 2 acres

g. Dam. The height of the dam is defined to be the overall vertical distance from the lowest point of foundation surface at the downstream toe of the barrier, to the top of the dam.

(1) Type ... Earthfill, homogeneous*

(2) Length ... 400 ft.

(3) Height ... 40 ft.

(4) Top width ... 17 ft.

*Per construction plans prepared by Reitz & Jens, Inc.

(5) Side slopes

a. Upstream ... 1v on 2.5h (above waterline)

b. Downstream ... 1v on 2.1h; 1v on 2.8h; 1v on 2.3h (23-foot berm at Elev.542±; 8-foot berm at Elev.549±)

(6) Slope protection

a. Upstream ... Grass and cellular precast concrete blocks

b. Downstream ... Grass

h. Spillway.

(1) Type ... Uncontrolled, 4-foot square drop inlet

(2) Location ... Sta. 2+07, 48 feet upstream of dam centerline (in lake)

(3) Crest ... Elevation 553.0

i. Emergency Spillway ... None

j. Lake Drawdown Facility. According to the construction plans a 12-inch diameter cast-iron pipe enters the drop inlet spillway at a point 21 feet below the top of the inlet. Flow is controlled by a cast-iron gate valve located within the drop inlet.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

a. Subsurface Investigations. In 1974, test borings were drilled at six locations along the alignment of the dam by Reitz and Jens, Inc., Consulting Engineers. The location of the borings are indicated on Sheet 1, Reference Plate 3, of the construction plans. In addition to classifying the type of material encountered during drilling, the boring logs also present the results of standard penetration and shear vane tests performed on soil samples, as well as the natural moisture content of each of the soil samples examined. The boring logs are included as Plates 9 through 11.

b. Dam. The dam was apparently designed as a compacted earthfill embankment. The seepage cutoff trench was specified to have a minimum width of 14 feet, one scraper width, and have a minimum depth of 10 feet below the original ground surface. Details of the embankment design are shown on Sheet 2, Reference Plate 4, of the construction plans.

Records of the embankment design were unavailable to the inspection team. According to information provided by Reitz and Jens, Inc., the design of the dam was based on their experience with dams of similar size and materials that were constructed in this same general area.

c. Spillway. A drop inlet type spillway with a 30-inch diameter outlet pipe was designed to accommodate lake outflow. Based on design data included in the Master Drainage Plan Report prepared by Reitz & Jens in 1974, the spillway was sized to accommodate runoff from a 100-year frequency, 1-hour duration rainfall, assuming full development of the drainage area. This condition would produce a peak discharge of about 82 cfs. In addition, the dam was designed to accommodate the runoff due to a 100-year, 30-minute duration rainfall, assuming a blocked spillway outlet. This condition would produce a high water level at elevation 556.6 approximately 3.4 feet lower than the minimum top of dam elevation shown on the construction plans.

An outflow structure, with provisions to dissipate flow discharge energy, was provided at the downstream end of the discharge pipe. Three soil-bentonite type anti-seepage collars were provided along the alignment of the spillway outlet pipe. Details of the anti-seepage collars, the drop-inlet spillway, and the energy dissipator, are shown on Sheets 2 through 4, Reference Plates 4 through 6, of the construction plans.

d. Appurtenances. A 12-inch diameter lake drawdown pipe enters the drop inlet, presumably at a point about 21 feet below the inlet top. Flow is controlled by a gate valve located in the spillway inlet structure. Details of the drawdown pipe and valve are shown on Sheet 3, Reference Plate 5, of the construction plans. An 8-inch diameter sanitary sewer traverses the dam along the upper berm in the downstream face. The sanitary sewer enters a small lift station located about 140 west of the right, or north, abutment of the dam. A plan and profile of the sewer are shown on Sheets 1 and 2 respectively, Reference Plates 3 and 4, of the construction plans.

2.2 CONSTRUCTION

As previously indicated, the dam was constructed in 1975 by the Vic Koepke Excavating and Grading Company of Villa Ridge, Missouri. Surveillance of construction activities was performed by Reitz and Jens, Inc.

According to Phil Jozwiak, project engineer for Reitz & Jens at the time the dam was constructed, the dam and spillway structures were constructed in substantial accordance with the construction plans. According to the General Notes shown on Sheet 4 of the plans, compaction of earth for the embankment was specified to be a minimum of 85 percent of the maximum dry density as determined by ASTM D-1557 (Modified Proctor). A review of construction records indicated that 111 compaction tests were made and that 8 of these tests were less than 85 percent, 103 were greater than 85 percent, and that the average of all tests was 88.2 percent.

2.3 OPERATION

The lake level is uncontrolled and governed by the elevation of the top of the drop inlet type spillway. No indication was found that the dam has been overtopped. The representative of the Owner reported that the dam has never been overtopped, but information regarding the highest observed lake level was indefinite and of no significant value.

2.4 EVALUATION

a. Availability. Seepage and stability analysis for assessing the design of the dam were unavailable. Data available is limited to information shown on the construction plans prepared by Reitz & Jens, Inc., in 1975 and on the boring logs obtained by Reitz & Jens in 1974 for design of the dam. Hydraulic/hydrologic data for assessing the design of the spillway and top of dam elevation were available for review.

b. Adequacy. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record. The information shown on the logs of the test borings may have to be supplemented by additional borings to obtain undisturbed samples of foundation materials for determination of necessary shear strengths to be utilized in the stability analyses.

The hydraulic/hydrologic data provided for design of the dam and spillway is considered adequate for their intended purpose. The hydrologic criteria used for the design of the dam and spillway was approved by St. Louis County, Department of Public Works, Division of Wastewater Control, in April of 1974. However, the design of the spillway does not meet the criteria specified in the preceding recommended guidelines. According to the guidlines, the spillway design flood should be the probable maximum flood of 24-hour duration instead of the 100-year frequency storm of 1-hour duration used.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

a. General. A visual inspection of the Lake Post Commons Dam was made by Horner & Shifrin engineering personnel, R. E. Sauthoff, Civil Engineer, and A. B. Becker, Jr., Civil and Soils Engineer, on 10 July 1980. An examination of the dam area was also made by an engineering geologist, Jerry D. Higgins, Ph.D., a consultant retained by Horner & Shifrin for the purpose of assessing the site geology. Also examined at the time of the inspection, were the areas and features below the dam within the potential flood damage zone. Photographs of the dam taken at the time of the inspection are included on pages A-1 through A-4 of Appendix A. The locations of the photographs taken during the inspection are indicated on Plate 3.

b. Site Geology. The Lake Post Commons Dam is located near the border of the Ozark Plateaus Physiographic Province and Dissected Till Plains section of the Central Lowlands Province. The topography is rolling, but urban development has modified much of the original land surface in the vicinity of the lake. There is, nevertheless, approximately 120 feet of relief between the reservoir and the surrounding drainage divide. The bedrock consists of gently northward-dipping Mississippian-age limestones of probably the Burlington-Keokuk formations. No faulting was observed or has been reported in the vicinity of the site.

The Burlington-Keokuk formations consist of light-to-buff colored, coarsely crystalline, medium-bedded limestones. The limestones are fossiliferous and contain abundant chert in the form of layers and nodules. The bedrock is highly susceptible to solution weathering. Sinkholes, caves, and solution-enlarged joints or bedding planes are common and often cause severe leakage of water impoundments. The contact between the bedrock and the overlying soils in the area is very irregular, and bedrock pinnacles or bedrock remnants surrounded by residual clays frequently occur. Solution features, especially sinkholes, are abundant in the general area. None were observed in the immediate area of the dam or reservoir; however, they could be masked by the deep soil deposits.

The unconsolidated surficial materials consist primarily of cherty clay residuum overlain by the deep, silty soils of the Memphis series. The residual soils were formed by in-place weathering of limestone bedrock. According to the Unified Soil Classification System, the soils are considered to be CL-ML material. They consist of red, blocky, cherty clays, are moderately permeable, and often cause seepage from water impoundments. Seepage is generally most severe in areas of very thin soil cover. The Memphis soils overlying the residuum were derived from loess deposits. They consist of dark yellowish-brown, friable silt (ML) in the upper layers, becoming more clayey (ML-CL) with depth. These soils are generally susceptible to erosion, especially on slopes. Much of the area has been disrupted by grading and landscaping which has mixed the loessal soils and residuum.

The most significant geologic conditions at the site are the karst bedrock conditions which may cause reservoir leakage, and erosion of the dam embankment material.

c. Dam. The visible portions of the upstream and downstream faces of the dam (see Photos 2 and 3) as well as the dam crest, were inspected and appeared to be in sound condition. No significant settlement of the crest, sloughing of the slopes, or misalignment of the dam were noted. However, several gullies up to 3 feet in depth and 10 feet in width had been eroded into the downstream face of the embankment below the lower berm in the vicinity of the spillway outlet structure. The erosion appeared to be due to storm water runoff. One gulley was filled with large pieces of concrete rubble (see Photo 8), apparently in an attempt to control the erosion. The visual inspection and survey of the dam indicated elevations along the crest are very near the elevations specified on the construction plans prepared by Reitz & Jens. However, the configuration of the cross-section determined by survey was somewhat different than that shown on the construction plans. The cross-section determined by survey is shown on Plate 8. The sanitary sewer traversing the dam crest was found to be in about the same location as shown on the plans.

The upstream face of the dam was protected from erosion by fescue grass and lespedeza cover, as well as cellular concrete blocks (see Photo 7) which extended about 2 feet above the normal waterline. The grass was as high as 3 feet, and several small willow trees were present along the dam at the waterline. A 6-foot wide asphalt walkway traverses the crest of the dam. The downstream slope had a few patches of brushy undergrowth, but was mostly covered with lespedeza and fescue grass up to 3 feet high. Examination of a soil sample obtained from the downstream face of the dam indicated the material to be a silty lean clay (CL) of low-to-medium plasticity.

The drop inlet spillway structure (see Photo 4) could not be thoroughly inspected because of its lake location; however, the visible portions of the structure appeared to be in satisfactory condition. A large piece of driftwood was lodged on top of the spillway grate at the time of inspection. The location of the structure appeared to be approximately as drawn on the construction plans by Reitz & Jens.

The spillway outlet pipe and the concrete energy dissipator structure (see Photo 5) were inspected and found to be in sound condition. However, due to flow passing the spillway, the lower submerged portions of the energy dissipator could not be inspected. In general, the portions of the spillway which were examined appeared to have been built in accordance with the construction plans. An exception was found to be the level of the riprap immediately downstream of the energy dissipator which was about 18 inches below the outlet end of the dissipator rather than at the same level as the outlet, as indicated on the construction plans. However, there was no evidence of erosion of the downstream channel near the energy dissipator. The concrete headwall for the 12-inch diameter storm sewer (see Photo 6) although overgrown with brush, also appeared to be in satisfactory condition.

d. Appurtenant Structures. No appurtenant structures were observed at the dam site.

e. Downstream Channel. The original stream channel is unimproved. The channel is an irregular section and for the most part tree-lined. The channel joins Bonhomme Creek at the edge of the Missouri River flood plain about 1.3 miles downstream of the dam.

f. Reservoir. The banks surrounding the lake are mostly grass covered and well maintained. Several areas about the lake are protected from erosion by limestone riprap. An asphalt paved walkway about 6 feet wide traverses the perimeter of the lake. At the time of the inspection the lake was at normal pool and cloudy.

A report titled "Subsurface Investigations and Erosion Control Recommendations for the Development of Lake 1, Chesterfield Village" was prepared for the Owner by Reitz & Jens, Inc., in 1975. The report contains recommendations for controlling erosion of the lake shoreline and for minimizing erosion of the ground surface within the watershed by overland drainage. The amount of sediment within the lake could not be determined at the time of the inspection. However, judging by the grass and riprap protection evident about the lake as well as the concern shown by the Owner to prevent erosion of the lake shoreline and drainage area, sedimentation of the lake is believed to be minimal.

3.2 EVALUATION

The deficiencies observed during this inspection and noted herein, are not considered of significant importance to warrant immediate remedial action. The concrete block type slope protection on the upstream face of the dam is considered adequate to prevent erosion by wave action or by a fluctuating lake level.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

The spillway is uncontrolled. The lake surface level is governed by precipitation runoff, evaporation, seepage, and the capacity of the uncontrolled spillway.

4.2 MAINTENANCE OF DAM

According to Mr. David Rosenberg, Development Manager for Sachs Properties, the dam is inspected every three to four months. Mr. Rosenberg did report that a "wet spot" was noticed on the downstream face of the dam sometime earlier in the year and that the condition was being investigated. No evidence of seepage at the downstream slope was observed during the visual inspection.

Judging by the small trees present on the upstream face of the dam, the 3-foot high grass on the slopes of the dam, and the eroded areas of the downstream face of the dam below the lower berm, it appears that routine maintenance of the dam proper could be improved.

4.3 MAINTENANCE OF OPERATING FACILITIES

With the exception of the lake drawdown valve, no outlet facilities requiring operation exist at this dam. A representative (name unknown) of the Owner reported that the valve had been leaking and that measures were being taken to repair it. There is no reservoir regulation plan.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT

The inspection did not reveal the existence of a dam failure warning system.

4.5 EVALUATION

It is recommended that maintenance of the dam also include removal of trees and periodic cutting of grass on the slopes. Measures should also be taken to prevent further erosion of the downstream face of the dam below the lower berm. It is also recommended that a detailed inspection of the dam be instituted on a regular basis by an engineer experienced in the design and construction of dams and that records be kept of all inspections made and remedial measures taken.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

a. Design Data. Hydraulic/Hydrologic data pertinent to the design of the dam and spillway is discussed in Section 2, paragraph 2.1c.

b. Experience Data. The drainage area and lake surface area were developed using topographic data shown on the construction plans and the 1954 USGS Chesterfield, Missouri, Quadrangle Map, photo revised 1968 and 1974. The proportions and dimensions of the spillway and dam were developed from surveys made during the inspection and from data shown on the construction plans. Records of rainfall, streamflow, or flood data for the watershed were not available.

Due to the fact that the watershed for this reservoir is small and since there is no history of excessive reservoir leakage that would adversely affect the normal operating level of the lake, the lake level was assumed to be at normal pool as a result of antecedent storms prior to occurrence of the PMF and the probabilistic storm.

According to the St. Louis District, Corps of Engineers, the estimated flood damage zone, should failure of the dam occur, extends two miles downstream of the dam.

c. Visual Observations.

(1) The spillway, located to the left of the center of the dam, consists of a 48-inch square reinforced concrete drop inlet with a 30-inch diameter reinforced concrete outlet pipe extending through the dam. Flow from the outlet pipe enters a concrete energy dissipating structure which discharges to the original stream channel at the toe of the dam.

(2) According to the construction plans, a 12-inch diameter cast-iron pipe is provided for lake drawdown. The pipe enters the drop inlet structure 21 feet below the top of the inlet and is controlled by a valve installed within the structure.

d. Overtopping Potential. The spillway is inadequate to pass the probable maximum flood or 1/2 the probable maximum flood without overtopping the dam. The spillway is adequate, however, to pass the 1 percent probability (100-year frequency) flood without overtopping the dam. The results of the dam overtopping analyses are as follows:

(Note: The data appearing in the following table has been extracted from the computer output data appearing in Appendix B. Decimal values have been rounded to the nearest one-tenth in order to prevent assumption of unwarranted accuracy.)

Ratio of PMF	Q-Peak Outflow (cfs)	Max. Lake W.S. Elev.	Max. Depth (Ft.) of Flow over Dam (Elev. 559.9)	Duration of Overtopping of of Dam (Hrs.)
0.50	882	561.1	1.2	3.2
1.00	2,716	562.1	2.2	5.8
1 Percent Probability	125	557.0	0.0	0.0

Elevation 559.9 was found to be the lowest point in the dam crest. The flow safely passing the spillway just prior to overtopping amounts to approximately 129 cfs, which is the routed outflow corresponding to about 35 percent of the probable maximum flood inflow. During peak flow of the probable maximum flood, the greatest depth of flow over the dam is projected to be 2.2 feet and overtopping will extend across the entire length of the dam.

e. Evaluation of Overtopping Effect. Experience with embankments constructed of similar material (a silty lean clay of low-to-medium plasticity) to that used to construct this dam have shown evidence that the material under certain conditions, such as high velocity flow, can be very erodible. An example of such erosion is apparent below the lower berm in the downstream face of the dam. Such a condition exists during the PMF when large lake outflow, accompanied by high flow velocities, occurs. For the PMF condition where the depth of flow over the dam crest and the duration of flow over the dam, 2.2 feet (maximum) and 5.8 hours, respectively, are substantial, damage by erosion to the downstream face of the dam is expected. The extent of this damage is not predictable within the scope of this report; however, there is a possibility that it could result in failure by erosion of the dam.

f. References. Procedures and data for determining the probable maximum flood, the 1 percent probability flood, and the discharge rating curves for flow passing the spillway are presented on pages B-1 and B-2 of Appendix B. Listings of the HEC-1 (Dam Safety Version) input data for both the probable maximum flood and the 1 percent probability flood are shown on pages B-3 through B-5. Computer output data, including unit hydrograph ordinates, tabulation of PMF rainfall, loss and inflow data are shown on pages B-6 through B-9; tabulation of lake surface area, elevation, and storage volume is shown on page B-10; and tabulations titled "Summary of Dam Safety Analysis" for the PMF and 1 percent probability (100-year frequency) flood are also shown on page B-10.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

a. Visual Observations. Visual observations of conditions which adversely affect the structural stability of the dam are discussed in Section 3, paragraph 3.1c.

b. Design and Construction Data. With the exception of information shown on the logs of test borings that were taken along the axis of the dam, no design data relating to the structural stability of the dam are known to exist. Available construction data are discussed in Section 2, paragraph 2.2. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. Operating Records. With the exception of the valve on the lake drawdown pipe, no appurtenant structures or facilities requiring operation exist at this dam. According to the Owner's representative, no records are kept of the lake level, spillway discharge, dam settlement, or seepage.

d. Post Construction Changes. The Owner's representative also reported that to his knowledge no significant post construction changes have been made or have occurred which would affect the structural stability of the dam.

e. Seismic Stability. The dam is located within a Zone II seismic probability area. An earthquake of the magnitude that might occur in this area would not be expected to cause structural damage to a well constructed earth dam of this size provided that static stability conditions are satisfactory and conventional safety margins exist. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT

a. Safety. A hydraulic analysis indicated that the spillway is capable of passing lake outflow of about 129 cfs without the level of the lake exceeding the low point in the top of the dam. A hydrologic analysis of the lake watershed area, as discussed in Section 5, paragraph 5.1d, indicates that for storm runoff of probable maximum flood magnitude, the lake outflow would be about 2,716 cfs, and that for the 1 percent probability (100-year frequency) flood, the lake outflow would be about 125 cfs.

