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RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM. E--ETC(U)
JUL 79 J PEREZ , Y LACROIX DACW43-78-C-0005
UNCLASSIFIED NL

1 OF 3
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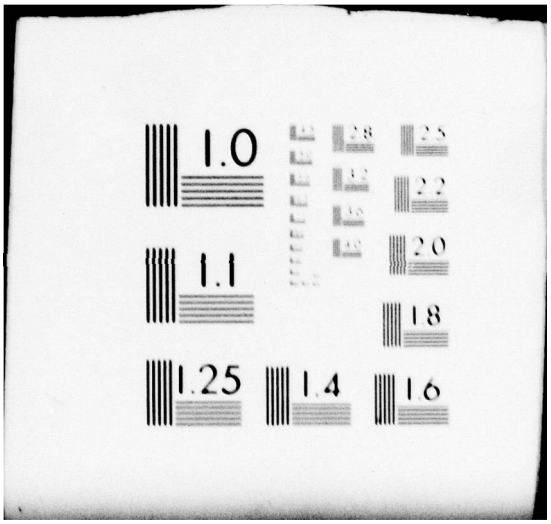
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1.8

LEVEL III

PHASE IV REPORT

VOLUME II A

APPENDICES A THROUGH G

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

EXISTING LOCKS AND DAM NO. 26
MISSISSIPPI RIVER, ALTON, ILLINOIS

Prepared for

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

St. Louis District

By

Woodward-Clyde Consultants
Chicago, Illinois

15 July 1979

Contract No. DACW43-78-C-0005
Y7C825

PHASE IV REPORT

VOLUME II A

APPENDICES A THROUGH G

(6)

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM.

EXISTING LOCKS AND DAM ~~NO.~~ 26, MISSISSIPPI RIVER, ALTON, ILLINOIS.

numbered

Volume IIA. Appendices A through G.
Phase IV Report.

Prepared for

United States Army
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St. Louis District

(9) Final rept.,

By

(10) Jean-Yves Perez
Yves Lacroix

Yves Lacroix

Woodward-Clyde Consultants
Chicago, Illinois

(12) 246

(11) 15 Jul 79

Contract No. DACW43-78-C-0005

(15) Y7C825

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Unclassified

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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18. SUPPLEMENTARY NOTES

Vol I Overview of Foundation Investigation and Test Program
Vol II Results and Interpretation of Chemical Grouting Test Program
Vol IIA Appendices A through G, Results and Interpretation of Chemical Grouting Test Program
Vol III Results and Interpretation of Pile Driving Effects Test Program
Vol IIIA Appendices H through T, Results and Interpretation of Pile Driving Effects Test Program
Vol IV Results and Interpretation of Drilled-In Pile Test Program
Vol IVA Appendices A through E, Results and Interpretation of Drilled-In Pile Test Program
Vol V Results and Interpretation of Rock Anchor Test Program
Vol VA Appendices A through E, Results and Interpretation of Rock Anchor Test Program

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

Lock and Dam No. 26, Mississippi River
Chemical grout test
Rock anchor test
Drilled-in pile test
Pile driving effects test
Timber piles
Alluvial sands
Benoto method
Instrumentation of tests
Vibrational effects on structures

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

A series of tests examining various foundation systems and construction techniques were conducted on Ellis Island near Locks and Dam No. 26 in alluvial sand deposits underlain by glacial deposits and limestone. The chemical grout test consisted of grouting the upper 20 feet of the alluvial sand by injecting a number of different silicate and cement-bentonite grout types, while varying the grouting method, hole spacing, and injecting rates. Heave, lateral displacement, and pore pressure were monitored during grout injection. The in situ properties of the sand were measured before and after grouting by standard

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20. penetration tests, static cone penetration tests, pressuremeter tests, bore hole permeability tests, and shear wave velocity tests. Concurrently laboratory tests were conducted to investigate the strength and creep behavior of the grouted sand. After completion of grouting, the site was excavated to examine and evaluate the grouted sand. In the rock anchor test, inclined rock anchors were installed in limestone through 130 feet of alluvial and glacial deposits using a pneumatic down-the-hole hammer with an offset reamer. Load tests were conducted on three instrumentated rock anchors and the feasibility of installation of the rock anchors was determined by evaluating loss of ground during installation, performance of the installation equipment, and rate of installation. The drilled-in pile test consisted of installation of large diameter high capacity pipe piles by the Benoto method. The feasibility of installing these piles was determined by evaluating loss of ground during installation, performance of the Benoto equipment, and rate of installation. In the pile driving effects test, pile founded monoliths were constructed, supported on either one, eight or twelve timber piles jetted and driven in alluvial sand to a depth of 35 feet. After applying lateral and vertical load to the monoliths, steel piles were driven at varying distances from the monoliths while monitoring movement of the monolith and supporting piles; shear, moment, and axial load in the timber piles; and pore pressure, movement, and particle velocity, in the soil. Parameters examined were pile type being driven (sheet, pipe, or H-pile), pile driving hammer (diesel, air-steam, or vibratory), distance of driven piles from monolith, driving of multiple piles at the same distance from the monolith, load level applied to the monolith, and soil properties (grouted and ungrouted). Vertical and lateral load tests were conducted on each pile founded monolith. Tests were also conducted to assess what effect grouted soil has on piles. Piles were driven in both grouted and ungrouted sand to examine driving characteristics and lateral load tests were conducted on H and pipe piles in both grouted and ungrouted sand.

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

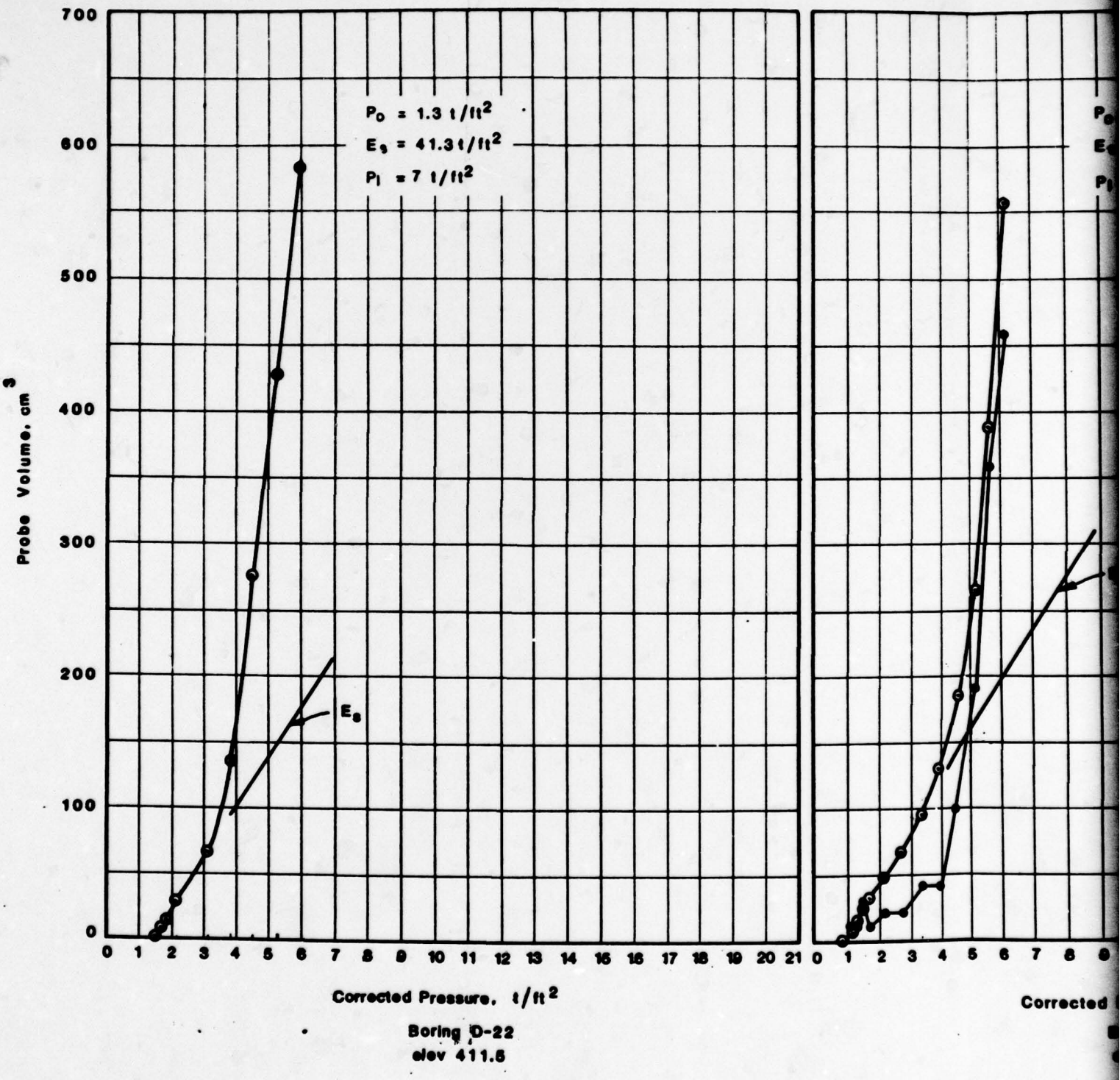
APPENDIX A

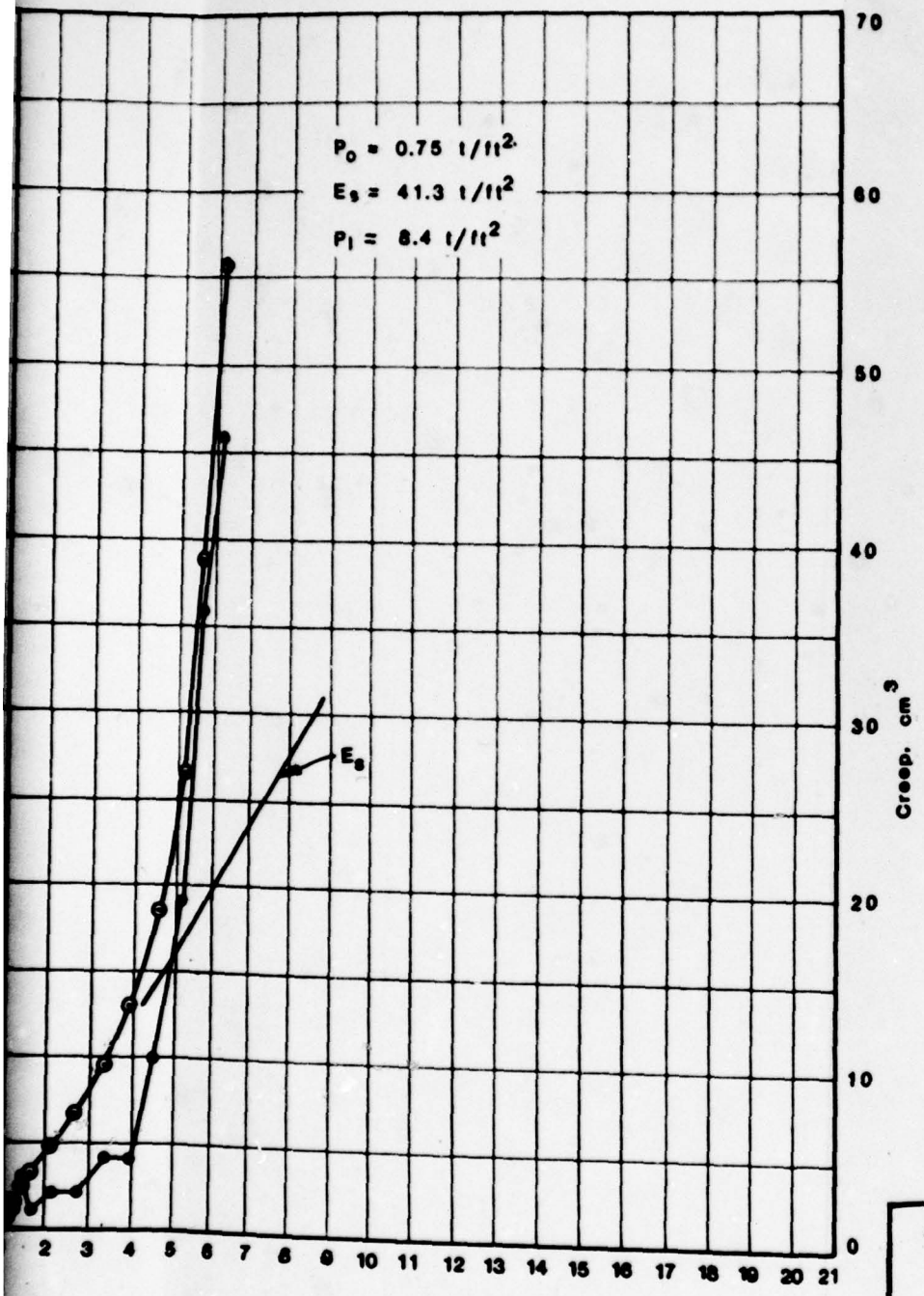
TEST AREA SUBSURFACE CONDITIONS

APPENDIX A

TEST AREA SUBSURFACE CONDITION

TABLE OF CONTENTS


P_o = 1.3 t/ft²
E_s = 41.3 t/ft²
P_l = 7 t/ft²
E_s
Probe Volume, cm³
700
600
500
400
300
200
100
0
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Corrected Pressure, t/ft²
Boring D-22
elev 411.5



Boring D-27
elev 406.8

Legend

- O Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

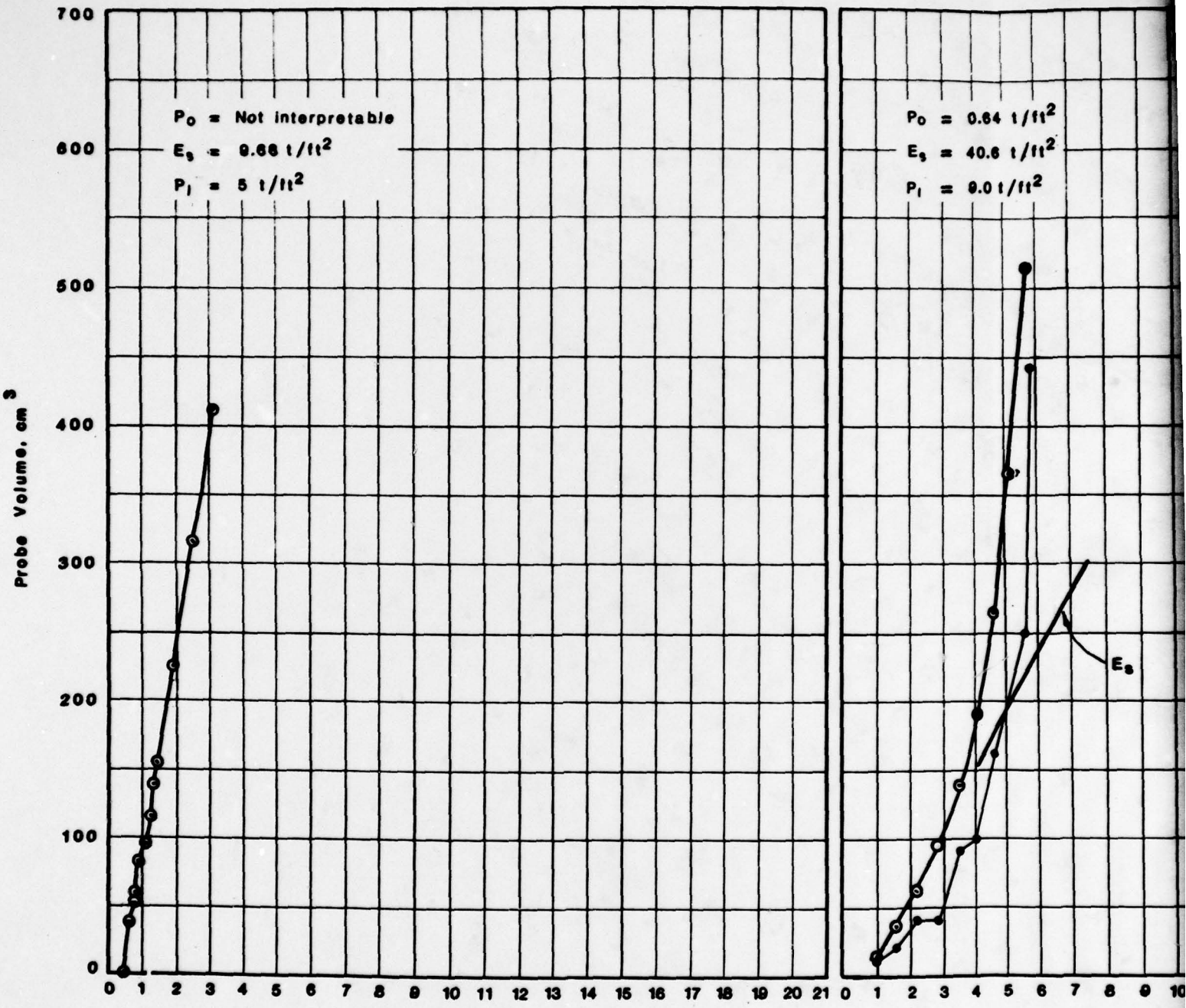
PRESSUREMETER TEST RESULTS BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Fig. A. 1

Y7C525 Phase III



Corrected Pressure, t/ft^2

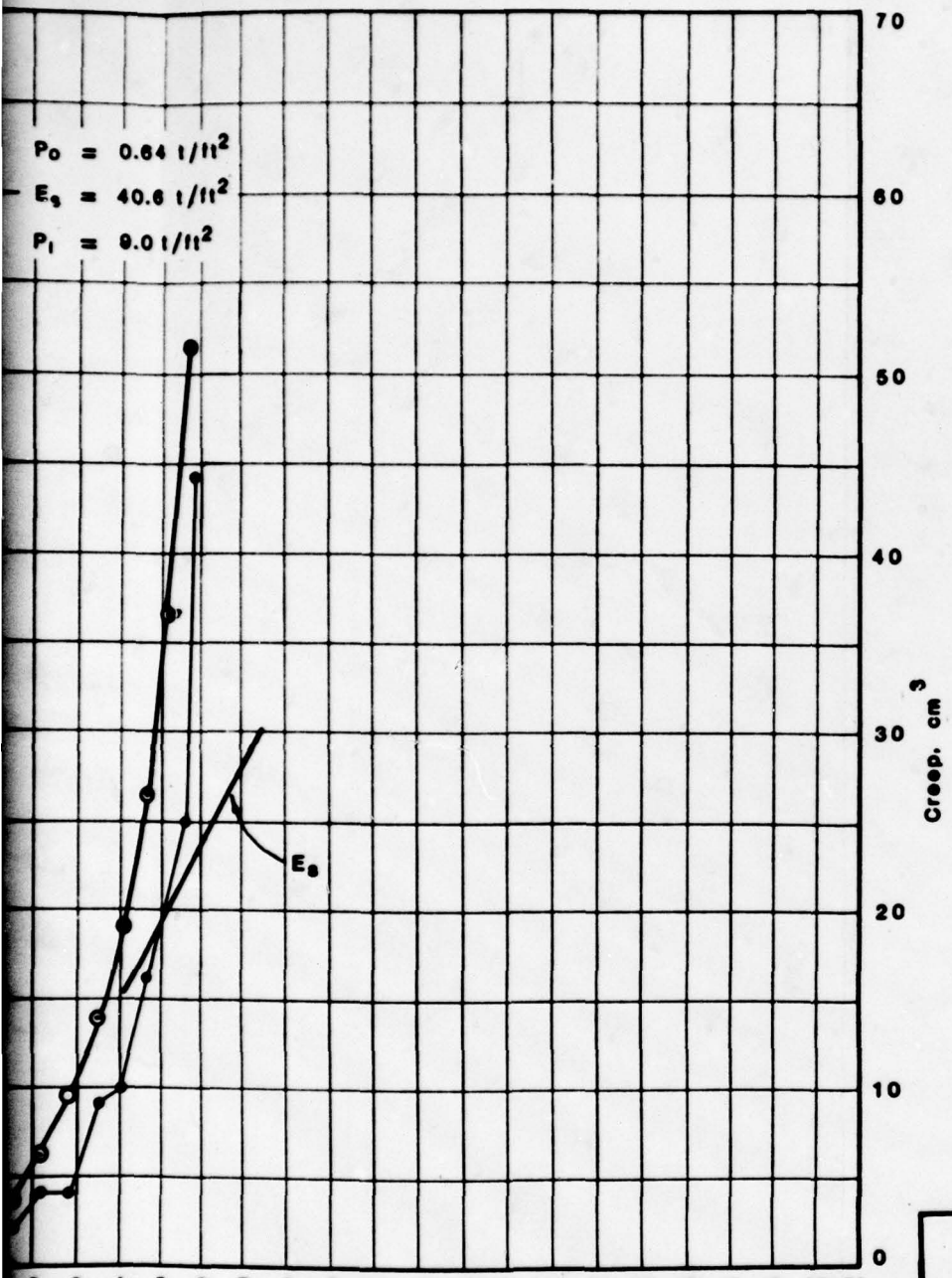
Boring D-22

elev 401.5

Corrected Pre

Borin

elev



Boring D-27
elev 402

Legend

- O Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

CHEMICAL GROUTING TEST PROGRAM

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DACW43-78-C-0006

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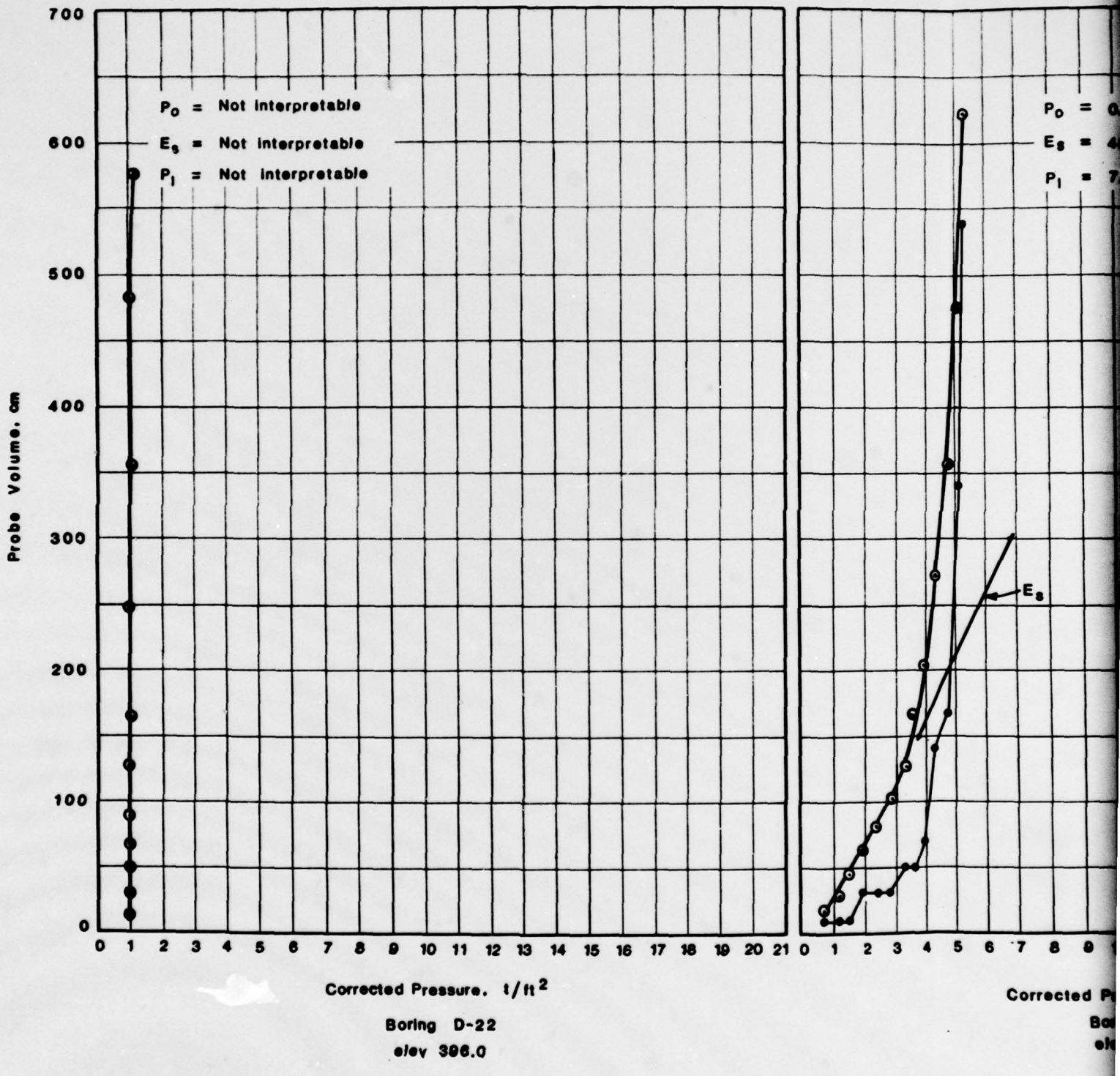
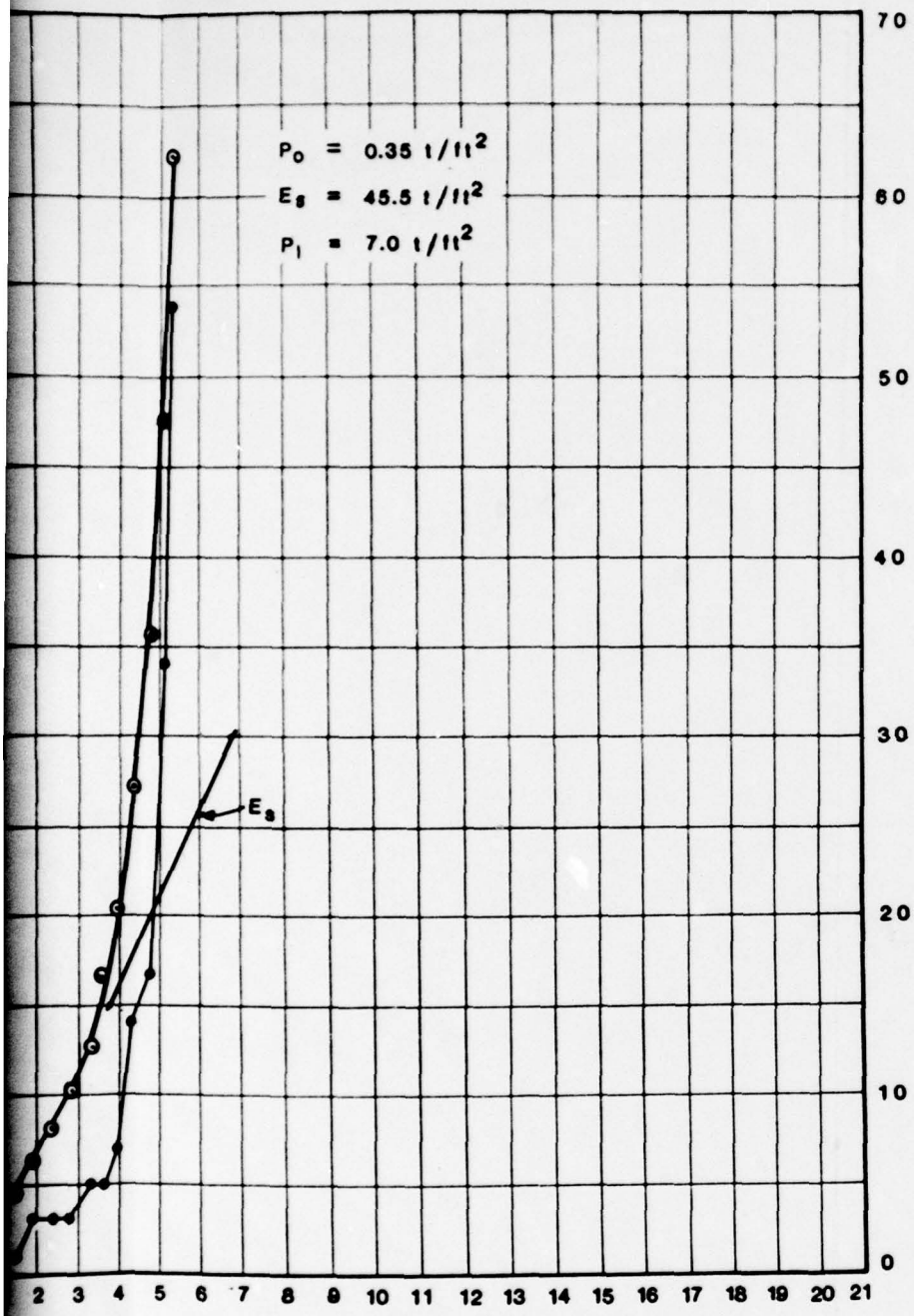
Fig. A.2

Y7C826 Phase IX



Boring D-22
elev 396.0



Boring D-27
elev 396.5

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
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CHEMICAL GROUTING TEST PROGRAM

PRESSUREMETER TEST RESULTS BEFORE GROUTING

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DACW43-78-C-0005

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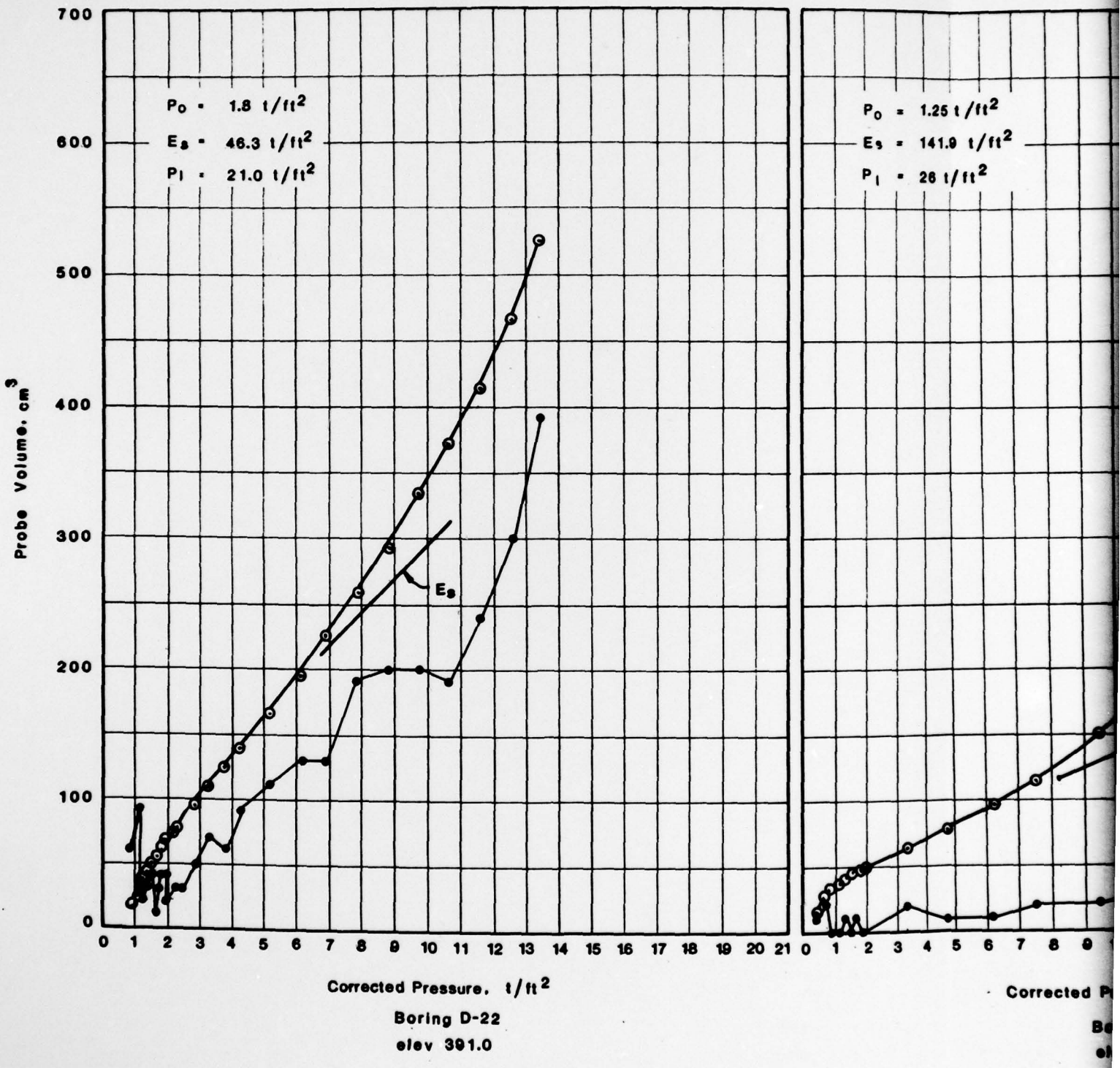
Y7C825 Phase IX

Fig. A.3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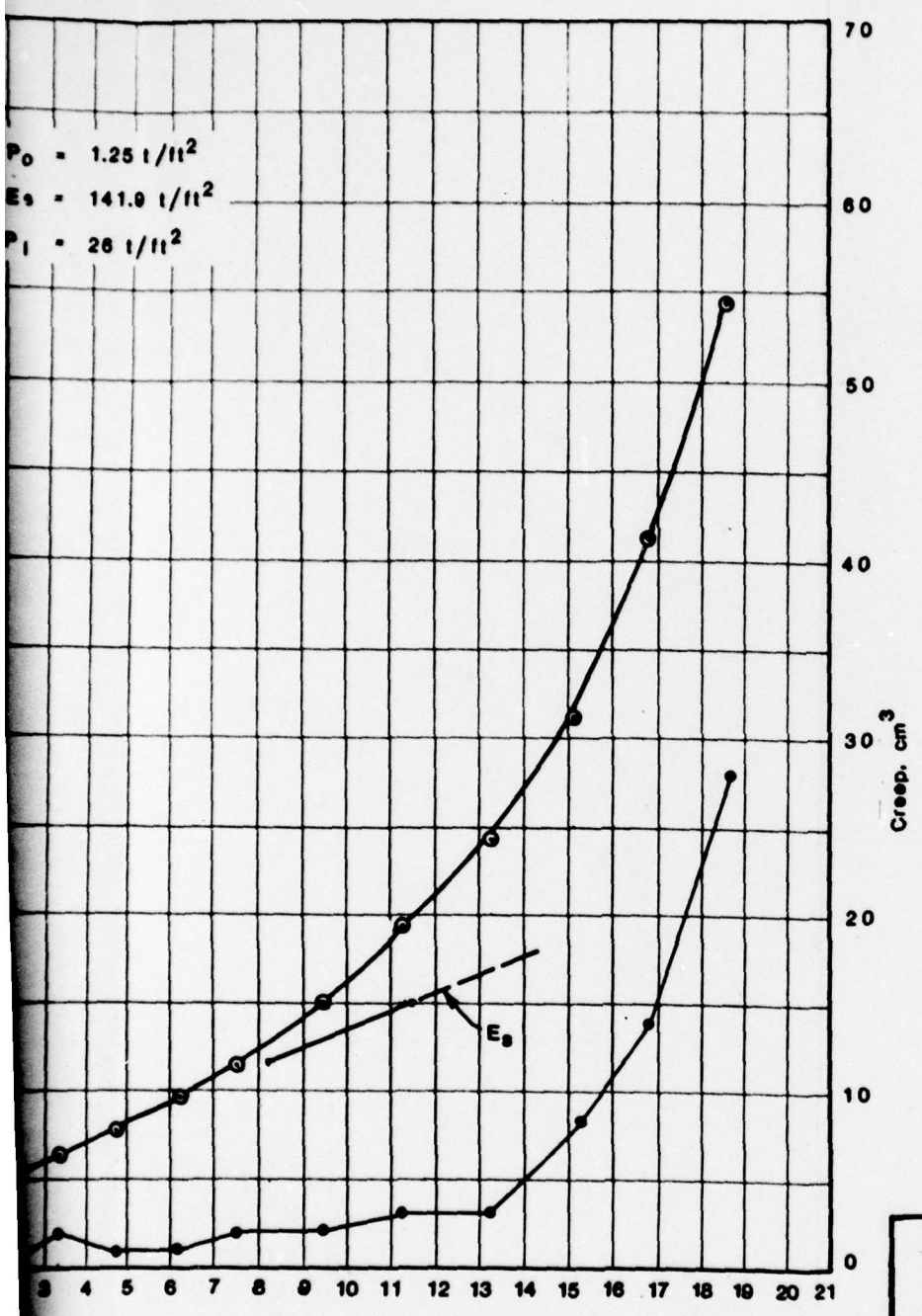
E_s = 46.3 t/ft²
P_l = 21.0 t/ft²
P_o = 1.25 t/ft²
E_s = 141.9 t/ft²
P_l = 26 t/ft²
E_s
Probe Volume, cm³
Corrected Pressure, t/ft²
Boring D-22
elev 391.0
Corrected P



Boring D-27
elev 390.5

Legend

- O Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

PRESSUREMETER TEST RESULTS BEFORE GROUTING

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EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

