MULTIPLE-PURPOSE PROJECT OSAGE RIVER BASIN HUNDRED AND TEN MILE CREEK KAN. (U) CORPS OF ENGINEERS KANSAS CITY MO KANSAS CITY DISTRICT L C MYERS ET AL. OCT 83
The purpose of this report is to present a complete record of the geology and foundation conditions encountered during construction of Pomona Dam. The report focuses primarily on the foundations of the outlet works, right abutment, and spillway area where the bulk of rock foundations are involved.
APPENDIX VII

CONSTRUCTION FOUNDATION REPORT

1977
(Revised October 1983)

DEPARTMENT OF THE ARMY
KANSAS CITY DISTRICT, CORPS OF ENGINEERS
KANSAS CITY, MISSOURI
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1-01. Location and Description.

a. Pomona Lake is located at mile 7.0 on One Hundred and Ten Mile Creek, a tributary of the Marais des Cygnes River in Osage County, Kansas (see plate No. 1). The project is designed for multipurpose use in flood control and water conservation. The flood control (full) pool at elevation 1003 covers 8,600 surface acres and stores 176,500 acre-feet of water. The conservation pool, at elevation 974 covers 4,000 surface acres and stores 70,000 acre-feet of water. The dam consists of a zoned earthfill embankment, about 7,750 feet long, 111 feet high, with a maximum base width of 900 feet (see plate No. 21). The top of dam elevation is 1031. The outlet works is located in the right abutment approximately at flood plain level (see plate No. 21) and consists of an approach channel, control tower, a 13.5 foot (ID) single horseshoe conduit, transition section, stilling basin and outlet channel. Invert elevations range from 925 at the intake tower to 914 in the stilling basin. Outlet works capacity is 9,200 c.f.s. The uncontrolled spillway is located in a natural saddle about 1,760 feet west of the right abutment (see plate No. 21) and consists of a 200 foot wide by 1,500 foot long channel with an anchored concrete sill.


1-03. Purpose and Scope. The purpose of this report is to present a complete record of the geology and foundation conditions, excavation procedures and equipment for future use. This report will focus primarily on foundations for the outlet works, right abutment, and spillway area where the bulk of rock foundations are involved. Stage I Construction was awarded to List and Clark Construction Company, Kansas City, Missouri, by Contract Number DA-23-028-CIVENG-59-551. Work on this contract started in July 1959 and consisted of excavating and making initial diversion of the stream, placing a portion of the embankment between the right abutment and the diversion channel, excavating and constructing the outlet works, and the bulk of work in constructing the spillway and construction of some of the access and service roads. The Resident Engineer was Mr. Fredrick Blanks.
Completion of Embankment Contract was awarded to Cook Construction Company, Jackson, Mississippi, Contract Number DA-23-028-CIVENG-61-250. Work on this contract started in January 1961 and consisted primarily of completing the embankment and making closure and diversion. The Resident Engineer was Mr. Ralph Dennis. The Project Geologist for both Stages was Mr. Lynn C. Myers.
CHAPTER 2
FOUNDATION INVESTIGATIONS

2-01. Investigations Prior to Construction.

a. A total of 326 test borings were completed prior to construction, of which 152 were drive holes, 20 undisturbed sample holes, 71 bedrock core holes, and 33 auger holes. In addition, fifty 30-inch or 36-inch machine auger holes were drilled as test pits. Most of the drive holes were 3-inch diameter and the balance were 6-inch. The bedrock core borings were of 2-1/8-inch and 6-inch diameter. A total of 4,420 lineal feet of overburden drilling and 4,053 lineal feet of bedrock coring was completed prior to construction (see plate No. 31).

b. Pressure Testing. Eleven core holes were pressure tested before construction. Two of these were located on the left abutment, two in the flood plain, four in the outlet works area, and three in the spillway area. Expansion packers set at 5-foot intervals were used in conducting flow tests and pressure duration tests at each location immediately following completion of drilling. Tests indicate a relatively tight foundation. Water and water pressure losses were practically negligible except in the upper few feet of the borings, in the primary zone of weathering. Results of pressure tests during grouting are shown on plates Nos. 36 thru 41.