Significant items noticed during the inspection that could adversely affect the safety of the dam consist of the embankment erosion at the downstream toe of the dam and the small trees and patches of undergrowth on the dam slopes.

Seepage and stability analyses of the dam were not available for review and therefore no judgment could be made with respect to the structural stability of the dam.

b. Adequacy of Information. Due to lack of sufficient detailed engineering design and construction data, the assessments reported herein were based largely on external conditions as determined during the visual inspection. The assessment of the hydrology of the watershed and capacities of the spillway were based on a hydraulic/hydrologic study as indicated in Section 5. Seepage and stability analyses comparable to the requirements of "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

c. Urgency. The remedial measures recommend in paragraph 7.2 for the items concerning the safety of the dam noted in paragraph 7.1a should be accomplished within a reasonable time. The item recommended in paragraph 7.2a concerning provision of additional spillway capacity should be pursued on a high priority basis.

d. Necessity for Phase II. Based on the results of the Phase I inspection, a Phase II investigation is not recommended.

e. Seismic Stability. The dam is located within a Zone II seismic probability area. An earthquake of the magnitude that might occur in this area would not be expected to cause structural damage to a well constructed earth dam of this size provided that static stability conditions are satisfactory and conventional safety margins exist. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES

a. Recommendations. The following actions are recommended:

(1) Based upon criteria set forth in the recommended guidelines, spillway size and/or height of dam should be increased to pass lake outflow resulting from a storm of probable maximum flood magnitude.

(2) Obtain the necessary soil data and perform dam seepage and stability analyses in order to determine the structural stability of the dam for all operational conditions. Seepage and stability analyses should be performed by a qualified professional engineer experienced in the design and construction of earthen dams.

b. Operation and Maintenance (O & M) Prodcedures. The following O & M Procedures are recommended:

(1) Restore the eroded portions of the downstream face of the dam below the lower berm and provide some form of protection to prevent further erosion of the embankment by overland drainage. Loss of embankment by erosion can impair the stability of the dam.

(2) Remove the small trees and patches of undergrowth that may conceal animal burrows from the upstream and downstream faces of the dam. Tree roots and animal burrows can provide passageways for the lake seepage

that could lead to a piping condition (progressive internal erosion) and failure of the dam.

(3) Provide maintenance of all areas of the dam and spillway including periodic cutting of grass on the dam slopes, on a regularly scheduled basis in order to insure features of being in satisfactory operational condition.

(4) A detailed inspection of the dam should be instituted on a regular basis by an engineer experienced in the design and construction of dams. It is also recommended, for future reference, that records be kept of all inspections made and remedial measures taken.

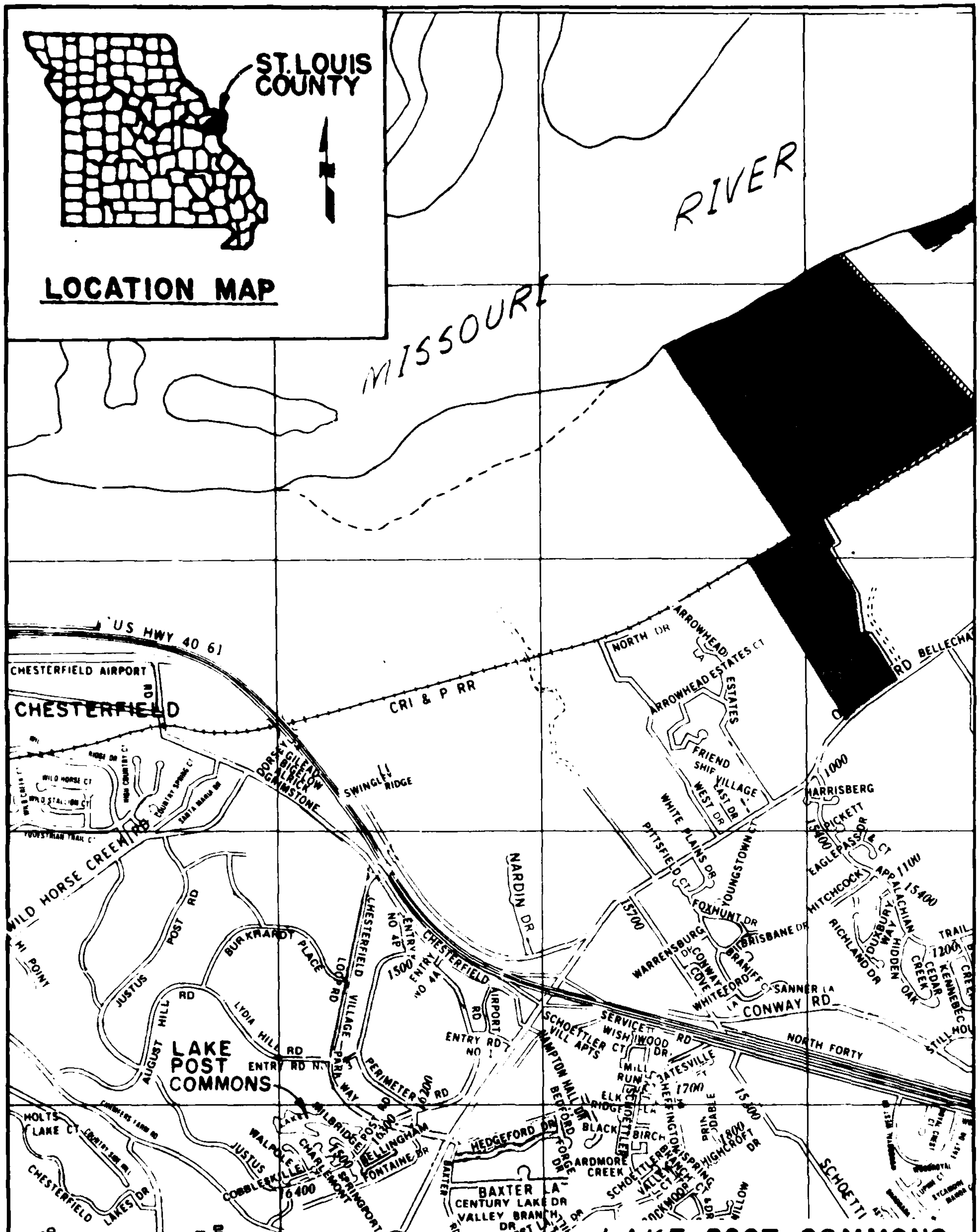
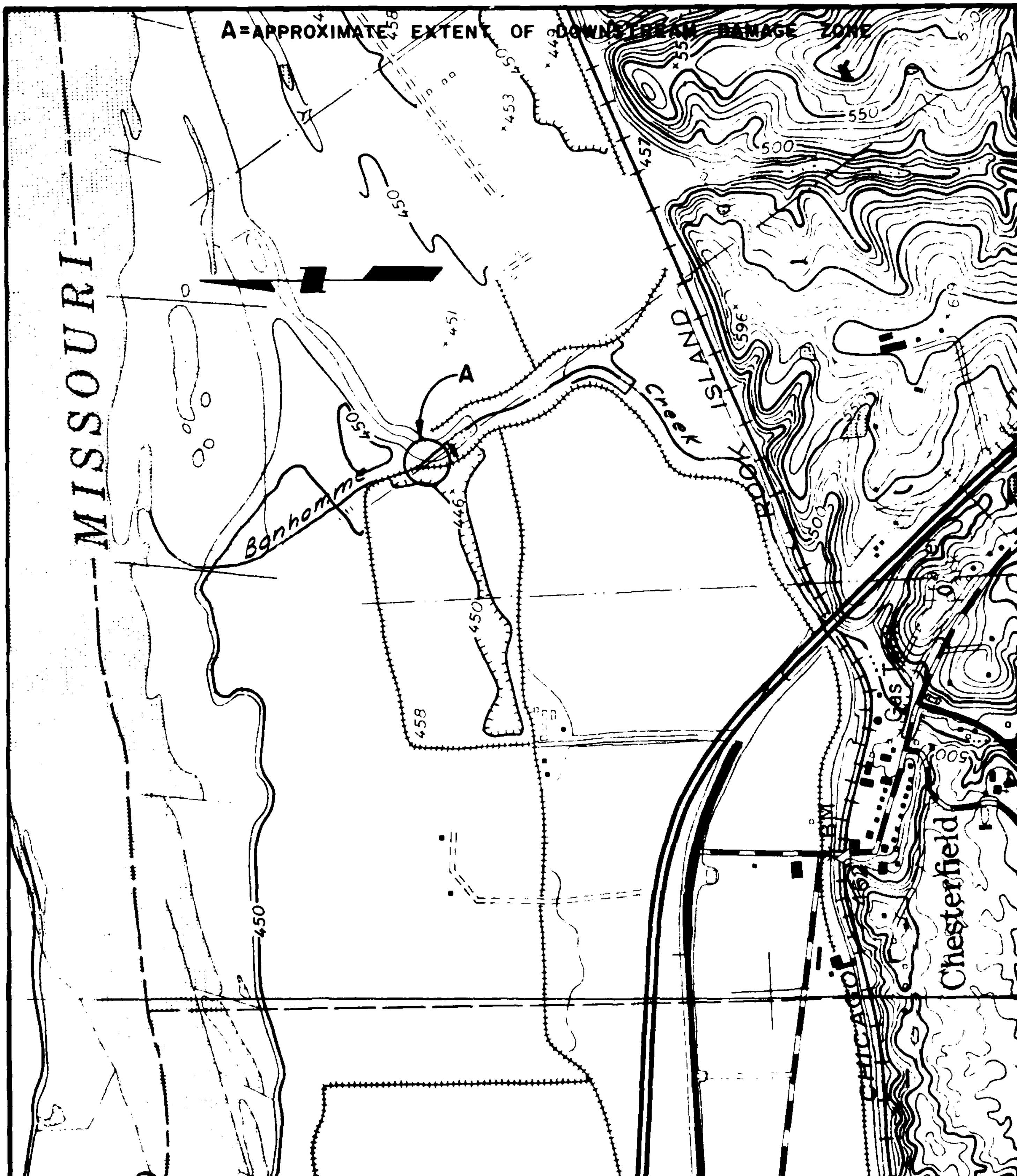
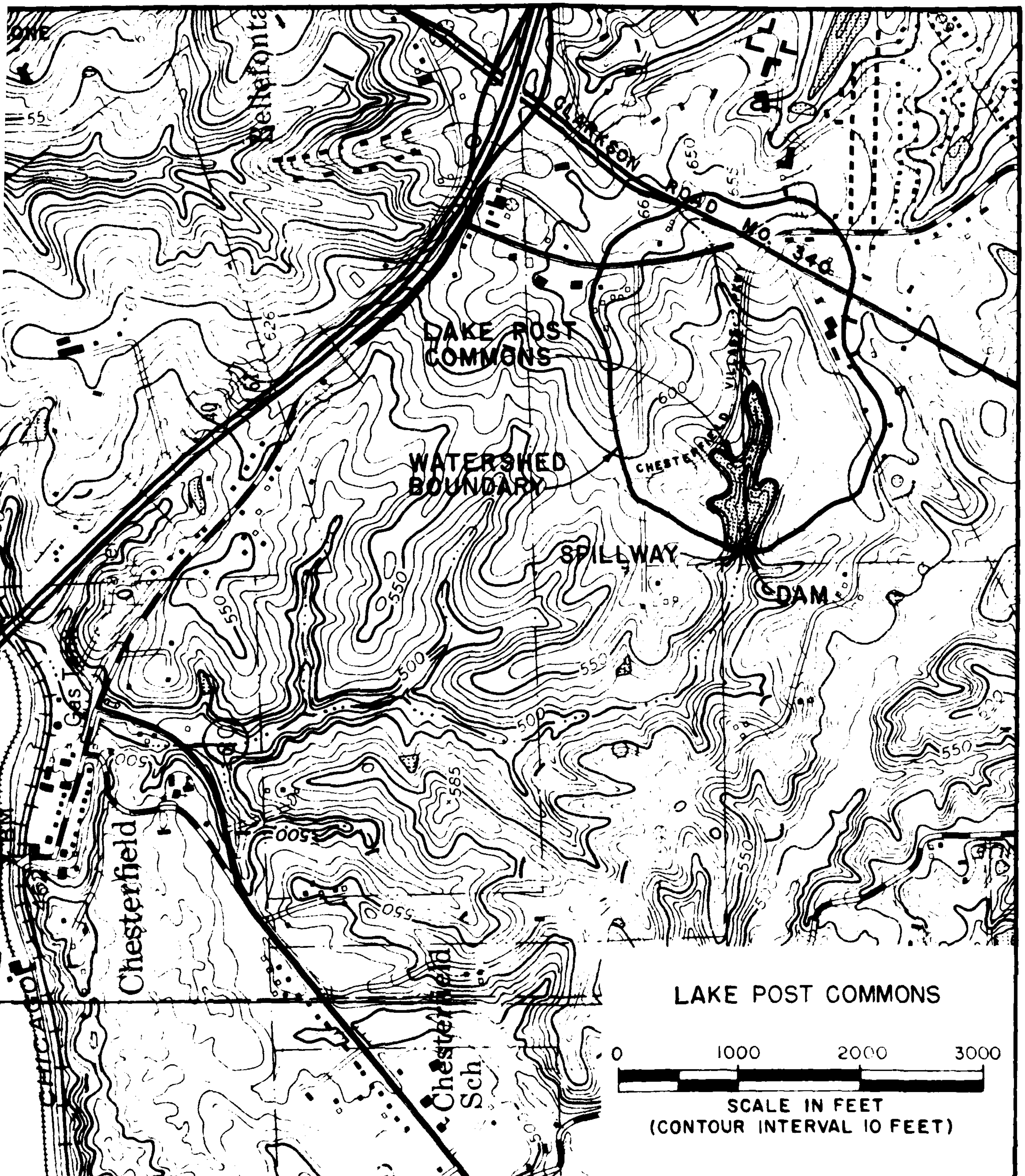

ST. LOUIS COUNTY
LOCATION MAP
MISSOURI RIVER
US HWY 40 61
CHESTERFIELD AIRPORT
CHESTERFIELD
CRI & P RR
WILD HORSE CREEK RD
JUSTUS POST RD
BURKHARDT PLACE
CHESTERFIELD VILLAGE PARKWAY
CHESTERFIELD AIRPORT RD
SWINGLEY RIDGE
NARDIN DR
CONWAY RD
NORTH FORTY
SCHOETTLER RD
HEDGEFORD DR
BAXTER LA
CLARKSON RD
OLD CLARKSON
LAKE POST COMMONS
LAKE POST COMMONS
1000' 0 1000' 2000' 3000'
SCALE
REGIONAL VICINITY MAP