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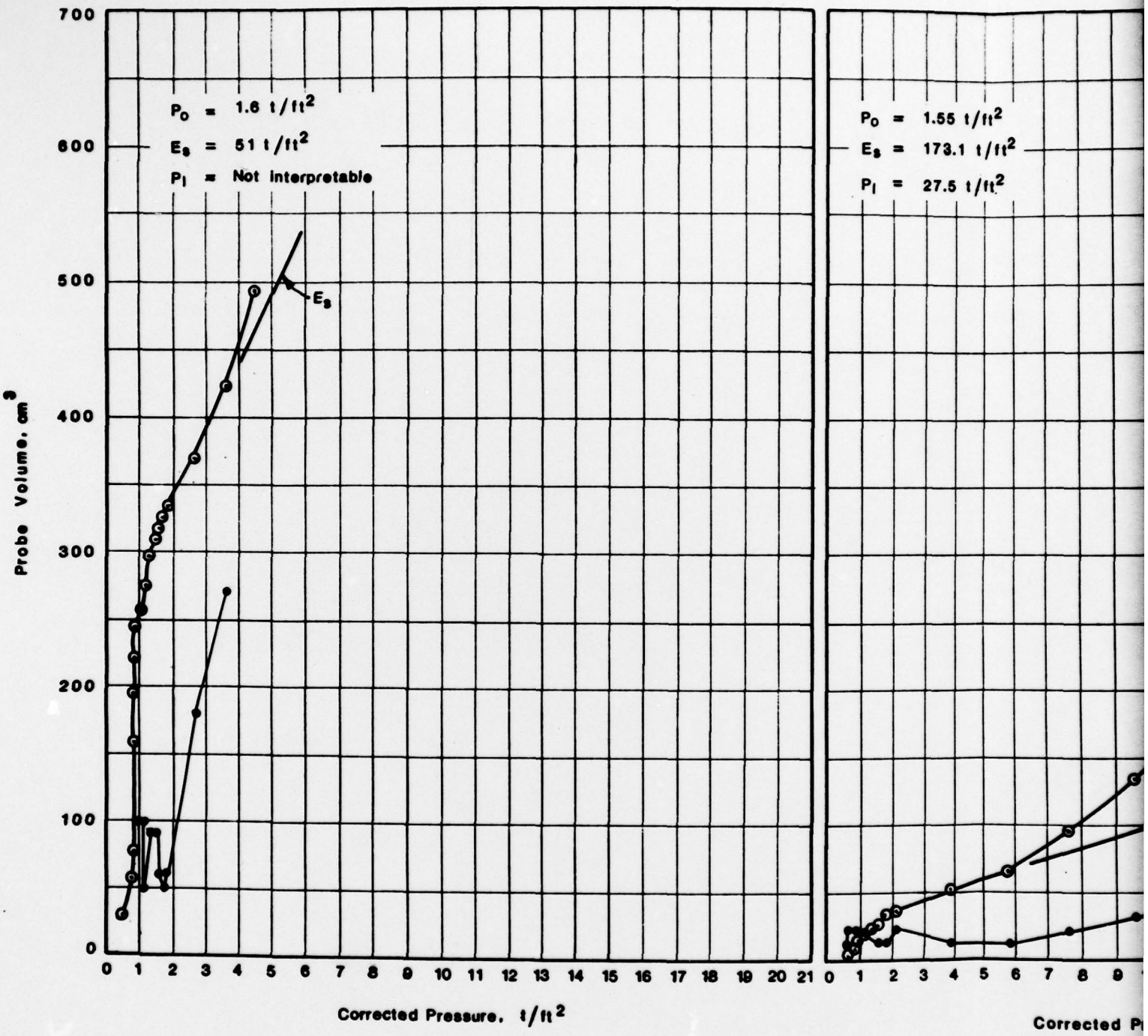
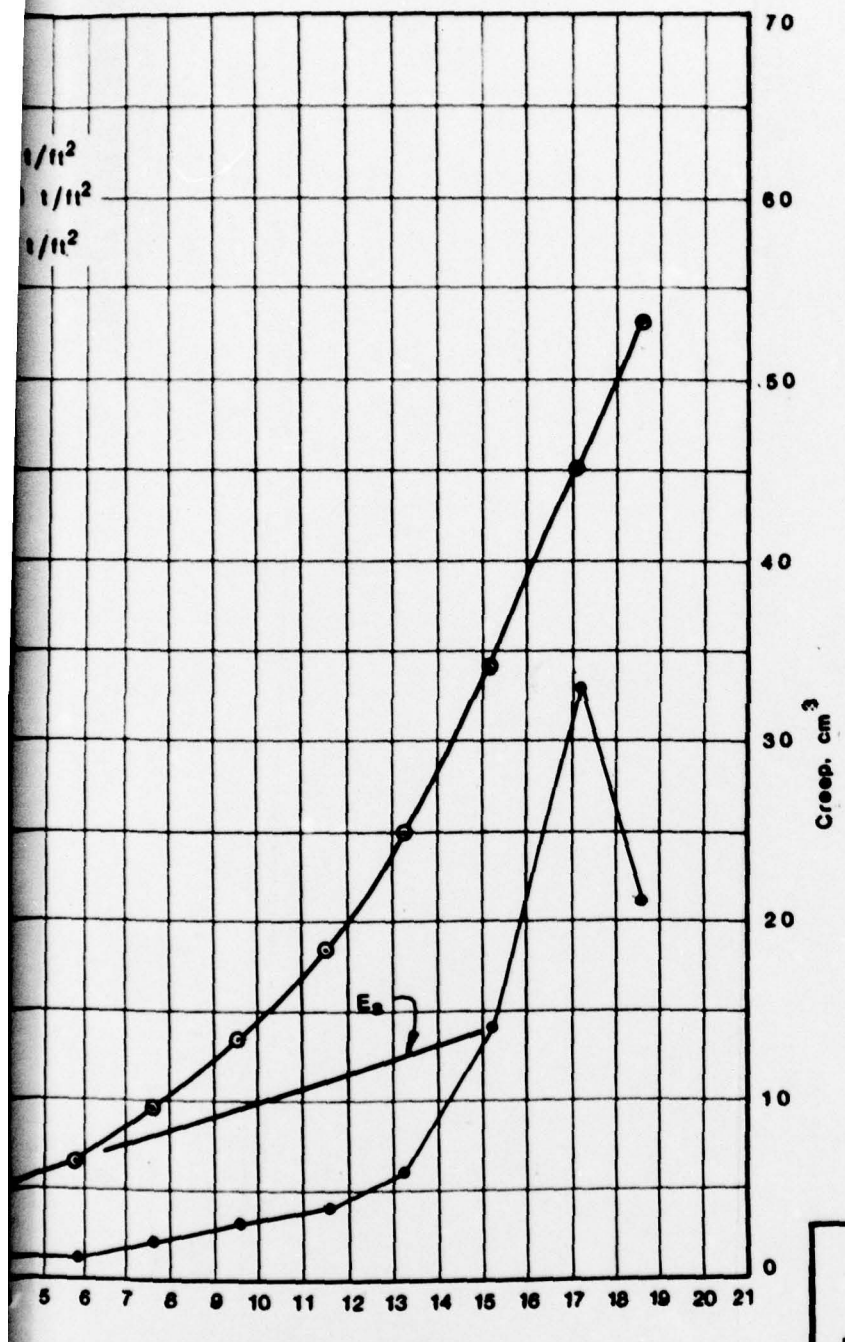
YTC625 Phase IX

Fig. A.4



Boring D-22
elev 386.0

Bo
el



Boring D-27
elev 367.5

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

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CHEMICAL GROUTING TEST PROGRAM

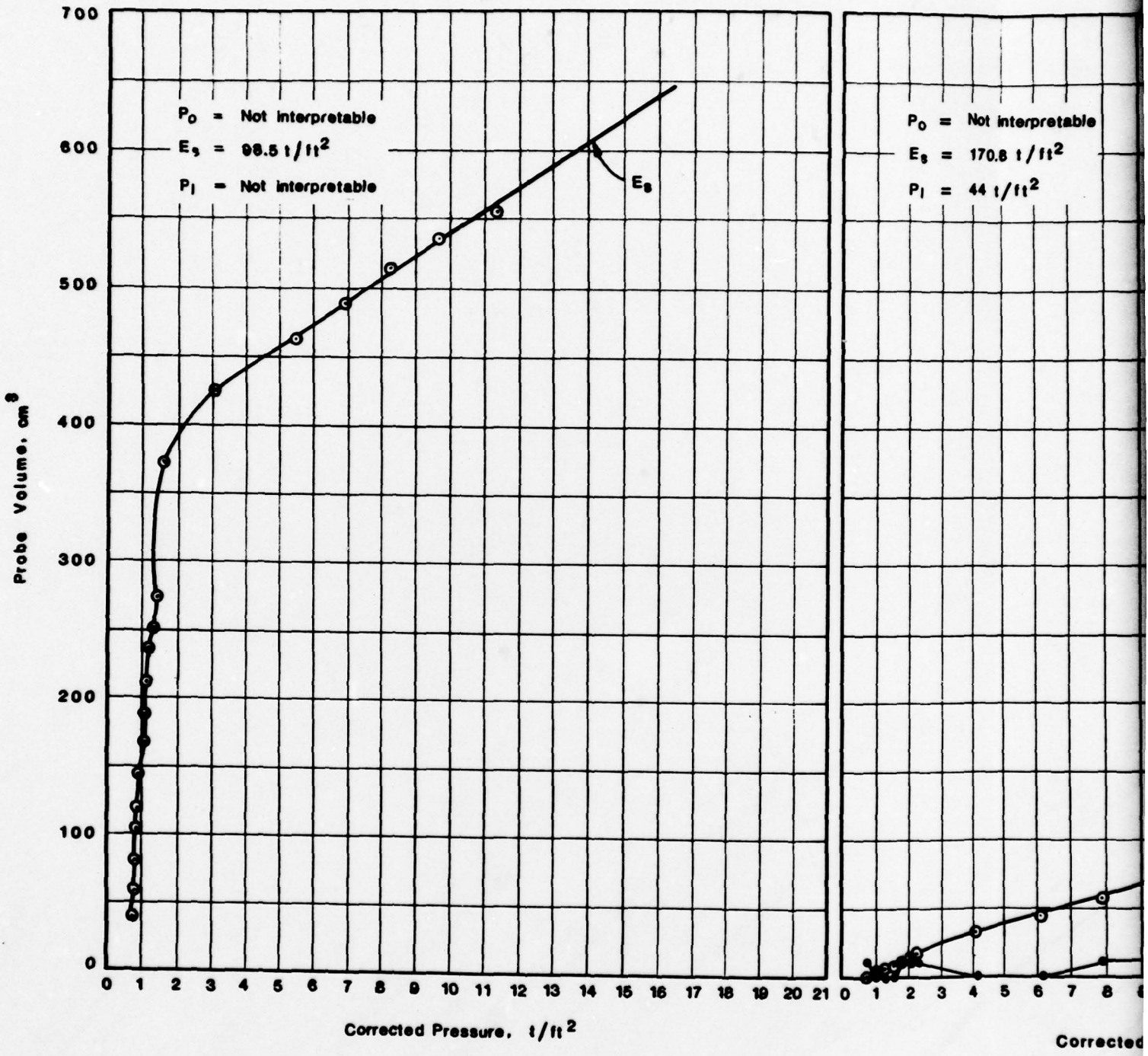
PRESSUREMETER TEST RESULTS BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0065

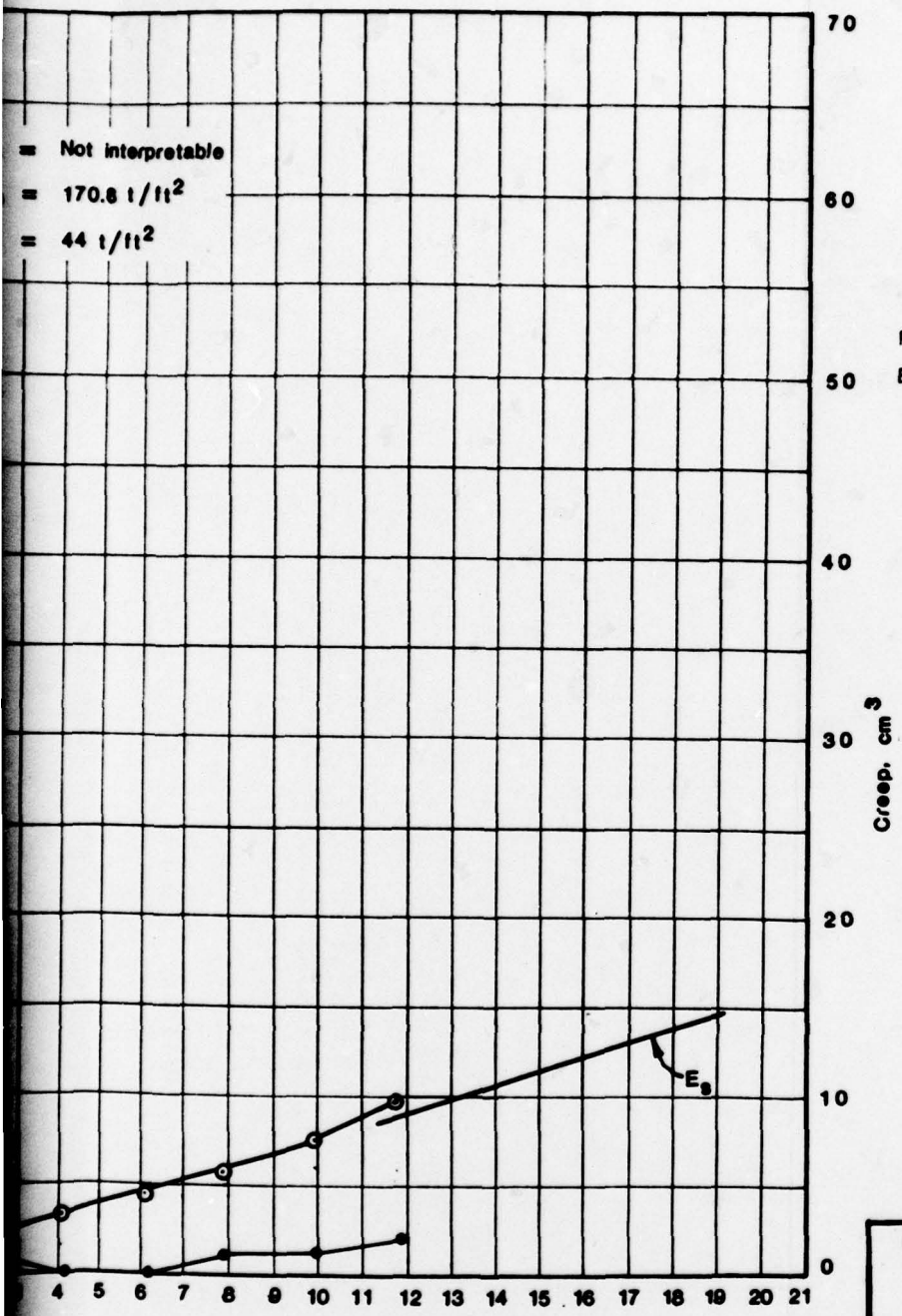
Woodward-Clyde Consultants

Y7C025 Phase IX

Fig. A.5



Boring D-22,
elev 381.5



Boring D-27,
elev 380.5

Legend

- O Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

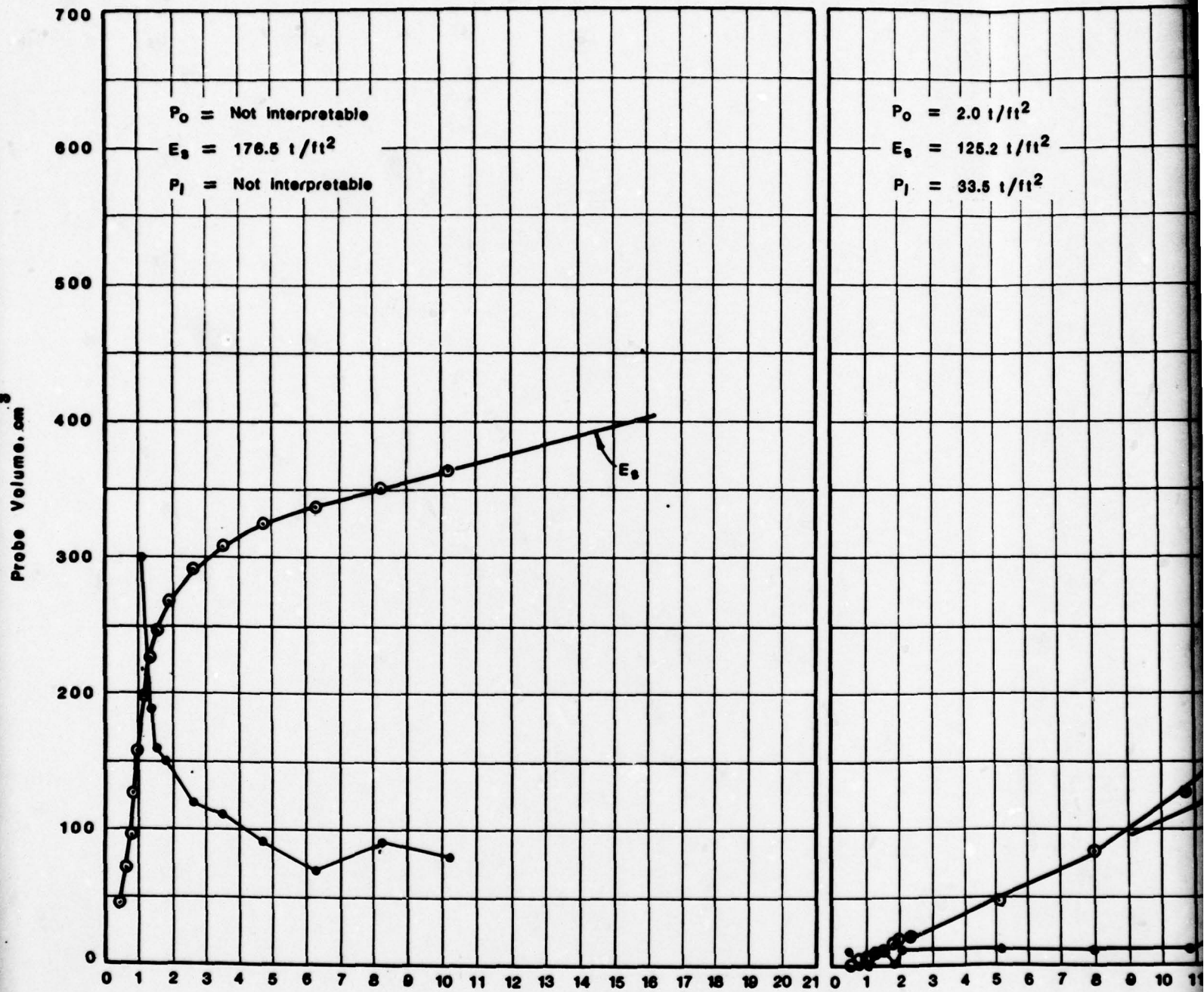
PRESSUREMETER TEST RESULTS BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS,
DACW43-76-C-0005

Woodward-Clyde Consultants

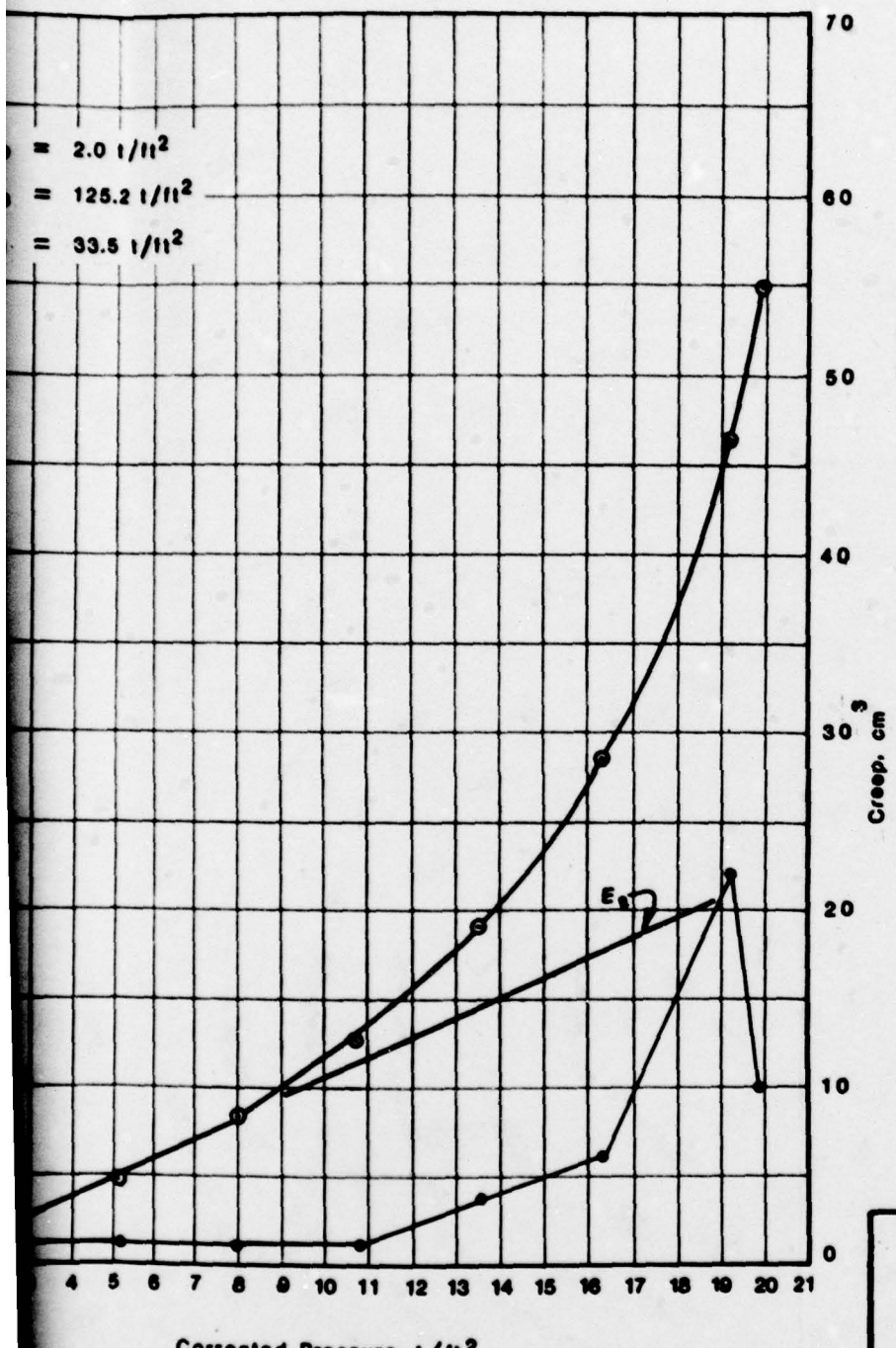
Y7C026 Phase IX

Fig. A.6



Boring D-22
elev 376.5

Boring D
elev 376



Boring D-27
elev 378.0

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

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CHEMICAL GROUTING TEST PROGRAM

PRESSUREMETER TEST RESULTS BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
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ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

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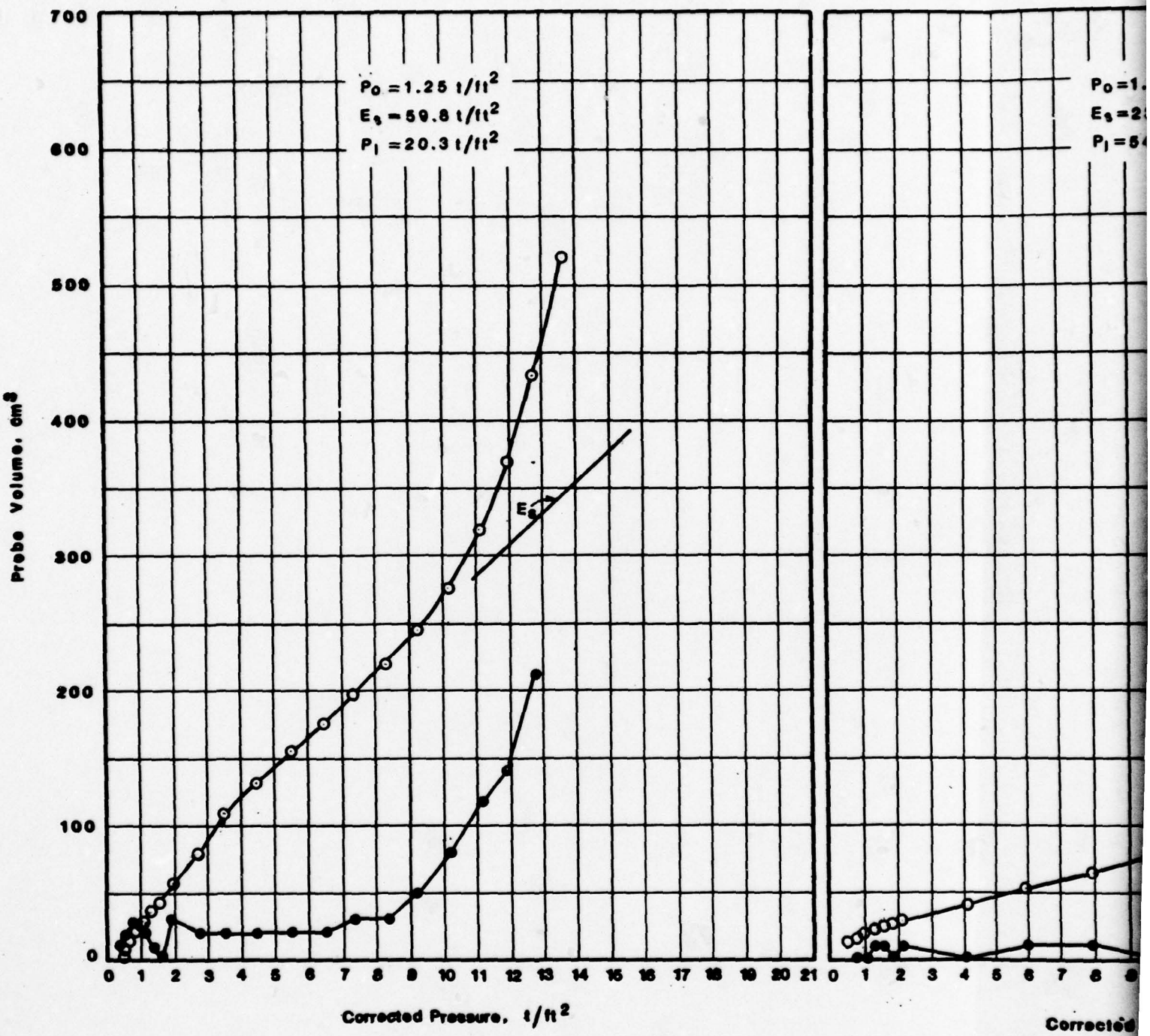
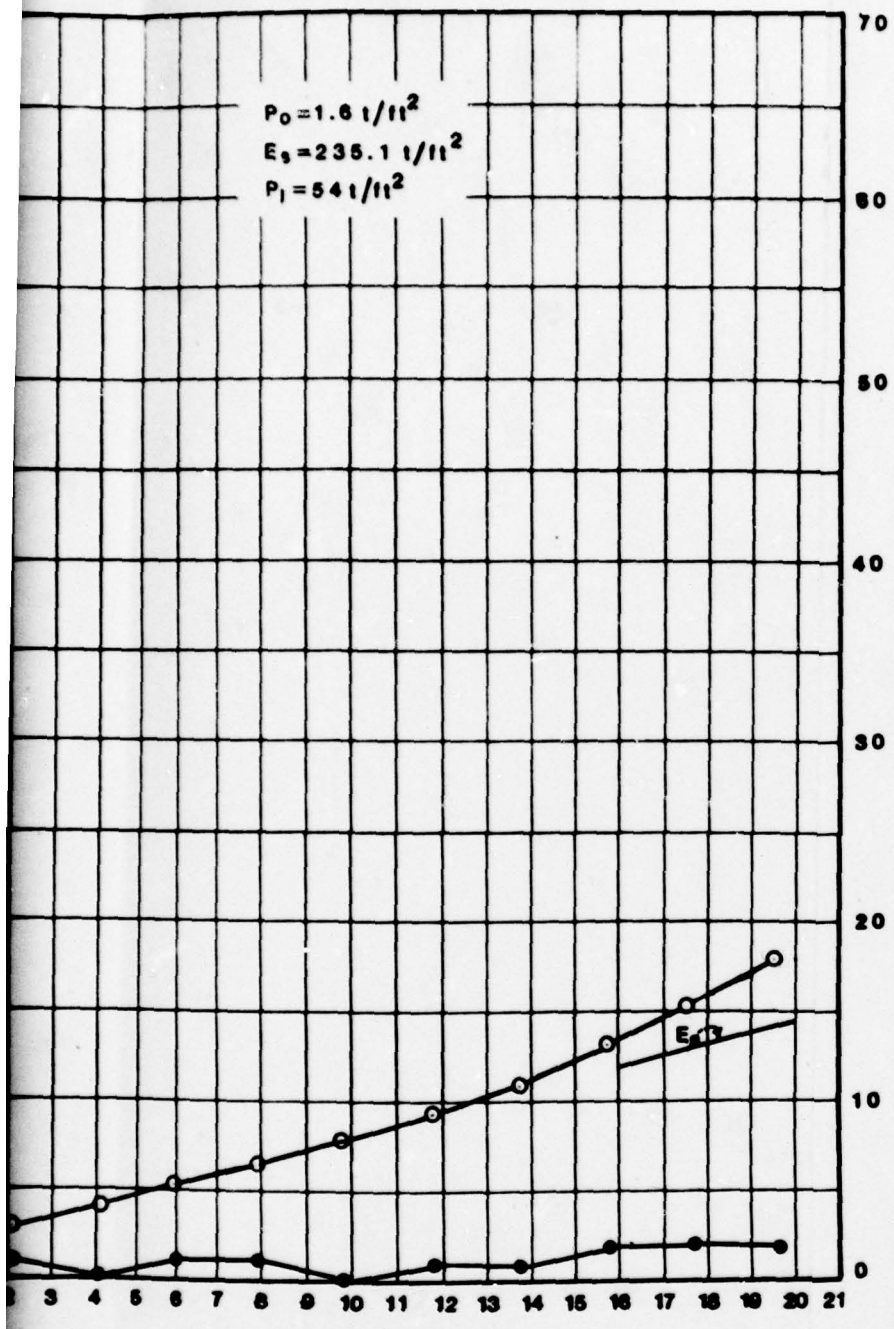
Y7C026 Phase IX

Fig. A.7



Boring D-27
elev 393.5



Boring D-27
elev 384

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

PRESSUREMETER TEST RESULTS BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

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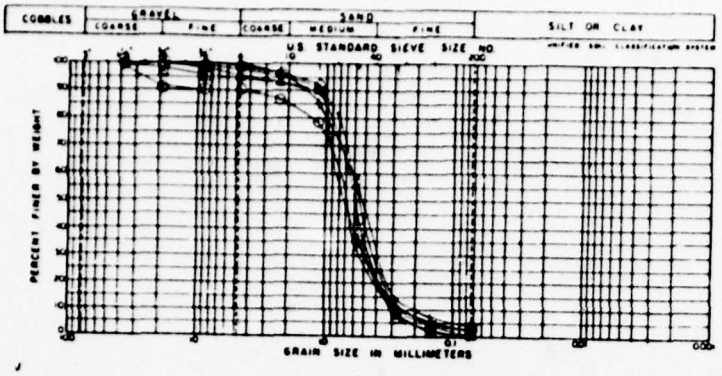
Fig. A.8

Y7C025 Photo 2K



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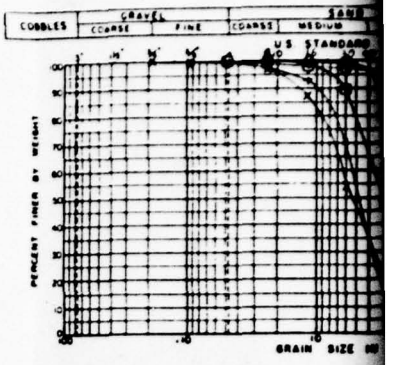
X	H-26/P7	388	SP
+	H-25/P8	388	SP



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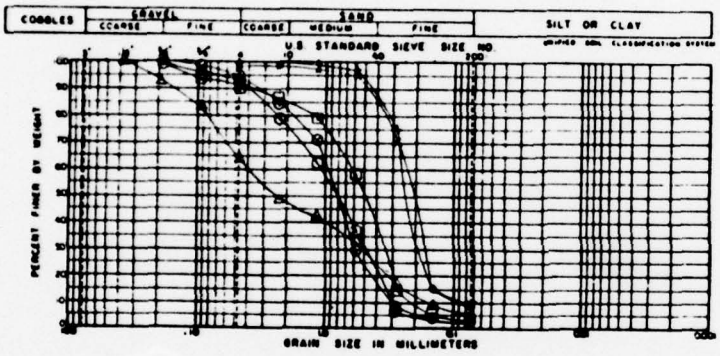
△	S-8
□	S-8
X	S-8
+	S-8



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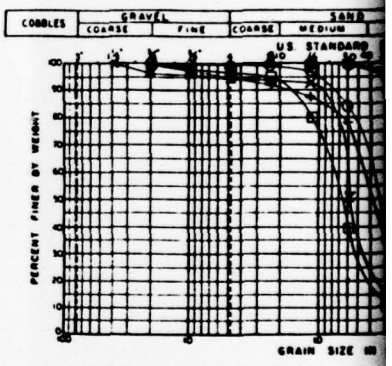

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□	S-6
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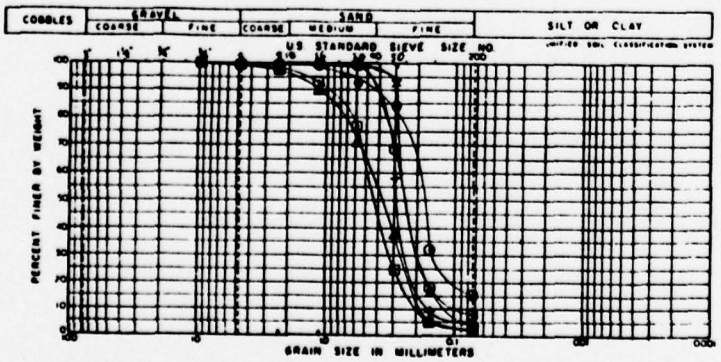
+	S-6



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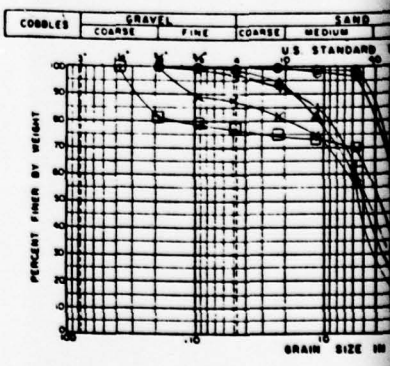
+	D-22	369	SP



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○	D-28
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□	D-28
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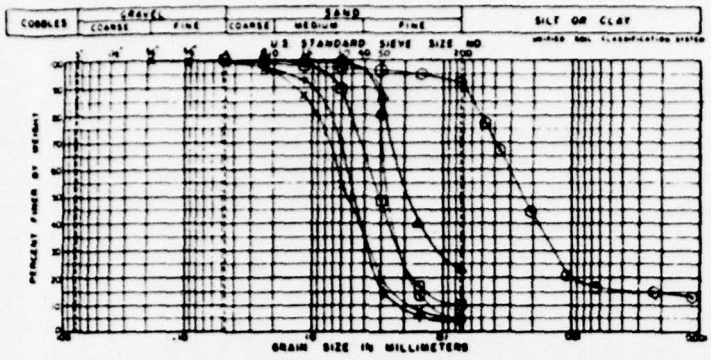
+	D-28



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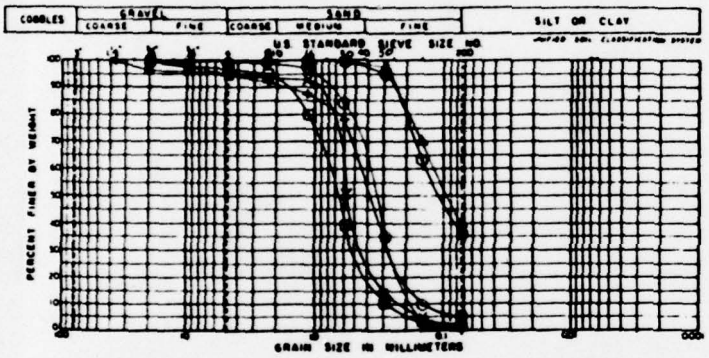
+	S-8	386	SP



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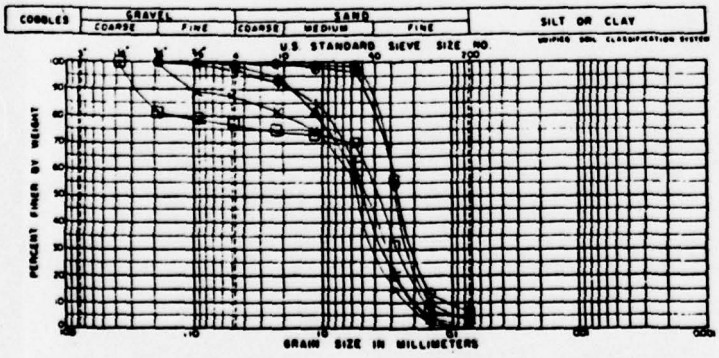
×	S-6	389	SP
+	S-6	384	SP



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○	D-28	407	SP-SM
△	D-28	397	SP
□	D-28	392	SP
×	D-28	387	SP
+	D-28	377	SP

2

CHEMICAL GROUTING TEST PROGRAM

GRAIN-SIZE DISTRIBUTION OF ALLUVIAL SAND BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

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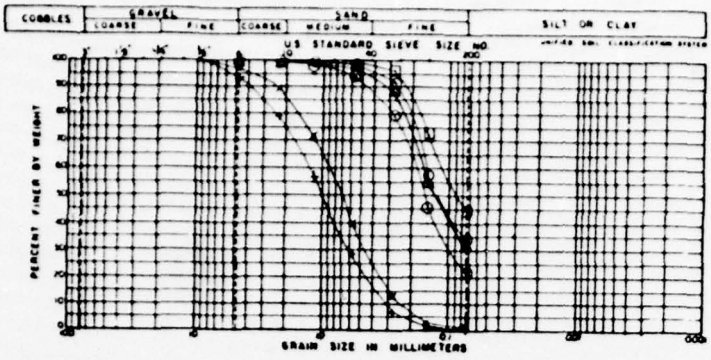
Y7C825 Phase IX