2-02. Investigations During Construction. Sixty-three drive holes totaling 762 lineal feet and 30 core holes totaling 531 lineal feet were completed by Government drill crews. Sixty-three hand auger holes were completed by project personnel in developing the borrow areas.

2-03. Geology and Physiography.

a. General. Pomona Lake lies within the physiographic region known as the Osage Plains Section of the Central Lowland Province. This section is characterized by a series of plains separated by eastward facing escarpments, formed by differential erosion of harder and softer, upper Pennsylvanian limestone and shale strata, which dip gently westward. Hundred and Ten Mile Creek rises in the northwestern corner of Osage County, a few miles north of the town of Burlingame. It is a moderately incised, meandering stream with a relatively low gradient flowing within a mature valley. Valley widths average about 3,000 feet along Hundred and Ten Mile Creek with slightly greater widths along Dragoon Creek, a major tributary.

b. Topography. Major topographic forms in the dam and reservoir area are the Hundred and Ten Mile Creek flood plain and bordering steeper slopes on the right and more gentle slopes on the left abutment. At the centerline of the dam, the flood plain is approximately 3,500 feet wide. Hundred and Ten Mile Creek flowed near the right valley wall at the elevation 920 feet, m.s.l., with flood plain elevations ranging from 935 to 950 feet, m.s.l. The right abutment rises steeply at the axis to an elevation of 1066 in 800 feet, while the left abutment rises gently to elevation 1085 in 4,600 feet from the left edge of the flood plain.
Along the left abutment slope, two levels of terrace remnants form rather pronounced benches; one at elevation 945± and another at elevation 990±. These terraces reflect the positions of two major limestone ledges underlying them. At the damsite, ancient stream action has scoured deeply at a point in the vicinity of the present stream channel producing, in effect, a "buried channel."

c. **Overburden.** Overburden soils are primarily alluvial in origin, with older alluvial terrace remnants covering a major portion of the valley slopes. Residual soils occur as thin layers immediately above bedrock over a considerable area and also comprise a major portion of the overburden in the upper abutment slopes in the vicinity of the dam. Soils vary from fat to lean clays with fat clays predominating in the valley slopes and lean clays in the flood plain. The older alluvial terrace soils contain varying amounts of chert gravel which locally range as high as 60 percent. The recent alluvium of the buried channel contains irregular lenses and layers of silty, clayey gravel below a depth of 22 feet and may persist over areas of considerable extent. The maximum amount of overburden exists in a buried channel that is located along and intersecting the upstream toe of the embankment. This ancient channel was exposed in the diversion at station 41+00, range 4±25 U.S. and indications are that it extends along a NE-SW line to station 30+00, range 0+00. Elsewhere, the overburden is generally 3 to 15 feet thick. The Plattsmouth limestone exhibits a subdued outcrop on the left abutment while more prominent outcrops of Kereford limestone Clay Creek limestone, and Spring Branch limestone occur on the right abutment. Consequently, no appreciable amount of excavation was required on the abutments to find competent foundation. The right abutment was brought to preliminary grade after clearing and grubbing operations by the Stage I Contractor.

d. A cutoff trench was excavated from station 25+00 on the right abutment to station 85+00 on the left abutment according to plans and specifications (see photo No. 31), except in the vicinity of station 26+50 to station 27+00 where the necessity for such a trench was eliminated by the removal of materials from slides which occurred along the excavated slope of the Heumader shale. The plane of weakness causing the slides was in the transition zone between the residual clay and the shale. This shale weathers to a fat clay and it is, therefore, extremely difficult to hold on slopes steeper than 1V on 2.5H. Another such slide occurred downstream of the stilling basin. This slide necessitated removal of some 18,000 cubic yards of overburden and the placement of rockfill.