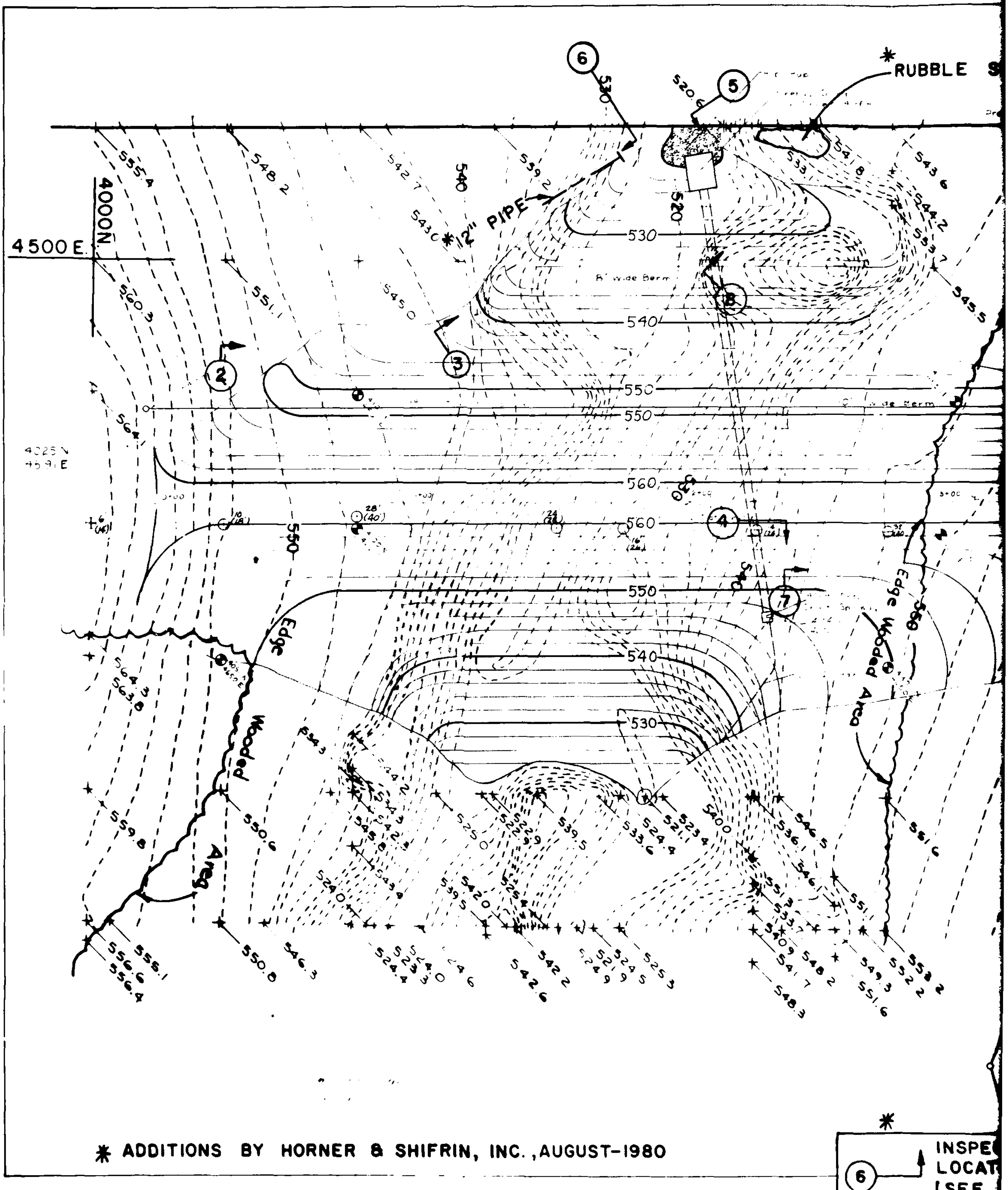
PLATE I

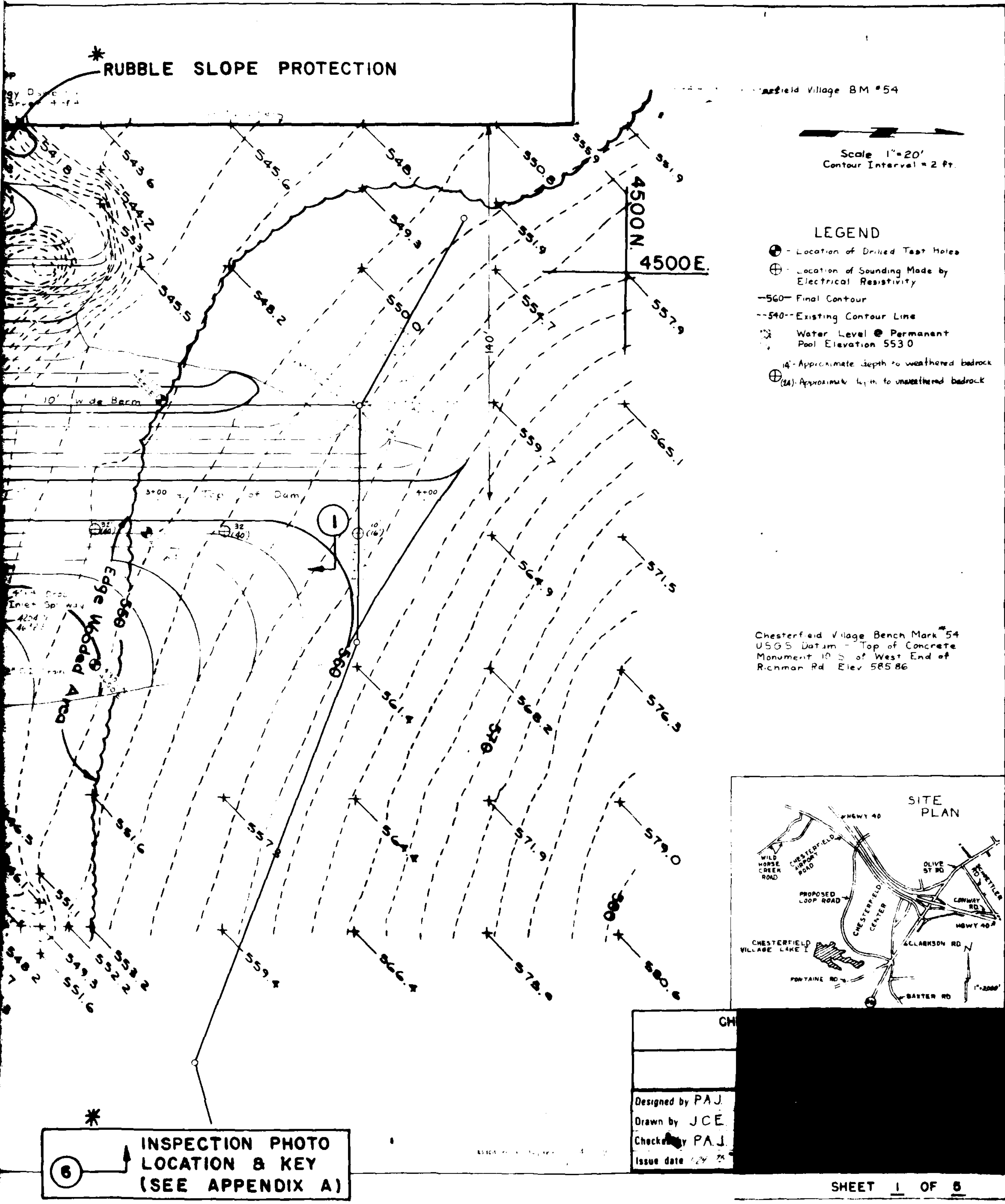

A=APPROXIMATE EXTENT OF DOWNSTREAM DAMAGE ZONE
A
MISSOURI
Bonhomme
Creek
ROCK ISLAND
CHICAGO
Chesterfield
LEVEE
BM
CO


CLARKSON ROAD NO. 340
LAKE POST COMMONS
WATERSHED BOUNDARY
SPILLWAY
DAM
Chesterfield
Chesterfield Sch
LAKE POST COMMONS
0 1000 2000 3000
SCALE IN FEET
(CONTOUR INTERVAL 10 FEET)
LAKE WATERSHED MAP

·2

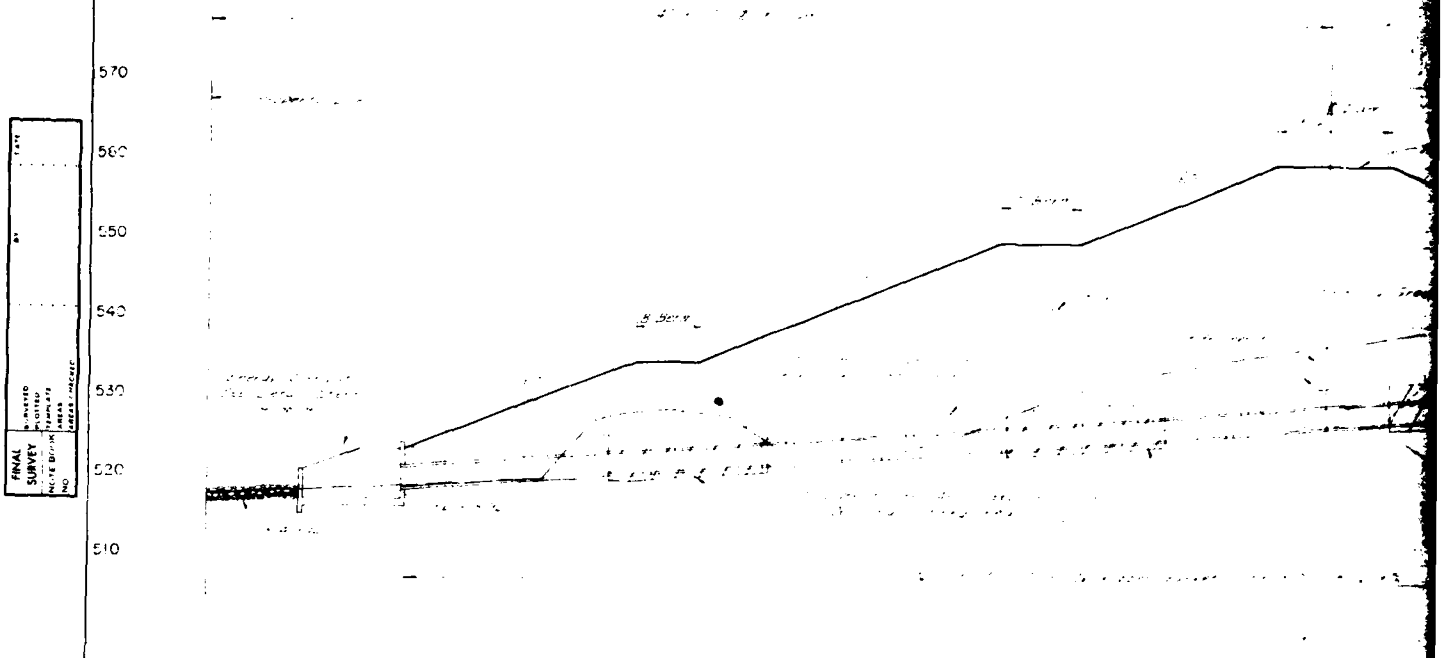
PLATE 2


RUBBLE
12" PIPE
4500 E.
4000N.
4025 N
4591 E
8' wide Berm
530
540
550
560
Edge Wooded Area
* ADDITIONS BY HORNER & SHIFRIN, INC., AUGUST-1980
INSPE
LOCAT
(SEE