Fig. A.9



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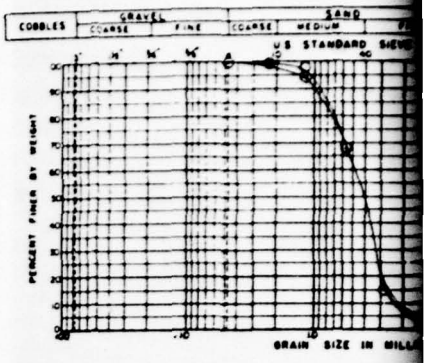
○	E	397	SM
△	E	395	SM
□	E	395	SM
×	E	394	SP
+	E	395	SP



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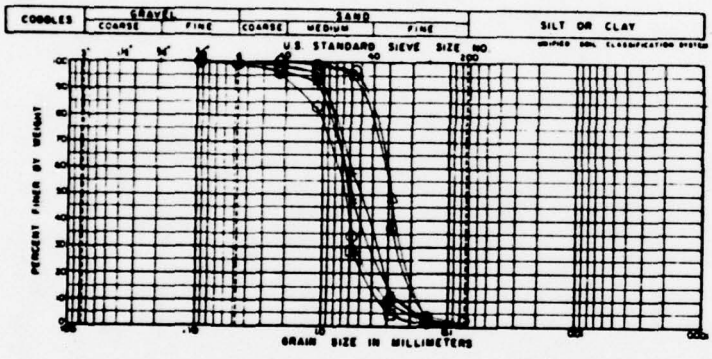
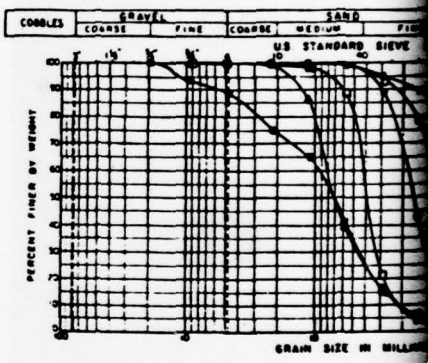
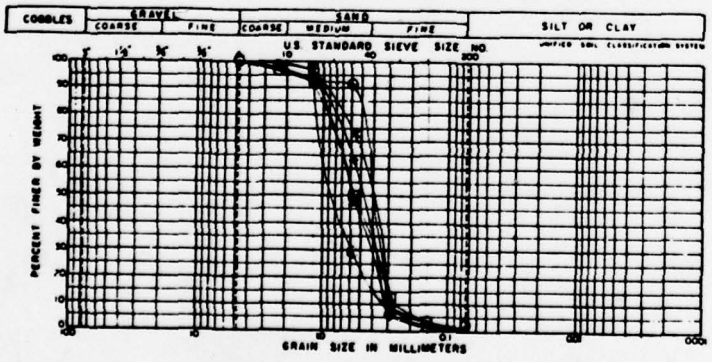
○	E	3
○	E	3



SYMBOL	BORING NO.	ELEVATION	CLASSIFICATION
○	E	394	SP
○	E	393	SP
△	E	391	SP
□	E	391	SP
×	E	390	SP
+	E	390	SP



SYMBOL	BORING NO.	ELEVAT
○	D-21	419
●	D-21	414
△	D-21	409
▲	D-21	404
□	D-21	399
■	D-21	394



SYMBOL	BORING NO.	ELEVATION	CLASSIFICATION
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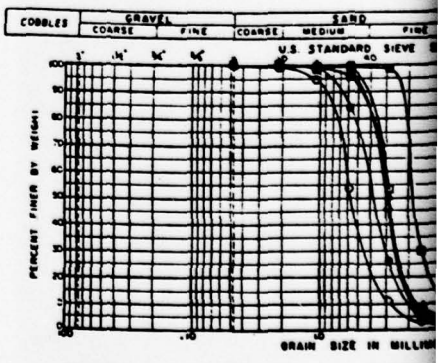
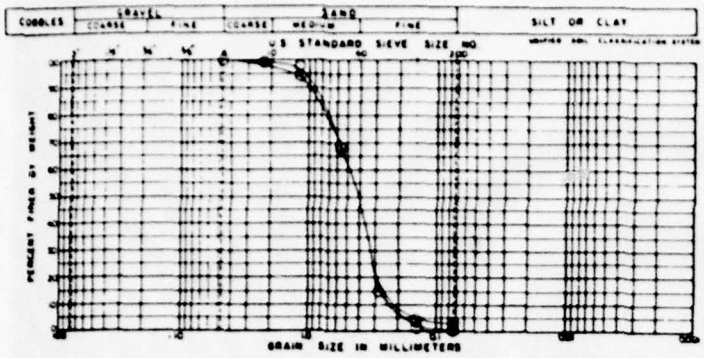
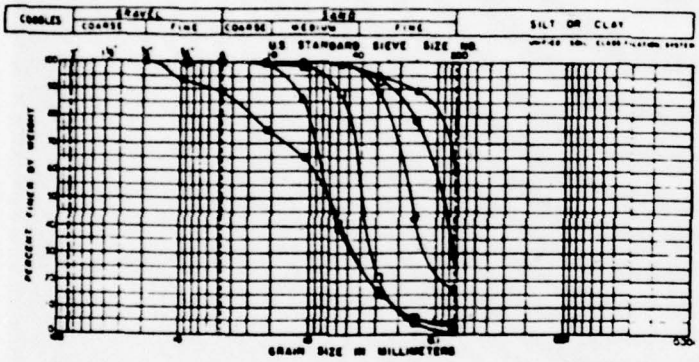
○	E	390	SP
△	E	390	SP
□	E	389	SP
×	E	388	SP
+	E	388	SP



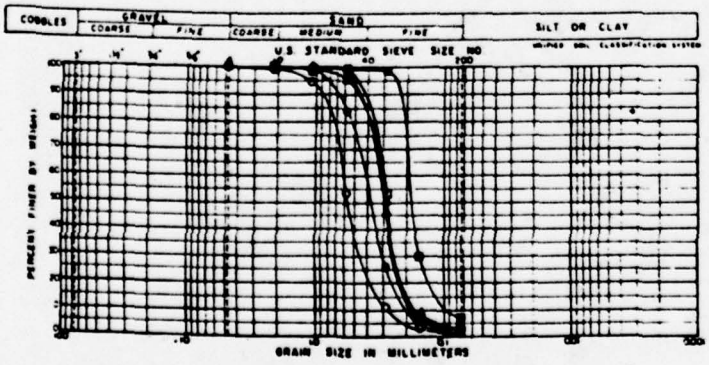
SYMBOL	BORING NO.	ELEVAT
○	D-21	389
●	D-21	384
△	D-21	379
▲	D-21	374
□	D-21	369
■	D-21	364



SYMBOL	BORING NO.	ELEVATION	CLASSIFICATION
○	E	385	SP
○	E	384	SP



SYMBOL	BORING NO.	ELEVATION	CLASSIFICATION
○	D-21	419	SM
●	D-21	414	SM
△	D-21	409	ML
▲	D-21	404	SP
□	D-21	399	SP
■	D-21	394	SP



SYMBOL	BORING NO.	ELEVATION	CLASSIFICATION
○	D-21	389	SP
●	D-21	384	SP
△	D-21	379	SP
▲	D-21	374	SP
□	D-21	369	SP
■	D-21	364	SP-SM

2

CHEMICAL GROUTING TEST PROGRAM

GRAIN-SIZE DISTRIBUTION OF ALLUVIAL SAND BEFORE GROUTING

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants
Y7C825 Phase IX

Fig. A.10

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

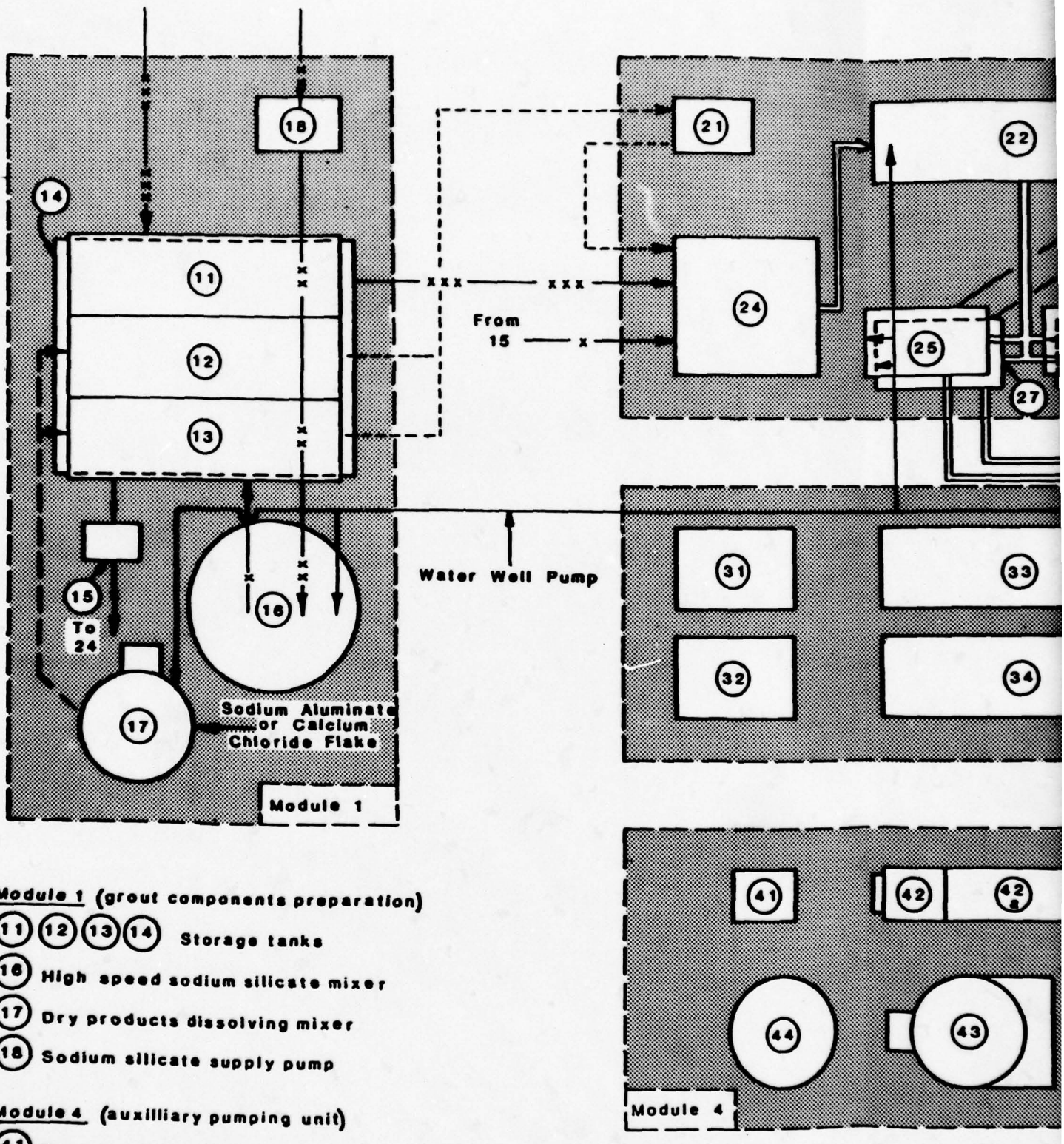
APPENDIX B

GROUTING PLANT

APPENDIX B

GROUTING PLANT

TABLE OF CONTENTS



Module 1 (grout components preparation)

(11) (12) (13) (14) Storage tanks

(16) High speed sodium silicate mixer

(17) Dry products dissolving mixer

(18) Sodium silicate supply pump

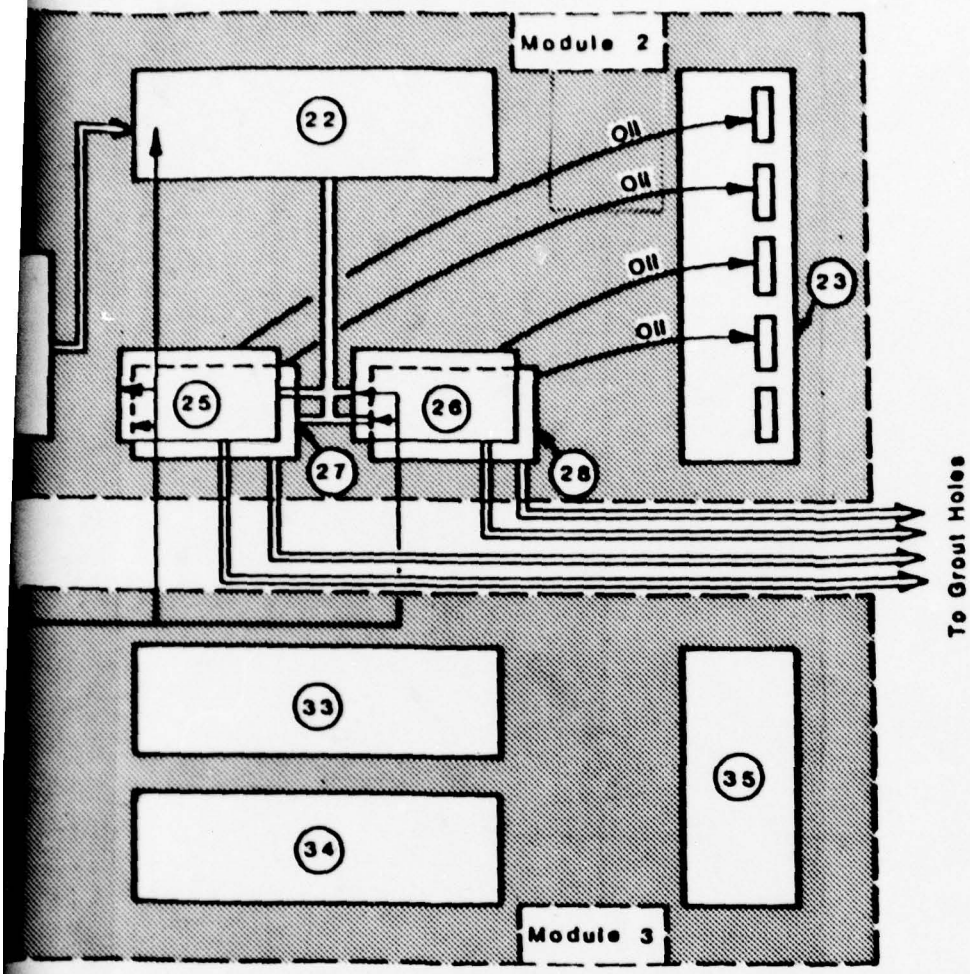
Module 4 (auxilliary pumping unit)

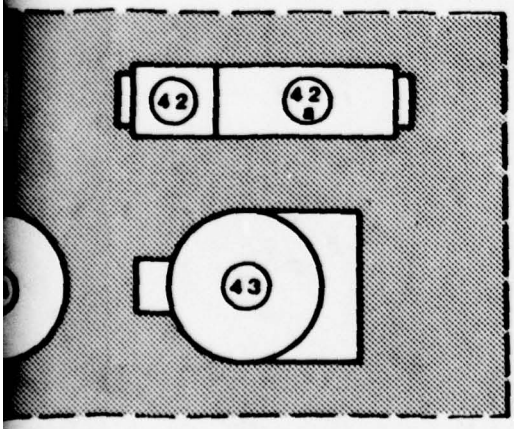
(41) Pump from Module 4 to Module 3

(42) (42a) Proportioning tanks

(43) Mixer

(44) Buffer grout tank





Module 2 (main pumping unit)

- (21) Pump
- (22) Main grouting pump
- (23) Control panel
- (24) Proportioning and mixing mother tank
- (25) Through (28) metering and grouting pumps

Module 3 (cement-bentonite or auxilliary unit)

- (31) (32) Metering tanks
- (33) (34) Main grouting pumps
- (35) Electrical panel