2-04. **Bedrock Stratigraphy.** The bedrock strata of this area are classified as upper Pennsylvanian system; the Virgilian series, Shawnee group. The uppermost formation is the Lecompton limestone with the members named in descending order: Avoca limestone, King Hill shale, Bell limestone, Queen Hill shale, Big Springs limestone, Doniphan shale and the Spring Branch limestone. The spillway is founded on the Spring Branch limestone member. For convenience during excavation, it was divided into three zones: "A" zone - 7 feet of limestone, "B" zone - 6 feet of shale, and "C" zone - 6 feet of limestone. The middle formation is the Kanwaka shale with the members named in descending order: Stull shale, Clay Creek limestone and

VII-2-2
Jackson Park shale. The abutment of the service bridge is founded on top of the Clay Creek limestone member. The lowest formation in the work area is the Oread limestone. Its members in descending order are as follows: Kereford limestone, Heumader shale, Plattsmouth limestone, Heebner shale, Leavenworth limestone, Snyderville shale and Toronto limestone which is present in the left abutment only. The bulk of foundation excavation was in the upper three members of this formation, and the Plattsmouth serves as foundation for the outlet works. The lower four members are below any excavation (see plate No. 32).

2-05. Bedrock Structure. The general bedrock structure of the area can be described as a gentle homocline dipping slightly NNW approximately one foot vertical for every 110 feet horizontal with minor variations in local areas of the foundation of the outlet works. There the strata dip downstream SSE. From range 2+25 U.S. to 0+50 D.S. The dip is one foot in 55 feet. From range 0+50 D.S. to 1+00 D.S. The dip is one foot in 8 feet. From range 1+00 D.S. to 1+60 D.S., the strata rises one foot in 30 feet. From range 1+60 D.S. to 4+99 D.S. the dip is one foot in 170 feet. Bedrock in the spillway is essentially horizontal, dipping due east approximately 1.5 feet in 200 feet.

2-06. Weathering.

a. Chemical weathering of the strata was noted in the foundations of monoliths 5 thru 10 of the conduit. The lower Plattsmouth limestone was stained red and some solution channels were noted. The upper 0.5 foot of the limestone in this area was somewhat leached. Shale partings were weathered to clay or were completely removed.

b. Mechanical weathering was noted in the limestone foundation of monoliths 5 thru 9 of the conduit. The left (or riverward) half of the foundation was generally 0.5 feet to 1.0 foot lower than the right half of the foundation, with some small potholes 1.5 feet lower than the general foundation surface.

2-07. Strength of Rock. Core samples from 17 drill holes have been tested for strength in vertical compression, dry weight, moisture content, and wet-dry tests. Results are included in table II. With the exception of the Heebner shale member, all shale samples broken down completely during the first cycle of wetting and drying. The Heebner shale ranged from 100 percent breakdown in one cycle to no change in 20 cycles. The upper Heebner was the more vulnerable to this type of test.
CHAPTER 3

FOUNDATION CONDITIONS AND TREATMENT

3-01. Excavation.

a. Common Excavation. Overburden excavation of the diversion channel began in July 1959. After stripping, all satisfactory material was placed in the impervious zone of the embankment. This was followed by overburden excavation of the outlet works and the spillway. The excavated materials were placed in either the impervious, berm, or in waste areas as determined by their character during excavation. The equipment used for overburden excavation was a dragline and Euclid belly dump trucks.

b. Rock Excavation. Rock, from required excavation, was utilized in the embankment. Ammonium nitrate and 60 percent dynamite were used. No blasting records were kept. The powder factor averaged 0.75 pounds of explosives per cubic yard of rock. Rock from required excavation in the diversion channel and outlet works was used as class I rockfill, class II rockfill and bedding, (see photo No. 34). Rock excavated from the spillway was used as limestone and shale fill. Line drilling and shot hole drilling was accomplished with air-trac type equipment. The rock excavation lines were generally within the prescribed limits, (see photo No. 19). One notable exception occurred where the right training wall ties into the Plattsmouth limestone approach channel. This portion was somewhat overshot and 19 cubic yards of fill concrete were used by the Stage I Contractor to backfill the overbreak. Another overbreak occurred in the upstream key trench of the spillway where 15 cubic yards of structural concrete was used. Excavation of this trench and the downstream trench was difficult because of the interior rock slopes indicated in the plans. After trying several schemes involving variations of shot hole drilling and firing delays, the Contractor line drilled (on an angle) this slope. The resulting excavation line was excellent and this method was used for the remaining interior slopes, (see photos Nos. 20 thru 30, and plate No. 32). Rock excavation was accomplished with power shovels, draglines, Turnarockers, and Euclids.