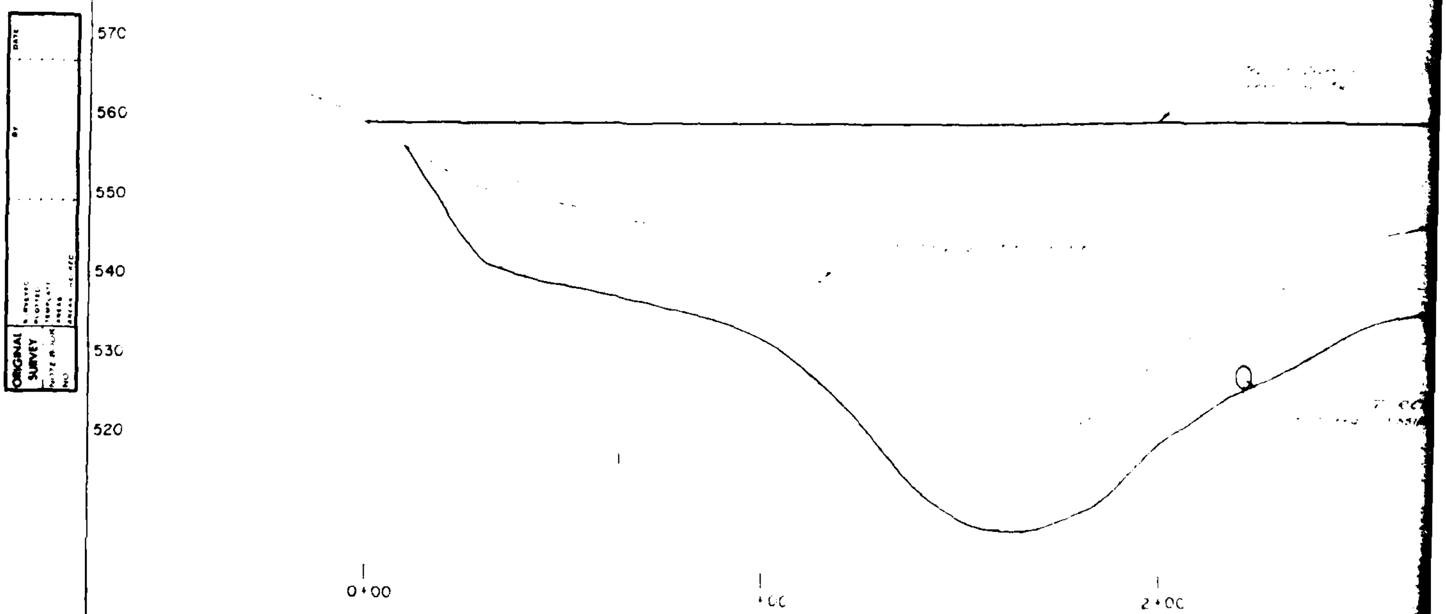


SHEET 1 OF 5

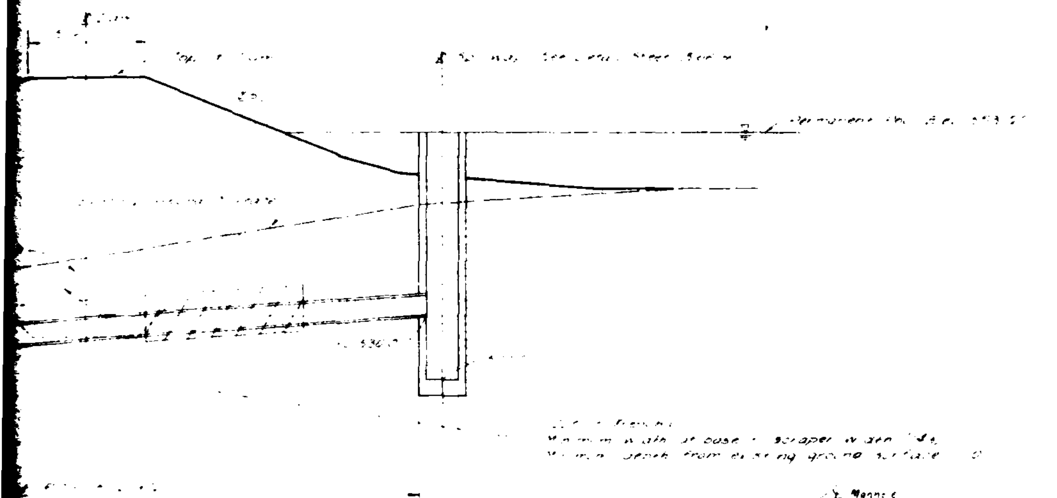
PLATE 3



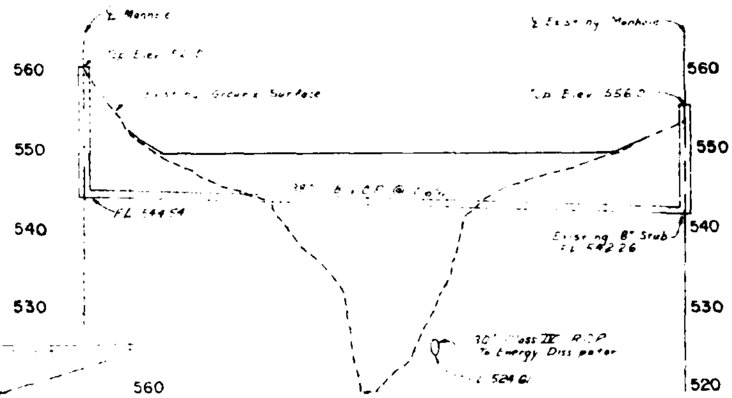
CROSS SECTION THRU S



PROFILE ALONG ¢ OF DAM

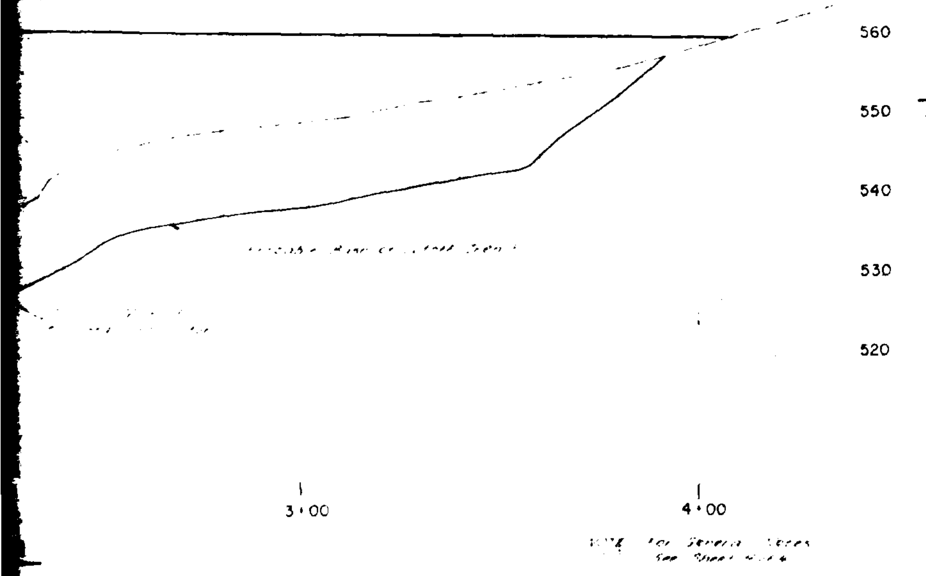


ION THRU SPILLWAY



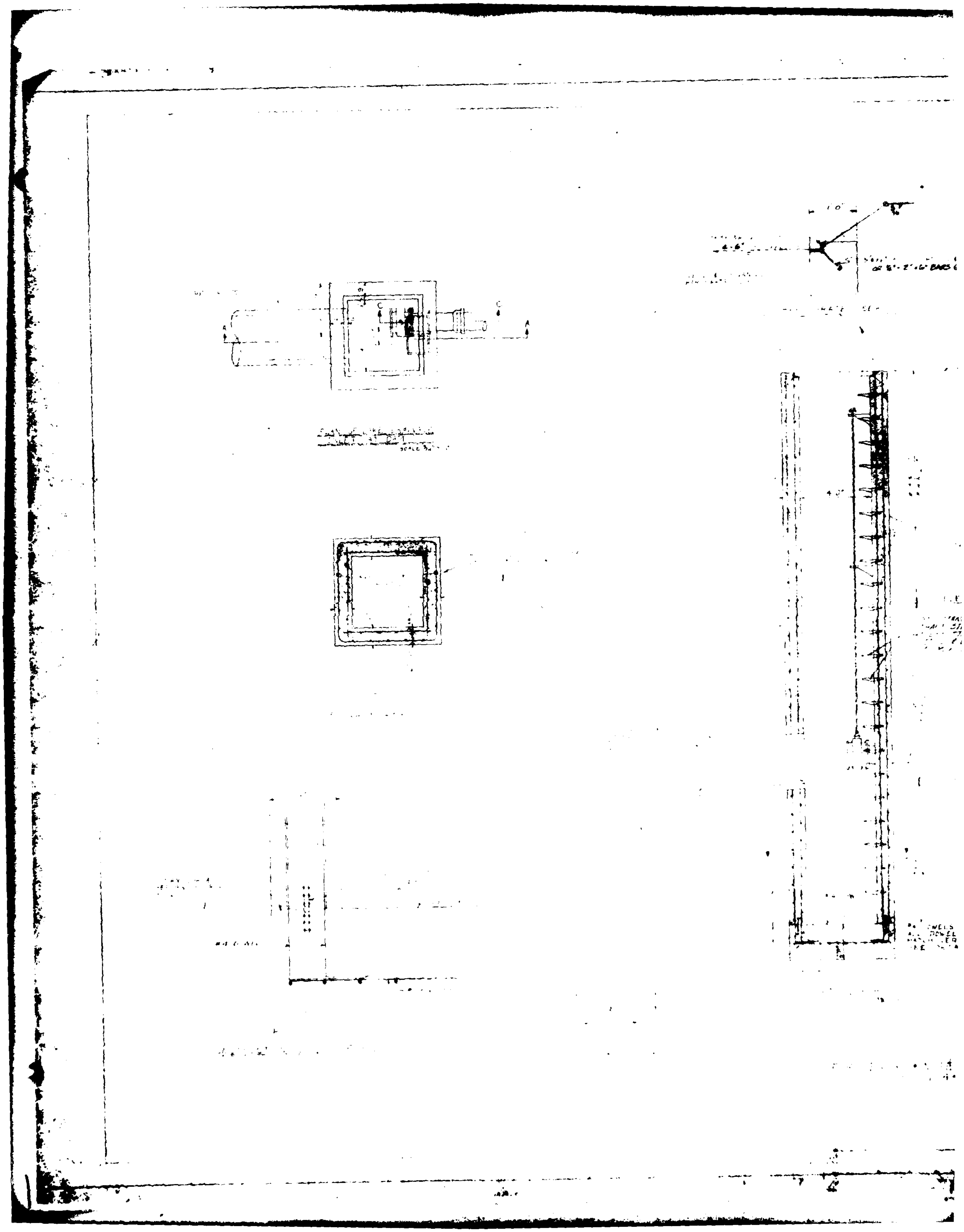
SANITARY SEWER PROFILE

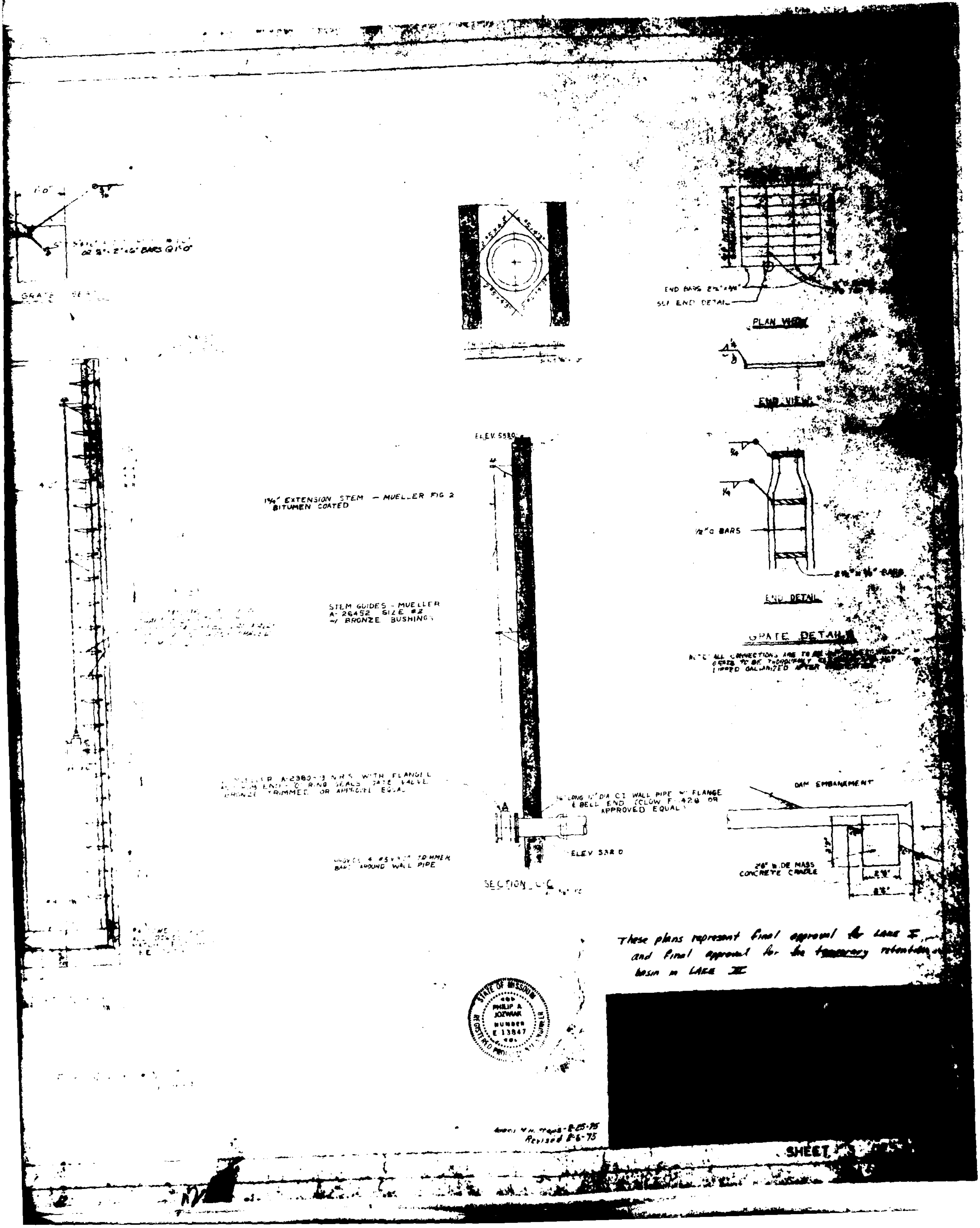
Horiz. Scale 1"=50'   Vert. Scale 1"=10'



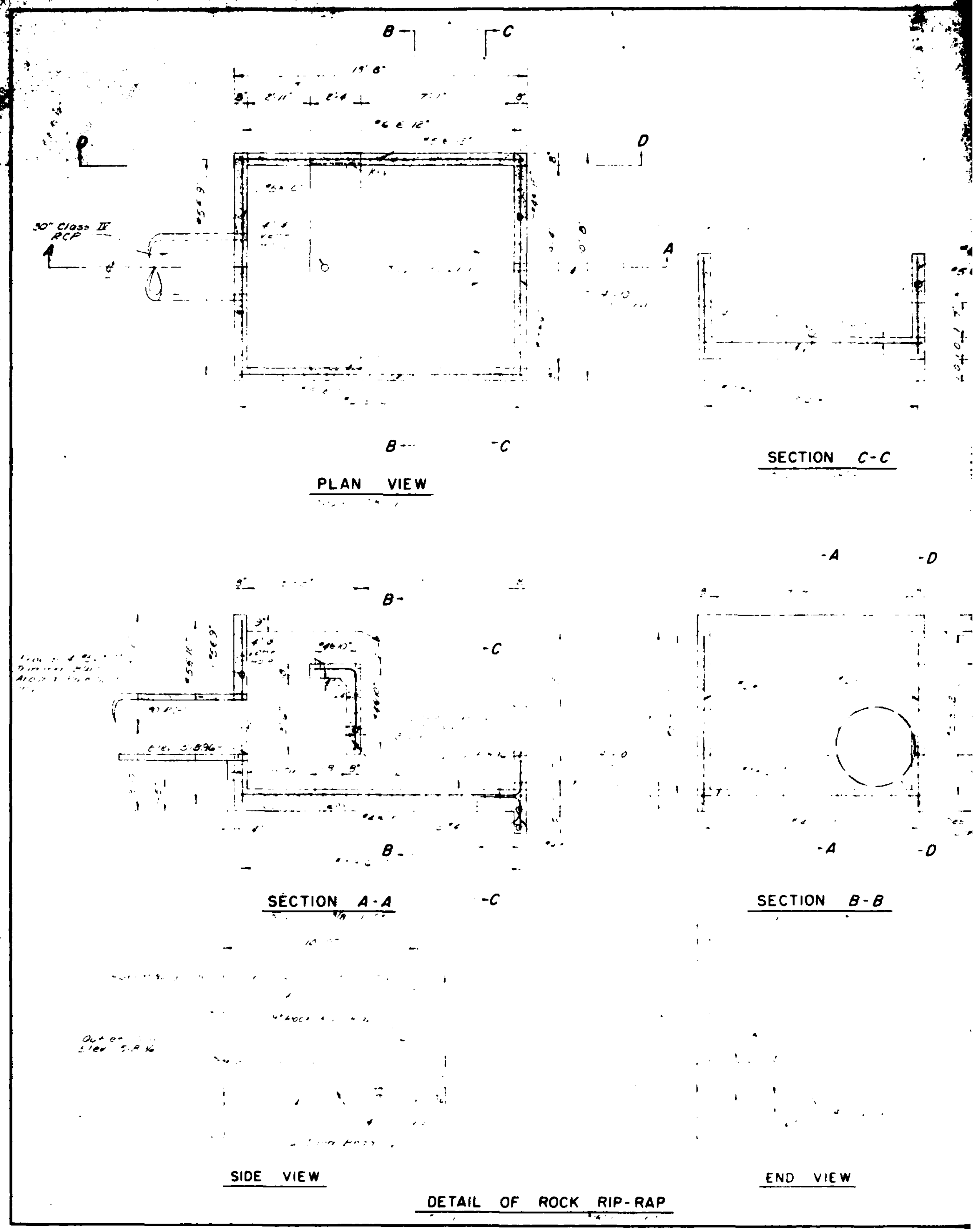
These plans represent final approval for LAKE I and final approval for the temporary retention basin in LAKE III

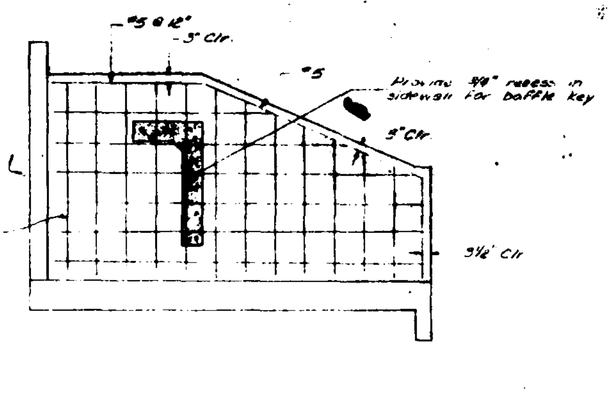
SHEET 2 OF 5





PLAN VIEW
END VIEW
END BARS 2½"x¼"
SEE END DETAIL
½"⌀ BARS
END DETAIL
GRATE DETAIL
GRATE DETAIL
ELEV. 553.0
1¼" EXTENSION STEM - MUELLER FIG 2
BITUMEN COATED
STEM GUIDES - MUELLER
A-26452 SIZE #2
W/ BRONZE BUSHINGS
MUELLER A-2380-8 N.R.S. WITH FLANGE
RING SEALS GATE VALVE,
BRONZE TRIMMED, OR APPROVED EQUAL
APPROVED EQUAL)
ELEV. 532.0
BARS AROUND WALL PIPE
SECTION C-C
DAM EMBANKMENT
28" WIDE MASS
CONCRETE CRADLE
These plans represent final approval for Lake I, and final approval for the temporary retention basin in LAKE II
STATE OF MISSOURI
PHILIP A.
JOZWIAK
NUMBER
E 13847
Revised 8-6-75
SHEET

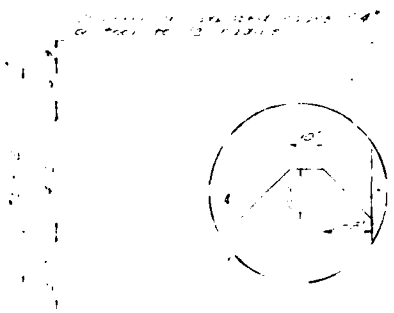

30" Class IV RCP
PLAN VIEW
SECTION C-C
SECTION A-A
SECTION B-B
SIDE VIEW
END VIEW
DETAIL OF ROCK RIP-RAP



SECTION D-D (Sidewall)

C-C

-D



DETAIL

-D

DEPTH OF 8 FEET. THE PIPE ... OF THE PIPE. ...

12. THREE ... PLACED IN THE ... THESE LOCATIONS, THE ... (MINIMUM THICKNESS 1 FT.) AND ... THE TOP OF THE PIPE TRENCH. THE ... EQUAL PARTS BY WEIGHT OF THE LOCAL ... THIS MATERIAL SHALL BE COMPACTED TO THE ... THE DAM EMBANKMENT.

13. THE CUTOFF TRENCH BELOW THE BASE OF ... MINIMUM OF 10 FEET INTO THE CLAYEY SOILS. ... TRENCH SHALL BE DETERMINED BY THE ... CUTOFF TRENCH IS CONSIDERED A ... COMPACTED TO THE MINIMUM DENSITY REQUIREMENT ...

14. THE DAM EMBANKMENT SHALL BE COMPACTED ... OF 95% OF THE MAXIMUM DRY DENSITY AS ... PROCTOR).

15. THE ROCK RIP-RAP EROSION ... SHALL BE LAID WITH LIMESTONE ROCK ... CHANNEL BOTTOM SHALL HAVE A MINIMUM THICKNESS OF ... BELOW THE ROCK RIP-RAP.

16. THE ENERGY DISSIPATOR DRAIN LINE SHALL BE ... PIPE DRAINING TO THE END OF THE ROCK RIP-RAP. THE ... STRUCTURE SHALL BE SLOPED TOWARD THE DRAIN.

17. CLAY PIPE (VCP) SHALL CONFORM TO ... ALL JOINTS CONFORMING TO ASTM C-425.

18. MANHOLE AND SANITARY SEWER CONSTRUCTION SHALL BE ... STANDARDS.

These plans represent final approval for Lake ... and final approval for the temporary ... basin in Lake III

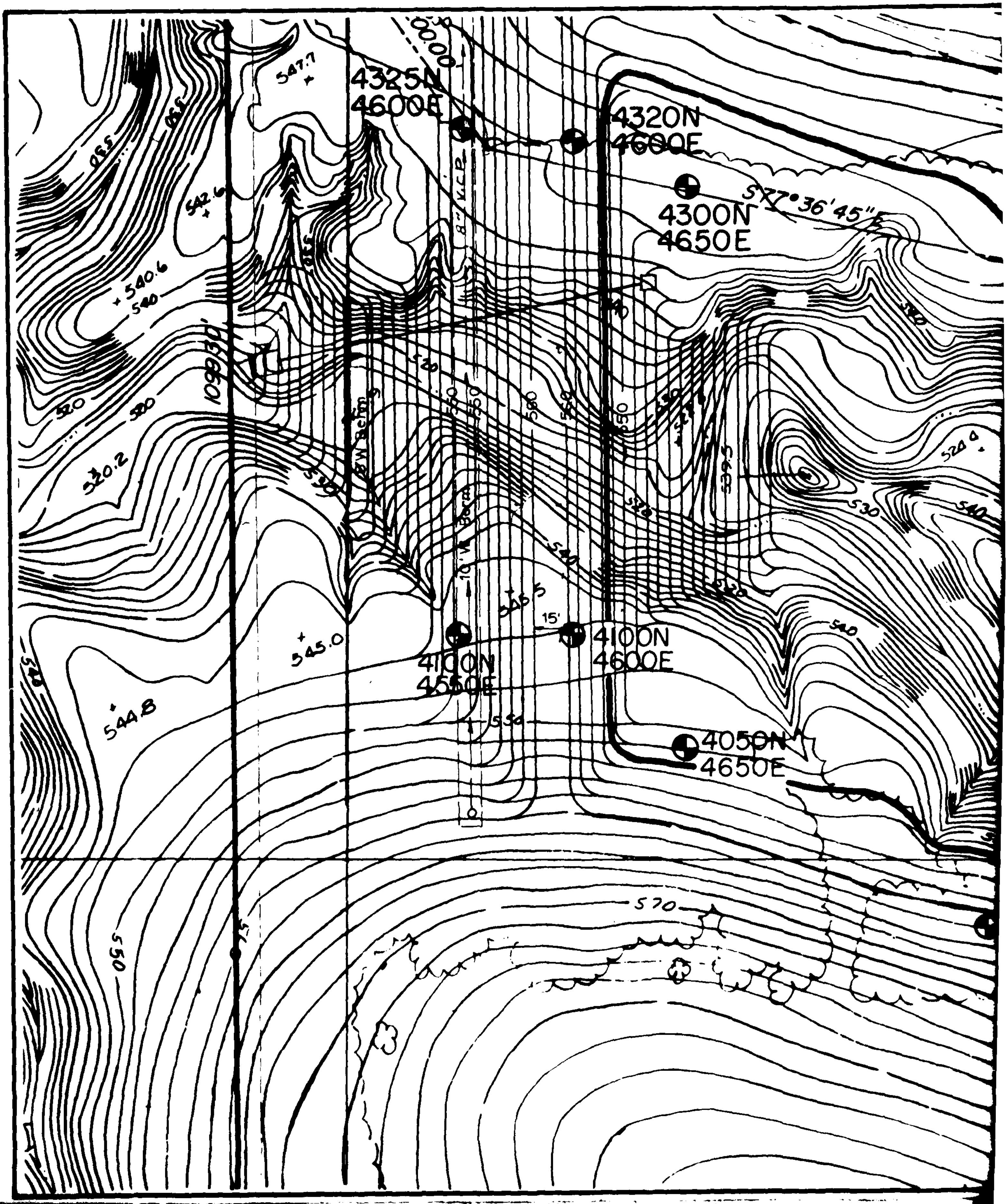
STATE OF MISSOURI
PHILIP A. JOZWIAK
NUMBER E 13847
REGISTERED PROFESSIONAL ENGINEER