LEGEND

- ——— Water
- —xx— Concentrated Sodium Silicate
- —x— Diluted Sodium Silicate
- —xxx— Formamide
- — — — Sodium Aluminate or Calcium Chloride Solution
- ═══ Grout
- ~~~ Oil

2

CHEMICAL GROUTING TEST PROGRAM

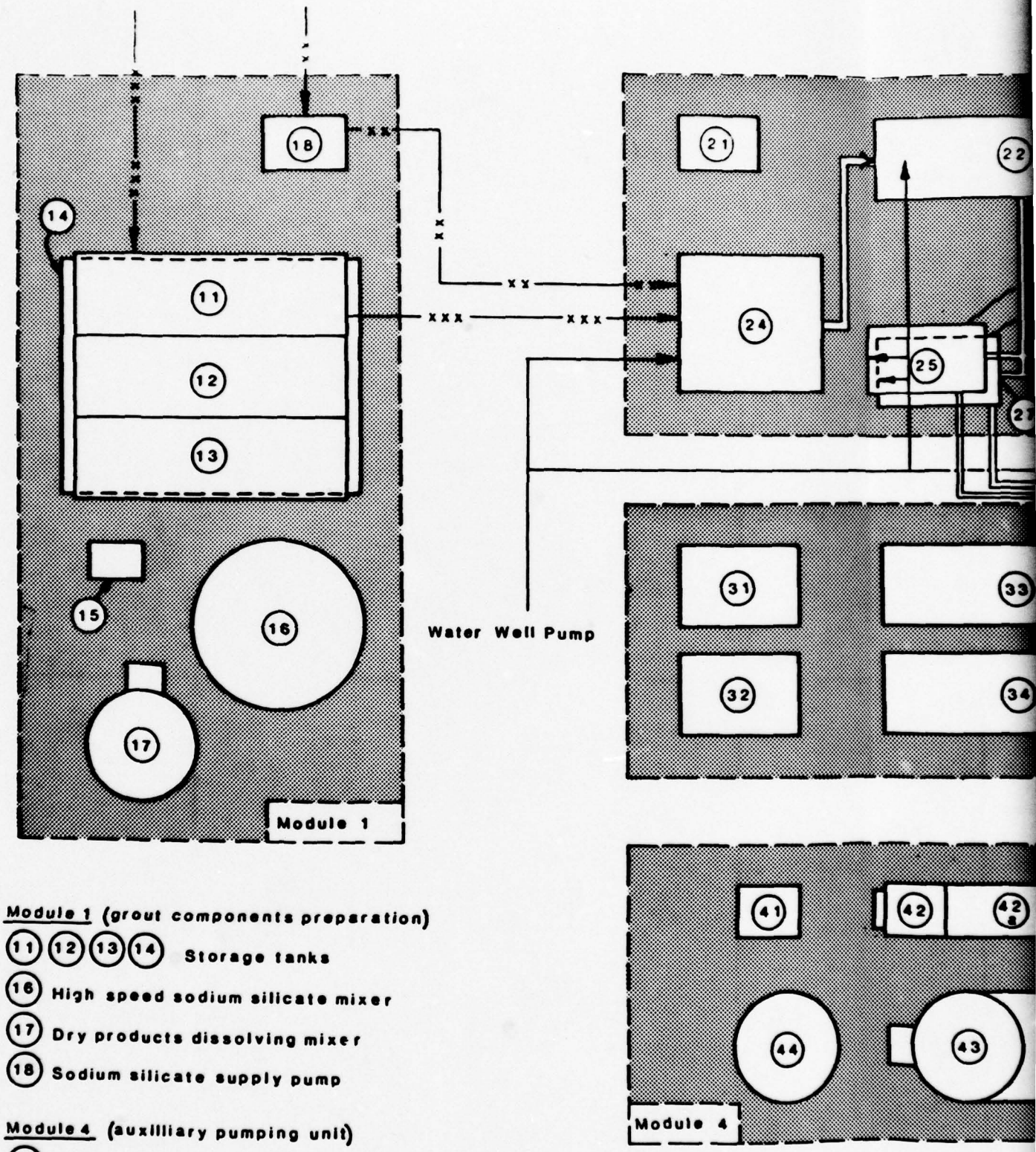
GROUTING PLANT OPERATION FOR SIROC GROUTS

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0068

Woodward-Clyde Consultants

Fig B.1

YYC826 Phase IX



Module 1 (grout components preparation)

(11) (12) (13) (14) Storage tanks

(16) High speed sodium silicate mixer

(17) Dry products dissolving mixer

(18) Sodium silicate supply pump

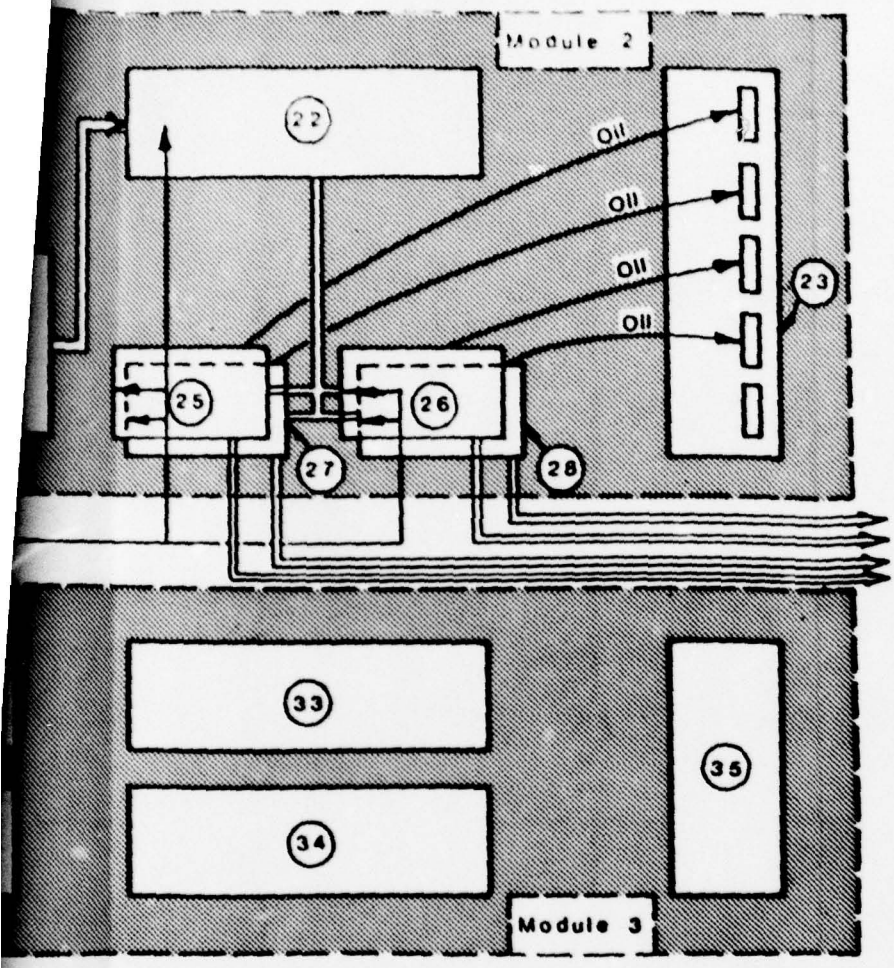
Module 4 (auxilliary pumping unit)

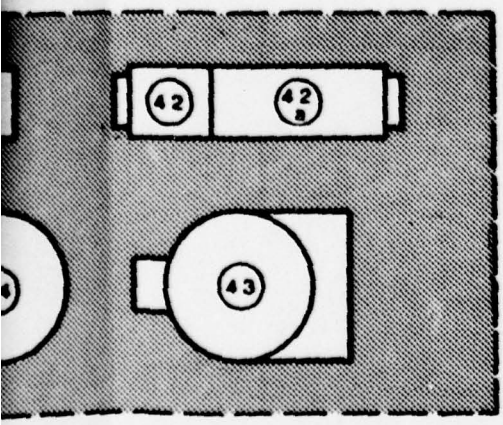
(41) Pump from Module 4 to Module 3

(42) (42a) Proportioning tanks

(43) Mixer

(44) Buffer grout tank





Module 2 (main pumping unit)

21 Pump

22 Main grouting pump

23 Control panel

24 Proportioning and mixing mother tank

25 Through 28 metering and grouting pumps

Module 3 (cement-bentonite or auxilliary unit)

31 32 Metering tanks

33 34 Main grouting pumps

35 Electrical panel

LEGEND

Water

Concentrated Sodium Silicate

R 600

Grout

Oil

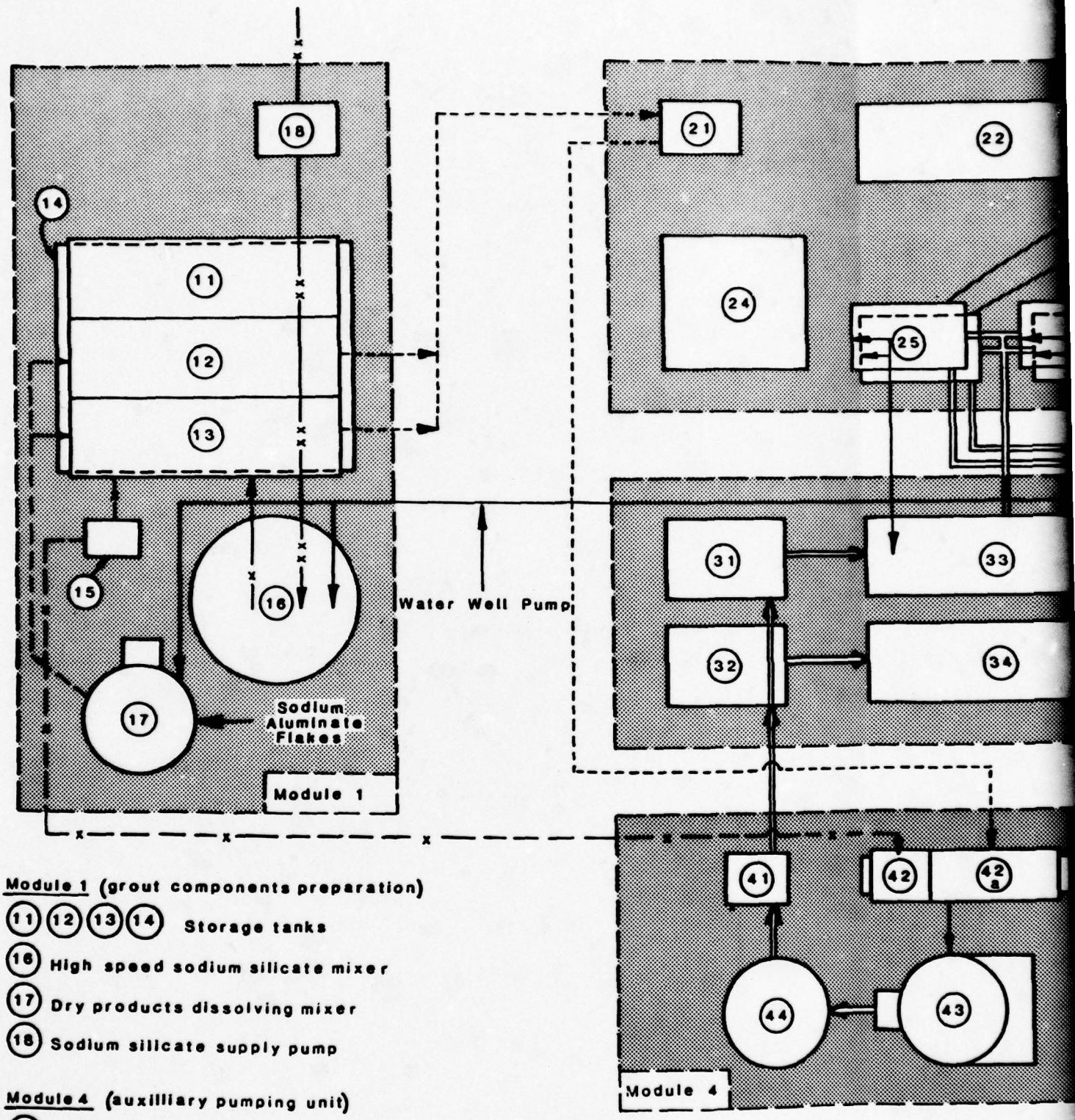
CHEMICAL GROUTING TEST PROGRAM

GROUTING PLANT OPERATIONS FOR SILICATE R 600 GROUTS

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM NO. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0065

Woodward-Clyde Consultants

Fig B.2



Module 1 (grout components preparation)

(11) (12) (13) (14) Storage tanks

(16) High speed sodium silicate mixer

(17) Dry products dissolving mixer

(18) Sodium silicate supply pump

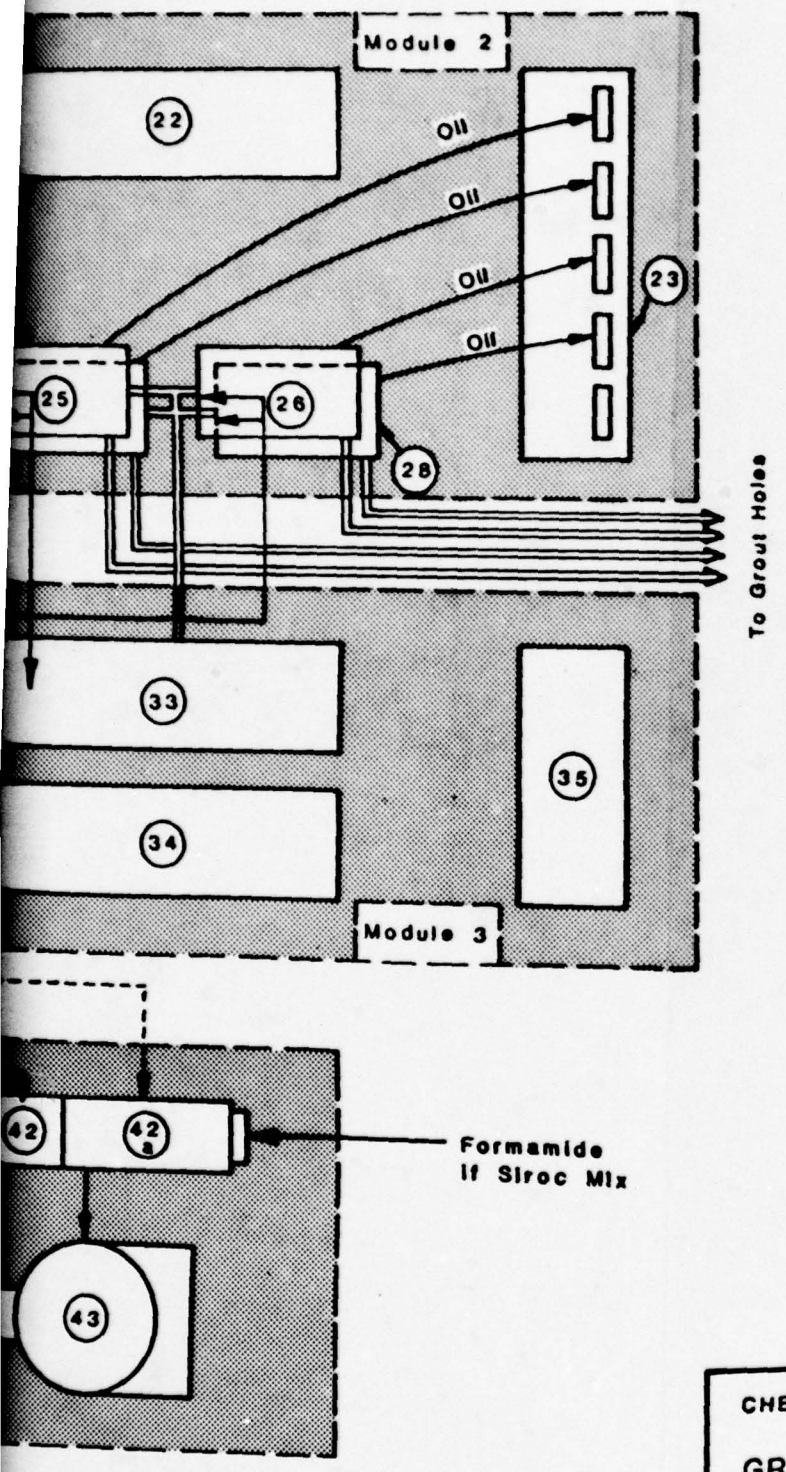
Module 4 (auxilliary pumping unit)

(41) Pump from Module 4 to Module 3

(42) (42a) Proportioning tanks

(43) Mixer

(44) Buffer grout tank



Module 2 (main pumping unit)

(21) Pump

(22) Main grouting pump

(23) Control panel

(24) Proportioning and mixing mother tank

(25) Through (28) metering and grouting pumps

Module 3 (cement-bentonite or auxilliary unit)

(31) (32) Metering tanks

(33) (34) Main grouting pumps

(35) Electrical panel

LEGEND

——— Water

—xx— Concentrated Sodium Silicate

—x— Diluted Sodium Silicate

- - - - - Sodium Aluminate or Calcium Chloride Solution

═══ Grout

⌒⌒⌒ Oil

2

CHEMICAL GROUTING TEST PROGRAM

GROUTING PLANT OPERATION FOR SILICATE GROUTS

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig B.3

Y7C829 Phase IV

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

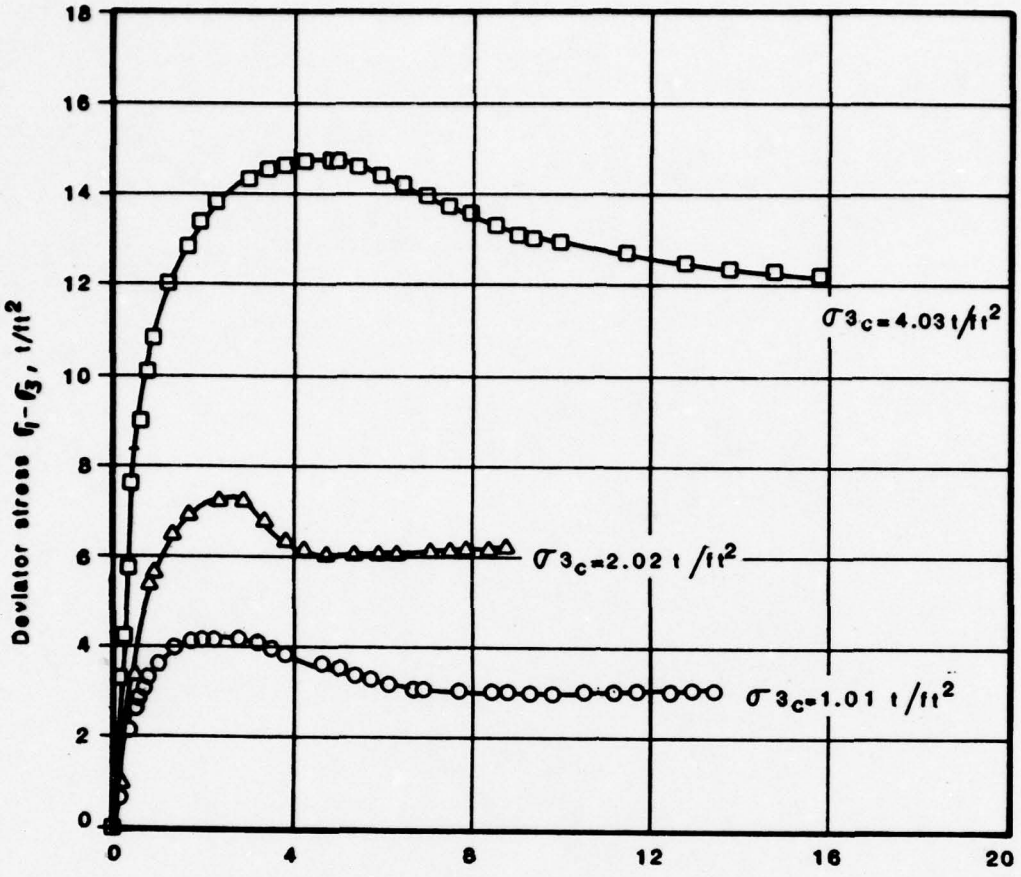
APPENDIX C

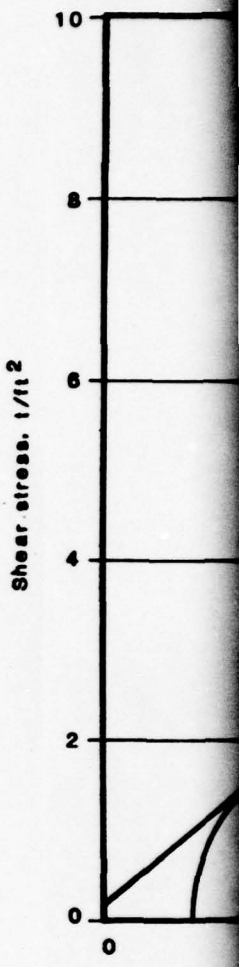
GROUTS

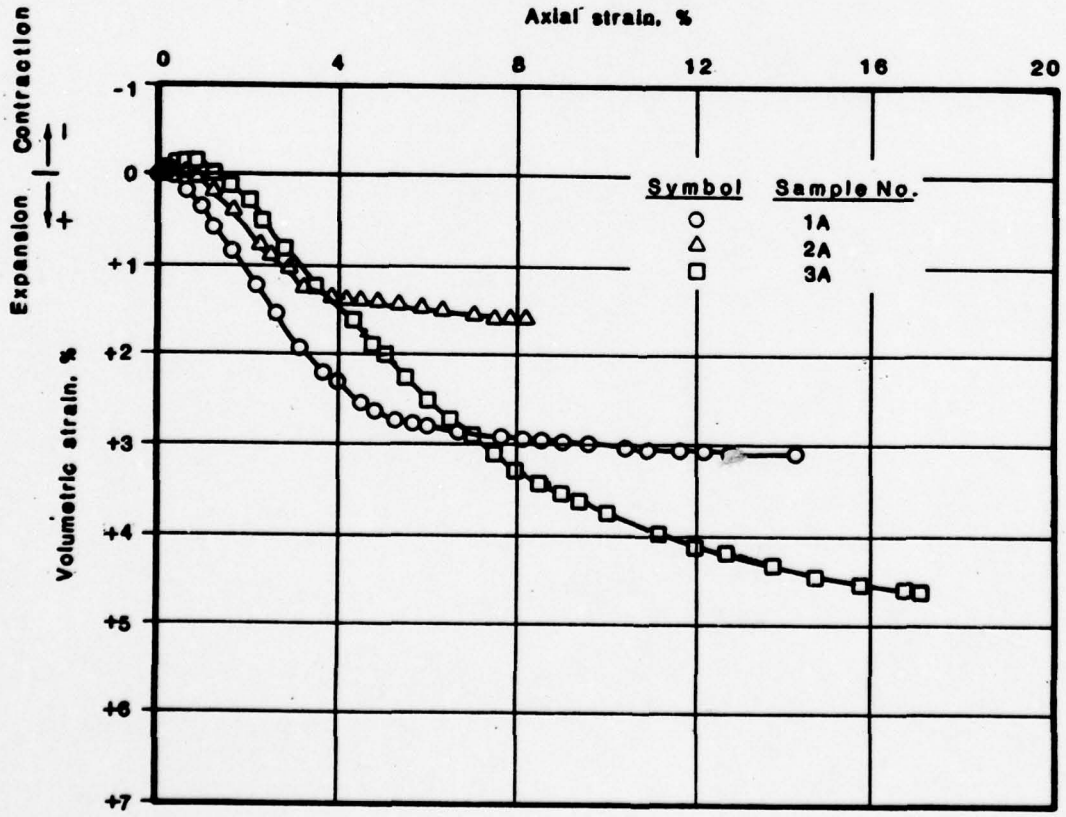
APPENDIX C

GROUTS

TABLE OF CONTENTS

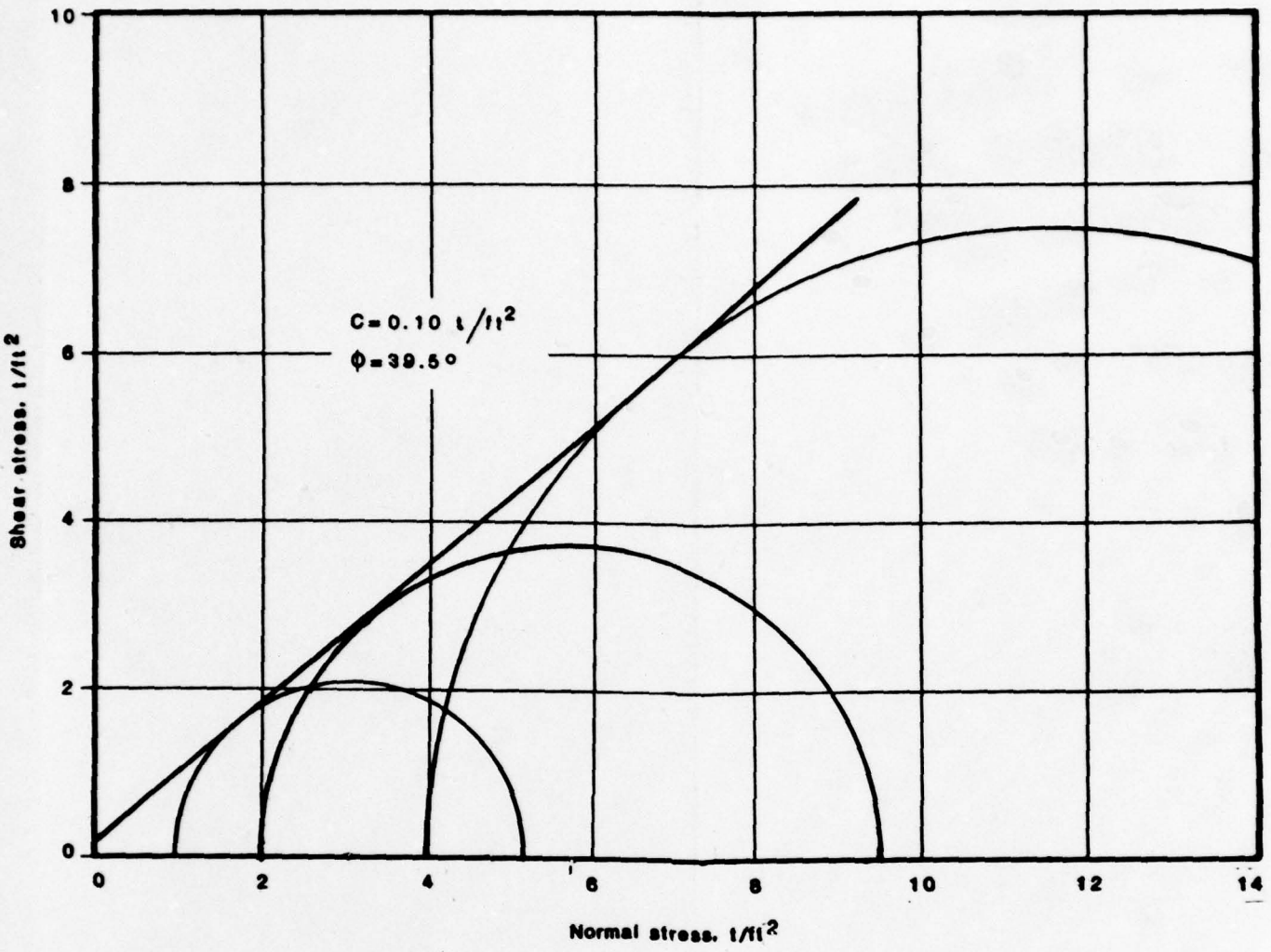






Notes:

1. Axial
2. Sand s
   D_r=70
3. Sand s
   and 6.



Notes:

1. Axial strain rate = 0.5 %/min
2. Sand samples were reconstituted at D_r = 70% ($\bar{\delta}_d$ 108 = lb/ft³)
3. Sand samples were 2.8- in.-dia and 6.6- in.-high

2

CHEMICAL GROUTING TEST PROGRAM