3-02. Anchor Bars. Anchor bars were installed in the stilling basin and in the spillway. Holes were drilled with 6-inch diameter tricone roller bits using air to remove drill cuttings. The drill rig was mounted on a D-8 caterpillar dozer that also carried a compressor and dust exhausting system. All holes in the horizontal section of the spillway were drilled prior to excavating the sill to final grade. This allowed the drilling to be done from a level surface. The holes were then filled with sand and remained in that condition until the excavation was later brought to final grade. The holes were overdrilled 0.5 foot and then cleaned by use of air-water jetting. The holes were then pumped and swabbed just prior to placing the anchor bars. Drilling of the anchor bar holes on the 1V on 1.5H side slopes of the spillway was done by Stage I grouting subcontractor. This drilling was done by laying track up the slope along the line of holes and using a drill rig mounted on a self-leveling platform (see photos Nos. 29, 30, 32 and 33). Anchor bar holes that penetrated more than 3 feet into the Stull shale were "belled" at
the bottom according to specifications. This was done by using a special bit designed to ride on the bottom of the hole and, by rotating and applying pressure, the cutting edges were forced out and the required dimensions obtained. The excavation was later brought to final grade, the sand was jetted out and the holes pumped and swabbed. Grout was then placed in the hole, rodded, and the anchor bar, adjusted to proper elevation, was then spaced and suspended in the grout.

3-03. Foundation Preparation. The preparation of rock foundations was accomplished in two phases. Preliminary preparation consisted of a close visual examination, aided by air-water jets, and sounding the foundation for drummy rock. A rock drill was also employed to check for soft clay seams, to a depth of 4 feet below the excavation line. Any objectionable material was hand excavated and final foundation cleanup was done immediately prior to placing concrete. This was a final wash with air and water. The water was pumped or sponged as necessary and grout and concrete placed. All rock foundations were in limestone except for a 5-foot section of Doniphan shale at the top of the 1V on 1.5H side slopes in the spillway and the service bridge pier foundation in the Heumader shale. On the shale foundation, brooming and air jets were used to prepare the foundation. Foundation surfaces where soil fill was to be placed received the same foundation cleanup as those surfaces which received concrete except that the final wash was omitted. The soil foundation areas were prepared to receive fill by scarifying and rolling according to the plans and specifications.

3-04. Character of Foundations.

a. Outlet Works. The rock foundations of both the outlet works and the spillway were excavated along essentially horizontal bedding planes and are considered to be excellent. Although the foundation of the outlet works is jointed, the joints are tight and unstained except in the riverward half of monoliths 5 thru 9, as indicated previously (see photos Nos. 1 thru 14 and plate No. 35). To further substantiate the degree of competency of the foundation, 22 rock drill holes were drilled to check the subsoil for weak zones. Where soft zones or solution channels were found, the material was removed prior to final preparation. A shale bed, in the lower Plattsmouth limestone in the outlet works foundation between monoliths 5 and 12, was excavated because of its soft condition. At monolith 12 the shale's competence improved and the foundation excavation grade was raised 1.5 feet to the top of the shale.