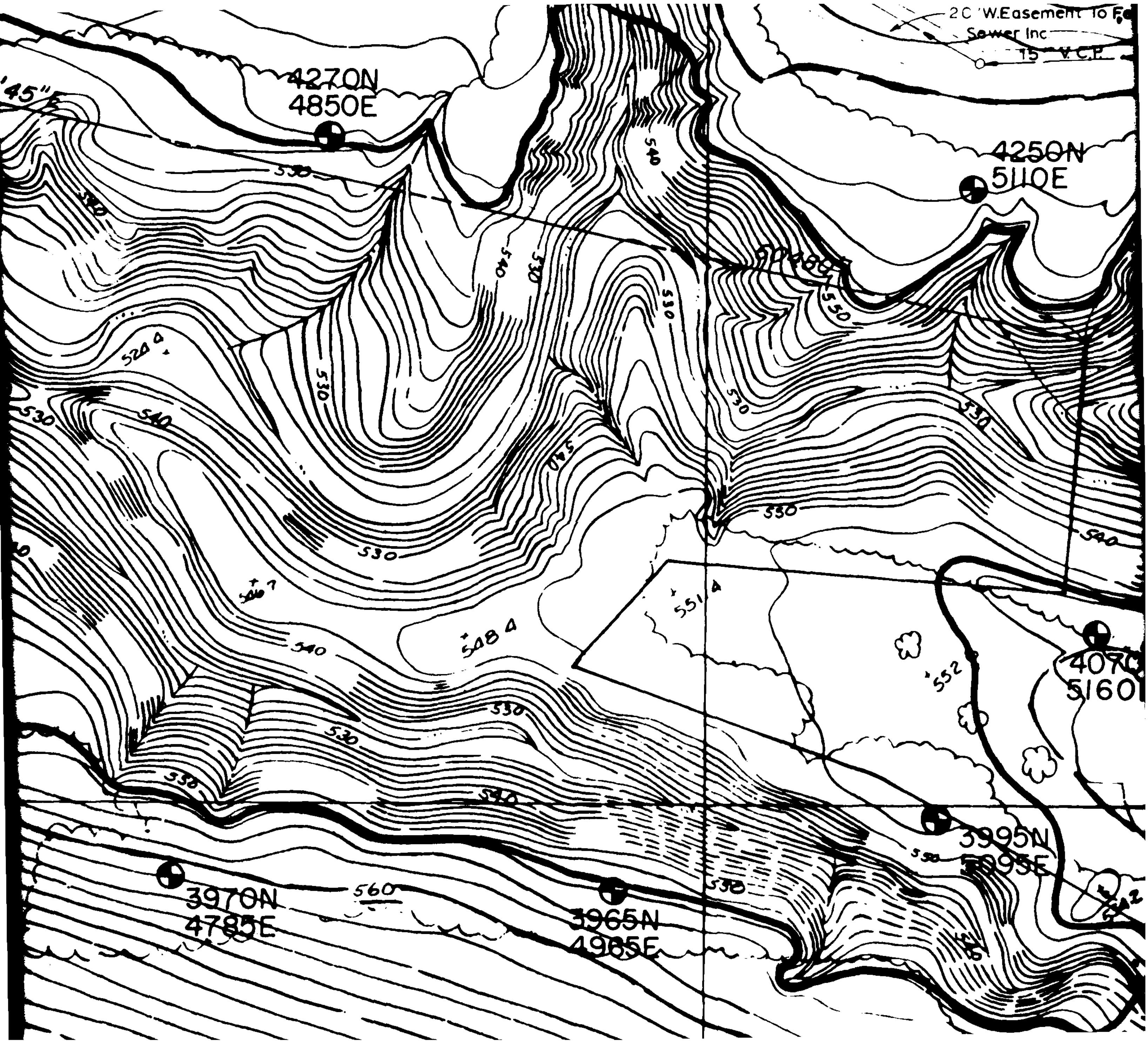
ISOMETRIC VIEW

Revised ...

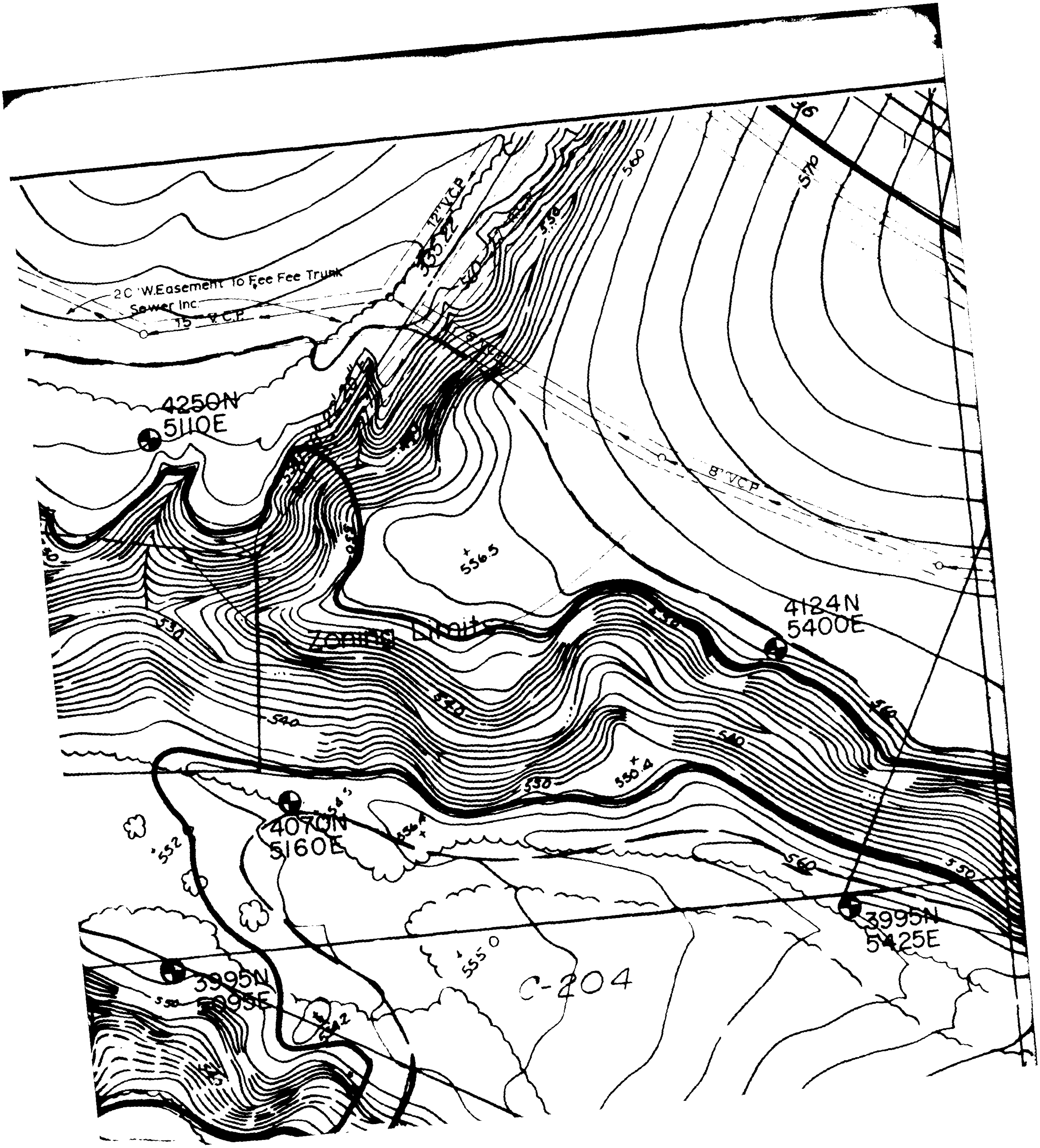
SHEET 4 OF 8

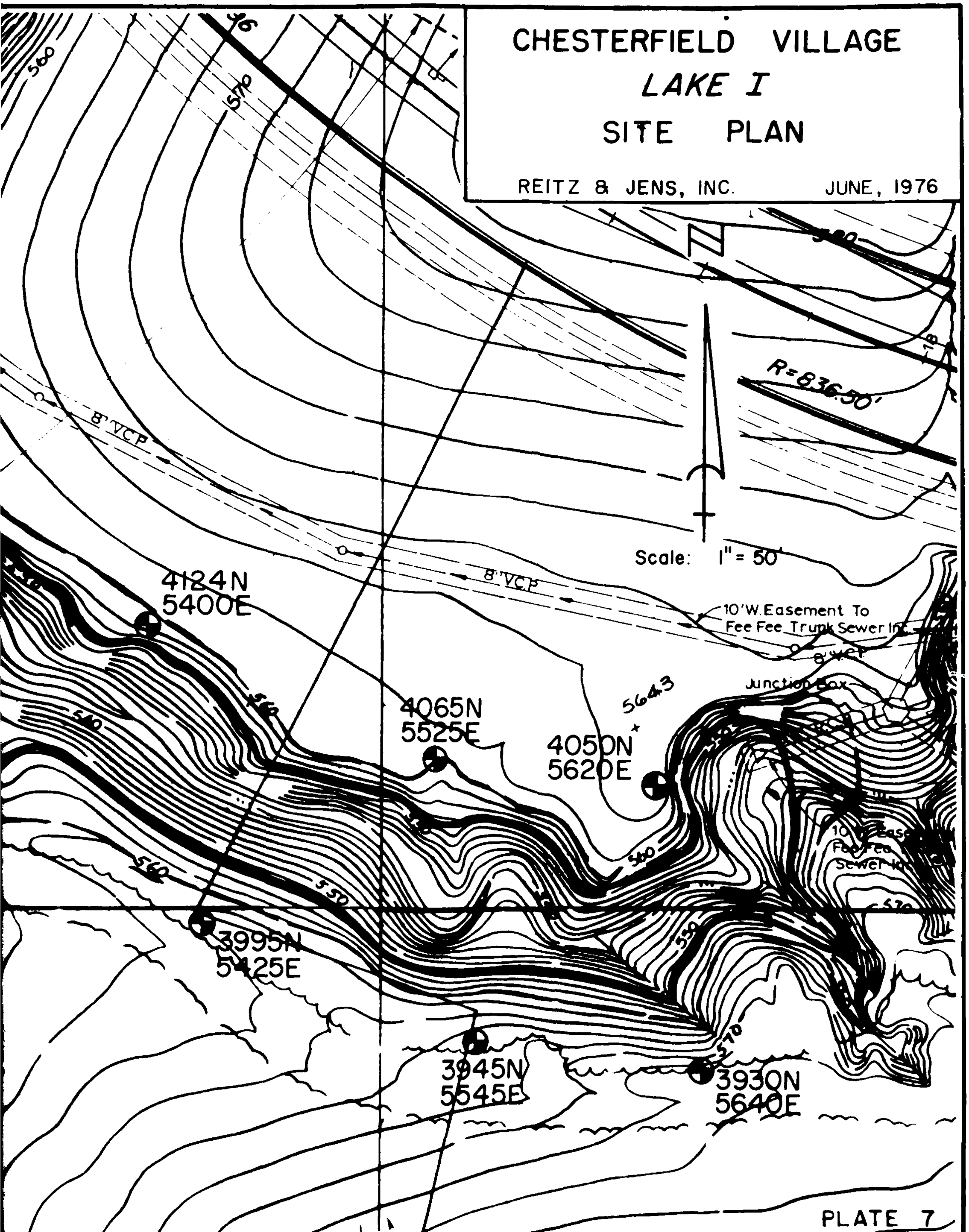
PLATE

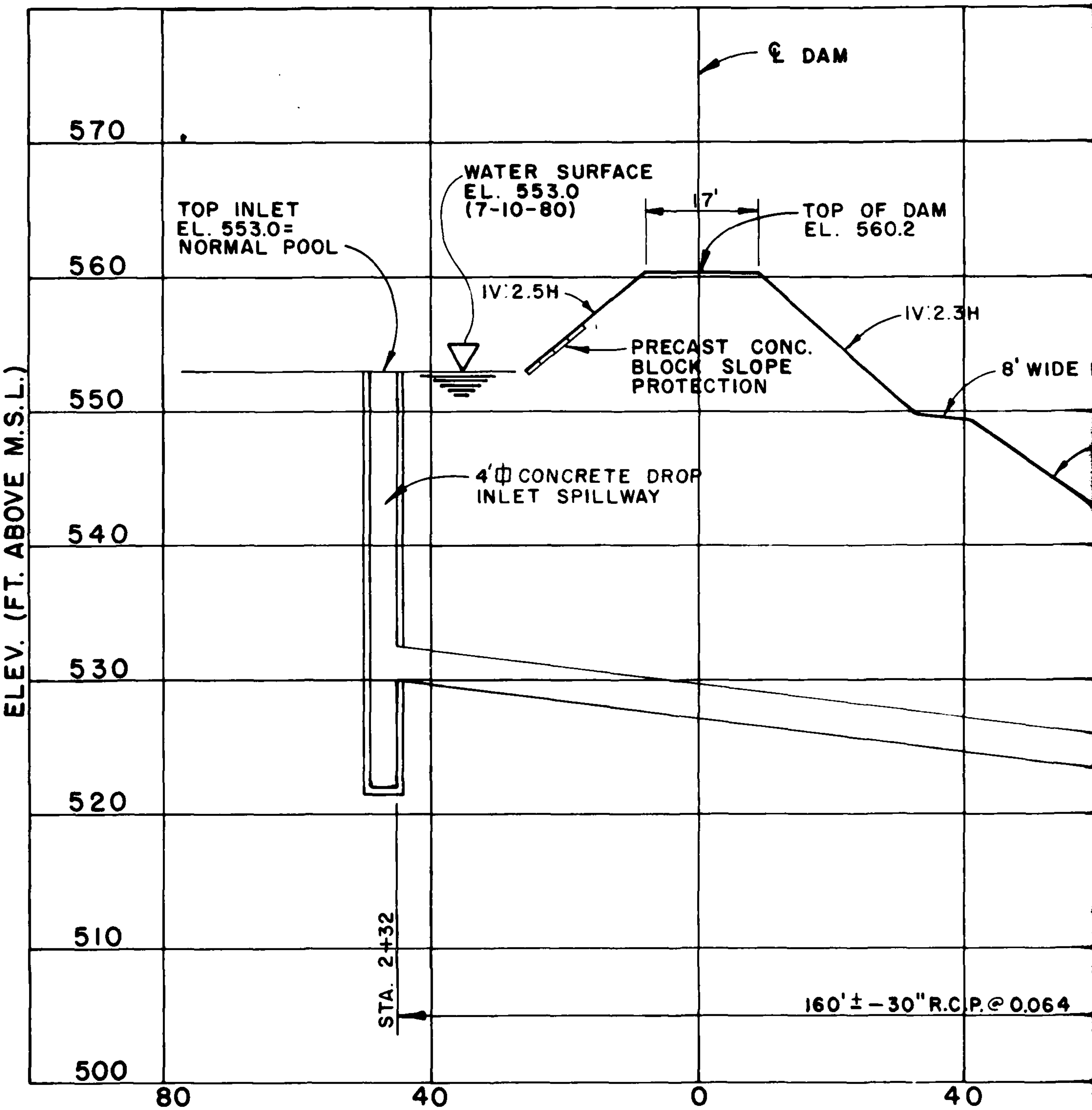

4325N
4600E
4320N
4600E
4300N
4650E
S77°36'45"E
547.7
542.6
540.6
540
520
520.2
545.0
544.8
545.5
4100N
4600E
4100N
4550E
4050N
4650E
550
570
530
540
15'



Sewer Inc
15" V.C.P.
4270N
4850E
4250N
5110E
520.4
548.4
551.4
552
530
540
550
560
3970N
4785E
3965N
4985E
3995N