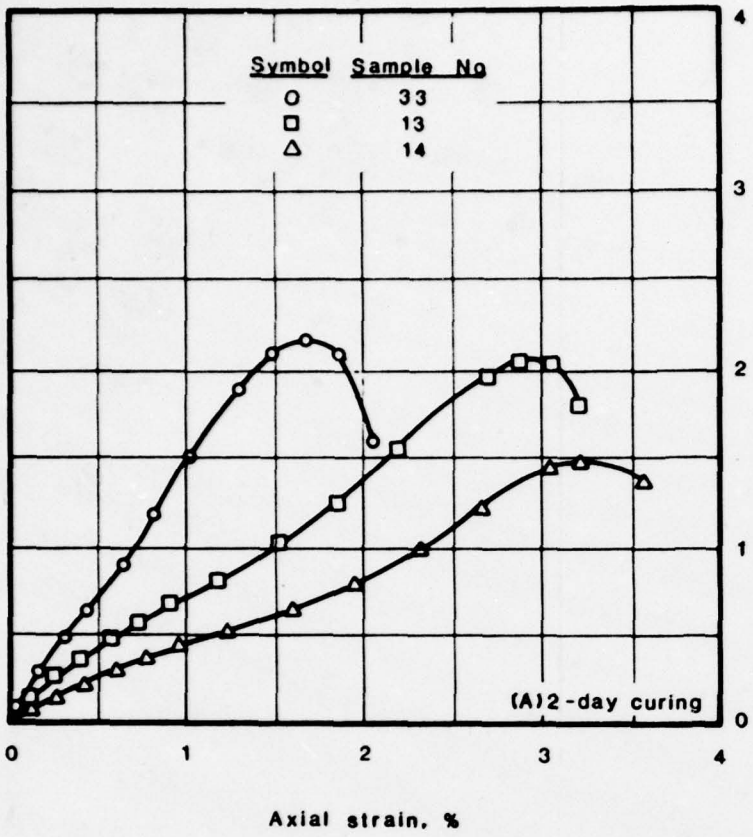
RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS UNGROUTED RECONSTITUTED SAND SAMPLES

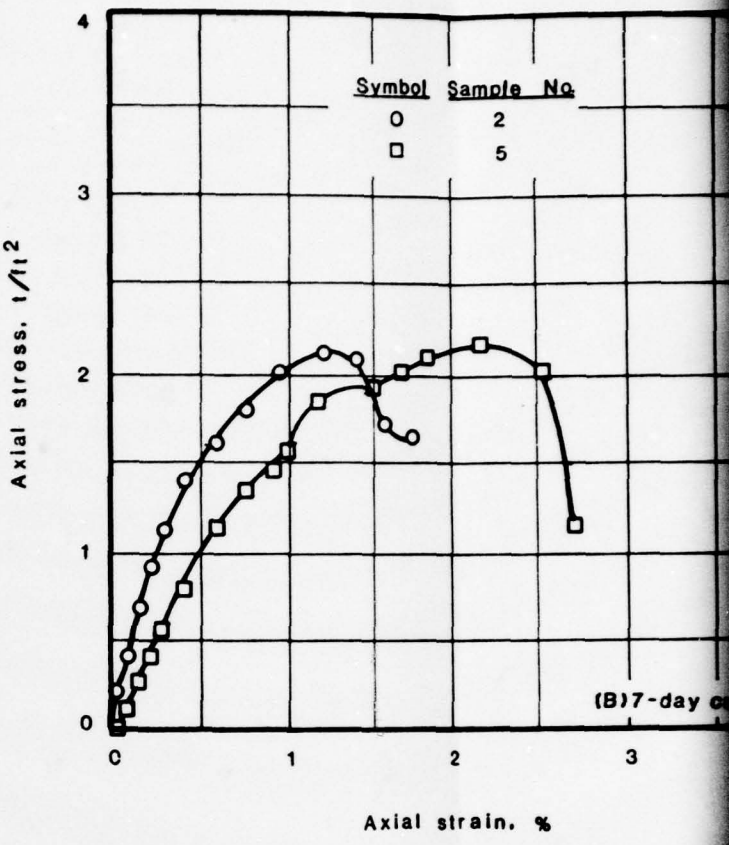
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

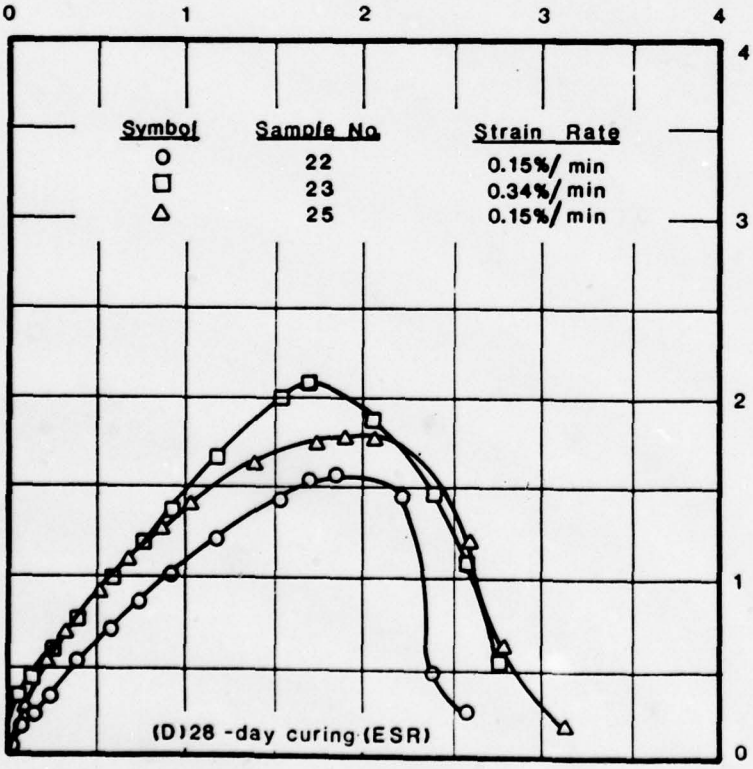
Woodward-Clyde Consultants

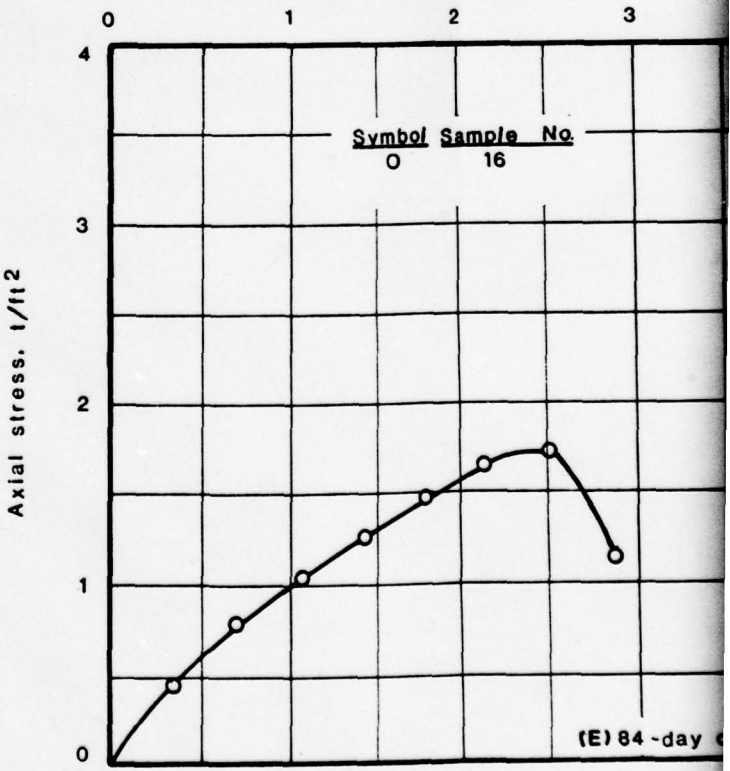
Fig C.1

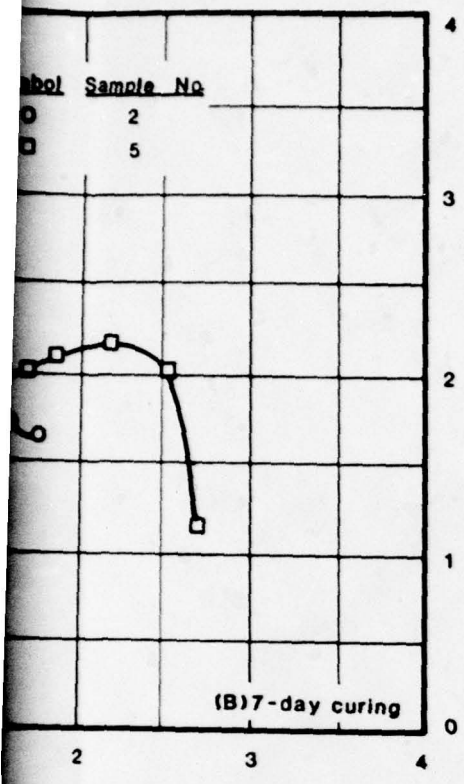
Y7C826 Phase IX

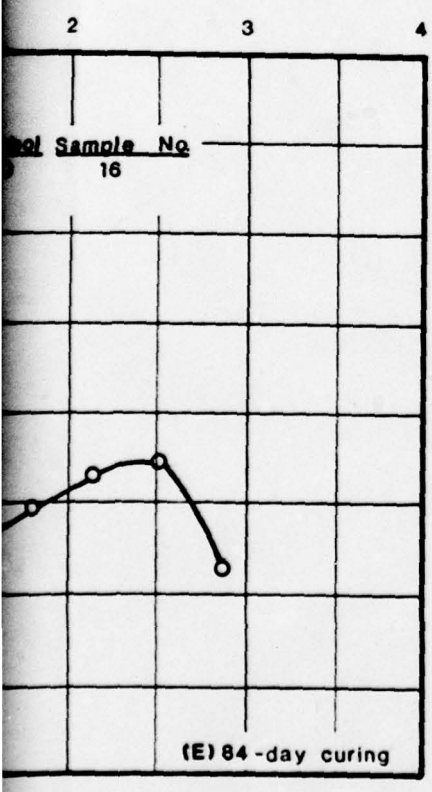

Symbol Sample No
O 33
□ 13
△ 14
(A) 2-day curing
0
1
2
3
4


Symbol Sample No.
O 2
□ 5
(B) 7-day c
Axial stress, t/ft²
Axial strain, %
0
1
2
3
4

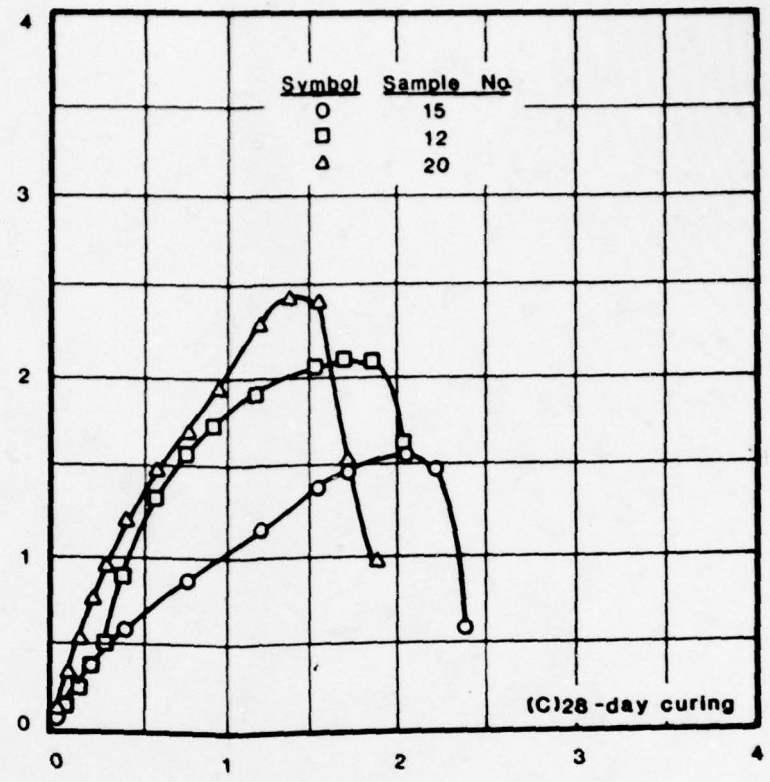

Symbol Sample No. Strain Rate
O 22 0.15%/ min
□ 23 0.34%/ min
△ 25 0.15%/ min
(D) 28 -day curing (ESR)
0
1
2
3
4


Symbol Sample No.
O 16
(E) 84 -day c
Axial stress, t/ft²
0
1
2
3
4





Axial strain, %



Axial strain, %

Notes

1. Axial strain rate = 0.5 %/min except (D)
2. Sand samples were reconstituted at D_r = 70 % (γ_d 107.9 lb/ft^3)
3. Sand samples were 2.8-in.-dia and 6.6-in.-high
4. Grout was 35% Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

CHEMICAL GROUTING TEST PROGRAM

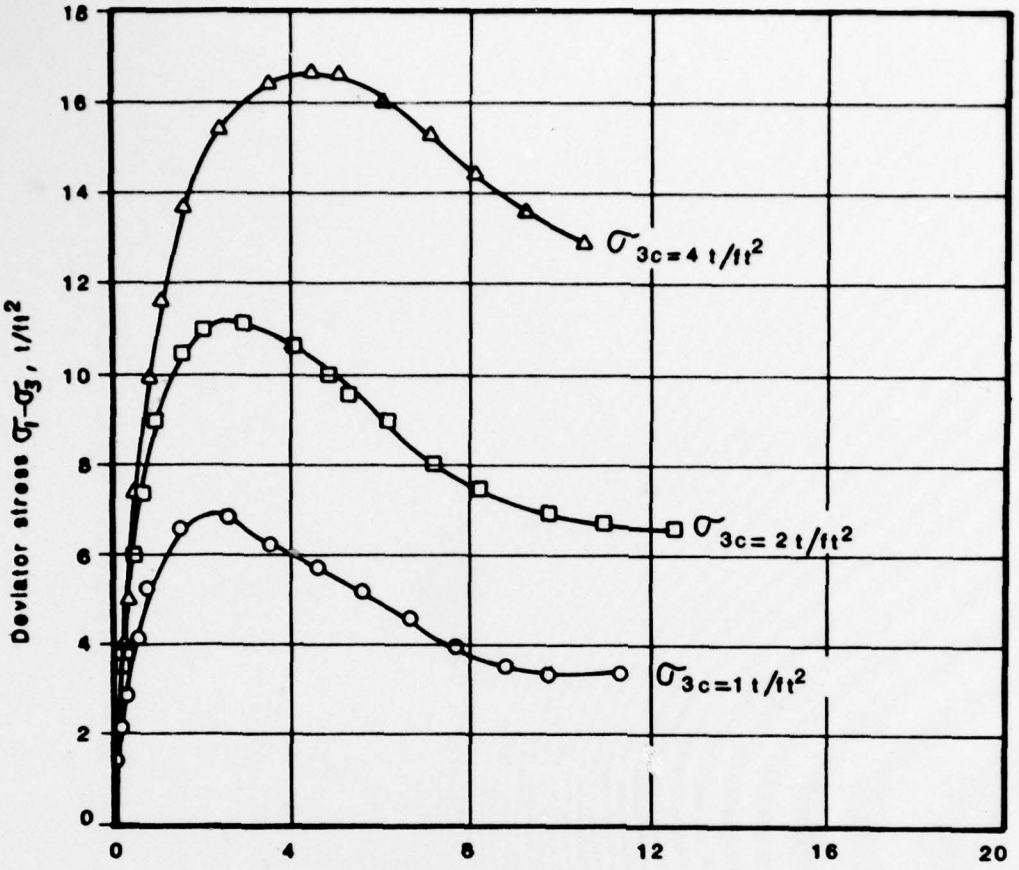
RESULTS OF UNCONFINED COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY

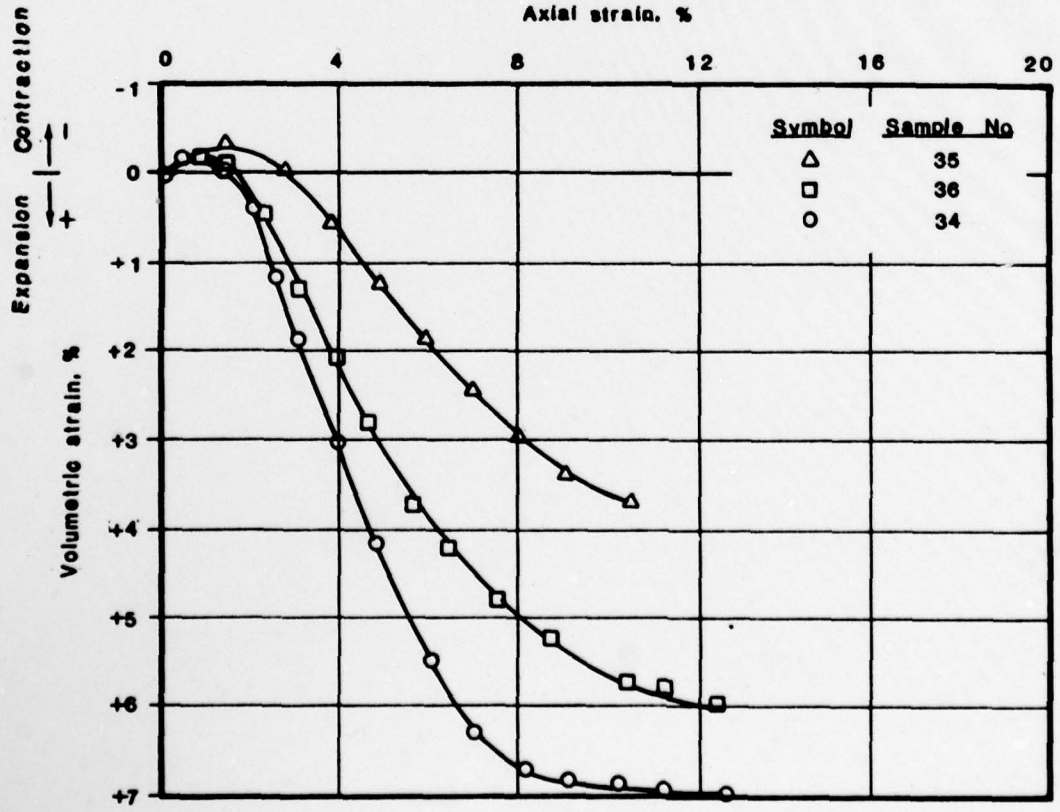
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

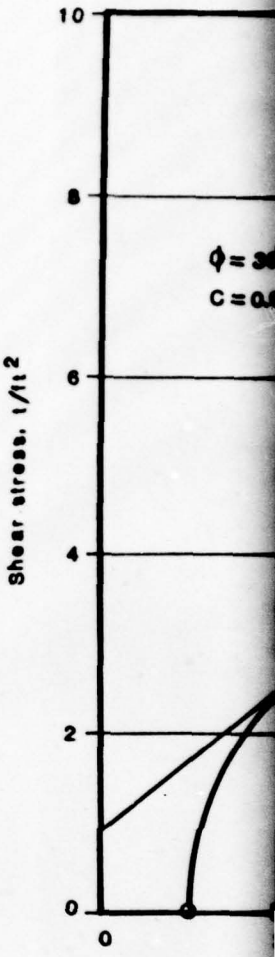
Woodward-Clyde Consultants

Y7C825 Phase II

Fig. C.2

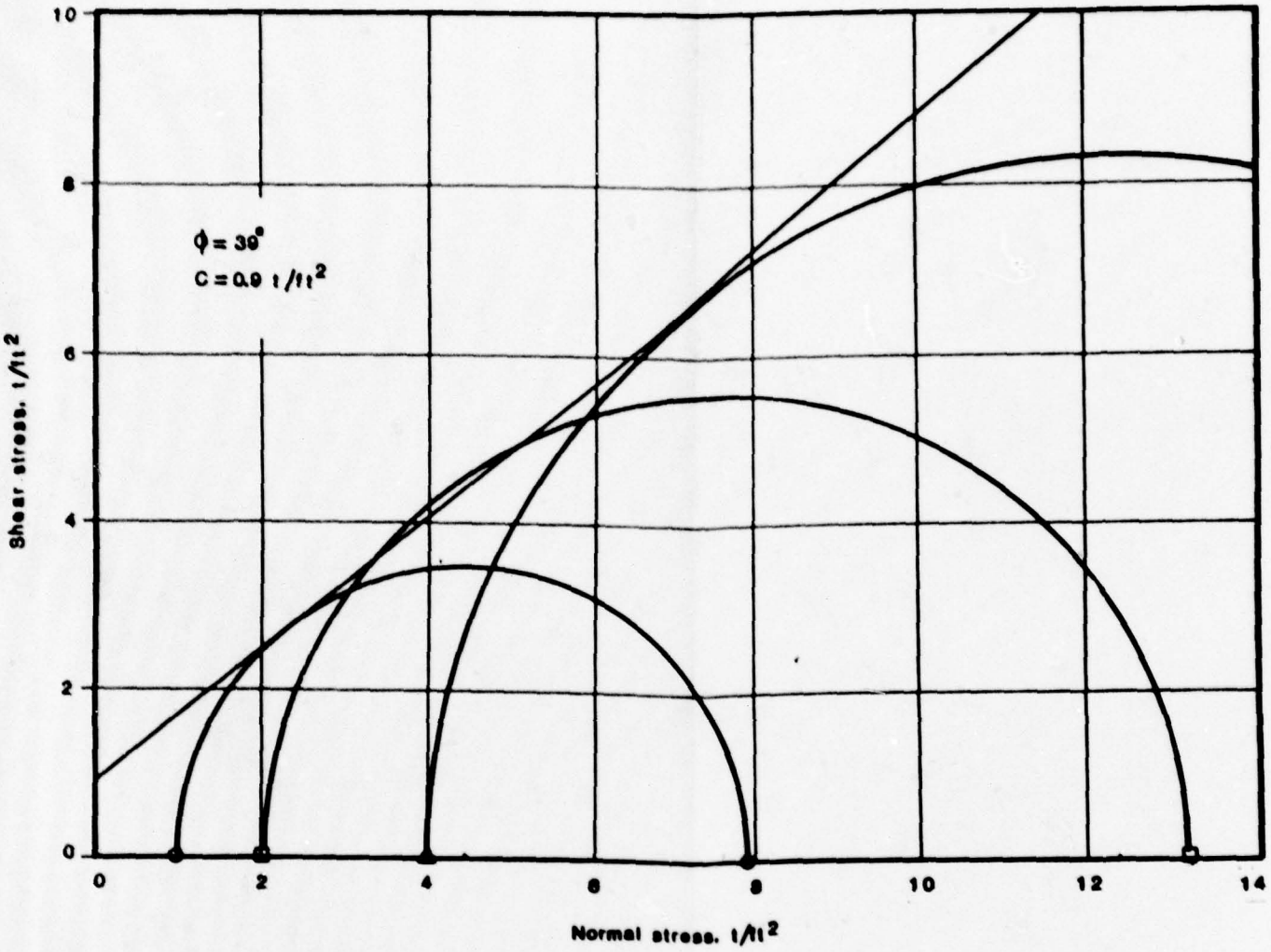






Notes:

1. Axial str
2. Sand sam
   D_r=70% [
3. Sand sam
   and 6.6-
4. Grout wa
   following
   Sodiu
   Forma
   Sodiu
   Water



Notes:

1. Axial strain rate – 0.5 %/min
2. Sand samples were reconstituted at D_r – 70% ($\bar{\sigma}_d$ 108 – lb/ft^3)
3. Sand samples were 2.8- in.-dia and 6.6- in.-high
4. Grout was 35 % Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

CHEMICAL GROUTING TEST PROGRAM

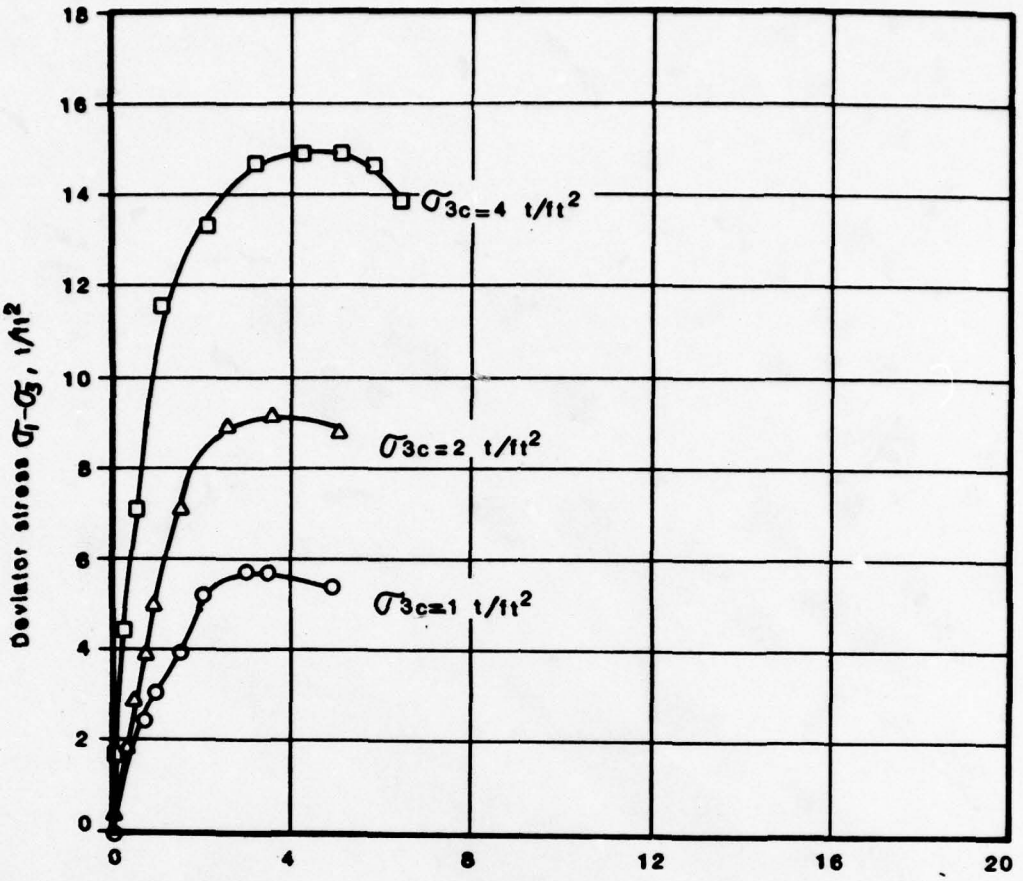
RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY 7-DAY CURING TIME

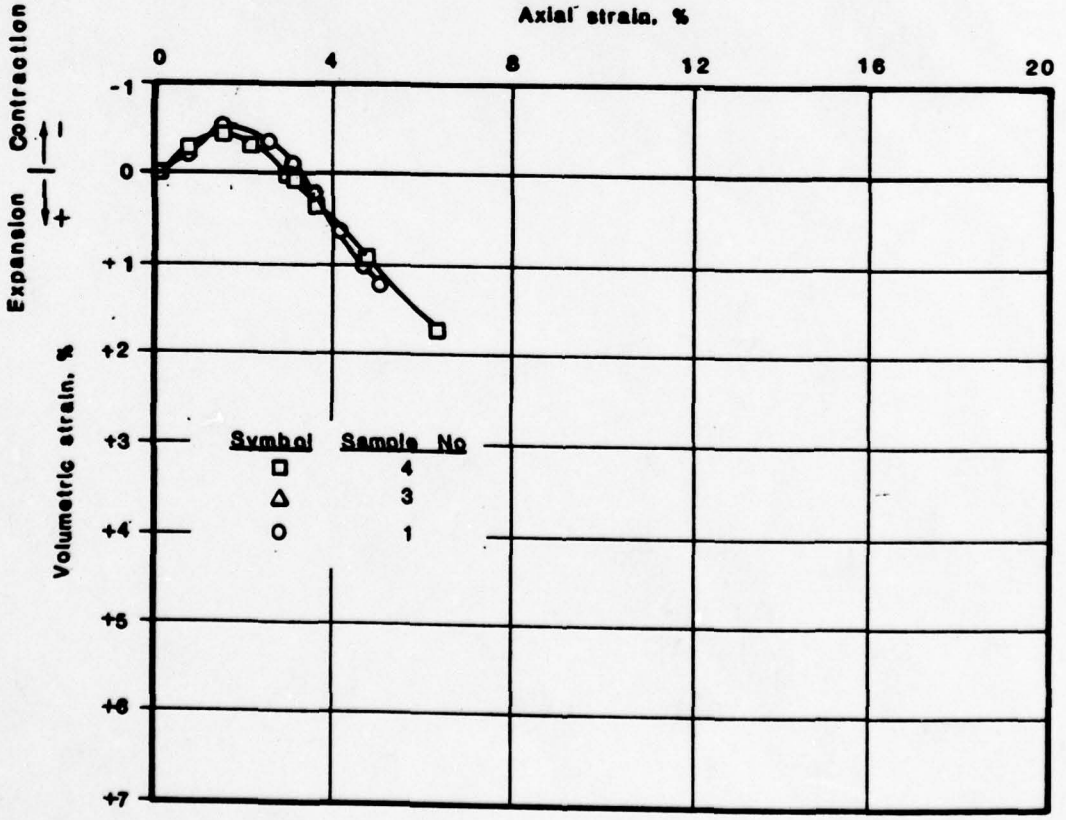
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0065

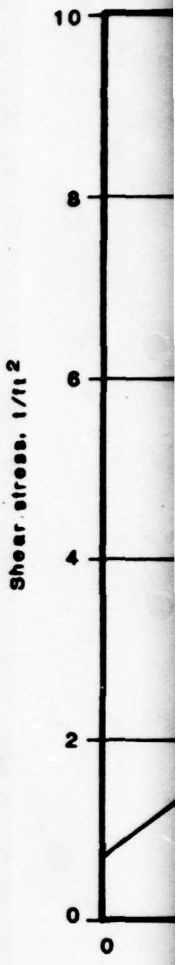
Woodward-Clyde Consultants

Y7C026 Phase III

Fig. C.3

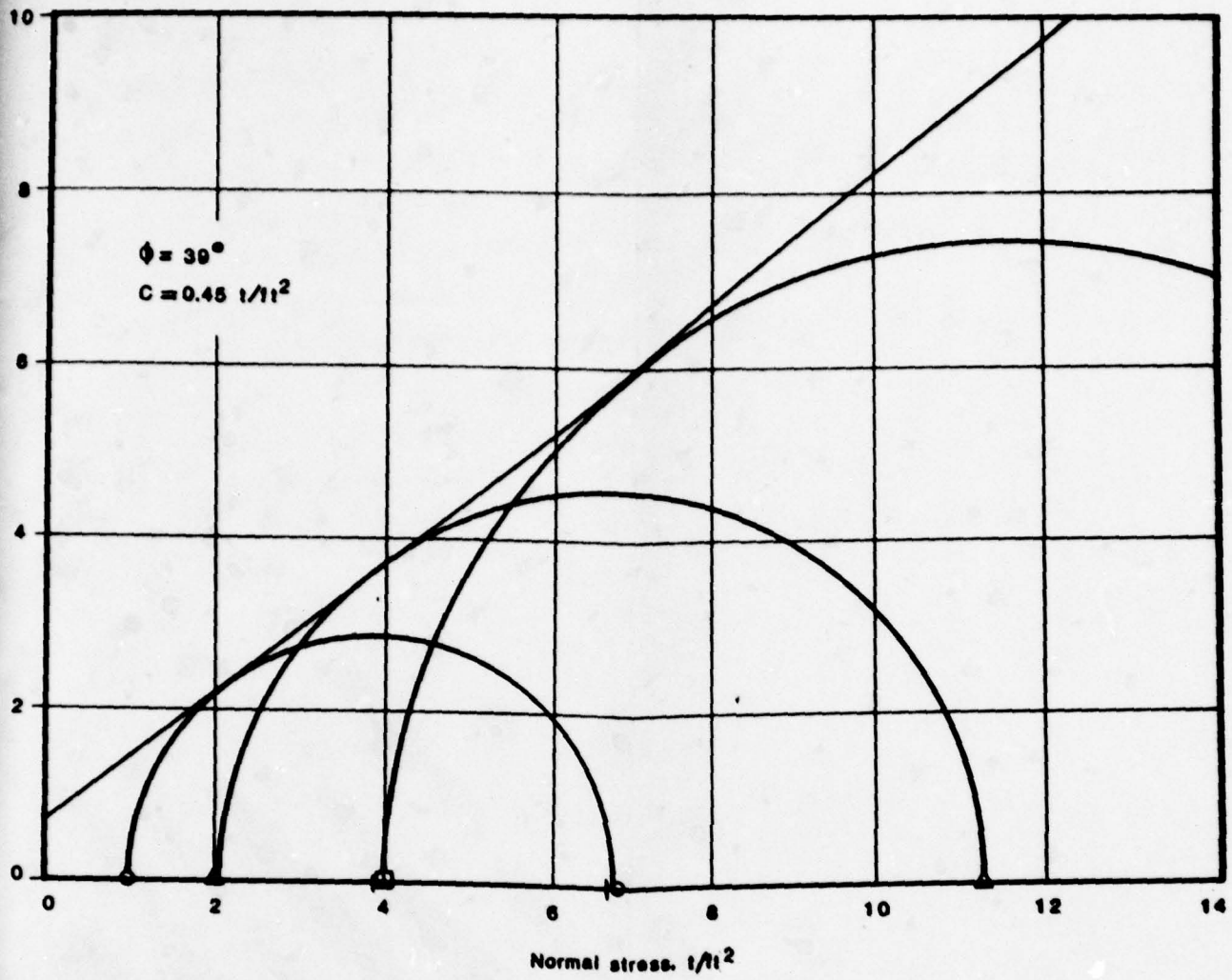






Notes

1. A
2. S
   D_r
3. S
   an
4. G
   fo



Notes:

1. Axial strain rate = 0.5 %/min
2. Sand samples were reconstituted at $D_r = 70\%$ (γ_d 108 = lb/ft^3)
3. Sand samples were 2.8- in.-dia and 6.8- in.-high
4. Grout was 35 % Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

2

CHEMICAL GROUTING TEST PROGRAM

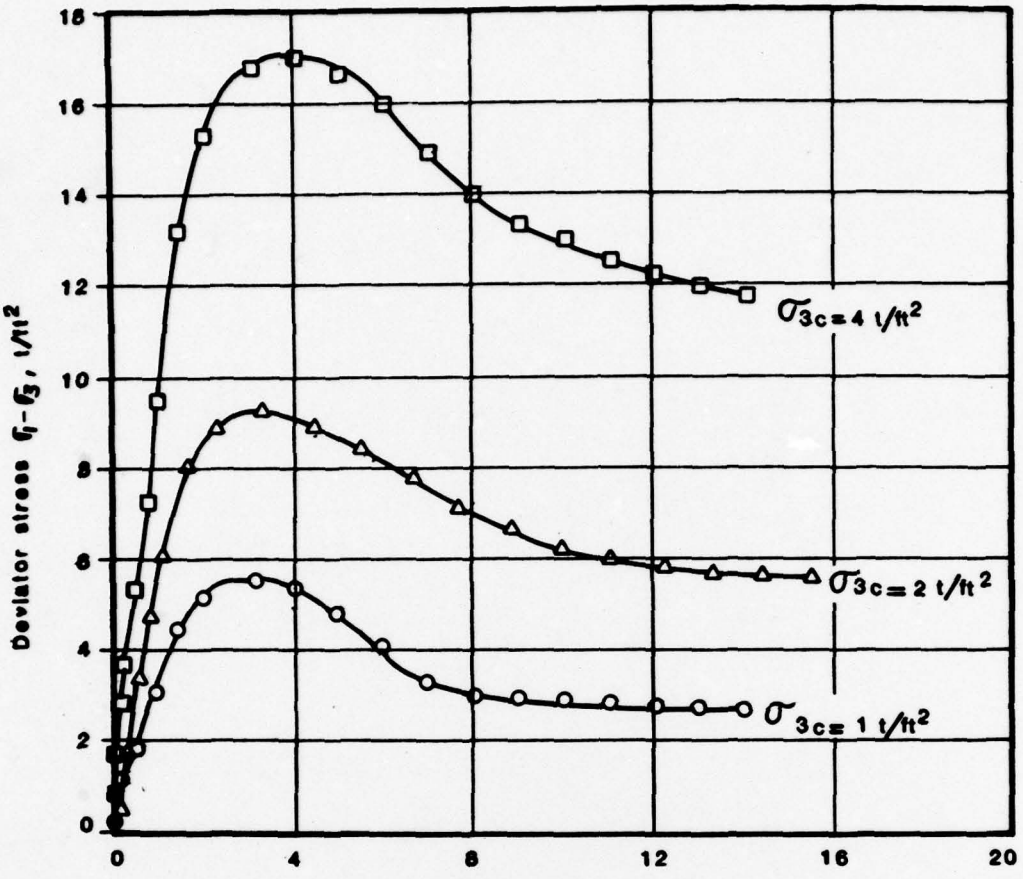
RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY 7-DAY CURING TIME

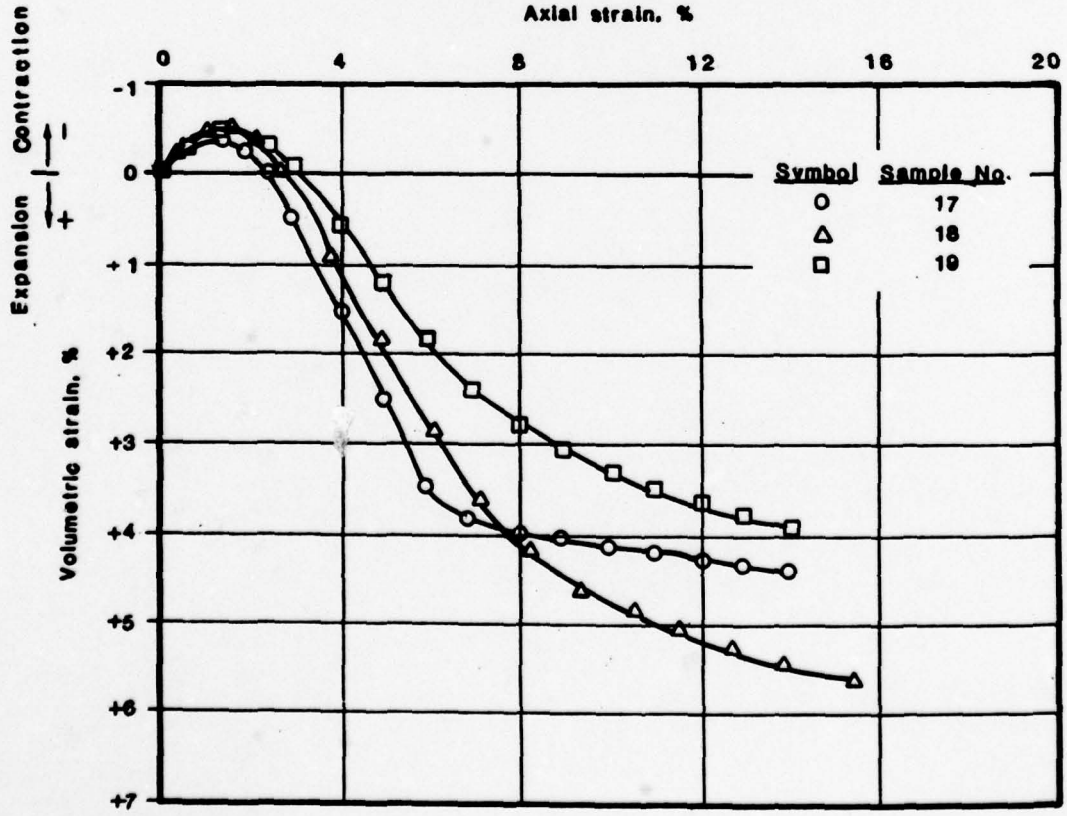
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0066

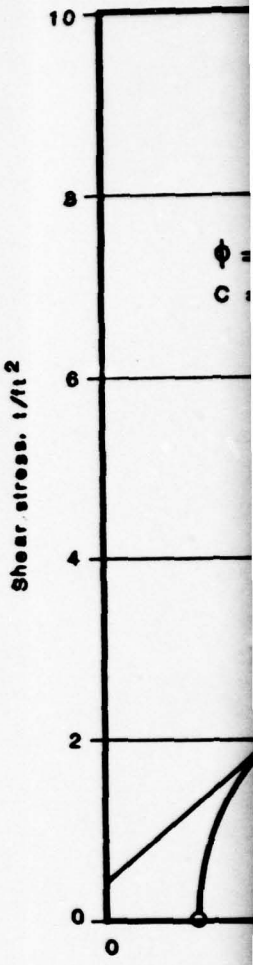
Woodward-Clyde Consultants

Fig. C.4

Y7C026 Phase III

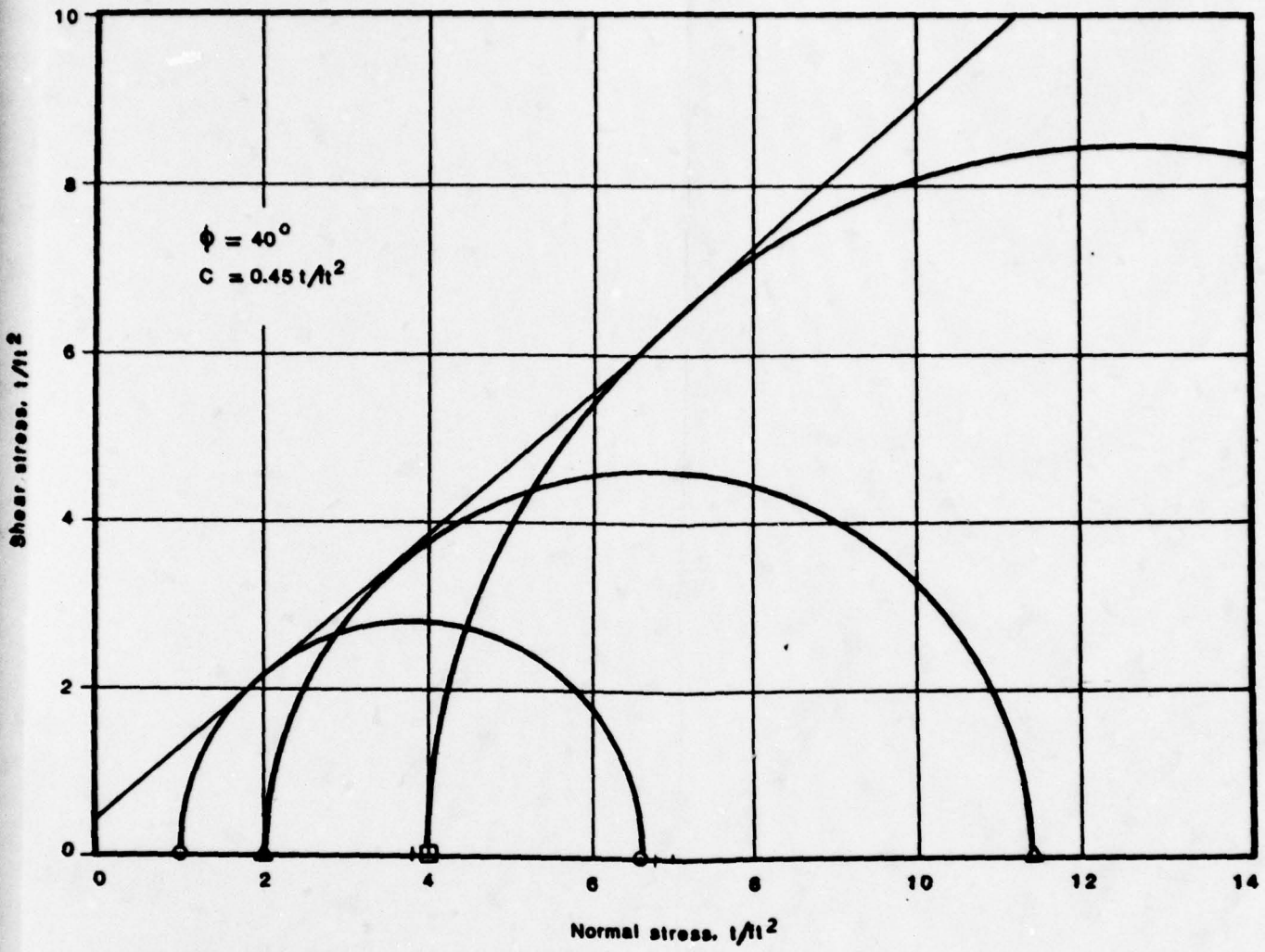






Notes:

1. Axial s
2. Sand s
   D_r=70%
3. Sand s