b. Spillway. The foundation of the spillway slab was not mapped. It was in unweathered Spring Branch limestone, "C" zone, and was in excellent condition. The least competent foundations here underlined the top slabs of the sill on both slopes. These portions rest on comparatively weak Doniphan shale. However, very little support is needed as no appreciable load is carried. The abutment pier of the service bridge was founded on top of the Clay Creek limestone. The usual prominent jointing of this member was in evidence but the foundation appeared quite competent, as did the service bridge pier foundation which was in firm and unweathered Heumader shale (see photos Nos. 20 thru 28).
3-05. **Ground Water.** Control of ground water entering the foundations was not difficult but several extended wet periods proved troublesome because of surface runoff and activation of wet weather springs. Considerable pumping was required to keep the various areas dewatered. The wet periods proved especially bothersome during excavation and backfill of the 5-foot deep cutoff trench in an area near the toe of the left abutment. In this area water migrated along the top of bedrock through the valley alluvium and into the cutoff trench. The water was controlled by using centrifugal pumps and, after removal of objectionable material, normal backfilling and compaction was accomplished.

3-06. **Curtain Grouting.**

a. Stage I grout operations began in December 1959 and were completed in December 1960 (see plate No. 38). Grouting, using the stage grouting method, was started at Sta. 31+00, Range 0+60 U.S. and progressed to Sta. 28+60, Range 0+60, Range 0+60 U.S. Because of haul road traffic and outlet works excavation, grouting operations were then moved to the right abutment. Grouting operations began there at Sta. 26+30, Range 0+60 U.S. and progressed up slope to Sta. 24+67, Range 0+05 U.S. (see plates Nos. 40 and 41). After completing this section of the grout curtain the operations were moved to Sta. 27+55, Range 0+60 U.S. and progressed up slope to tie into the grout curtain at Sta. 26+30, Range 0+60 U.S. (see plate No. 39). The curtain was then completed between Sta. 28+60, Range 0+60 U.S. and Sta. 27+84.5, Range 0+60 U.S., except for five conduit grout holes which were completed under Modification No. 15 in July 1961. The grouting subcontractor was Air-Made Well Company, Edwardsville, Kansas (now known as the Judy Drilling Co.). The subcontractor laid railroad track on the right abutment, on the outlet works slopes and drilled grout holes with the drill mounted on the rails. This method simplified the operation of relocating over the drill holes as the succeeding zones were drilled (see photo No. 37). Excluding the five conduit holes, the Stage I Contract grouting subcontractor drilled a total of 7,212 lineal feet of grout hole, made 122 grout hole connections, and used a total of 2,386 cubic feet of cement. One thousand nine hundred and thirty-seven cubic feet of cement were injected and 354 cubic feet were used for backfill of grout holes. Under Modification No. 15 for the conduit grouting, 143 lineal feet of grout holes were drilled, four connections were made and 17 cubic feet of cement were used.

b. Embankment grouting began in June 1961 and was completed in August 1961. This contract covered the following areas: from Sta. 63+80, Range 0+60 U.S. to Sta. 67+50, Range 0+60 U.S.; and the diversion channel from Sta. 40+03, Range 0+60 U.S. to Sta. 40+98, Range 0+60 U.S. (see plates Nos. 36 and 37). Stage grouting techniques were used. The grouting subcontractor was Layne-Western Company, Kansas City, Missouri. The subcontractor drilled 1,042 lineal feet of grout hole, made 23 connections, injected 31 cubic feet of cement and used a total of 78 cubic feet of cement. A summary of grout "takes" is shown on table I.

VII-3-3
3-07. Closure. Overburden in the diversion channel was excavated with scrapers when dry. Wet muck and organic clays were excavated with a dragline. The sides were sloped 1V on 2.5H. The excavation was continued down into Plattsmouth limestone to elevation 920 using jackhammers, and by picking and barring. The bottom width was 40 feet and the side slopes were cut 1V on 1H. After dewatering the foundation surfaces were cleaned with three separate washes using air-water jets. Rolled impervious clay was then placed. Compaction equipment traveled parallel to the rock side slopes until the fill reached the top of rock at which time the equipment resumed the normal direction of compaction parallel to the embankment (see photos Nos. 15 thru 18 and plate No. 26).