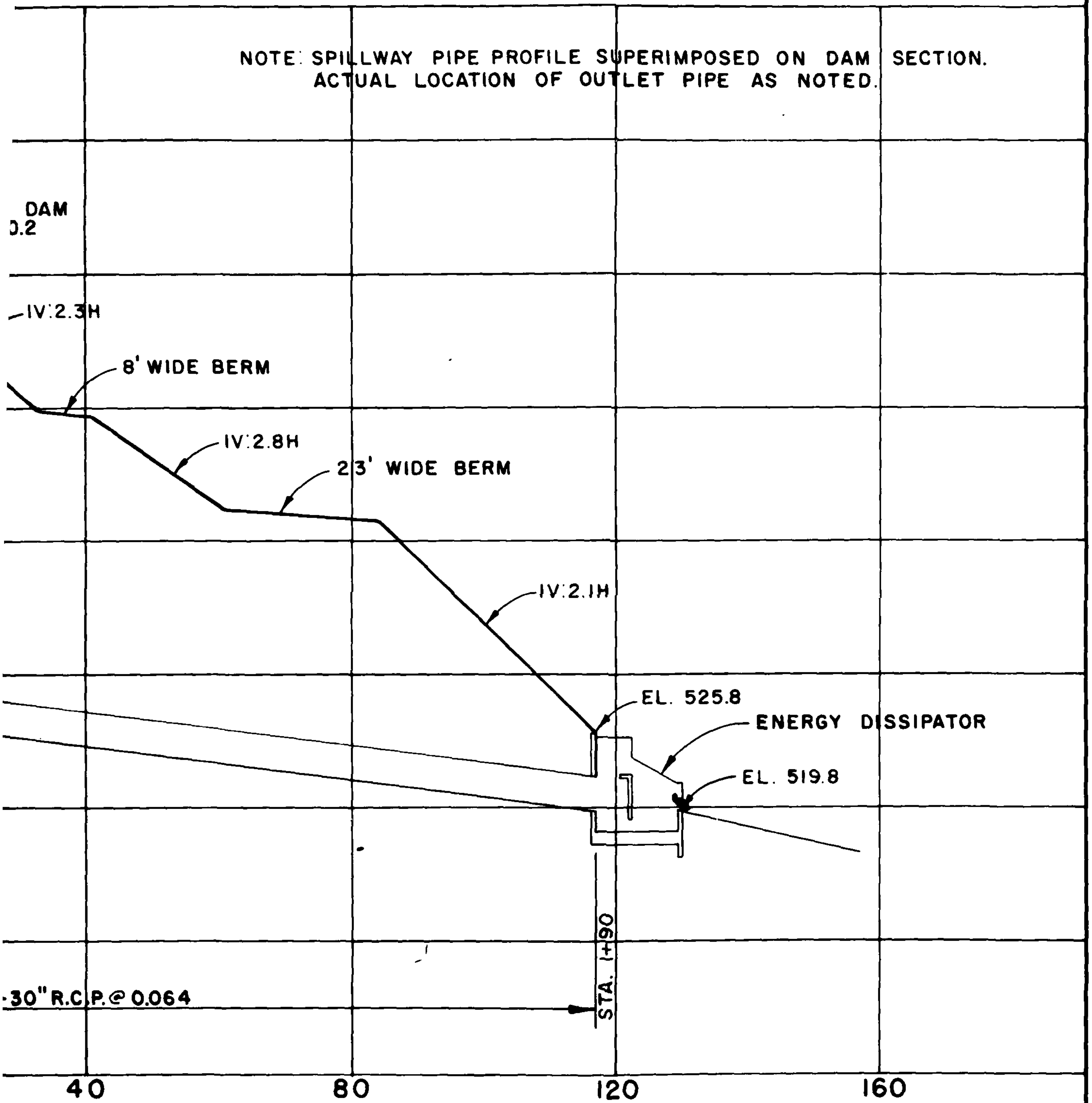

20'W.Easement To Fee Fee Trunk Sewer Inc.
15" V.C.P.
12" V.C.P.
8" V.C.P.
4250N
5110E
4124N
5400E
4070N
5160E
3995N
5425E
3995N
5095E
Zoning Limits
556.5
550.4
555.0
560
570
540
530
550
C-204


CHESTERFIELD VILLAGE
LAKE I
SITE PLAN
REITZ & JENS, INC.
JUNE, 1976
Scale: 1" = 50'
R=836.50'
8' VCP
8' VCP
10' W. Easement To
Fee Fee Trunk Sewer Inc.
Junction Box
5643
4124N
5400E
4065N
5525E
4050N
5620E
3995N
5425E
3945N
5545E
3930N
5640E
560
570
540
550
PLATE 7



DAM CROSS-SECTION STA

SCALES: 1"=10'V., 1"=2



S-SECTION STA. 1+90

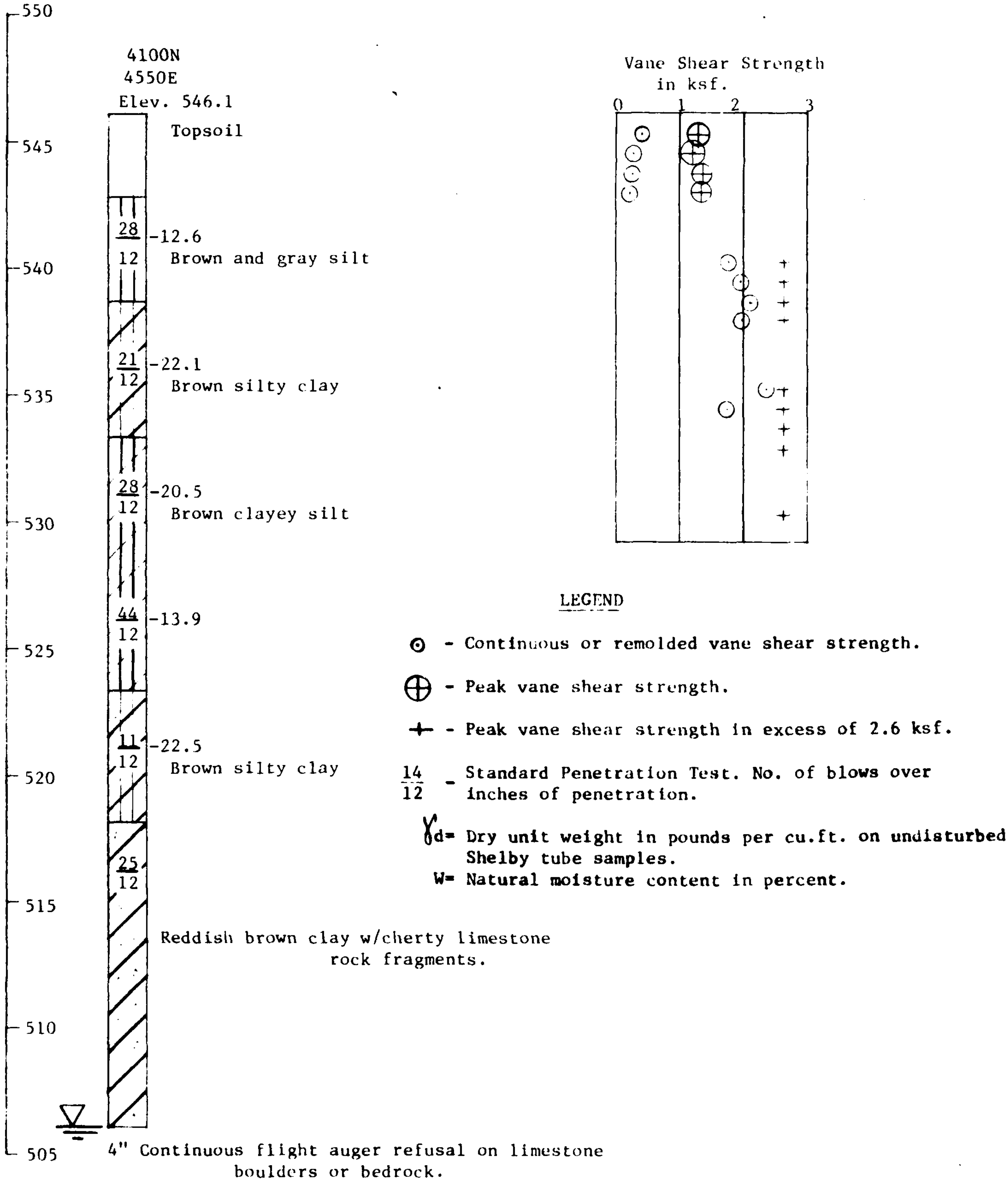
LES: 1"=10' V., 1"=20' H.

LAKE POST COMMONS
DAM CROSS-SECTION &
SPILLWAY PROFILE

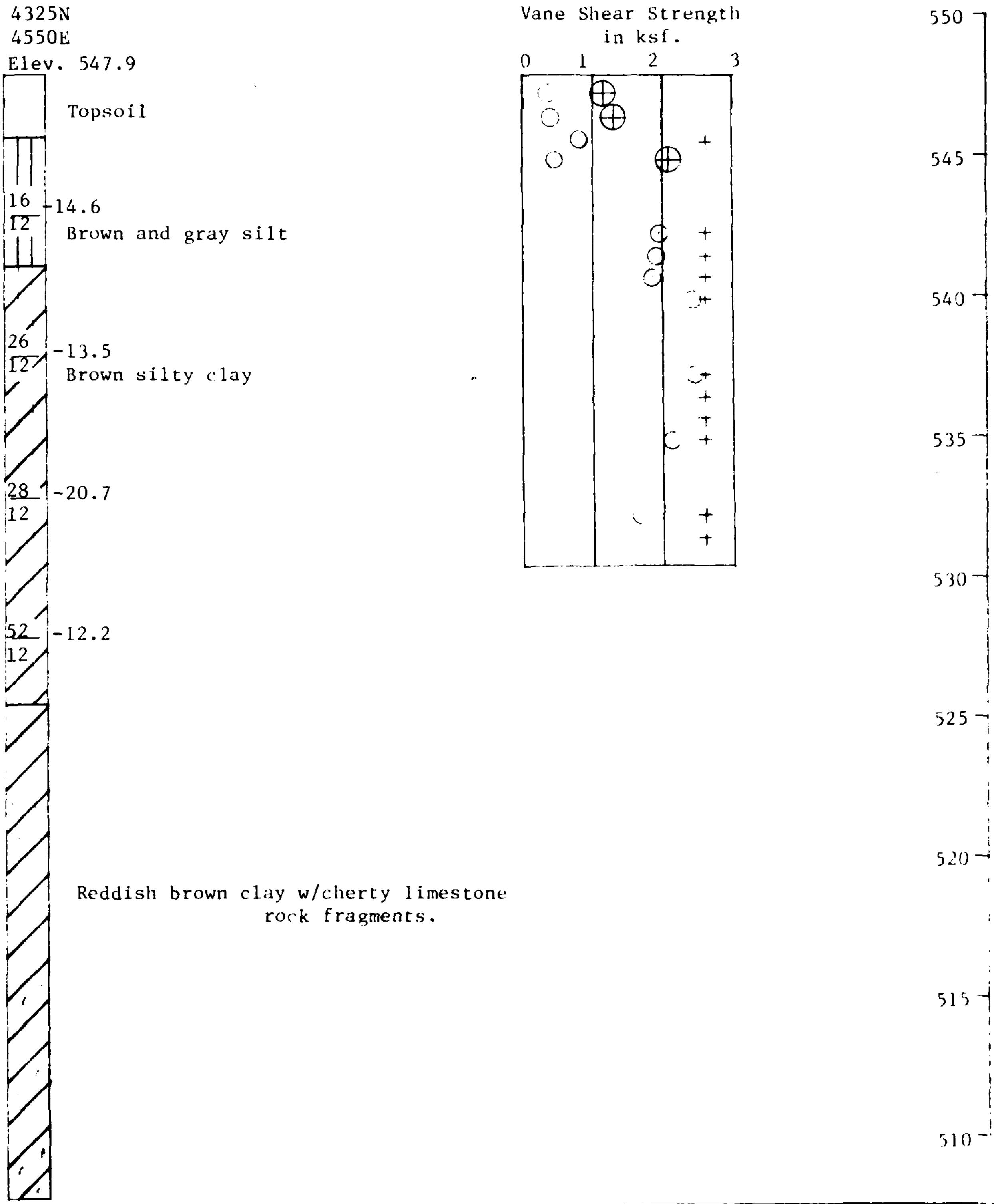
Horner & Shifrin, Inc. August 1980

PLATE 8

12



Drilled 11/22/74



4" Continuous flight auger refusal

Drilled 11/27/74

ngth.

2.6 ksf.

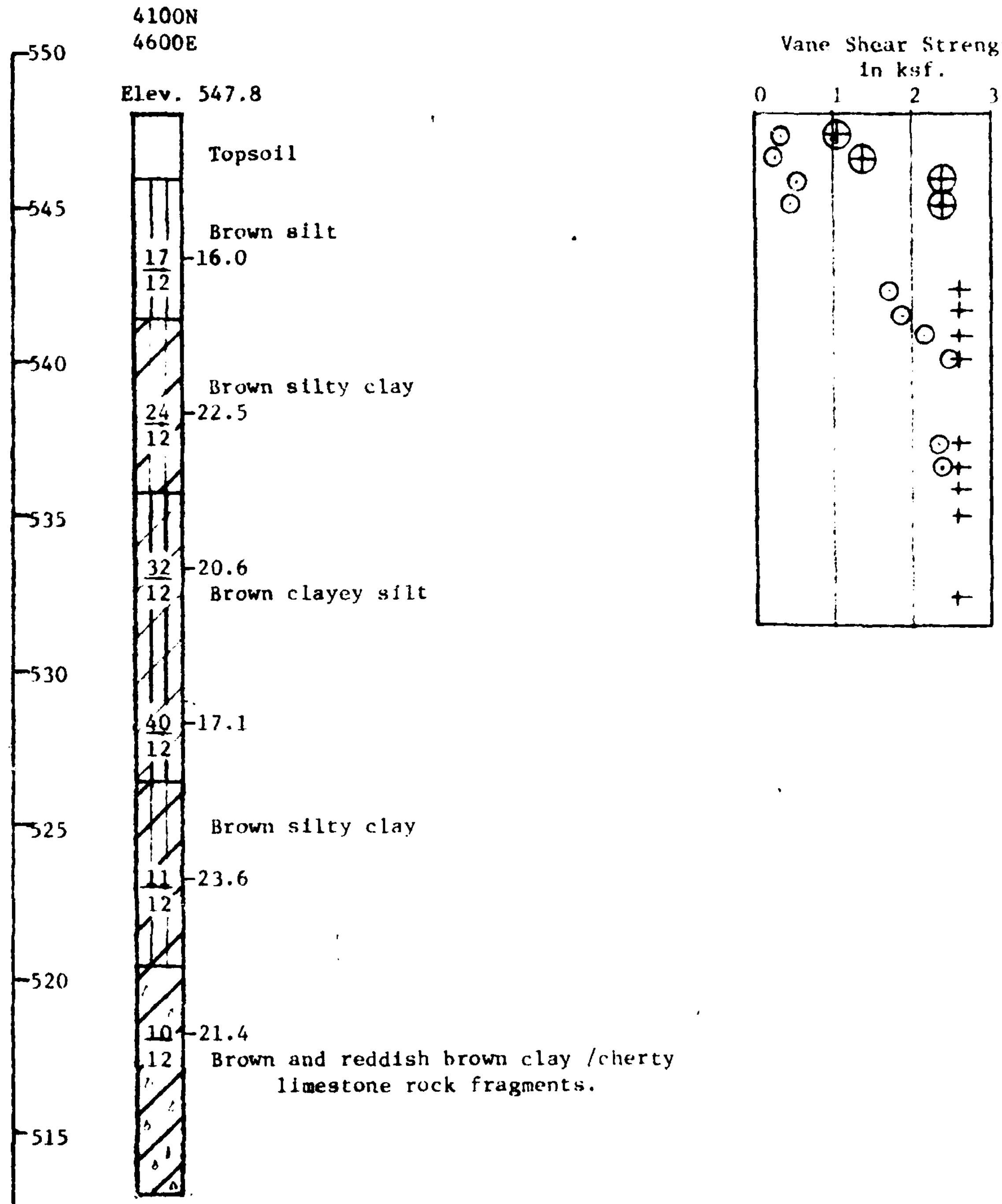
over

undisturbed

CHESTERFIELD VILLAGE Lake I	
BORING LOGS	
Reitz & Jens, Inc. Consulting Engineers — St. Louis, Mo. December 1974	Fig. 2-1

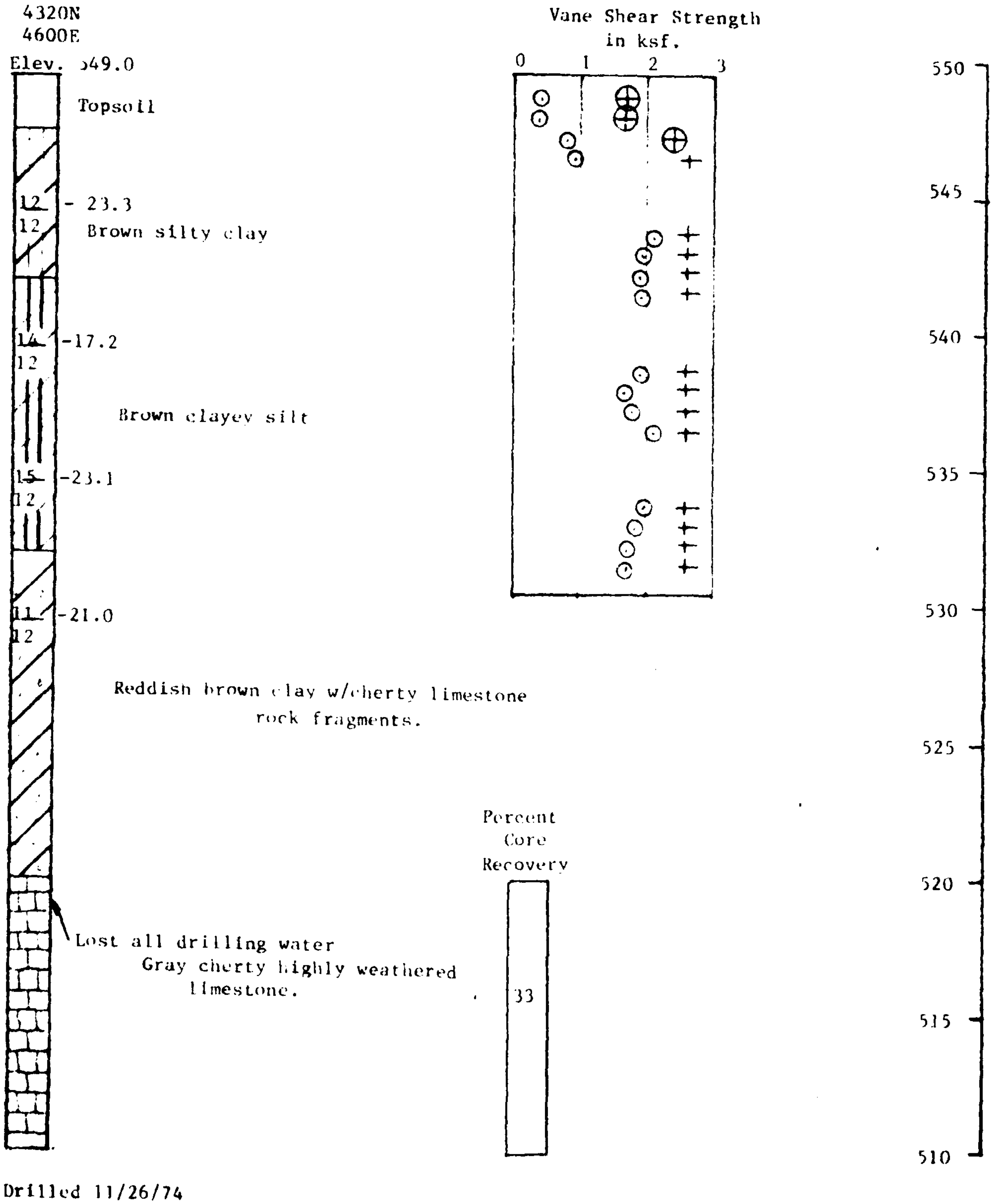
12

PLATE 9



4" Continuous flight auger refusal on limestone boulders or bedrock.