   and 6.6
4. Grout
   followi
   Soc
   For
   Soc
   Wa



Notes:

1. Axial strain rate = 0.5 %/min
2. Sand samples were reconstituted at $D_r = 70\%$ (γ_d 108 = lb/ft^3)
3. Sand samples were 2.8- in.-dia and 6.6- in.-high
4. Grout was 35 % Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

2

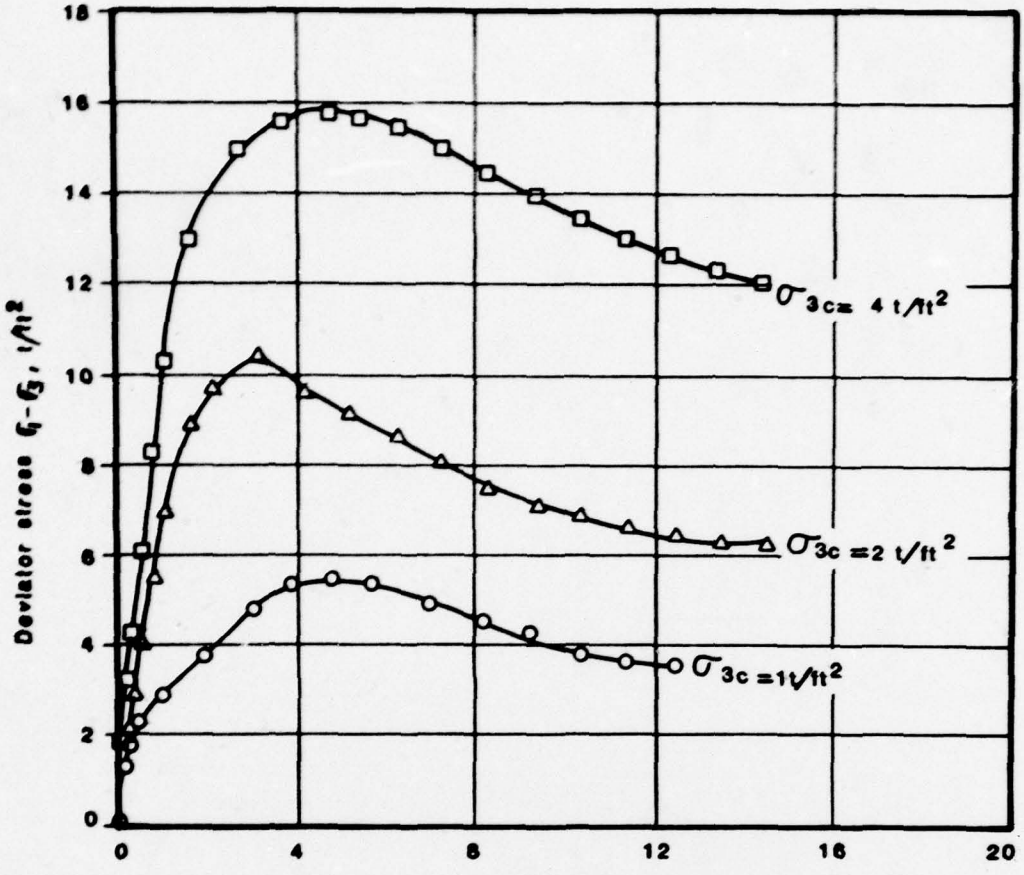
CHEMICAL GROUTING TEST PROGRAM

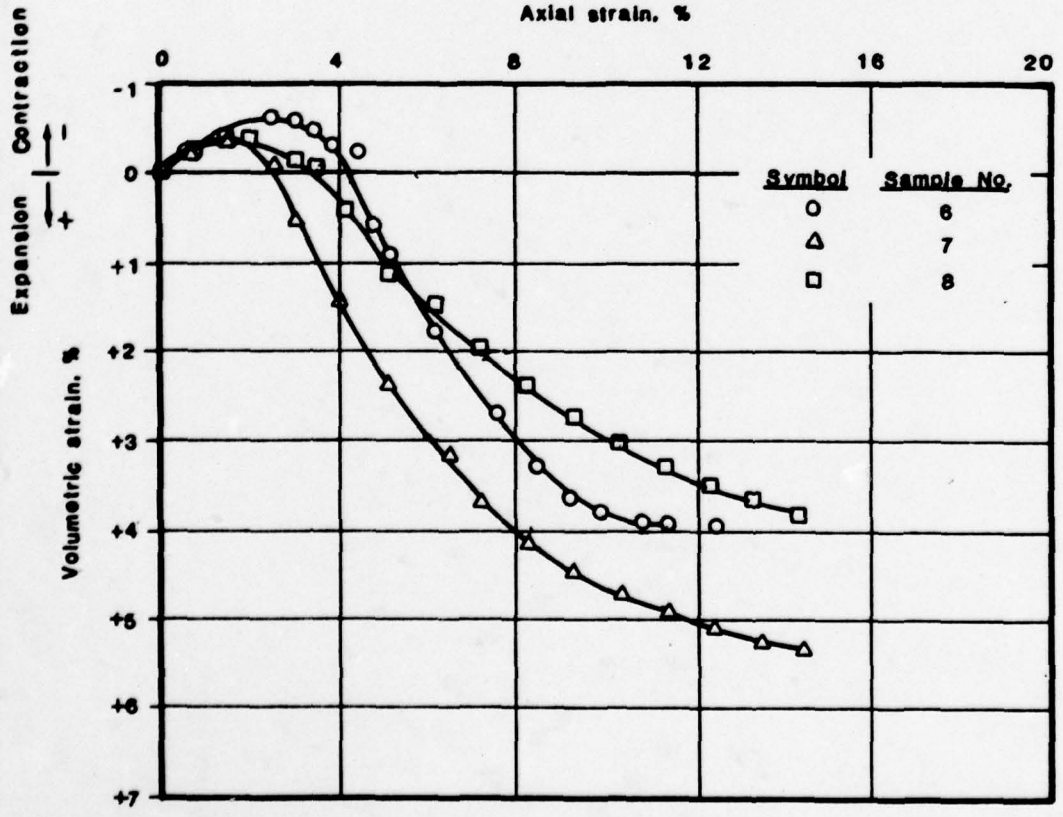
RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY 28-DAY CURING TIME

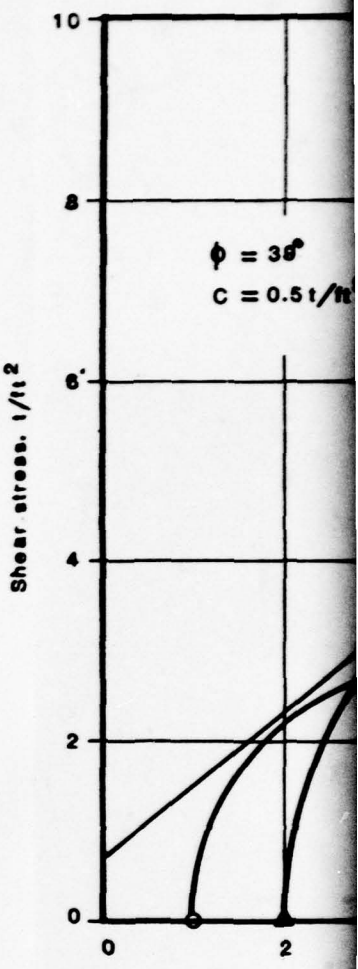
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants
Y7C025 Phase IV

Fig. C.5

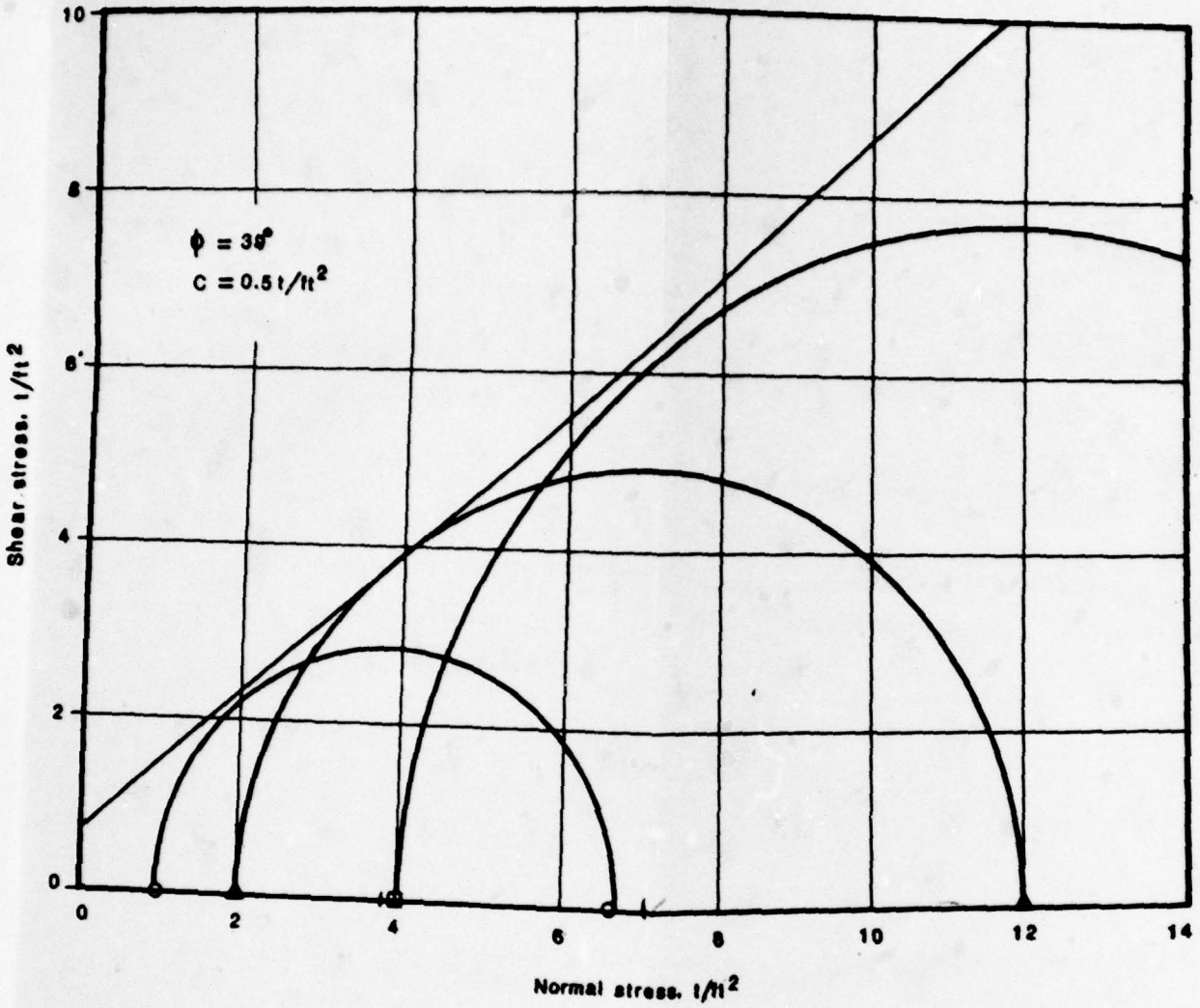






Notes:

1. Axial strain ra
2. Sand samples w
   D_r=70% (γ_d 108
3. Sand samples w
   and 6.6-in.-high
4. Grout was 35 %
   following comp
   Sodium Silic
   Formamide
   Sodium Alum
   Water



Notes:

1. Axial strain rate = 0.5 %/min
2. Sand samples were reconstituted at D_r = 70% (γ_d 108 = lb/ft^3)
3. Sand samples were 2.8- in.-dia and 6.6- in.-high
4. Grout was 35 % Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

2

CHEMICAL GROUTING TEST PROGRAM

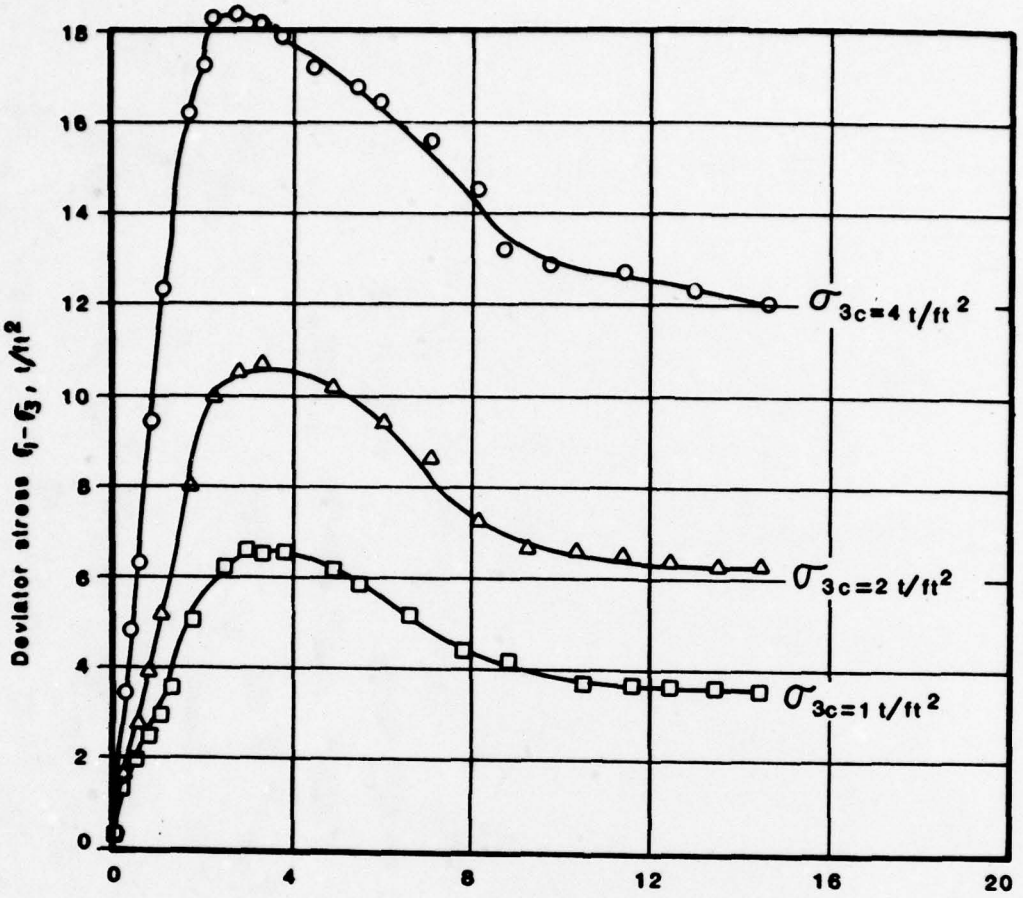
RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY 28-DAY CURING TIME

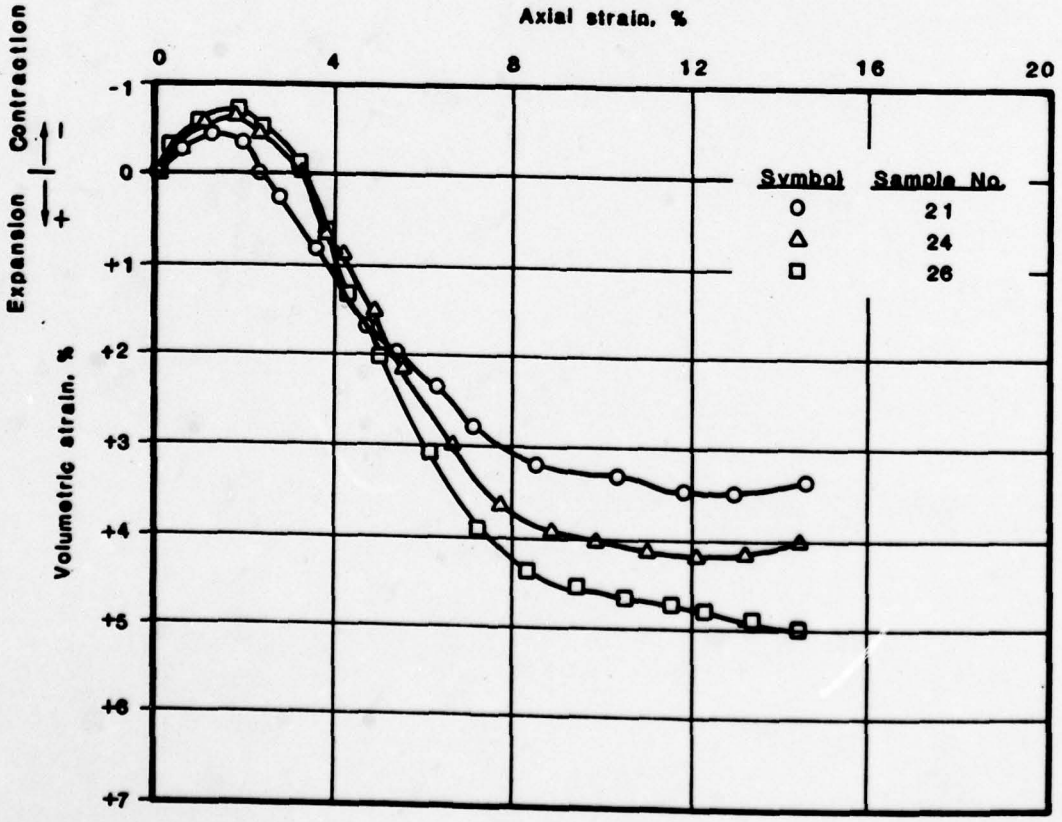
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

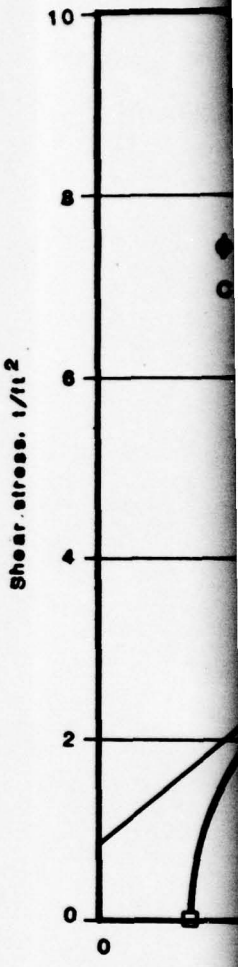
Woodward-Clyde Consultants

Fig. C.6

Y7C026 Phase III

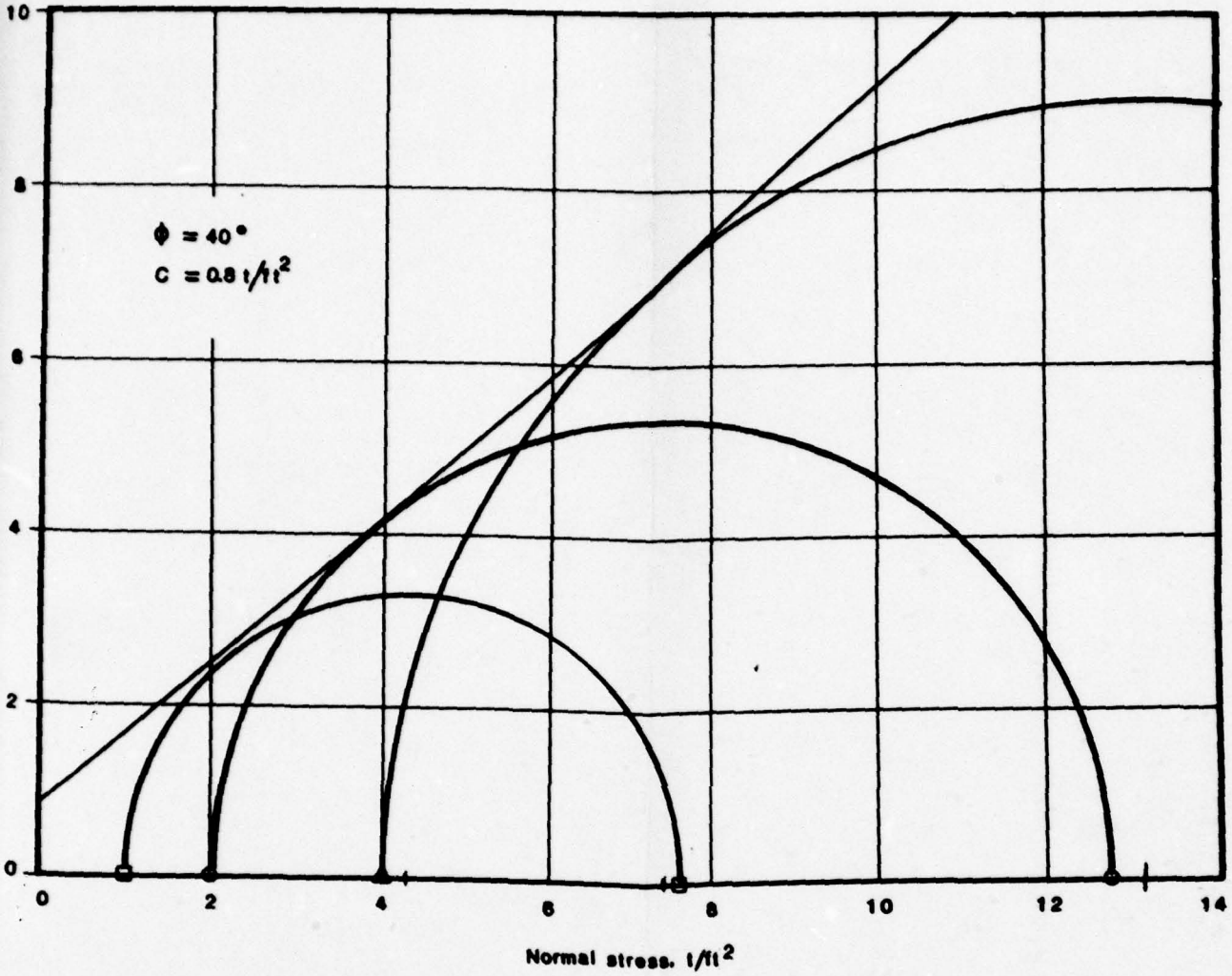






Notes:

1. Axial s
2. Sand s
   D_r=70%
3. Sand s
   and 6.6
4. Grout w
   followi
   Sod
   For
   Sod
   Wat



Notes:

1. Axial strain rate = 0.5 %/min
2. Sand samples were reconstituted at $D_r = 70\%$ (γ_d 108 lb/ft^3)
3. Sand samples were 2.8- in.-dia and 6.6- in.-high
4. Grout was 35 % Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

2

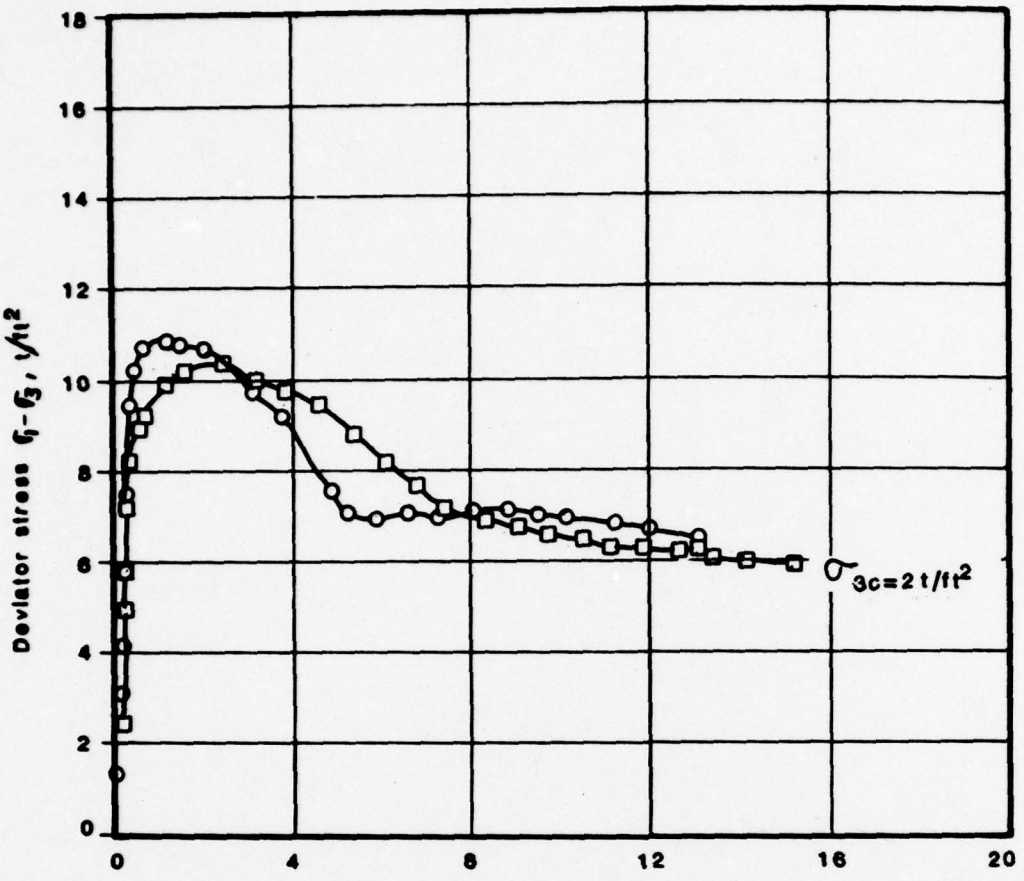
CHEMICAL GROUTING TEST PROGRAM

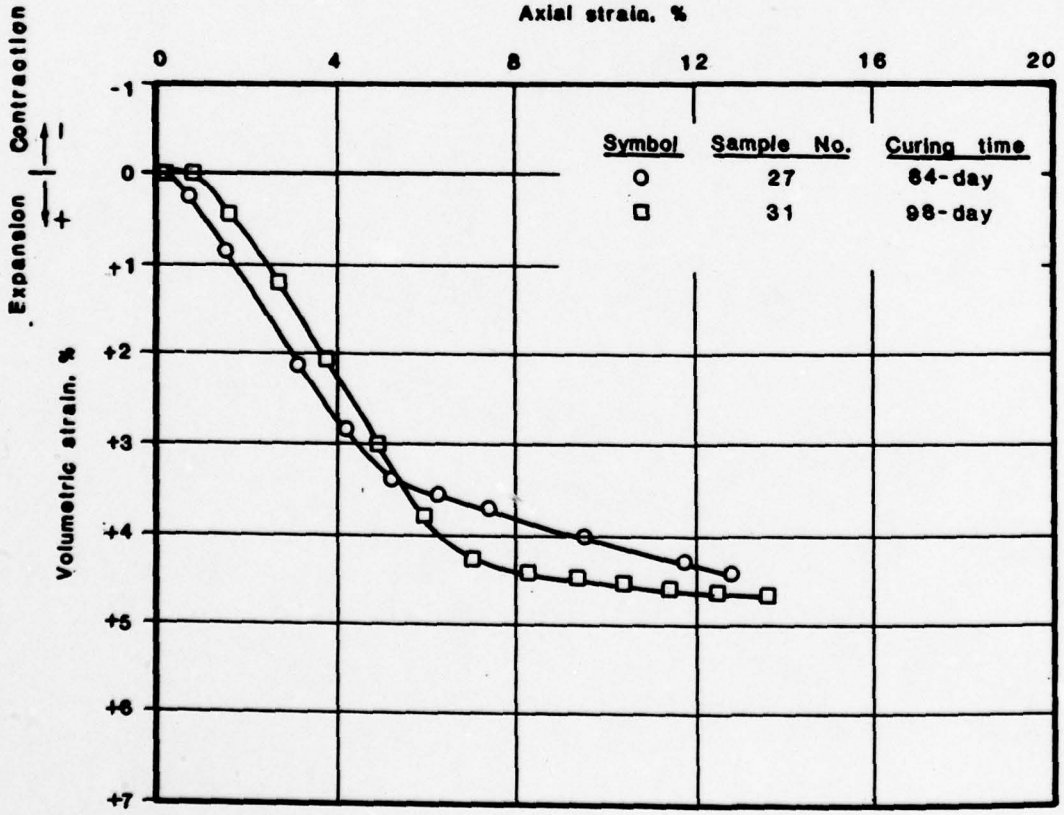
RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY 80-DAY CURING TIME

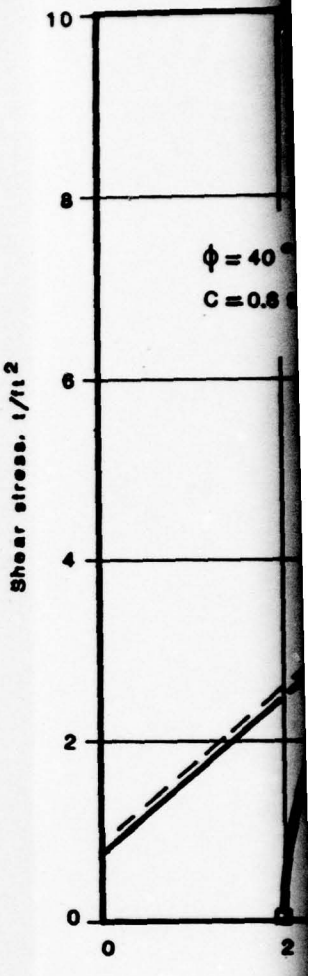
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants
Y7C625 Phase IX

Fig C.7

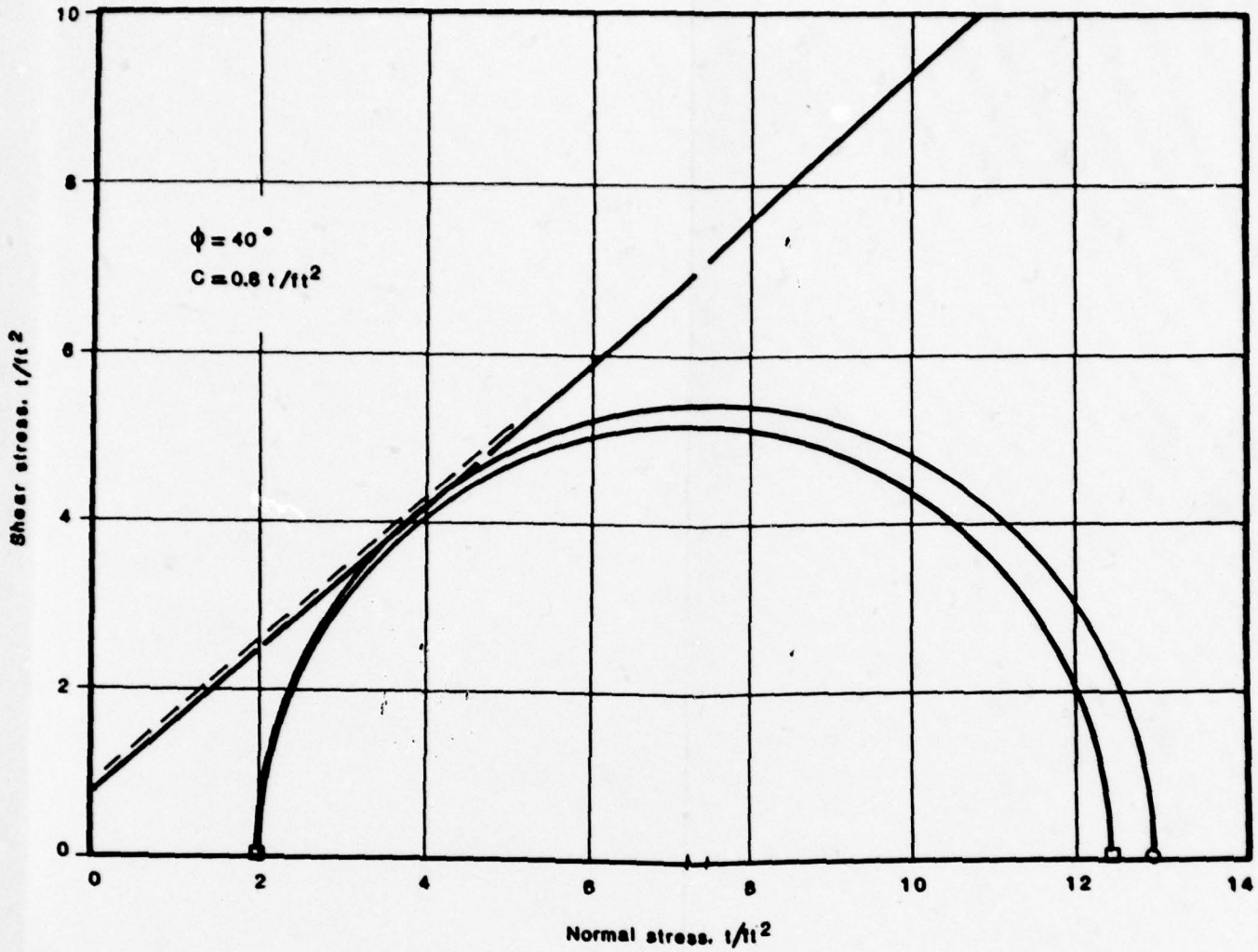






Notes:

1. Axial strai
2. Sand sampl D_r=70% (δ_d
3. Sand sampl and 6.6- in.-
4. Grout was following
   - Sodium
   - Formami
   - Sodium
   - Water
5. Samples w after creep



Notes:

1. Axial strain rate = 0.5 %/min
2. Sand samples were reconstituted at $D_r = 70\%$ (γ_d 108 = lb/ft^3)
3. Sand samples were 2.8- in.-dia and 6.6- in.-high
4. Grout was 35 % Siroc 142 with the following composition (by volume)

Sodium Silicate	35%
Formamide	6%
Sodium Aluminate	0.15 lb/gal
Water	58%

5. Samples were tested to failure after creep tests

2

CHEMICAL GROUTING TEST PROGRAM

RESULTS OF $\overline{CID}$ TRIAXIAL COMPRESSION TESTS RECONSTITUTED SAND SAMPLES GROUTED IN THE LABORATORY 84-DAY CURING TIME

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants
Y7C626 Phase IV

Fig C.8