3-08. Instrumentation. Four types of observation devices were installed in the embankment and foundation. Of 22 piezometers, tips of 13 are in the foundation clays, gravel or limestone. The remaining nine have tips in the embankment. All are the open tube type. These devices were installed during construction and are shown on plate No. 30. In June 1964, six crest settlement monuments were installed at the top of the dam, 14 feet downstream of the centerline. Two are located in the buried channel reach at stations 30+50 and 33+00. The other four are located at 1,500-foot intervals, starting at station 40+00. In February 1972, twenty-five horizontal alignment monuments were installed. The monuments are on 200-foot centers on a line 100 feet downstream of the centerline and extend across the valley from station 26+00 to station 74+00. Instrument monuments are located at each end of the line.

VII-3-4
### TABLE I - GROUTING SUMMARY - POMONA DAM

#### STAGE I CONTRACT

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<th>Grout Hole Drilling</th>
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#### COMPLETION OF EMBANKMENT CONTRACT

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GENERAL NOTE
The map compiled from the Kansas State General
Highway map, supplemented by the U.S. Army Corps of
Engineers photogrammetric surveys covering the
reservoir area.

LOCATION, VICINITY AND INDEX

POMONA DAM
COMPLETION OF EMBANKMENT

RECORD DRAWING

Sheet No. 1

SCALE AS SHOWN

PLATE NO. 1
CORPS OF ENGINEERS

SECTION V-V
TYPICAL STA 69225 TO STA 69450

Approx. existing ground surface

Approx. top of embankment

SECTION A-A

RECORD DRAWING

HUNDRED AND TEN MILE CREEK, KANSAS
POMONA DAM
STAGE 1 CONSTRUCTION
EMBANKMENT SECTIONS

NOTES
For plan of embankment see Sheets Nos. 46-5
For control point details see sheet No. 10

Sheets 100 sheets
U.S. ARMY ENGINEER DISTRICT
KANSAS CITY

Drawn by
N.E.L. 1-88

PLATE NO. 7
U.S. ARMY

RANGE DOWNSTREAM
PERVIOUS FILL

BEDDING LAYER OVER ROCK FILL AT STILLING BASIN
BERM FILL PRIOR TO ROCK FILL AT STILLING BASIN

DETAILS OF FILL WEST SIDE CONTROL TOWER

DETAILS OF FILL EAST SIDE CONTROL TOWER

TOE DETAIL ADJACENT TO STILLING BASIN

NOTES:
For plan of control tower see Sheet No 6
For plan of stilling basin see Sheets Nos 4 & 7

RECORD DRAWING

PLATE NO. 8
CORPS OF ENGINEERS

SECTION B-B
Scale 1/8" = 1'

SECTION C-C
Scale 2/8" = 1'

RECORD DRAWING
POMONA DAM
STAGE 1 CONSTRUCTION
SPILLWAY
CONTROL SILL
CONCRETE AND REINFORCEMENT

DETAIL OF UPSTREAM TOE
Scale 1/8" = 1'

Note: Coat elastic surface with concrete curing compound to eliminate bond

ORDDINATES
OF
ELLIPIC QUADRANT

i

1/16

1/8

3/16

1/4

2/5

3/8

1/2

2/5

1/4
CORPS OF ENGINEERS

RECORD DRAWING

HUNDRED AND TEN MILE CREEK, KANSAS
POMONA DAM
STAGE I CONSTRUCTION
LOGS OF UNDERGROUND EXPLORATIONS
QUARRY SITE AND BORROW AREA "A"

IN 80 SHEETS
U.S. ARMY ENGINEER DISTRICT
KANSAS CITY

SHEET NO. 78
SCALE 50' = 1'-0"

APRIL 1969

PLATE NO. 80
# Description of Excavations

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<th>Area of</th>
<th>Approx. Quantity</th>
<th>Generalized Principal Material</th>
<th>Usage</th>
<th>Remarks</th>
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**Section A-A**

**Description of Excavations**

- **Area of Excavation:**
  - **Excavation:**
  - **Usage:**
  - **Remarks:**

**Record Drawing**

**Hundred and Ten Mile Creek, Kansas**

**Pomona Dam**

**Completion of Embankment**

**Spillway Excavation**

**Plan, Profile and Section and Description of Excavations**

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<th>Kansas City, MO</th>
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**PLATE NO. 20**
COMBINATION SETTLEMENT PLATE AND PIEZOMETER GAGE
EXTENSION DETAIL
EMBANKMENT DETAIL AT GAGES