Drilled 11/22/74

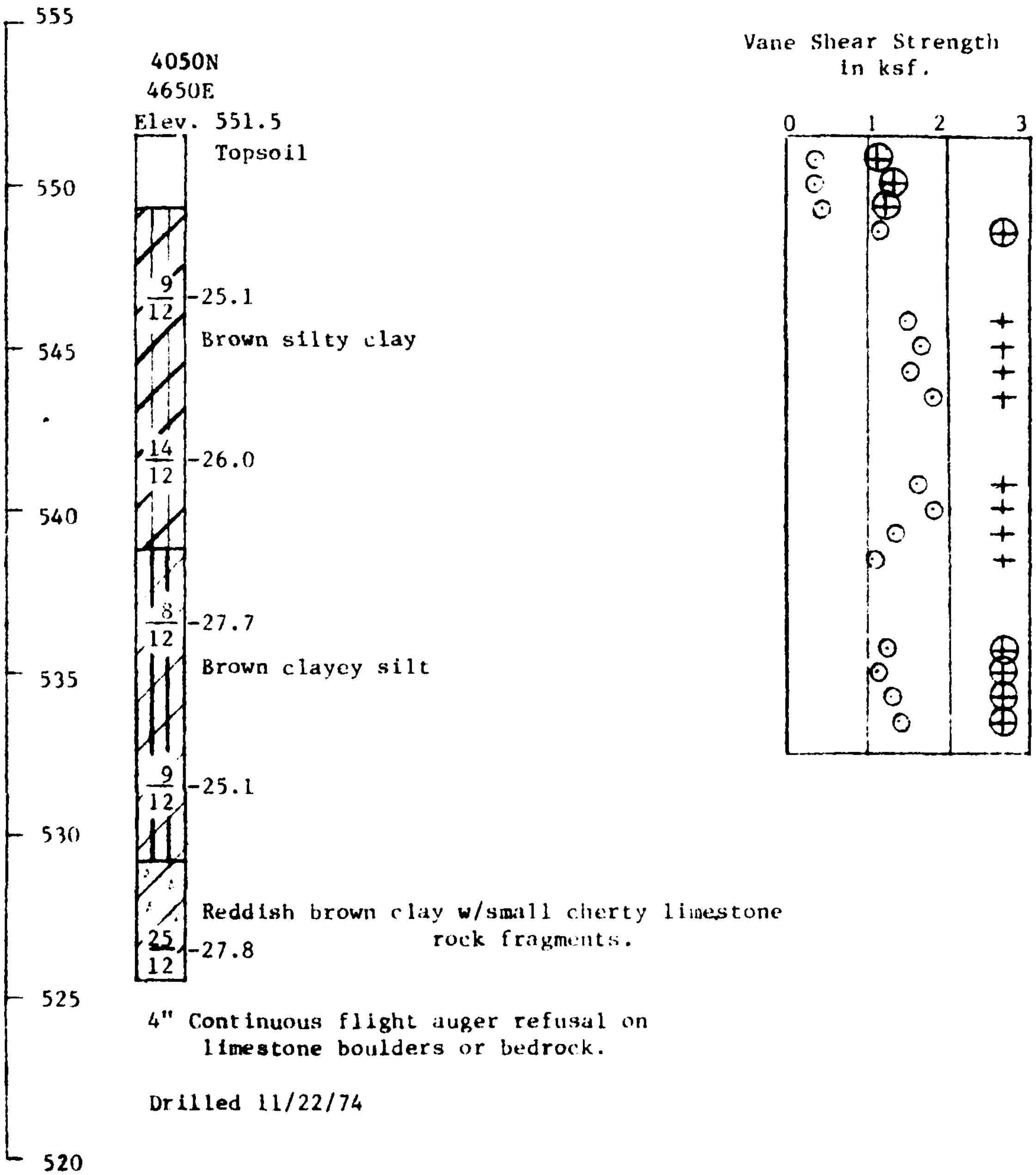


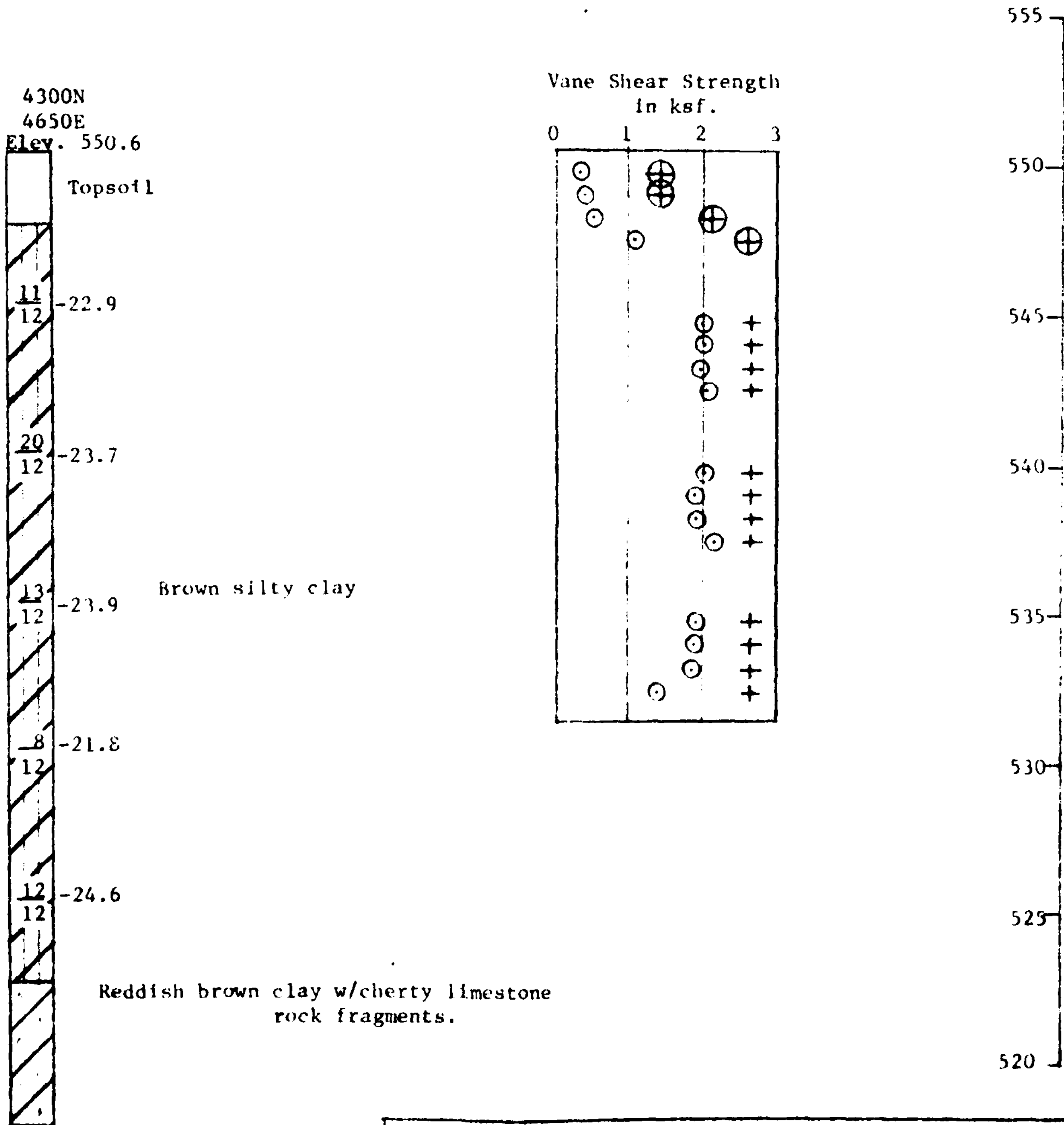
CHESTERFIELD VILLAGE
Lake I

BORING LOGS

Reitz & Jens, Inc. Consulting Engineers	St. Louis, Mo. December 1974	Fig. 2 2

PLATE 10


555
550
545
540
535
530
525
520
4050N
4650E
Elev. 551.5
Topsoil
9/12 -25.1
Brown silty clay
14/12 -26.0
8/12 -27.7
Brown clayey silt
9/12 -25.1
Reddish brown clay w/small cherty limestone rock fragments.
25/12 -27.8
4" Continuous flight auger refusal on limestone boulders or bedrock.
Drilled 11/22/74
Vane Shear Strength in ksf.
0
1
2
3



4" Continuous flight auger refusal on limestone.

Drilled 11/27/74

CHESTERFIELD VILLAGE Lake I		
BORING LOGS		
Reitz & Jens, Inc. Consulting Engineers	St. Louis, Mo. December 1974	Fig. 2-3

PLATE 11

APPENDIX A

INSPECTION PHOTOGRAPHS

NO. 1: UPSTREAM FACE OF DAM

NO. 2: DOWNSTREAM FACE OF DAM

NO. 3: LOWER BERM OF DAM AT ORIGINAL STREAM CHANNEL

NO. 4: DROP INLET SPILLWAY

NO. 5: ENERGY DISSIPATOR AT SPILLWAY OUTLET

NO. 6: 12" PIPE HEADWALL NEAR SPILLWAY OUTLET

NO. 7: CONCRETE BLOCK SLOPE PROTECTION ON UPSTREAM FACE OF DAM

NO. 8: RUBBLE SLOPE PROTECTION NEAR SPILLWAY OUTLET STRUCTURE

APPENDIX B

HYDROLOGIC AND HYDRAULIC ANALYSES

HYDROLOGIC AND HYDRAULIC COMPUTATIONS

1. The HEC-1 Dam Safety Version (July 1978, Modified 26 February 1979) program was used to develop inflow and outflow hydrographs and dam overtopping analyses, with hydrologic inputs as follows:

a. Probable maximum precipitation (200 sq. mile, 24-hour value equals 25.3 inches) from Hydrometeorological Report No. 33. The precipitation data used in the analysis of the 1 percent probability (100-year frequency) flood was provided by the St. Louis District, Corps of Engineers.

b. Drainage area = 0.19 square miles = 120 acres.

c. SCS parameters:

Time of Concentration (T_c) = $\left(\frac{11.9L^3}{H}\right)^{0.385}$ = 0.126 hours

Where: T_c = Travel time of water from hydraulically most distant point to point of interest, hours.

L = Length of longest watercourse, 0.35 miles

H = Elevation difference, 10 feet

The time of concentration (T_c) was obtained using Method C as described in Figure 30, "Design of Small Dams", by the United States Department of the Interior, Bureau of Reclamation, and was verified using average channel velocity estimates and watercourse lengths.

Lag Time = 0.075 hours (0.60 Tc)

Hydrologic Soil Group = 100% B (Memphis Series per County SCS Soil Report); urban development for entire area, with 49% average imperviousness

Soil type CN = 69 (AMC II, 1 percent probability flood condition)
= 84 (AMC III, PMF condition)

2. Spillway releases for the drop inlet spillway were computed utilizing equations and nomographs presented in "Design of Small Dams" by the U.S. Department of the Interior for drop inlet type spillways. The perimeter of the square inlet was equated to a circular section in order to determine a radius for use in the equations.

The rise of the nappe above the elevation of the crest lip was considered negligible. The following equation was used for crest control:

$$Q = C_o \ (2 \pi \ R_s) \ H_o^{3/2}$$

where "C_o" is a coefficient obtained from Figure 283 of the above reference, expressed in terms of H_o/R_s, "R_s" is the radius of the spillway crest (2.55 feet) , and "H_o" is the depth of flow over the crest.

Flow through the 30-inch diameter outlet pipe was determined using Bernoulli's equation for pressure flow in pipes. A friction factor (n) of 0.013 was used for the 30-inch diameter reinforced concrete pipe. Losses, including entrance, turn, pipe friction and exit losses totaled 2.57 velocity heads. Reference "Handbook of Hydraulics", Fifth Edition, by King & Brater, pages 8-5 and 8-6.

Limiting discharge quantities, determined by the methods described herein, were plotted versus corresponding lake water surface elevations to obtain the discharge rating curve for the drop inlet spillway, and corresponding values were entered into the program on the Y4 and Y5 cards.

3. The profile of the dam crest is irregular and flow over the dam cannot be determined by application of conventional weir formulas. Crest length and elevation data for the dam crest proper were entered into the HEC-1 Program on the $L and the $V cards. The program assumes that flow over the dam crest section occurs at critical depth and computes internally the flow over the dam crest and adds this flow to the flow passing the spillway as entered on the Y4 and Y5 cards.

```
A1      ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
A2      HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF LAKE POST COMMONS DAM
A3      RATIOS OF PMF ROUTED THROUGH RESERVOIR
B    288       0       5       0       0       0       0       0       0       0
B1     5
J      1       4       1
J1   .35     .40     .50      1.
K      0  INFLOW                                       1
K1      INFLOW HYDROGRAPH
M      1       2    .188                 1.0                     1
P      0    25.3     102     120     130
T                                               -1     -84             .49
W2          0.075
X   -1.0    -.10     2.0
K      1     DAM                                       1
K1      RESERVOIR ROUTING BY MODIFIED PULS
Y                              1       1
Y1     1                                     47.85      -1
Y4   553   553.5   554.0   554.5   555.0   555.2   564.0
Y5     0    22.6    57.6    91.1   113.1    122.    136.
$A     0    4.50    6.90   10.40
$E 521.1     553     560     570
$$   553
$D 559.9
$L     0     107     125     178     330     380     398     414     446
$V 559.9   560.2   560.3   560.5   560.7   560.9   562.1   563.6   566.9
K     99
```

```
A1       ANALYSIS OF DAM OVERTOPPING USING 100-YR FLOOD
A2       HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF LAKE POST COMMONS DAM
A3       100-YR FLOOD ROUTED THROUGH RESERVOIR
B      288       0       5                                               4
B1       5
J        1       1       1
J1      1.
K        0  INFLOW                                       1
K1       INFLOW HYDROGRAPH
M        0       2    .188                       1.0                     1
O      288   6.974
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01    .007    .007    .012    .012    .012    .012    .012    .012    .012    .012
01    .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
01    .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
01    .012    .012    .012    .012    .012    .012    .012    .012    .023    .023
01    .023    .023    .023    .023    .023    .023    .023    .023    .023    .023
01    .023    .023    .023    .023    .023    .023    .030    .030    .030    .030
01    .030    .030    .048    .048    .048    .049    .049    .049    .134    .134
01    .134    .255    .255    .546    .817    .380    .255    .134    .134    .134
01    .049    .049    .049    .048    .048    .048    .030    .030    .030    .030
01    .030    .030    .023    .023    .023    .023    .023    .023    .023    .023
```

100-YR. FLOOD (Cont'd)

```
01  .023    .023    .023    .023    .023    .023    .023    .023    .023    .023
01  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
01  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
01  .012    .012    .012    .012    .012    .012    .012    .012    .012    .012
01  .012    .012    .012    .012    .012    .012    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007    .007    .007
01  .007    .007    .007    .007    .007    .007    .007    .007
T                                                     -1     -69             .49
WZ         0.075
X   -1.0    -.10     2.0
K      1     DAM                                       1
K1     RESERVOIR ROUTING BY MODIFIED PULS
Y                              1       1
Y1     1                                           47.85      -1
Y4   553   553.5   554.0   554.5   555.0   555.2   564.0
Y5     0    22.6    57.6    91.1   113.1    122.    136.
$A     0    4.50    6.90   10.40
$E 521.1     553     560     570
$$   553
$D 559.9
$L     0     107     125     178     300     380     398     414     446
$V 559.9   560.2   560.3   560.5   560.7   560.9   562.1   563.6   564.9
K     99
```

ANALYSIS OF DAM OVERTOPPING USING RATIOS OF PMF
HYDROLOGIC-HYDRAULIC ANALYSIS OF SAFETY OF LAKE POST COMMONS DAM
RATIOS OF PMF ROUTED THROUGH RESERVOIR

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	5	0	0	0	0	0	0	0

JOPER	NWT	LROPT	TRACE
5	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 4 LRTIO= 1
RTIOS= .35 .40 .50 1.00

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INFLOW HYDROGRAPH

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
INFLOW	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.19	0.00	.19	1.00	0.000	0	1	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	25.30	102.00	120.00	130.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-84.00	0.00	.49

CURVE NO = -84.00 WETNESS = -1.00 EFFECT CN = 84.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .08

RECESSION DATA
STRTQ= -1.00 QRCSN= -.10 RTIOR= 2.00

TIME INCREMENT TOO LARGE--(NHQ IS GT LAG/2)

UNIT HYDROGRAPH 6 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .08 VOL= 1.00

635. 571. 173. 54. 17. 6.