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

APPENDIX D

GROUTING PROCEDURES

APPENDIX D

GROUTING PROCEDURES

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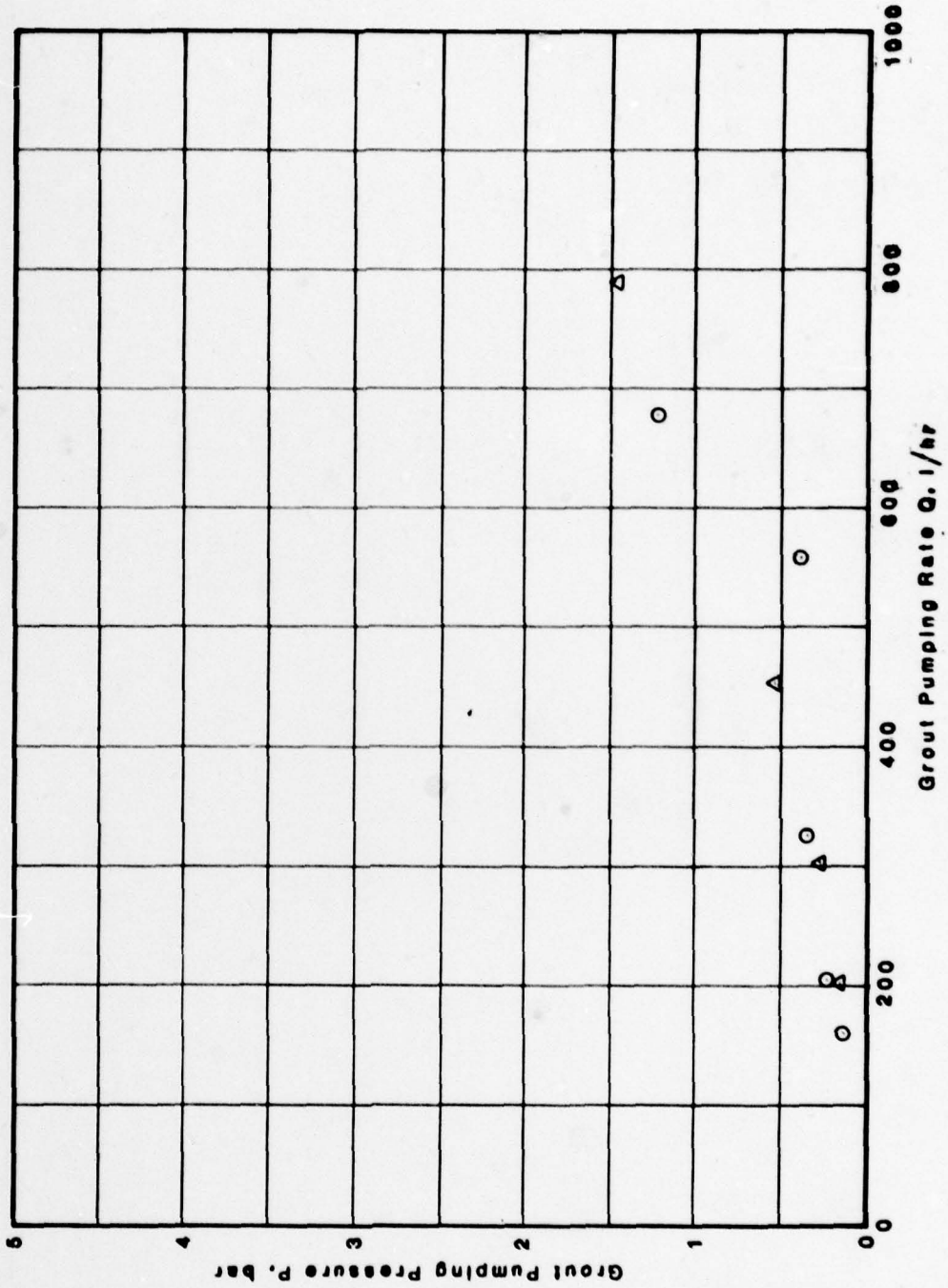


Legend

Symbol	Test el
O	380.0
Δ	383.3

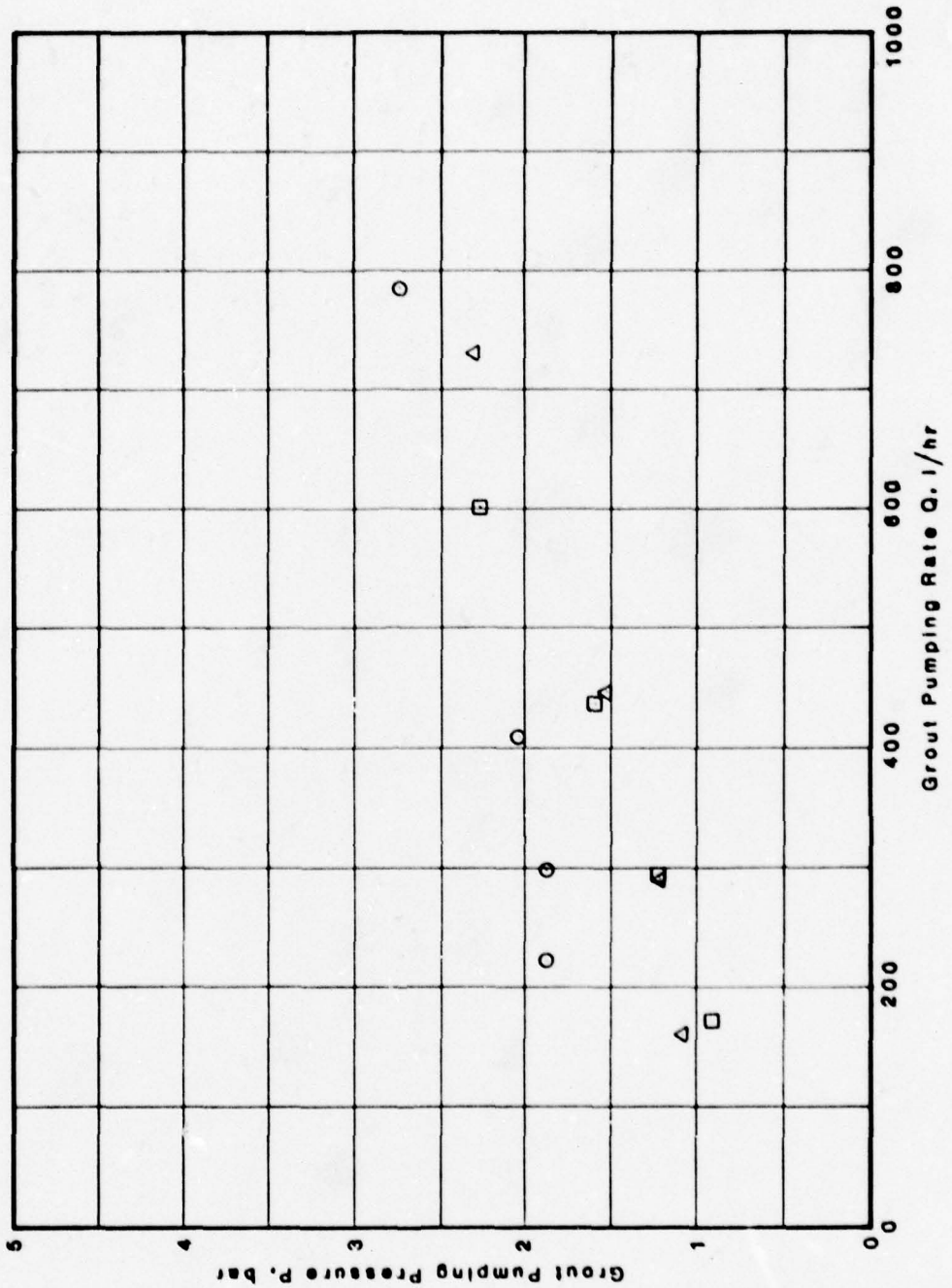
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO. 3-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-74-C-0005

Woodward-Clyde Consultants

Fig. D.1



Legend

Symbol	Test el
○	360.0
△	363.3
□	366.6

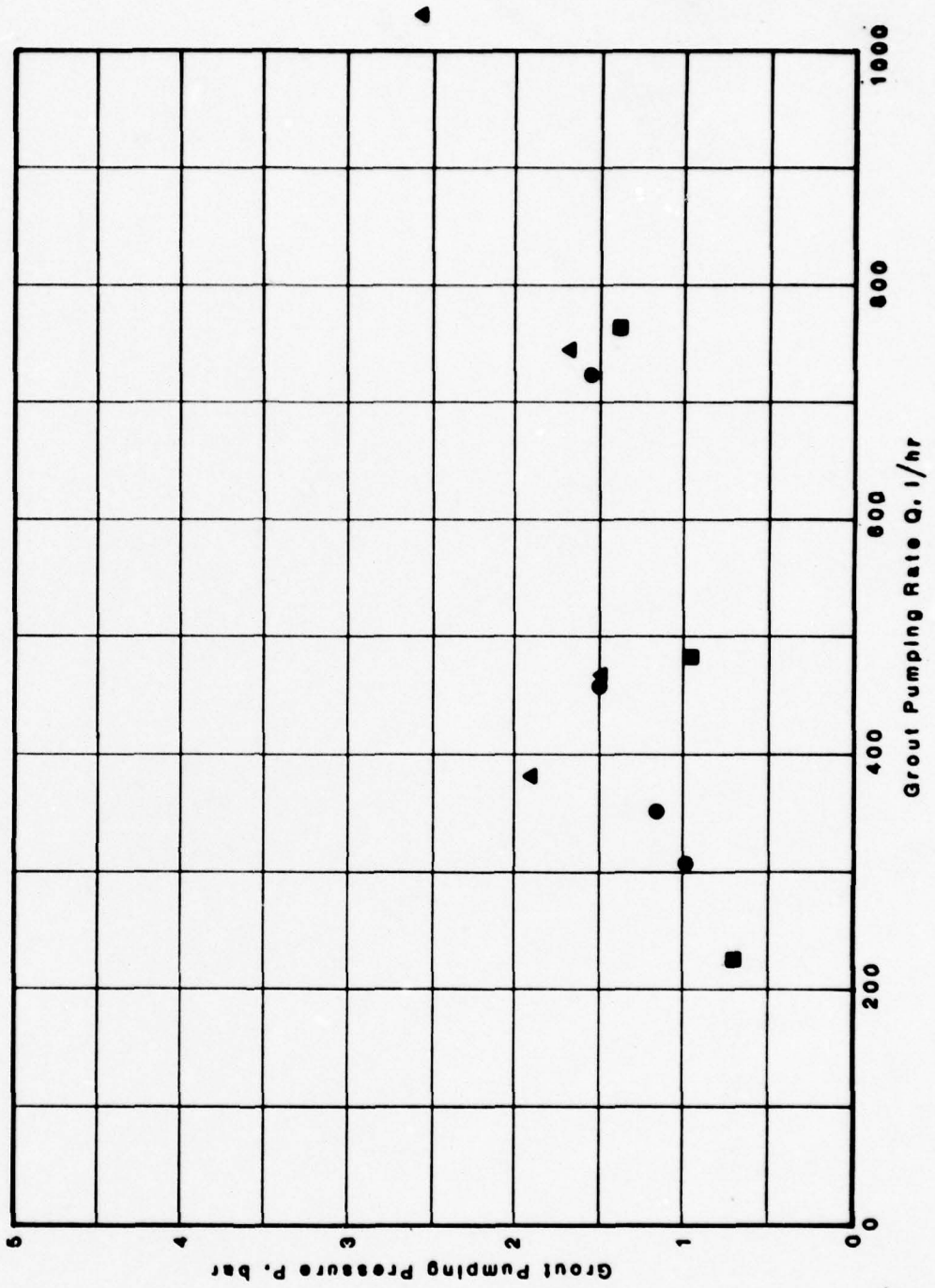
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO. 4-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-75-C-0005

Woodward-Clyde Consultants

Fig. D.2



Legend

Symbol	Test el
●	389.9
▲	393.2
■	396.4

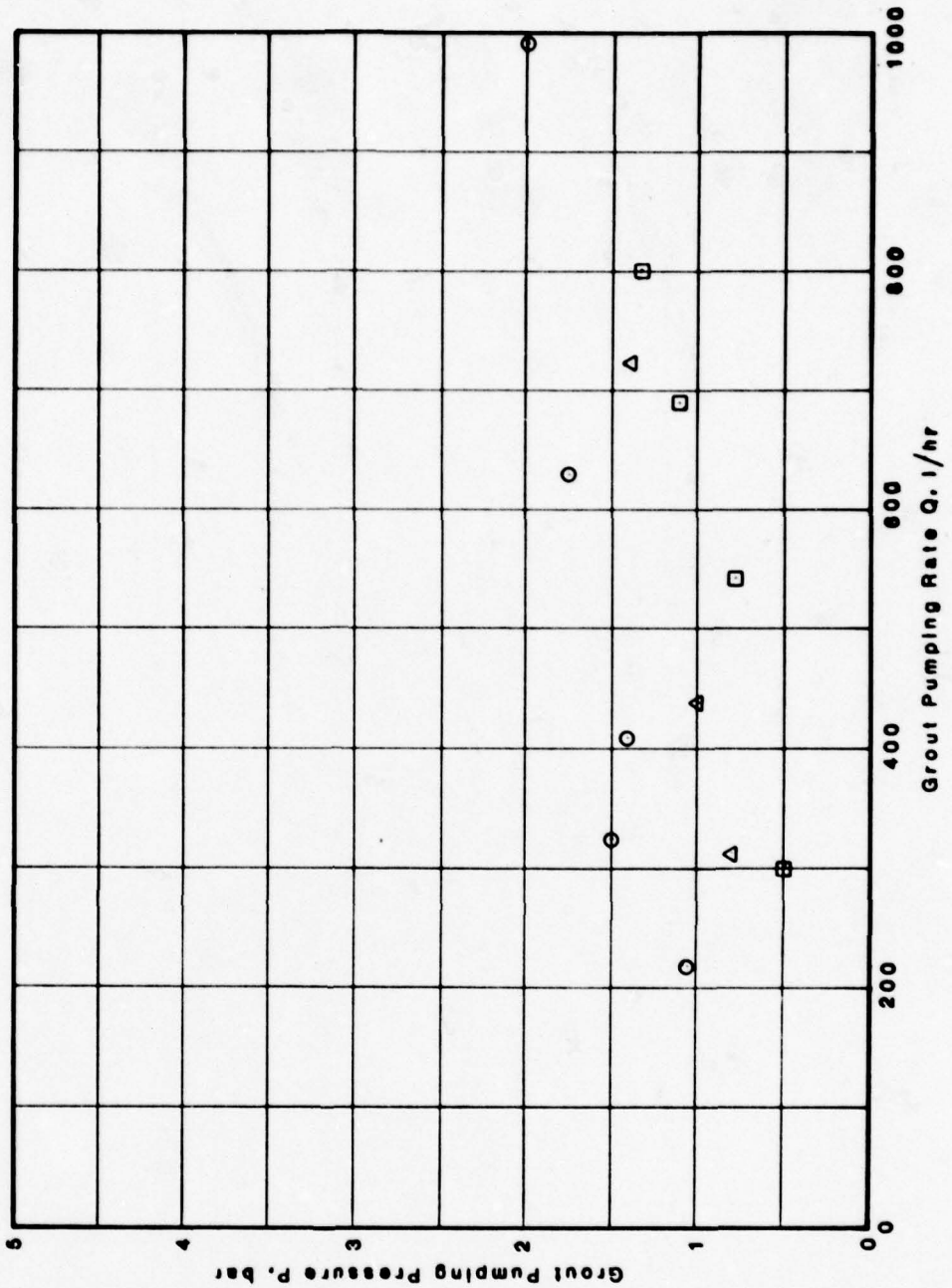
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO.6-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. D.3



Legend

Symbol	Test el
○	380.0
△	383.3
□	386.6

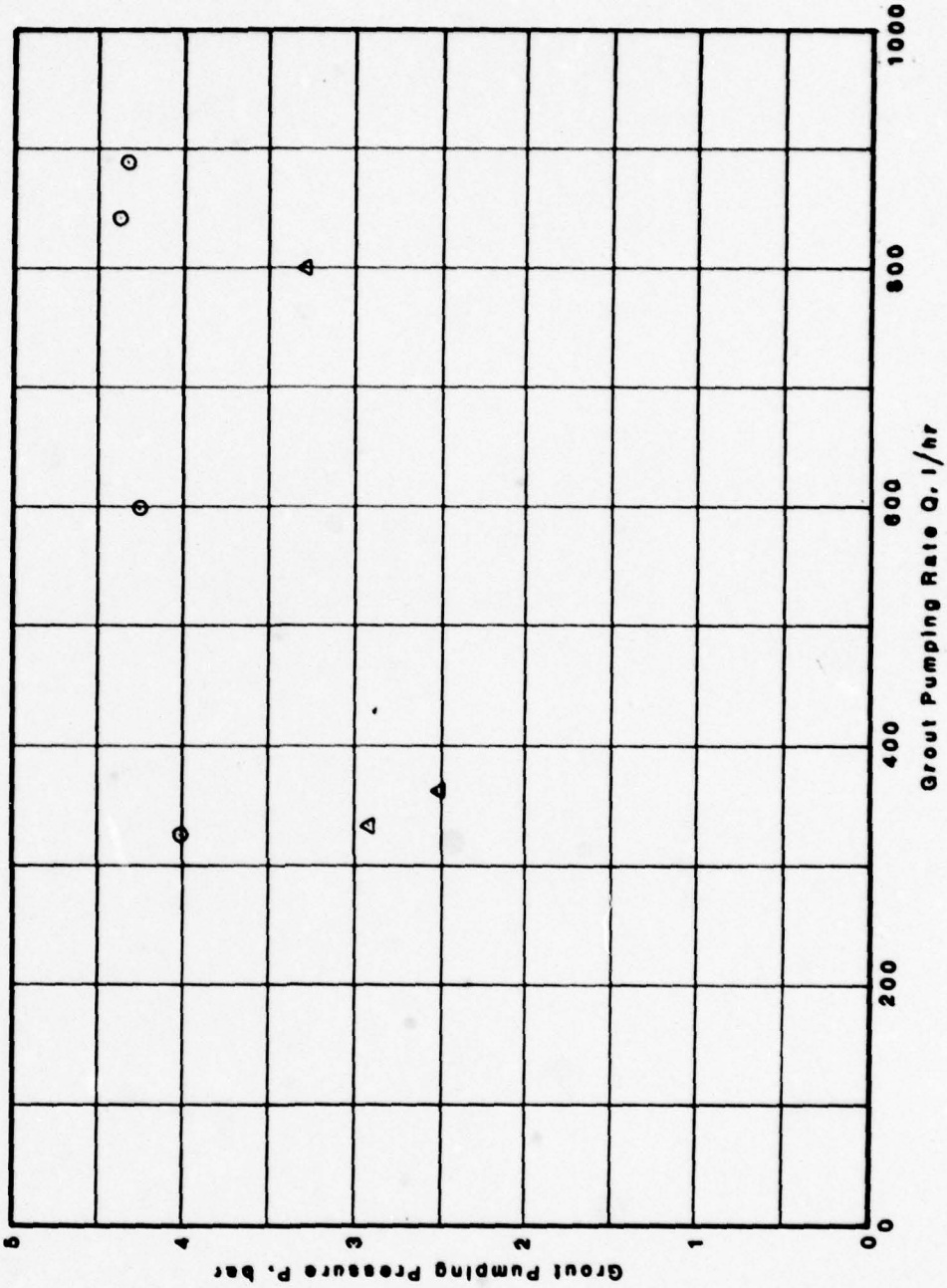
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO. 6-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-75-C-0005

Woodward-Clyde Consultants

Fig. D.4



Legend

Symbol	Test of
○	360.0
△	363.3

CHEMICAL GROUTING TEST PROGRAM

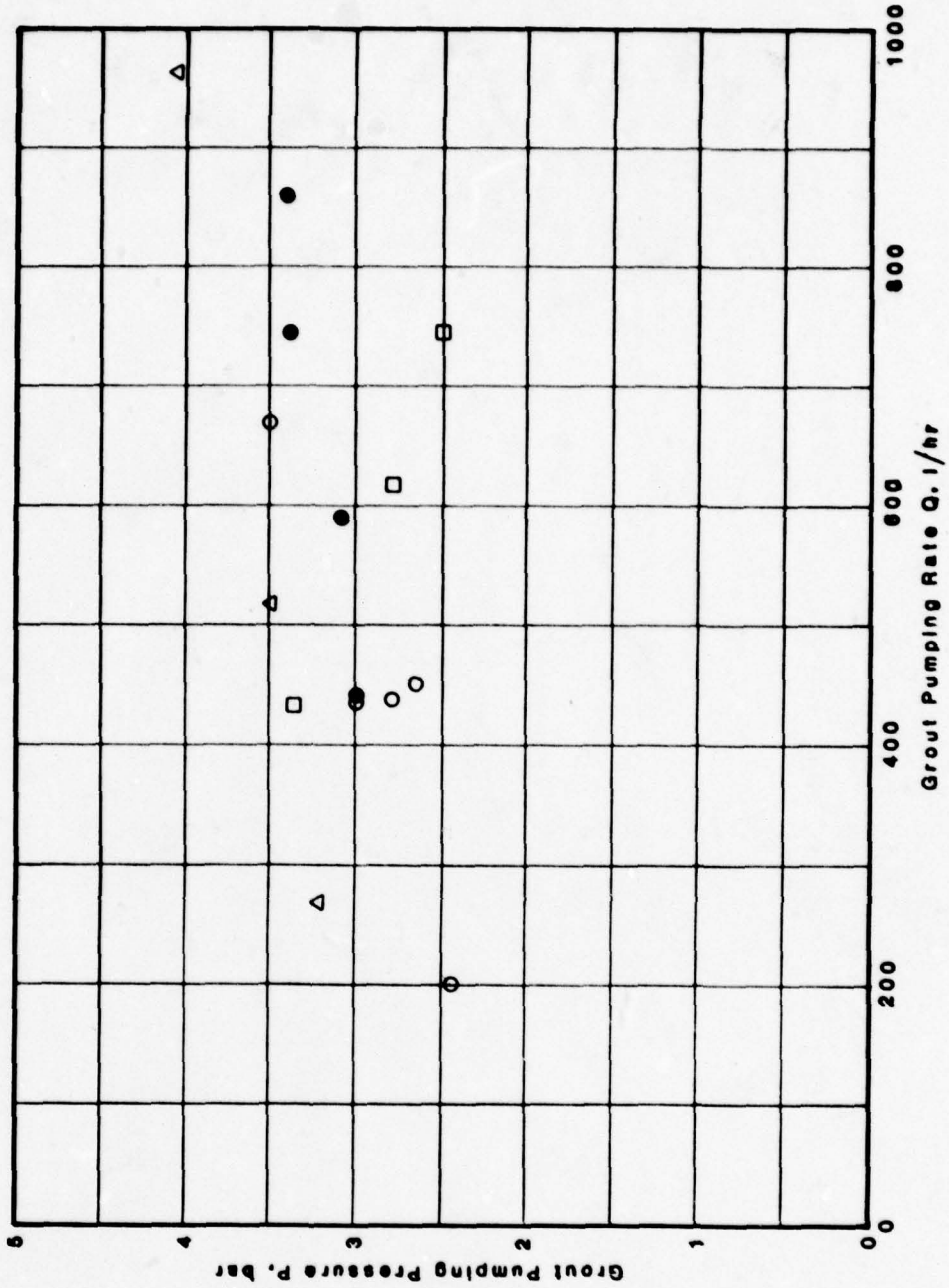
RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO. 7-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

YTC825 Phase III

Fig. D.5



Legend

Symbol	Test el
○	380.0
△	383.3
□	386.6
●	389.9

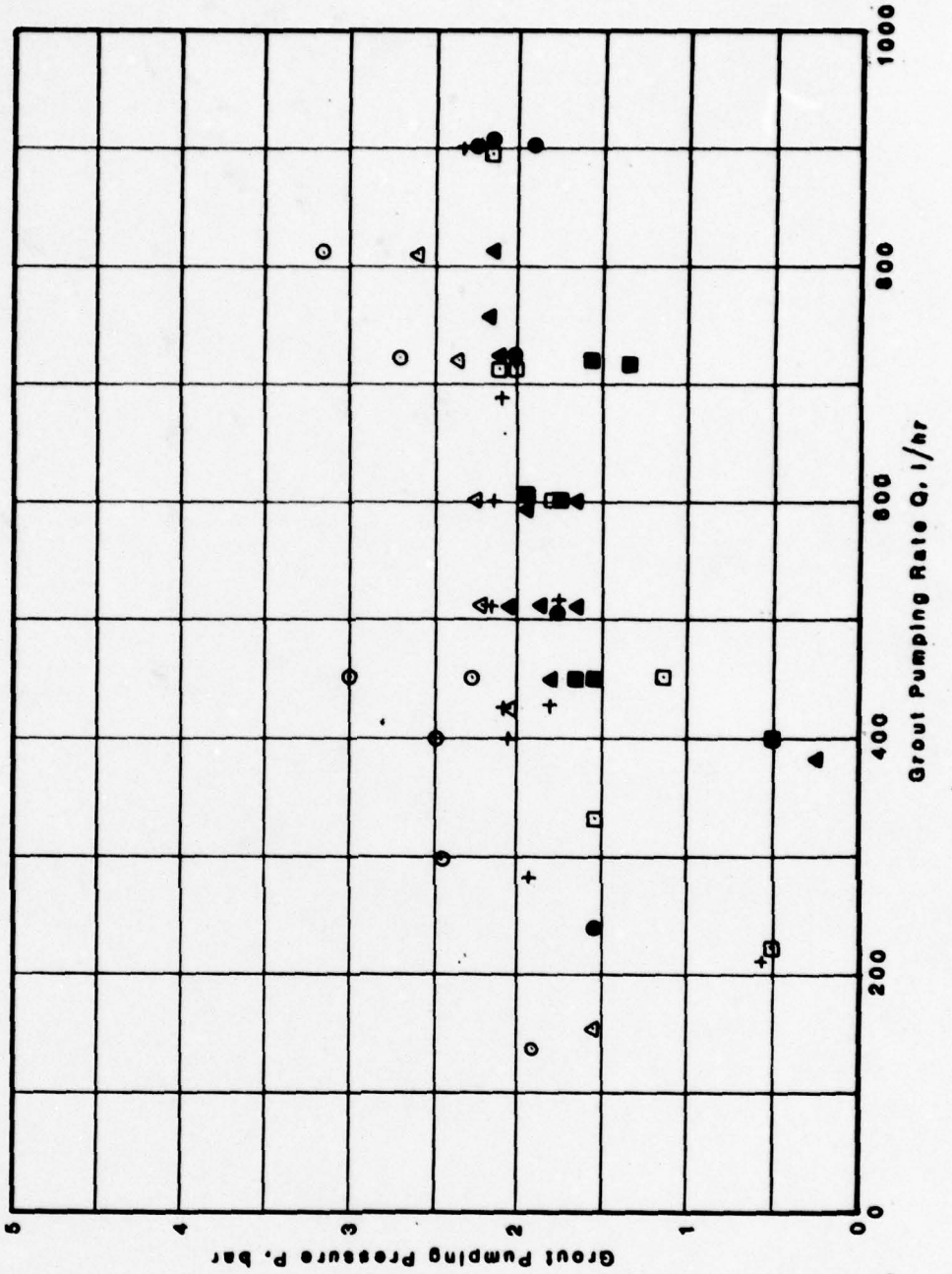
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO. 7-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS

Woodward-Clyde Consultants

Fig. D.6



Legend

Symbol	Test el
○	380.0
△	383.3
□	386.6
●	389.9
▲	393.2
■	396.4
+	399.7

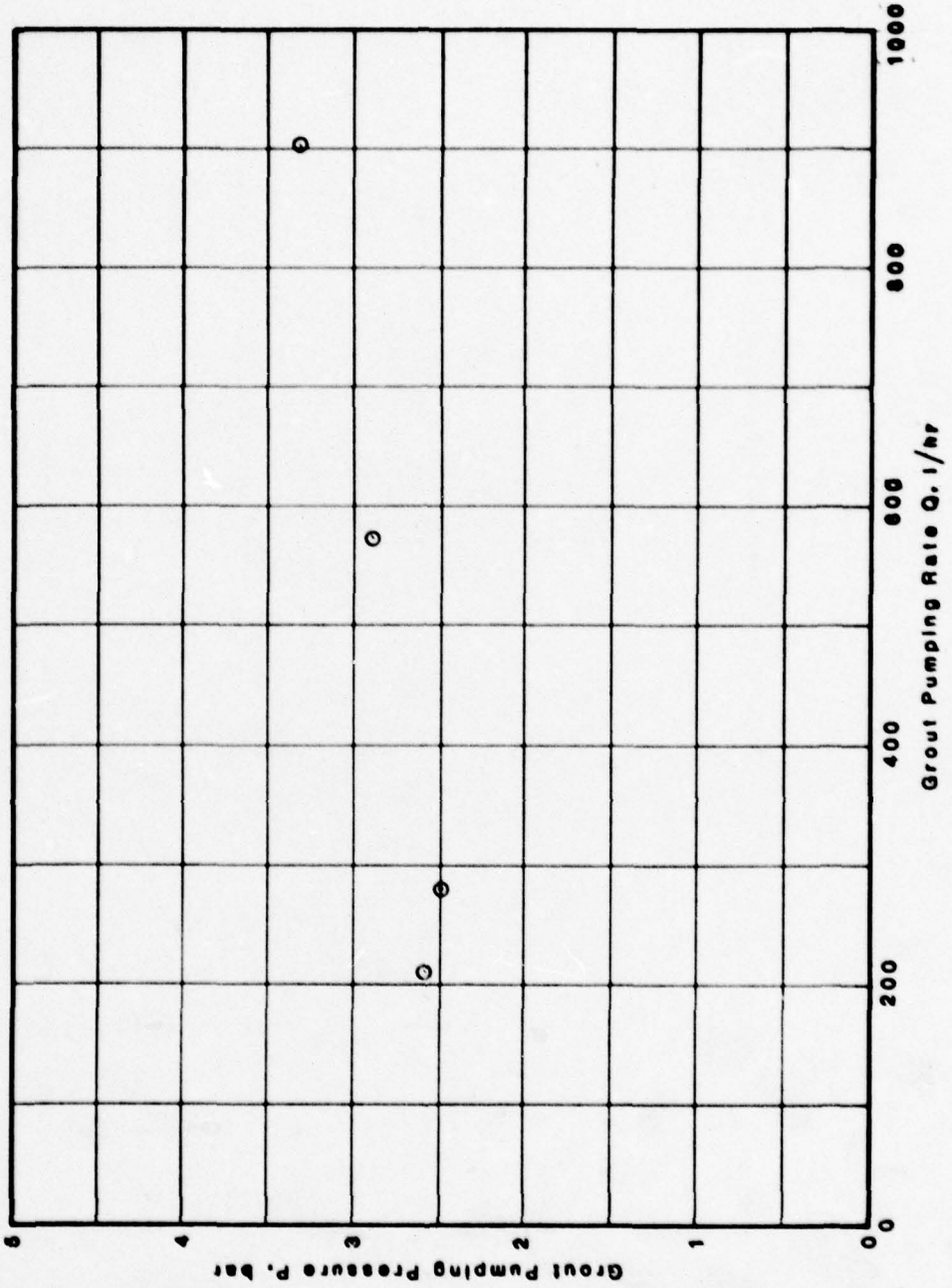
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO.10-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. D.7



Legend

Symbol	Test el
O	380.0

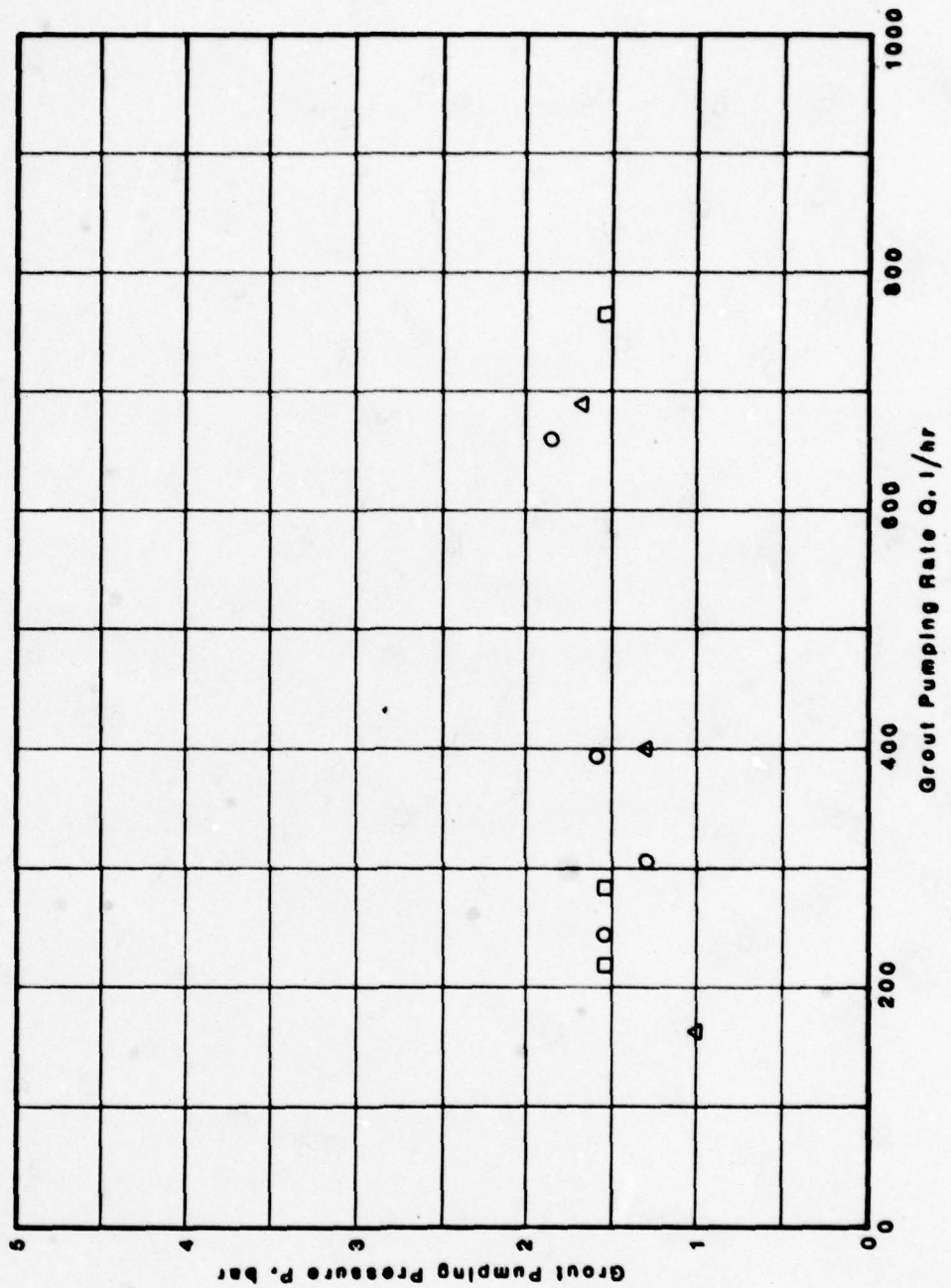
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO. 10-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-75-C-0005

Woodward-Clyde Consultants

Fig. D.8



Legend

Symbol	Test el
○	380.0
△	383.3
□	386.6

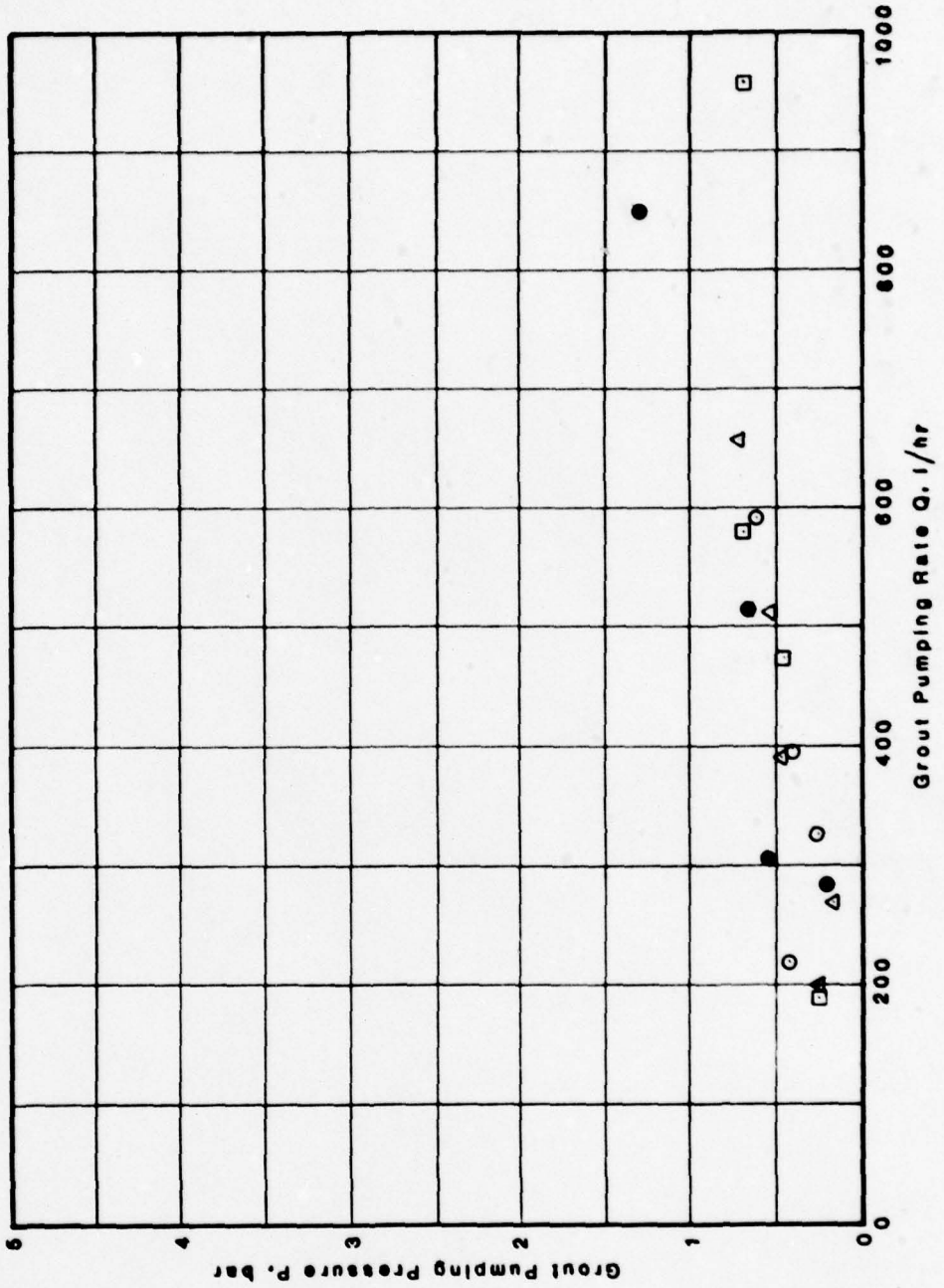
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO.12-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-75-C-0005

Woodward-Clyde Consultants

Fig. D.9



Legend

Symbol	Test el
○	380.0
△	383.3
□	386.6
●	389.9

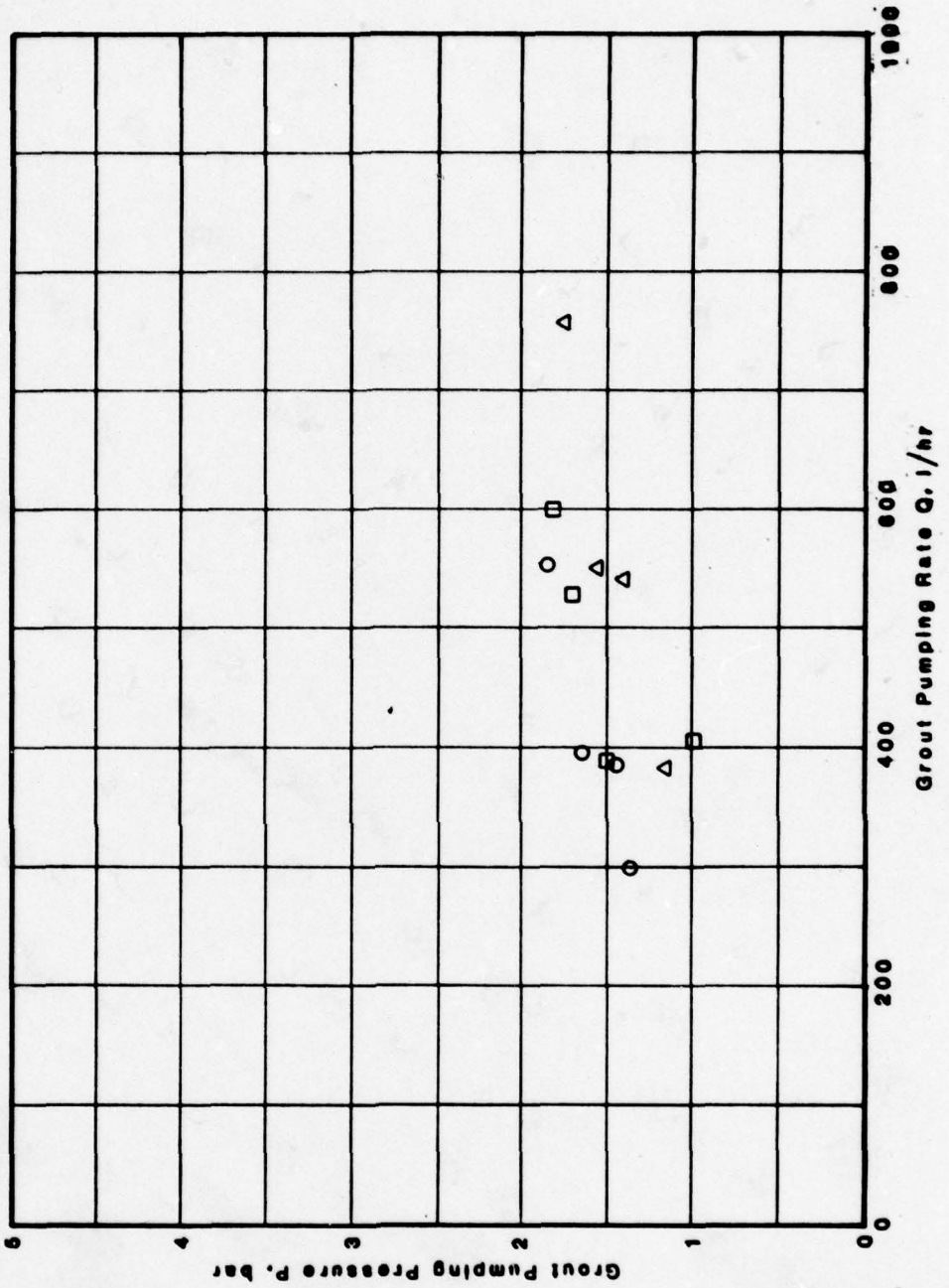
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO.12-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.

Woodward Clyde Consultants

Fig. D.10



Legend

Symbol	Test el
○	380.0
△	383.3
□	386.6

CHEMICAL GROUTING TEST PROGRAM

RESULTS OF HYDRAULIC FRACTURING TEST GROUT HOLE NO.13-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. D.11

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

APPENDIX E

MONITORING OF GROUTING ACTIVITIES

APPENDIX E

MONITORING OF GROUTING ACTIVITIES