TOP OF GAGE DETAIL

RECORD DRAWING

PIEZOMETER AND SETTLEMENT GAGES PLAN AND DETAILS

PLATE NO 30
CORPS OF ENGINEERS

PROFILE ON E OF OUTLET WORKS

CROSS SECTION - OUTLET WORKS
STA. 7+800

LEGEND FOR PROFILE

A Width of Excavation
B Cross Section of Outlet Works
C Profile of Outlet Works

NOTE:

1. Cross section of outlet works is not shown in work.

RECORD DRAWING

OCTOBER 1963

POMONA DAM
COMPLETION OF EMBANKMENT
GEOLOGIC PROFILE
OUTLET WORKS AND SPILLWAY

HUNDRED AND TEN MILE CREEK, KANSAS

PLATE NO. 38

U.S. ARMY ENGINEER DISTRICT
KANSAS CITY, MO
Profiles - Borrow Area "B"
CORPS OF ENGINEERS

PROFILE - BORROW AREA "D"

PROFILE - BORROW AREA "E"

PROFILE - BORROW AREA "F"

PROFILE - BORROW AREA "G"

PROFILE - BORROW AREA "H"

PROFILE - QUARRY SITE NO. 1

RECORD DRAWING

POMONA DAM
COMPLETION OF EMBANKMENT

LOGS OF UNDERGROUND EXPLORATIONS
BORROW AREAS AND QUARRY SITE

PLATE NO. 34
OUTLET WORKS FOUNDATION PLAN AND PROFILE

scale as shown
COMPLETION OF EMBANKMENT GROUTING

SCALE AS SHOWN
Approximate original rock line

POMONA LAKE

HUNDRED AND TEN MILE CREEK, KANSAS

COMPLETION OF EMBANKMENT GROUTING
STA 67+50 TO STA 63+50

In 1 sheet
Sheet No. 1
Scale: as shown
CORPS OF ENGINEERS
U.S. ARMY
KANSAS CITY DISTRICT
FILE NO. 0-3-994
FEBRUARY 1977

PLATE NO. 36

For notes and legend see plate No. 37.
DIVERSION CHANNEL GROUTING

SCALE AS SHOWN
GROUTING STA 41+00 TO STA 40+00

Legend
- Primary hole
- Secondary hole
- Tertiary hole
- Packer set depth
- Pressure Test Gallons per minute, water take
- Grout take in sacks of cement

HUNDRED AND TEN MILE CREEK, KANSAS
POMONA LAKE

DIVERSION CHANNEL GROUTING
STA 41+00 TO STA 40+00

In 1 sheet	Sheet No. 1	Scale: as shown
CORPS OF ENGINEERS
U.S. ARMY
KANSAS CITY DISTRICT
FILE NO. 0-3-995
FEBRUARY 1977

PLATE NO. 37
HUNDRED AND TEN MILE CREEK, KANSAS
POMONA LAKE
CURTAIN GROUTING
STA 31+00 TO STA. 27+90

In 1 sheet Sheet No. 1 Scale: as shown
CORPS OF ENGINEERS U.S. ARMY
KANSAS CITY DISTRICT
FILE NO. 0-3-96
FEBRUARY 1977

PLATE NO. 38
CURTAIN GROUTING OUTLET WORKS
SCALE AS SHOWN
HUNDRED AND TEN MILE CREEK, KANSAS
POMONA LAKE
CURTAIN GROUTING OUTLET WORKS
STA. 28+00 TO STA. 26+50

For notes and legend see plate No. 37.

CORPS OF ENGINEERS
U. S. ARMY
KANSAS CITY DISTRICT
FILE NO. O-3-997
FEBRUARY 1977

PLATE NO. 38


34. Pomona Lake, Nov 61, Neg. No. R-168-17. Placing Class II Rockfill Sta. 46+00.