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	.01	.01	5.	1.01	12.05	145	.22	.21	.01	182.
1.01	.10	2	.01	.01	.01	8.	1.01	12.10	146	.22	.21	.01	265.
1.01	.15	3	.01	.01	.01	10.	1.01	12.15	147	.22	.21	.01	291.
1.01	.20	4	.01	.01	.01	10.	1.01	12.20	148	.22	.21	.01	300.
1.01	.25	5	.01	.01	.01	10.	1.01	12.25	149	.22	.21	.01	303.
1.01	.30	6	.01	.01	.01	10.	1.01	12.30	150	.22	.21	.01	304.
1.01	.35	7	.01	.01	.01	10.	1.01	12.35	151	.22	.21	.01	305.
1.01	.40	8	.01	.01	.01	10.	1.01	12.40	152	.22	.21	.01	305.
1.01	.45	9	.01	.01	.01	10.	1.01	12.45	153	.22	.21	.01	305.
1.01	.50	10	.01	.01	.01	10.	1.01	12.50	154	.22	.21	.00	306.
1.01	.55	11	.01	.01	.01	10.	1.01	12.55	155	.22	.21	.00	306.
1.01	1.00	12	.01	.01	.01	10.	1.01	13.00	156	.22	.21	.00	306.
1.01	1.05	13	.01	.01	.01	10.	1.01	13.05	157	.26	.25	.00	333.
1.01	1.10	14	.01	.01	.01	10.	1.01	13.10	158	.26	.25	.00	358.
1.01	1.15	15	.01	.01	.01	10.	1.01	13.15	159	.26	.25	.00	365.
1.01	1.20	16	.01	.01	.01	10.	1.01	13.20	160	.26	.25	.00	368.
1.01	1.25	17	.01	.01	.01	10.	1.01	13.25	161	.26	.25	.00	369.
1.01	1.30	18	.01	.01	.01	10.	1.01	13.30	162	.26	.25	.00	370.
1.01	1.35	19	.01	.01	.01	10.	1.01	13.35	163	.26	.25	.00	370.
1.01	1.40	20	.01	.01	.01	10.	1.01	13.40	164	.26	.25	.00	370.
1.01	1.45	21	.01	.01	.01	10.	1.01	13.45	165	.26	.25	.00	370.
1.01	1.50	22	.01	.01	.01	10.	1.01	13.50	166	.26	.25	.00	371.
1.01	1.55	23	.01	.01	.01	10.	1.01	13.55	167	.26	.25	.00	371.
1.01	2.00	24	.01	.01	.01	10.	1.01	14.00	168	.26	.26	.00	371.
1.01	2.05	25	.01	.01	.01	10.	1.01	14.05	169	.32	.32	.00	412.
1.01	2.10	26	.01	.01	.01	10.	1.01	14.10	170	.32	.32	.00	448.
1.01	2.15	27	.01	.01	.01	10.	1.01	14.15	171	.32	.32	.00	460.
1.01	2.20	28	.01	.01	.01	10.	1.01	14.20	172	.32	.32	.00	463.
1.01	2.25	29	.01	.01	.01	10.	1.01	14.25	173	.32	.32	.00	465.
1.01	2.30	30	.01	.01	.01	10.	1.01	14.30	174	.32	.32	.00	465.
1.01	2.35	31	.01	.01	.01	10.	1.01	14.35	175	.32	.32	.00	465.
1.01	2.40	32	.01	.01	.01	11.	1.01	14.40	176	.32	.32	.00	465.
1.01	2.45	33	.01	.01	.01	11.	1.01	14.45	177	.32	.32	.00	466.
1.01	2.50	34	.01	.01	.01	11.	1.01	14.50	178	.32	.32	.00	466.
1.01	2.55	35	.01	.01	.01	11.	1.01	14.55	179	.32	.32	.00	466.
1.01	3.00	36	.01	.01	.01	11.	1.01	15.00	180	.32	.32	.00	466.
1.01	3.05	37	.01	.01	.01	11.	1.01	15.05	181	.20	.19	.00	386.
1.01	3.10	38	.01	.01	.01	11.	1.01	15.10	182	.39	.39	.00	437.
1.01	3.15	39	.01	.01	.01	11.	1.01	15.15	183	.39	.39	.00	528.
1.01	3.20	40	.01	.01	.01	12.	1.01	15.20	184	.59	.58	.00	679.
1.01	3.25	41	.01	.01	.01	12.	1.01	15.25	185	.69	.68	.00	861.
1.01	3.30	42	.01	.01	.01	12.	1.01	15.30	186	1.67	1.66	.01	1573.
1.01	3.35	43	.01	.01	.01	12.	1.01	15.35	187	2.75	2.74	.01	2842.
1.01	3.40	44	.01	.01	.01	12.	1.01	15.40	188	1.08	1.08	.00	2580.
1.01	3.45	45	.01	.01	.01	12.	1.01	15.45	189	.69	.68	.00	1626.
1.01	3.50	46	.01	.01	.01	12.	1.01	15.50	190	.59	.59	.00	1128.
1.01	3.55	47	.01	.01	.01	12.	1.01	15.55	191	.39	.39	.00	815.
1.01	4.00	48	.01	.01	.01	12.	1.01	16.00	192	.39	.39	.00	644.
1.01	4.05	49	.01	.01	.01	13.	1.01	16.05	193	.30	.30	.00	531.

END-OF-PERIOD FLOW (Cont'd)

1.01	4.10	50	.01	.01	.01	13.	1.01	16.10	194	.30	.30	.00	465.
1.01	4.15	51	.01	.01	.01	13.	1.01	16.15	195	.30	.30	.00	445.
1.01	4.20	52	.01	.01	.01	13.	1.01	16.20	196	.30	.30	.00	439.
1.01	4.25	53	.01	.01	.01	13.	1.01	16.25	197	.30	.30	.00	438.
1.01	4.30	54	.01	.01	.01	13.	1.01	16.30	198	.30	.30	.00	437.
1.01	4.35	55	.01	.01	.00	13.	1.01	16.35	199	.30	.30	.00	437.
1.01	4.40	56	.01	.01	.00	13.	1.01	16.40	200	.30	.30	.00	437.
1.01	4.45	57	.01	.01	.00	13.	1.01	16.45	201	.30	.30	.00	437.
1.01	4.50	58	.01	.01	.00	13.	1.01	16.50	202	.30	.30	.00	437.
1.01	4.55	59	.01	.01	.00	14.	1.01	16.55	203	.30	.30	.00	437.
1.01	5.00	60	.01	.01	.00	14.	1.01	17.00	204	.30	.30	.00	437.
1.01	5.05	61	.01	.01	.00	14.	1.01	17.05	205	.24	.24	.00	396.
1.01	5.10	62	.01	.01	.00	14.	1.01	17.10	206	.24	.24	.00	360.
1.01	5.15	63	.01	.01	.00	14.	1.01	17.15	207	.24	.24	.00	348.
1.01	5.20	64	.01	.01	.00	14.	1.01	17.20	208	.24	.24	.00	345.
1.01	5.25	65	.01	.01	.00	14.	1.01	17.25	209	.24	.24	.00	344.
1.01	5.30	66	.01	.01	.00	14.	1.01	17.30	210	.24	.24	.00	344.
1.01	5.35	67	.01	.01	.00	14.	1.01	17.35	211	.24	.24	.00	344.
1.01	5.40	68	.01	.01	.00	14.	1.01	17.40	212	.24	.24	.00	344.
1.01	5.45	69	.01	.01	.00	14.	1.01	17.45	213	.24	.24	.00	344.
1.01	5.50	70	.01	.01	.00	14.	1.01	17.50	214	.24	.24	.00	344.
1.01	5.55	71	.01	.01	.00	14.	1.01	17.55	215	.24	.24	.00	344.
1.01	6.00	72	.01	.01	.00	14.	1.01	18.00	216	.24	.24	.00	344.
1.01	6.05	73	.06	.05	.02	37.	1.01	18.05	217	.02	.02	.00	273.
1.01	6.10	74	.06	.05	.02	58.	1.01	18.10	218	.02	.02	.00	255.
1.01	6.15	75	.06	.05	.02	65.	1.01	18.15	219	.02	.02	.00	238.
1.01	6.20	76	.06	.05	.02	68.	1.01	18.20	220	.02	.02	.00	222.
1.01	6.25	77	.06	.05	.01	70.	1.01	18.25	221	.02	.02	.00	207.
1.01	6.30	78	.06	.05	.01	71.	1.01	18.30	222	.02	.02	.00	193.
1.01	6.35	79	.06	.05	.01	72.	1.01	18.35	223	.02	.02	.00	180.
1.01	6.40	80	.06	.05	.01	73.	1.01	18.40	224	.02	.02	.00	168.
1.01	6.45	81	.06	.05	.01	73.	1.01	18.45	225	.02	.02	.00	157.
1.01	6.50	82	.06	.05	.01	74.	1.01	18.50	226	.02	.02	.00	147.
1.01	6.55	83	.06	.05	.01	75.	1.01	18.55	227	.02	.02	.00	137.
1.01	7.00	84	.06	.05	.01	76.	1.01	19.00	228	.02	.02	.00	128.
1.01	7.05	85	.06	.05	.01	76.	1.01	19.05	229	.02	.02	.00	119.
1.01	7.10	86	.06	.05	.01	77.	1.01	19.10	230	.02	.02	.00	111.
1.01	7.15	87	.06	.05	.01	77.	1.01	19.15	231	.02	.02	.00	104.
1.01	7.20	88	.06	.05	.01	78.	1.01	19.20	232	.02	.02	.00	97.
1.01	7.25	89	.06	.05	.01	78.	1.01	19.25	233	.02	.02	.00	90.
1.01	7.30	90	.06	.05	.01	79.	1.01	19.30	234	.02	.02	.00	84.
1.01	7.35	91	.06	.05	.01	79.	1.01	19.35	235	.02	.02	.00	79.
1.01	7.40	92	.06	.06	.01	80.	1.01	19.40	236	.02	.02	.00	73.
1.01	7.45	93	.06	.06	.01	80.	1.01	19.45	237	.02	.02	.00	68.
1.01	7.50	94	.06	.06	.01	81.	1.01	19.50	238	.02	.02	.00	64.
1.01	7.55	95	.06	.06	.01	81.	1.01	19.55	239	.02	.02	.00	60.
1.01	8.00	96	.06	.06	.01	81.	1.01	20.00	240	.02	.02	.00	56.
1.01	8.05	97	.06	.06	.01	82.	1.01	20.05	241	.02	.02	.00	52.
1.01	8.10	98	.06	.06	.01	82.	1.01	20.10	242	.02	.02	.00	48.
1.01	8.15	99	.06	.06	.01	82.	1.01	20.15	243	.02	.02	.00	45.
1.01	8.20	100	.06	.06	.01	82.	1.01	20.20	244	.02	.02	.00	42.
1.01	8.25	101	.06	.06	.01	83.	1.01	20.25	245	.02	.02	.00	39.
1.01	8.30	102	.06	.06	.01	83.	1.01	20.30	246	.02	.02	.00	37.

1.01	8.35	103	.06	.06	.01	83.	1.01	20.35	247	.02	.02	.00	34.
1.01	8.40	104	.06	.06	.01	84.	1.01	20.40	248	.02	.02	.00	32.
1.01	8.45	105	.06	.06	.01	84.	1.01	20.45	249	.02	.02	.00	31.
1.01	8.50	106	.06	.06	.01	84.	1.01	20.50	250	.02	.02	.00	31.
1.01	8.55	107	.06	.06	.01	84.	1.01	20.55	251	.02	.02	.00	31.
1.01	9.00	108	.06	.06	.01	84.	1.01	21.00	252	.02	.02	.00	31.
1.01	9.05	109	.06	.06	.00	85.	1.01	21.05	253	.02	.02	.00	31.
1.01	9.10	110	.06	.06	.00	85.	1.01	21.10	254	.02	.02	.00	31.
1.01	9.15	111	.06	.06	.00	85.	1.01	21.15	255	.02	.02	.00	31.
1.01	9.20	112	.06	.06	.00	85.	1.01	21.20	256	.02	.02	.00	31.
1.01	9.25	113	.06	.06	.00	85.	1.01	21.25	257	.02	.02	.00	31.
1.01	9.30	114	.06	.06	.00	86.	1.01	21.30	258	.02	.02	.00	31.
1.01	9.35	115	.06	.06	.00	86.	1.01	21.35	259	.02	.02	.00	31.
1.01	9.40	116	.06	.06	.00	86.	1.01	21.40	260	.02	.02	.00	31.
1.01	9.45	117	.06	.06	.00	86.	1.01	21.45	261	.02	.02	.00	31.
1.01	9.50	118	.06	.06	.00	86.	1.01	21.50	262	.02	.02	.00	31.
1.01	9.55	119	.06	.06	.00	86.	1.01	21.55	263	.02	.02	.00	31.
1.01	10.00	120	.06	.06	.00	86.	1.01	22.00	264	.02	.02	.00	31.
1.01	10.05	121	.06	.06	.00	87.	1.01	22.05	265	.02	.02	.00	31.
1.01	10.10	122	.06	.06	.00	87.	1.01	22.10	266	.02	.02	.00	31.
1.01	10.15	123	.06	.06	.00	87.	1.01	22.15	267	.02	.02	.00	31.
1.01	10.20	124	.06	.06	.00	87.	1.01	22.20	268	.02	.02	.00	31.
1.01	10.25	125	.06	.06	.00	87.	1.01	22.25	269	.02	.02	.00	31.
1.01	10.30	126	.06	.06	.00	87.	1.01	22.30	270	.02	.02	.00	31.
1.01	10.35	127	.06	.06	.00	87.	1.01	22.35	271	.02	.02	.00	31.
1.01	10.40	128	.06	.06	.00	87.	1.01	22.40	272	.02	.02	.00	31.
1.01	10.45	129	.06	.06	.00	87.	1.01	22.45	273	.02	.02	.00	31.
1.01	10.50	130	.06	.06	.00	87.	1.01	22.50	274	.02	.02	.00	31.
1.01	10.55	131	.06	.06	.00	88.	1.01	22.55	275	.02	.02	.00	31.
1.01	11.00	132	.06	.06	.00	88.	1.01	23.00	276	.02	.02	.00	31.
1.01	11.05	133	.06	.06	.00	88.	1.01	23.05	277	.02	.02	.00	31.
1.01	11.10	134	.06	.06	.00	88.	1.01	23.10	278	.02	.02	.00	31.
1.01	11.15	135	.06	.06	.00	88.	1.01	23.15	279	.02	.02	.00	31.
1.01	11.20	136	.06	.06	.00	88.	1.01	23.20	280	.02	.02	.00	31.
1.01	11.25	137	.06	.06	.00	88.	1.01	23.25	281	.02	.02	.00	31.
1.01	11.30	138	.06	.06	.00	88.	1.01	23.30	282	.02	.02	.00	31.
1.01	11.35	139	.06	.06	.00	88.	1.01	23.35	283	.02	.02	.00	31.
1.01	11.40	140	.06	.06	.00	88.	1.01	23.40	284	.02	.02	.00	31.
1.01	11.45	141	.06	.06	.00	88.	1.01	23.45	285	.02	.02	.00	31.
1.01	11.50	142	.06	.06	.00	88.	1.01	23.50	286	.02	.02	.00	31.
1.01	11.55	143	.06	.06	.00	89.	1.01	23.55	287	.02	.02	.00	31.
1.01	12.00	144	.06	.06	.00	89.	1.02	0.00	288	.02	.02	.00	31.

SUM	32.89	31.78	1.11	48641.
	(835.)	(807.)	(28.)	(1377.36)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	2842.	516.	169.	169.	48608.
CMS	80.	15.	5.	5.	1376.
INCHES		25.52	33.40	33.40	33.40
MM		648.19	848.47	848.47	848.47
AC-FT		256.	335.	335.	335.
THOUS CU M		315.	413.	413.	413.

SURFACE AREA=	0.	5.	7.	10.
CAPACITY=	0.	48.	87.	173.
ELEVATION=	521.	553.	560.	570.

SUMMARY OF DAM SAFETY ANALYSIS
PMF

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	553.00	553.00	559.90
STORAGE	48.	48.	87.
OUTFLOW	0.	0.	129.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.35	559.82	0.00	86.	129.	0.00	17.17	0.00
.40	560.45	.55	91.	222.	2.75	16.08	0.00
.50	561.14	1.24	96.	882.	3.25	15.75	0.00
1.00	562.10	2.20	103.	2716.	5.75	15.67	0.00

SUMMARY OF DAM SAFETY ANALYSIS
100-YR. FLOOD

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	553.00	553.00	559.90
STORAGE	48.	48.	87.
OUTFLOW	0.	0.	129.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	557.01	0.00	68.	1[illegible]5.	0.00	12.58	0.00

DATE

ILME