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APPENDIX E

MONITORING OF GROUTING ACTIVITIES

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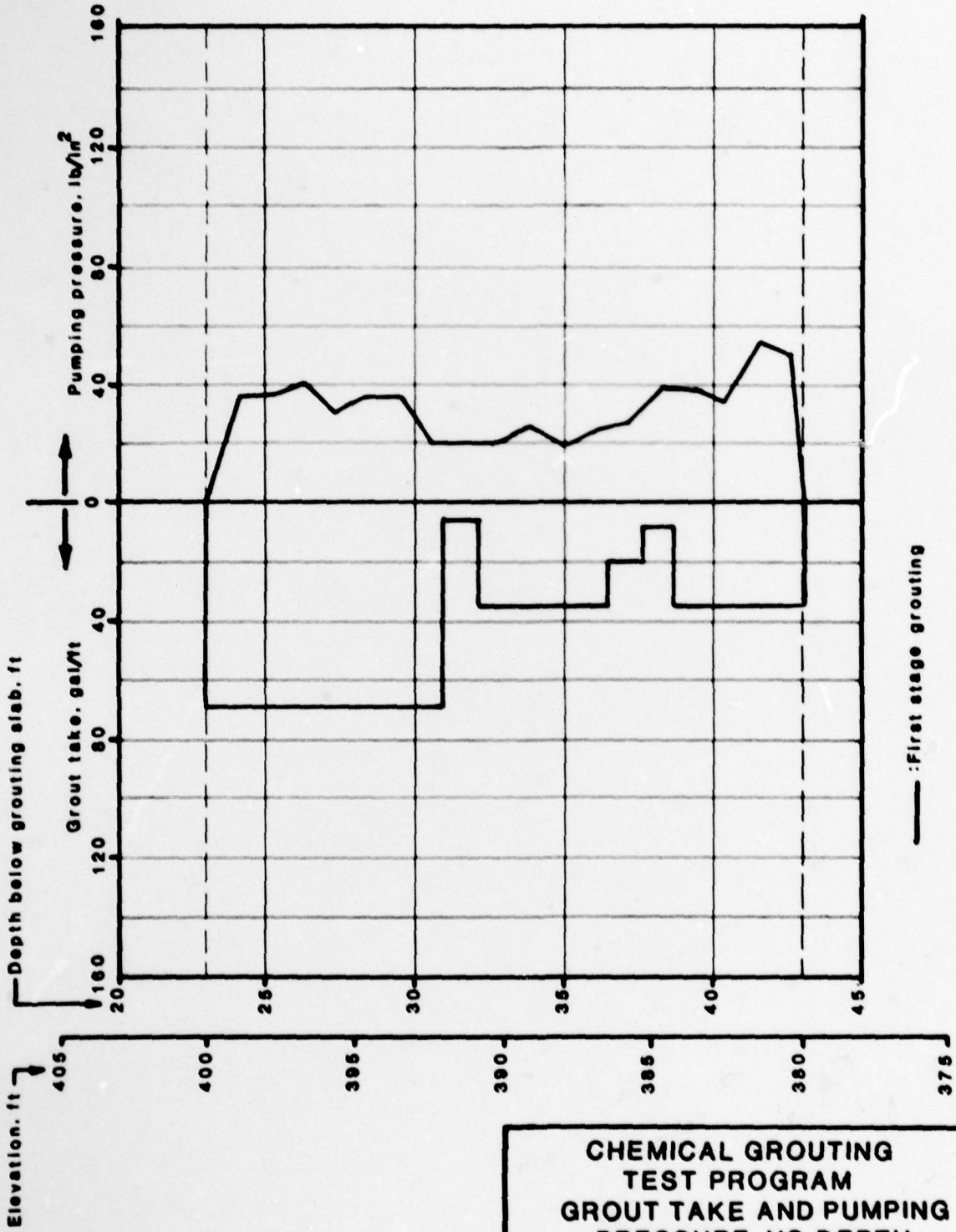
(Continued)



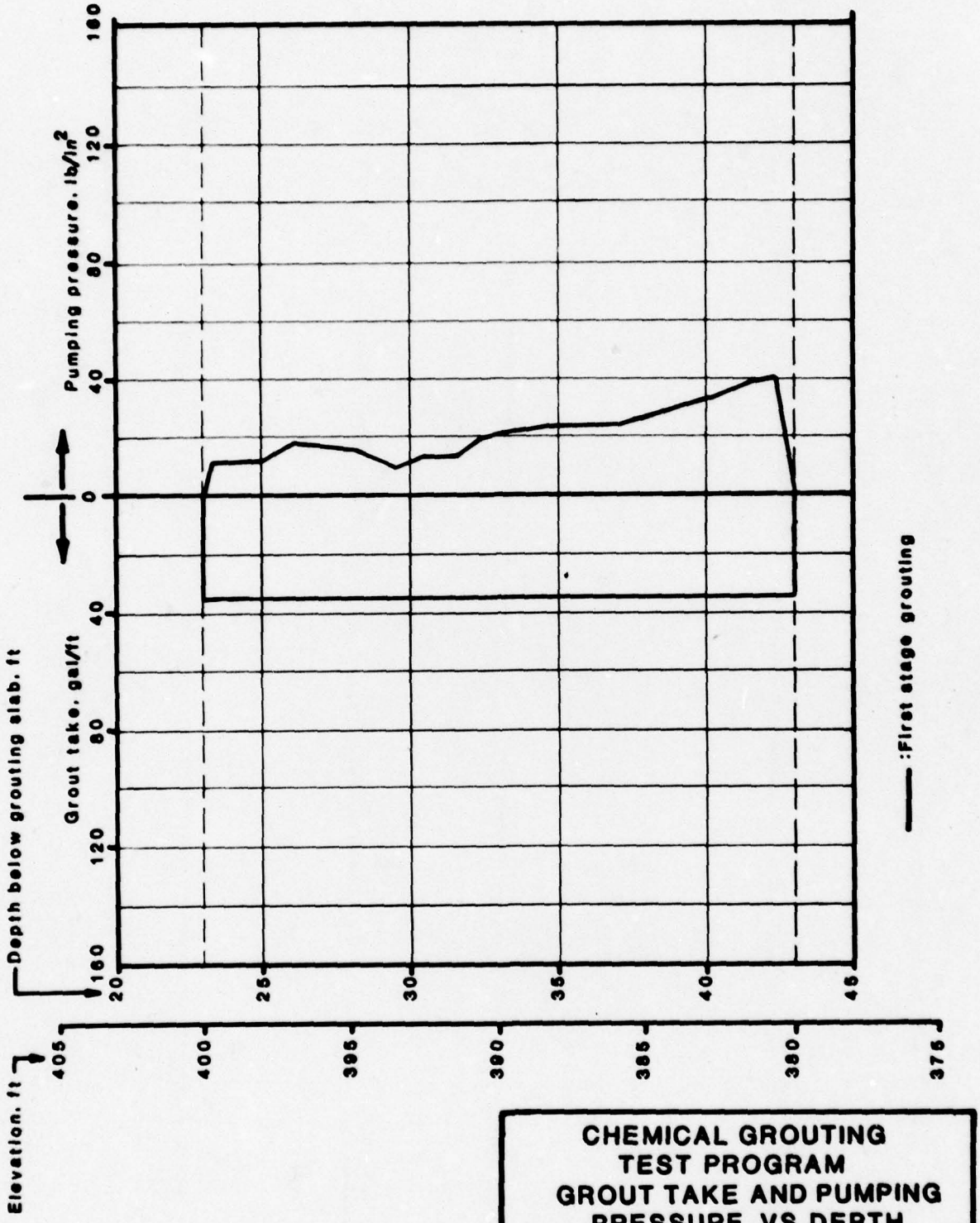
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 1-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0069

Woodward-Clyde Consultants

Fig. E.1

VTC026 Phase III

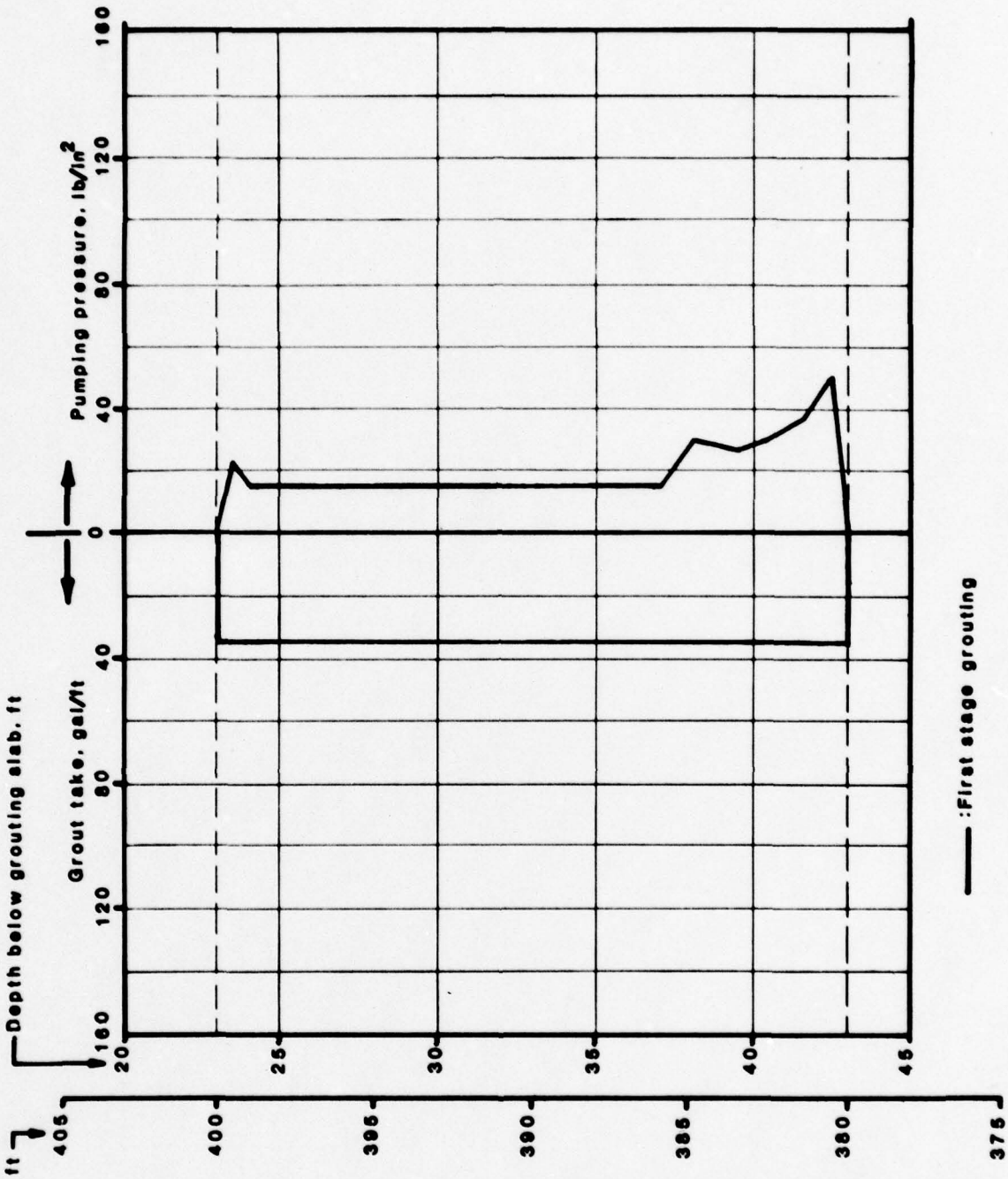


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 1-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants
V7C025 Phase III

Fig. E.2



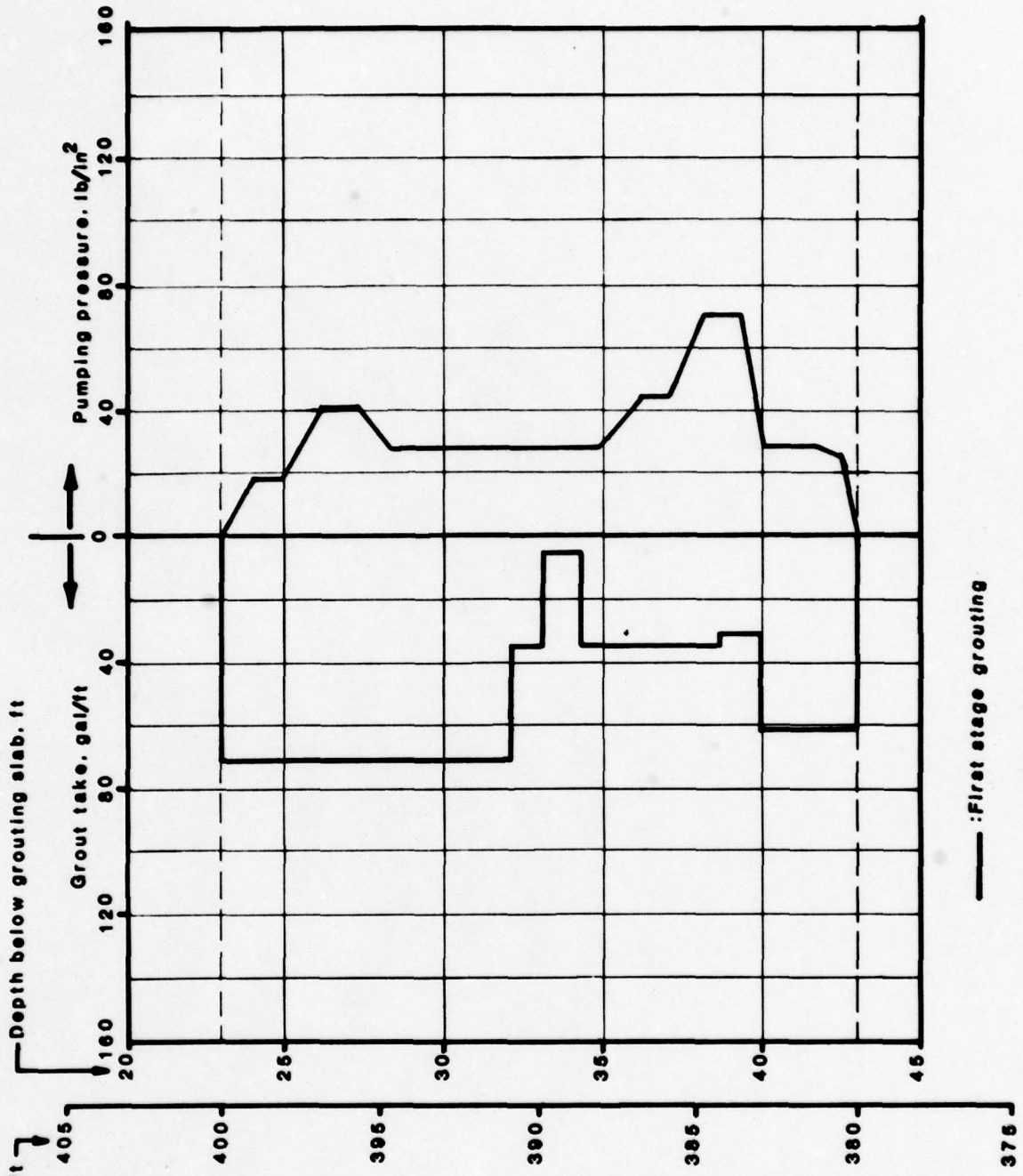
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 1-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.3

V7C825 Phase III



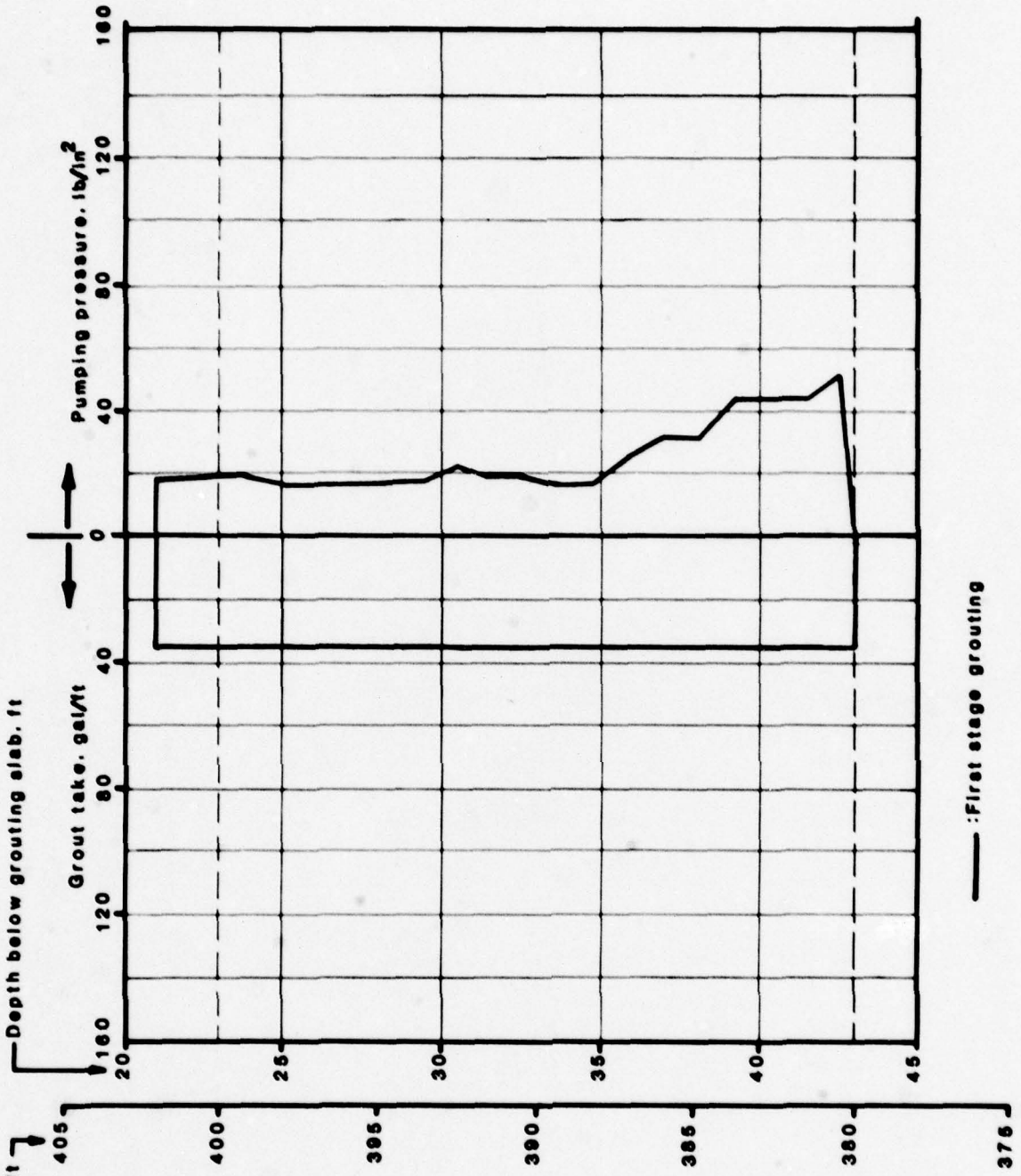
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 1-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Fig. E.4

Y7C026 Phase III



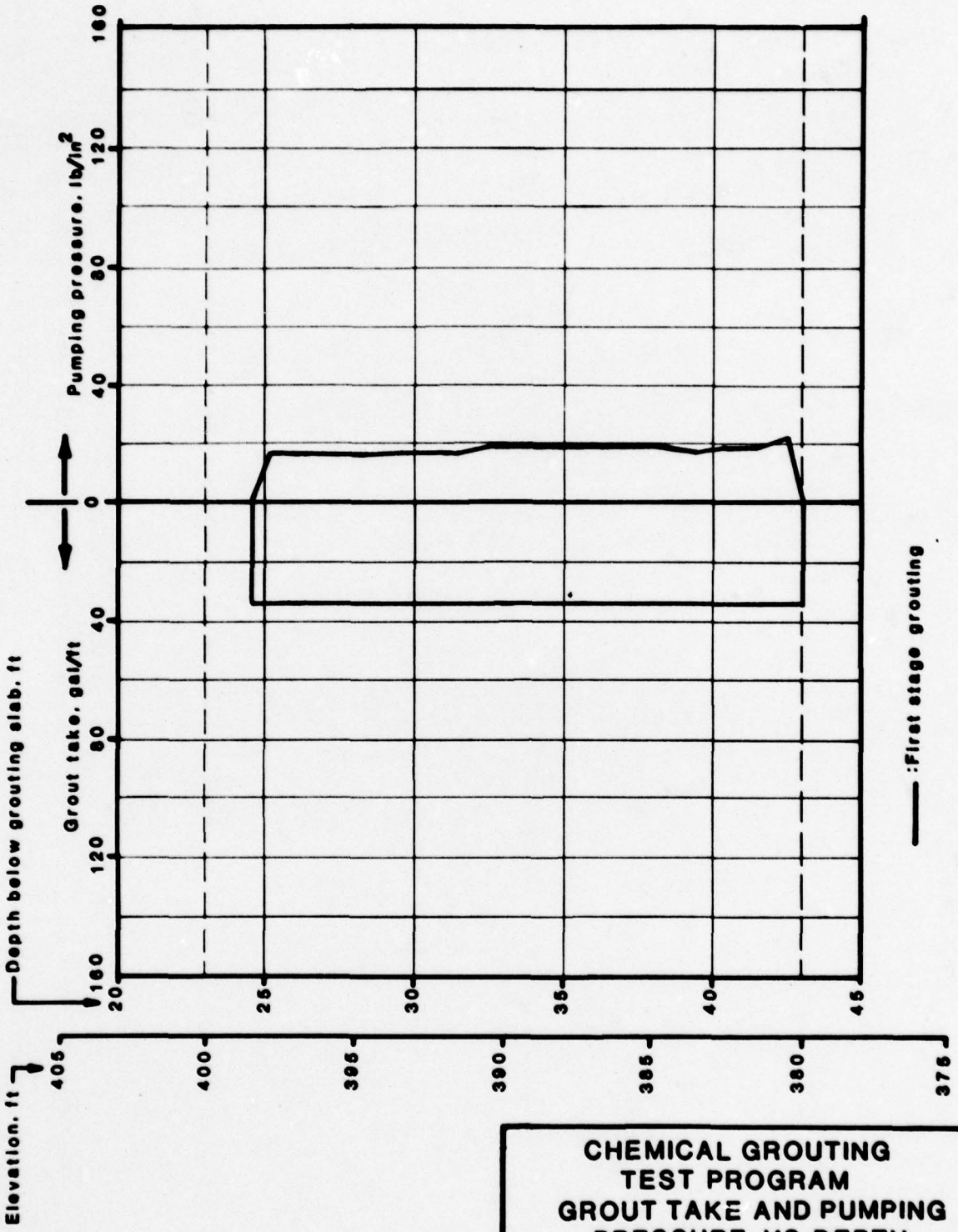
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 1-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0008

Woodward-Clyde Consultants

V7C026 Phase II

Fig. E.5



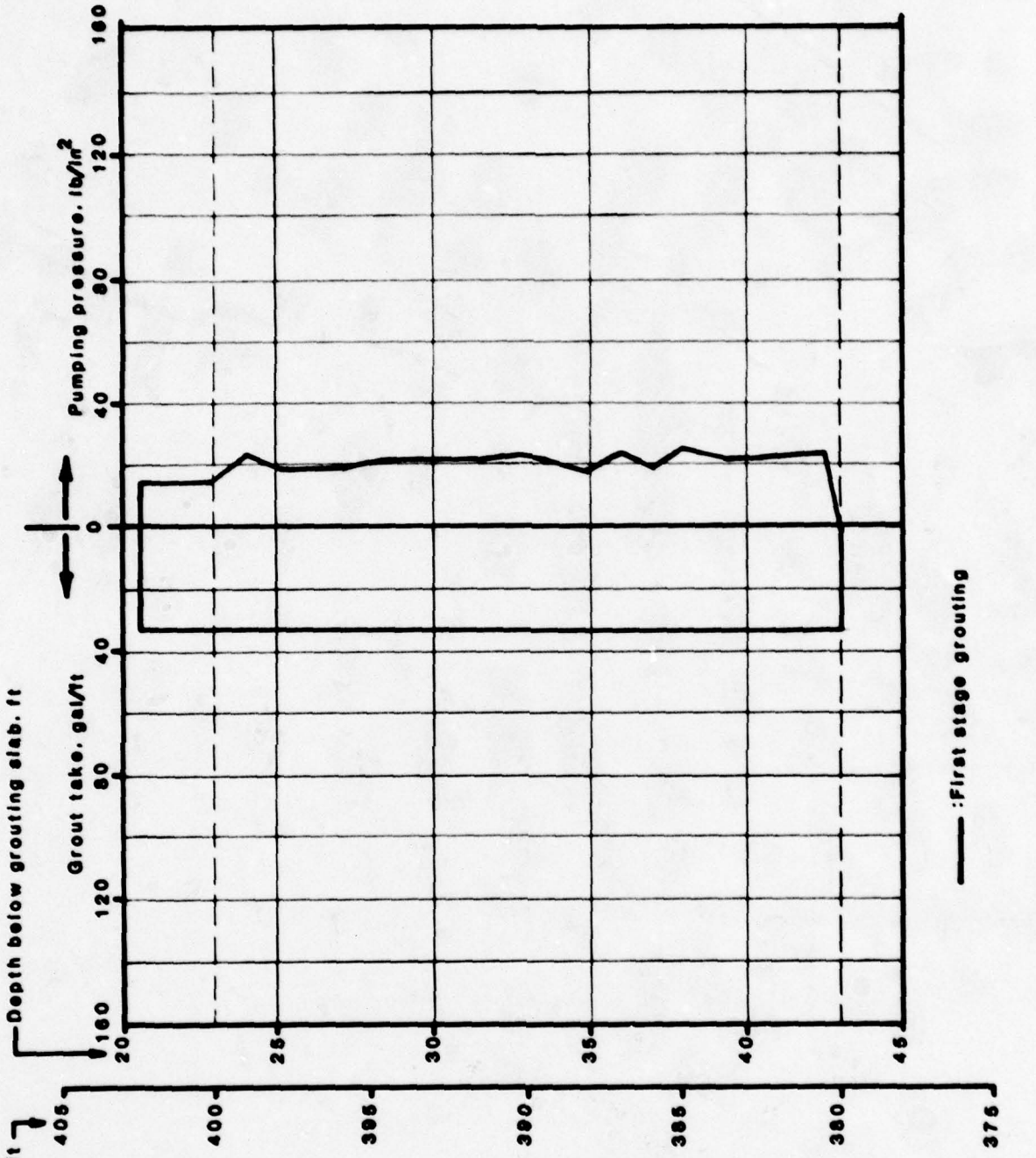
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 1-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Fig. E.6

YPC026 Phase IX



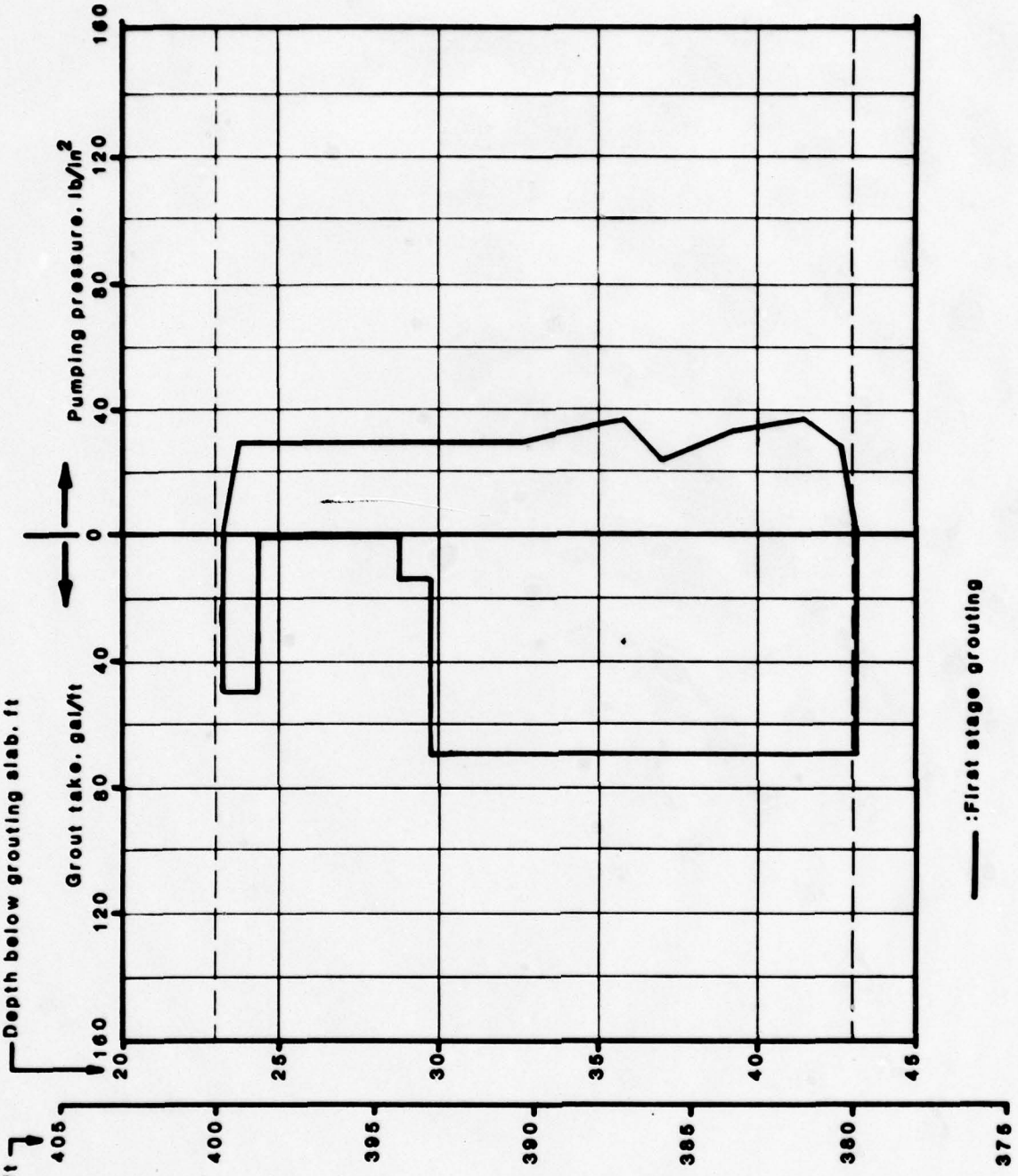
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 1-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.7

77C026 Phase II



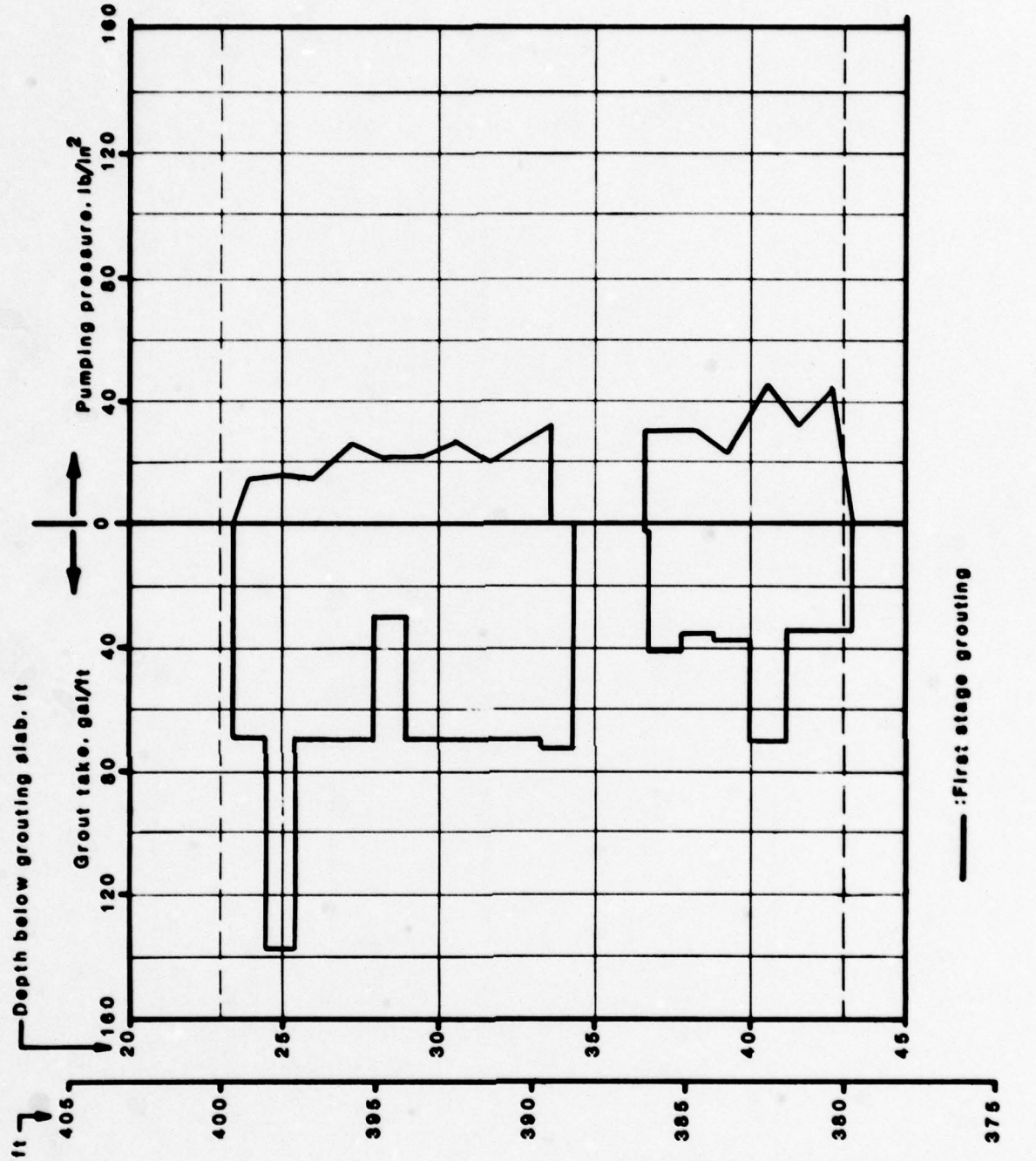
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 2-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.8

V7C826 Phase IX



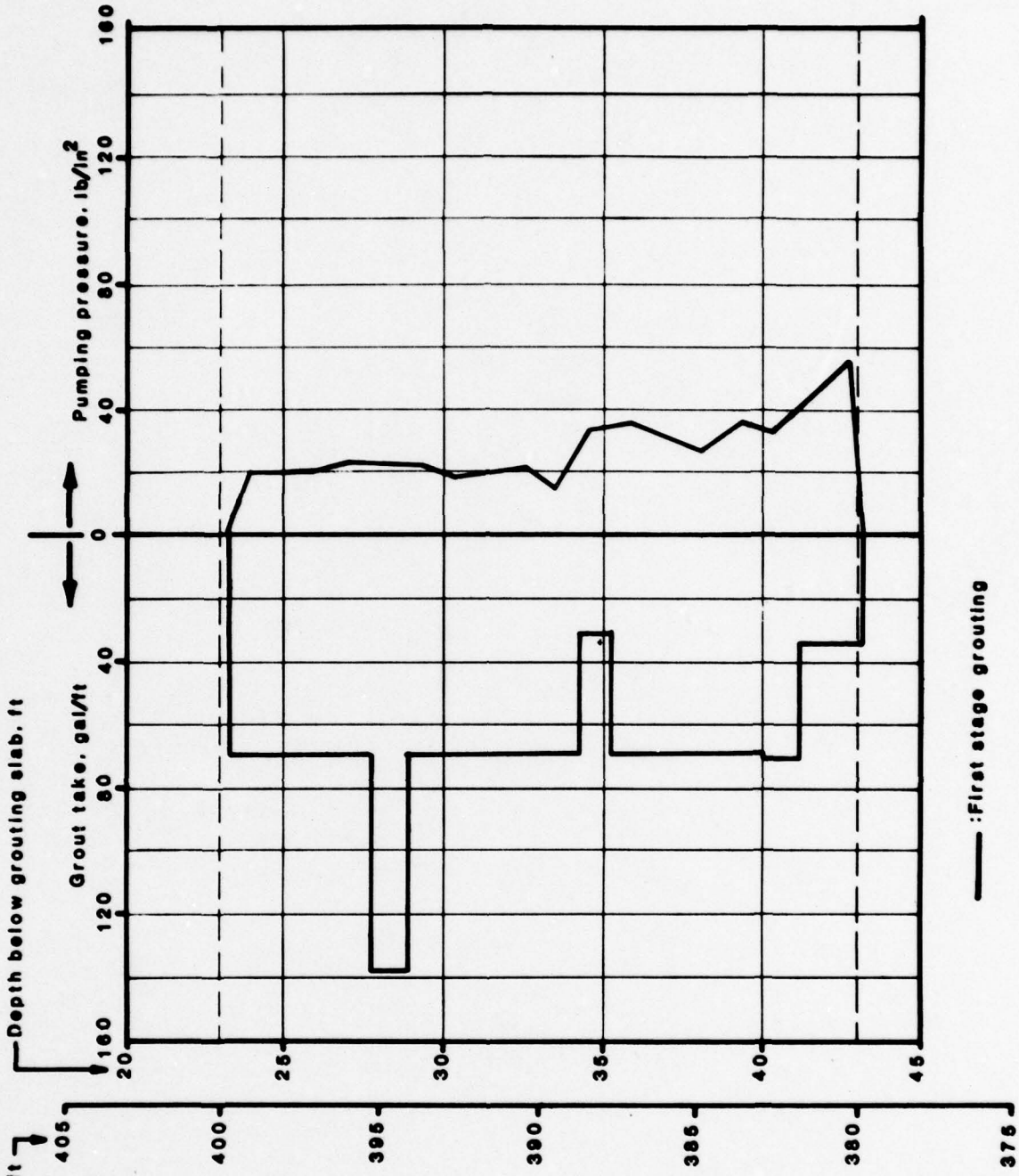
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 2-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.9

V7C826 Phase III



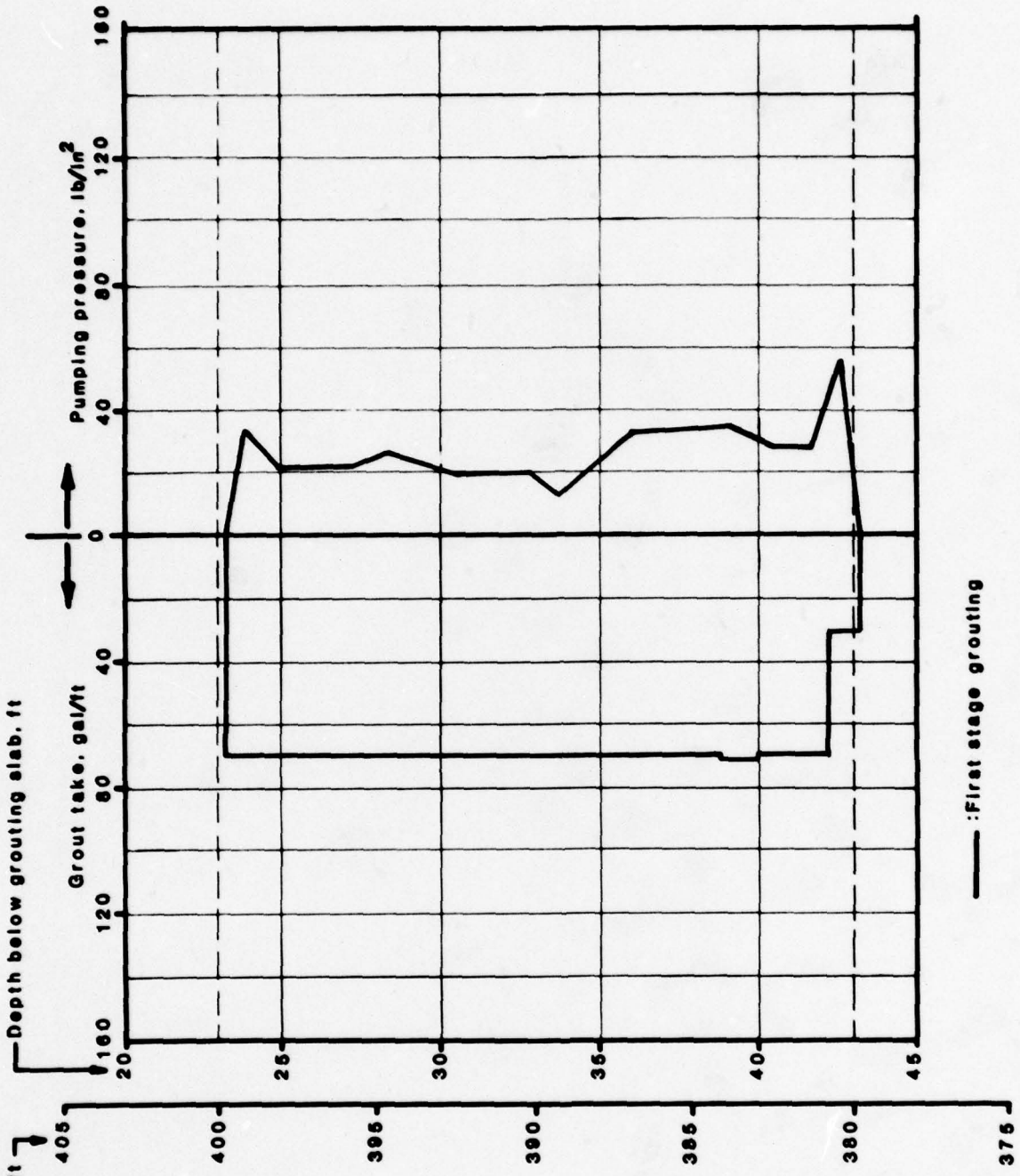
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 2-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig. E.10

Y7C026 Phase IX



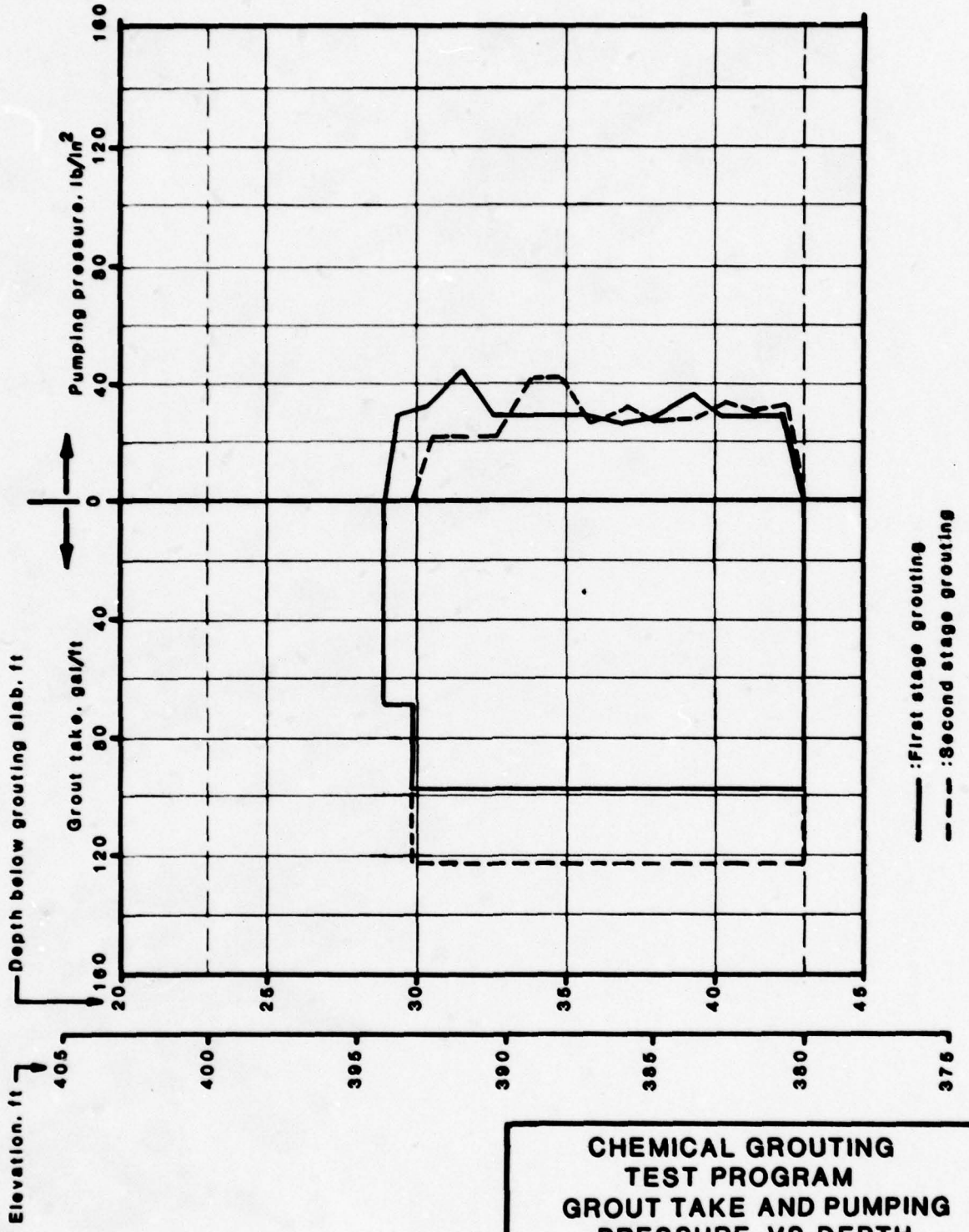
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 2-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig. E.11

Y7C026 Phase IX



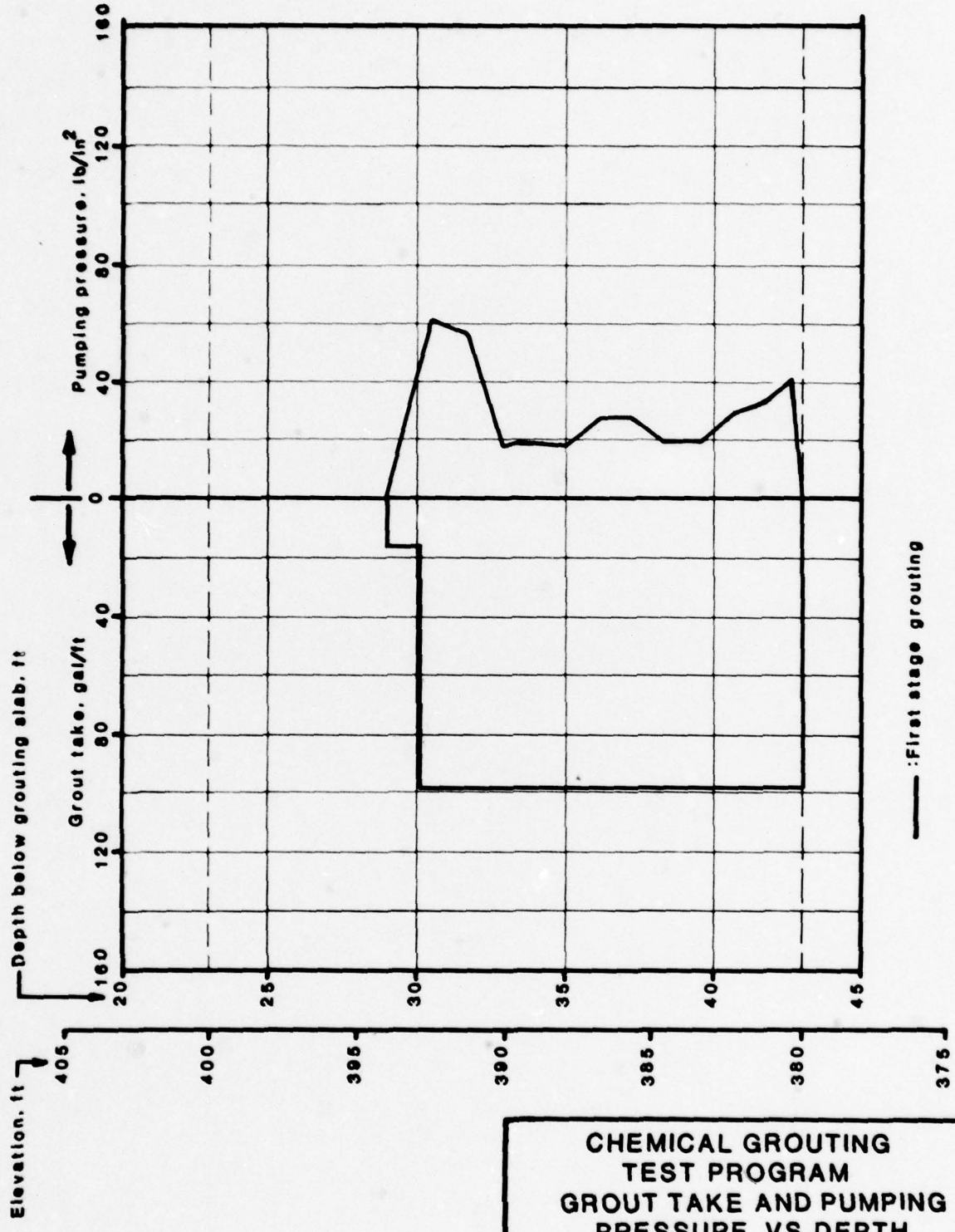
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 3-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0066

Woodward-Clyde Consultants

Fig. E.12

Y7C026 Phase III

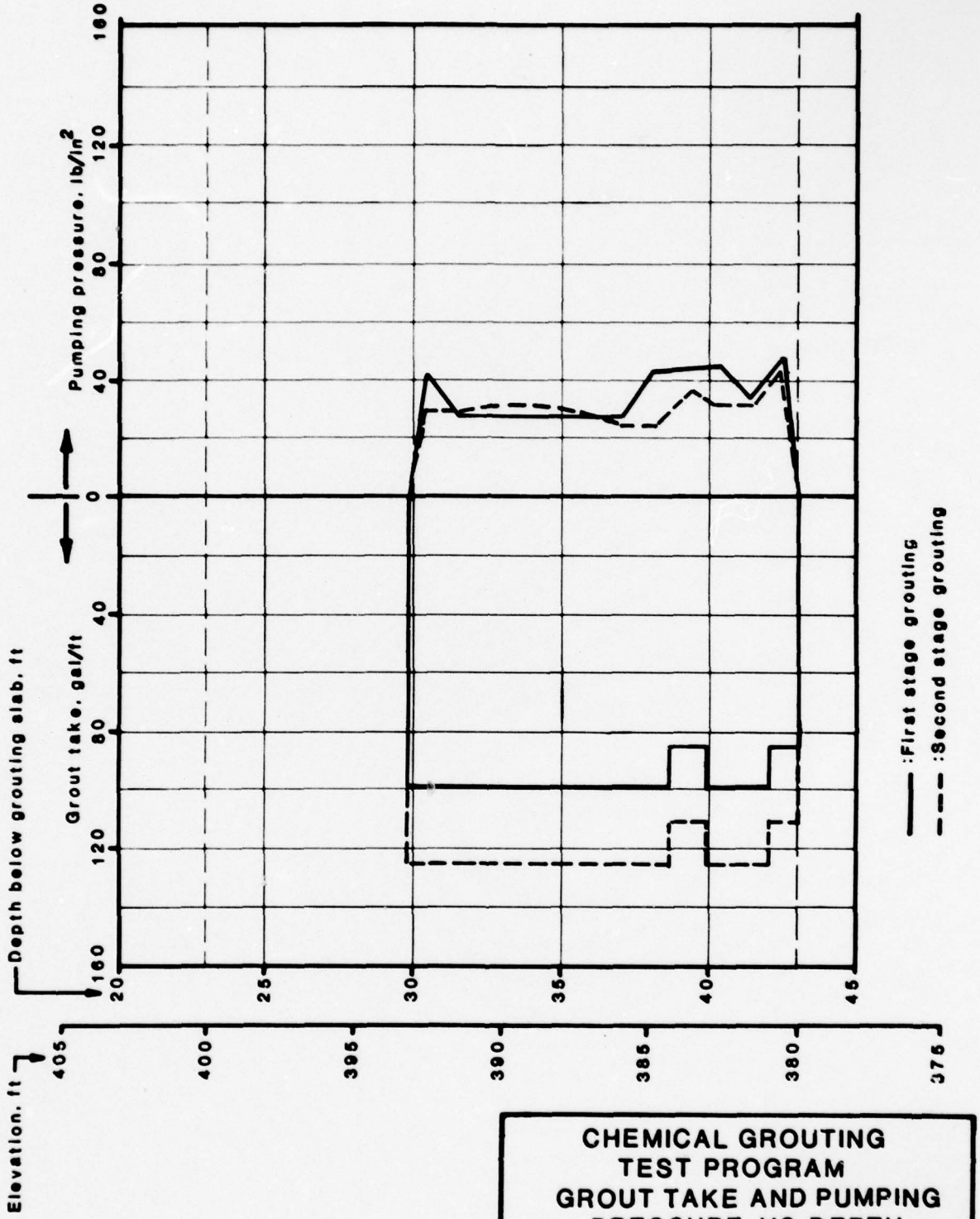


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 3-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants
Y7C826 Phase IX

Fig. E.13



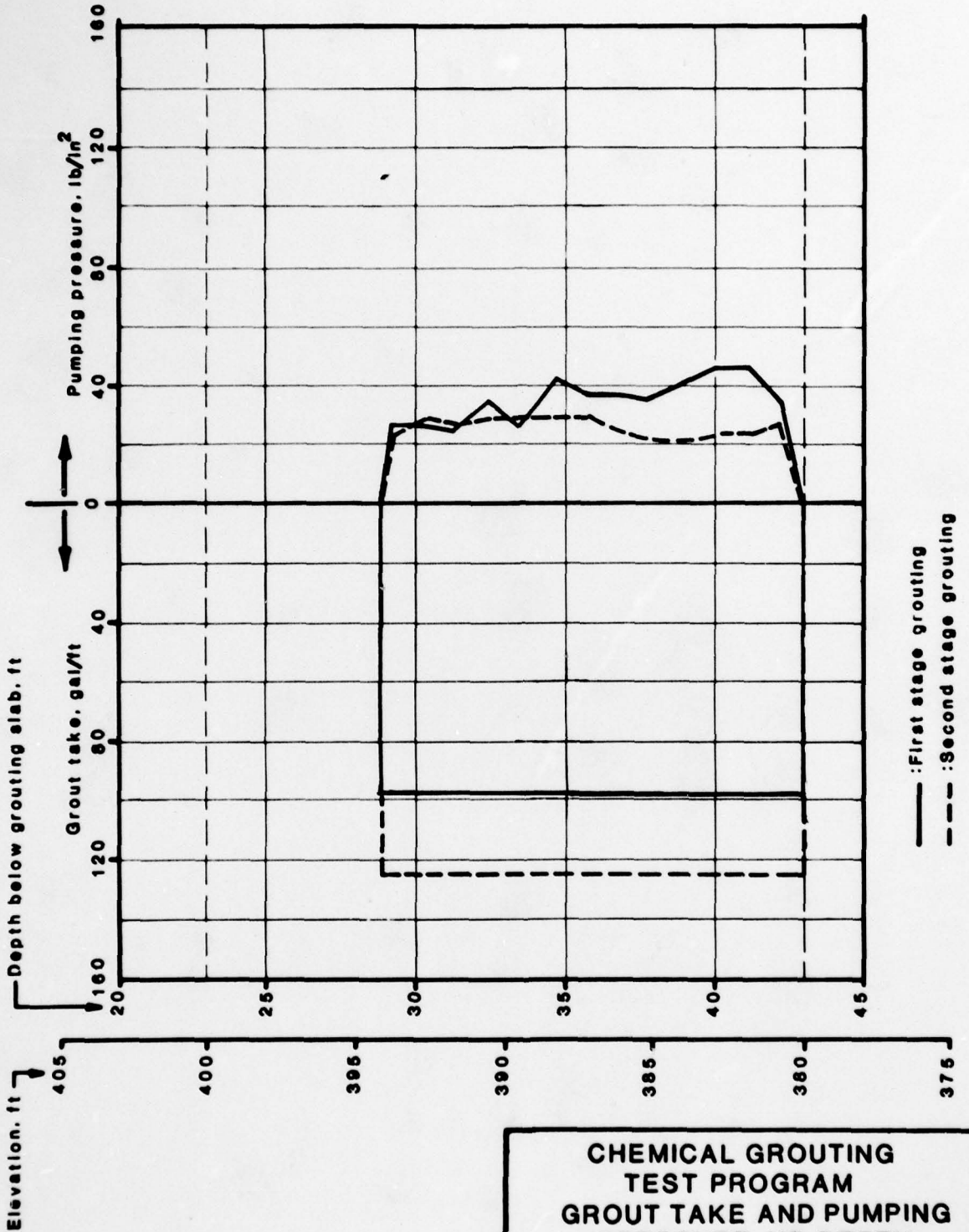
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 3-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Fig. E.14

Y7C626 Phase IX



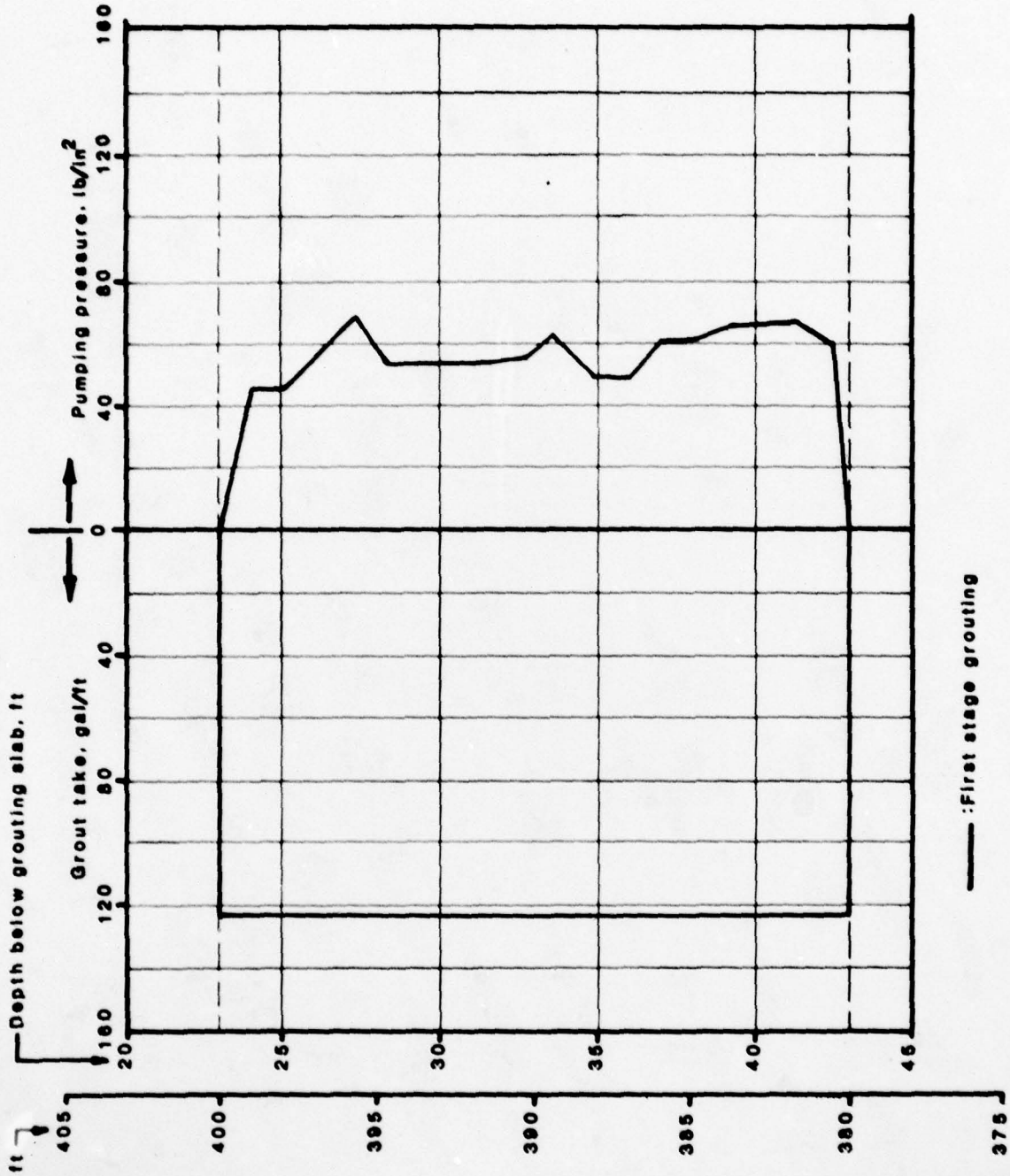
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 3-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

YYC626 Phase IX

Fig. E.15



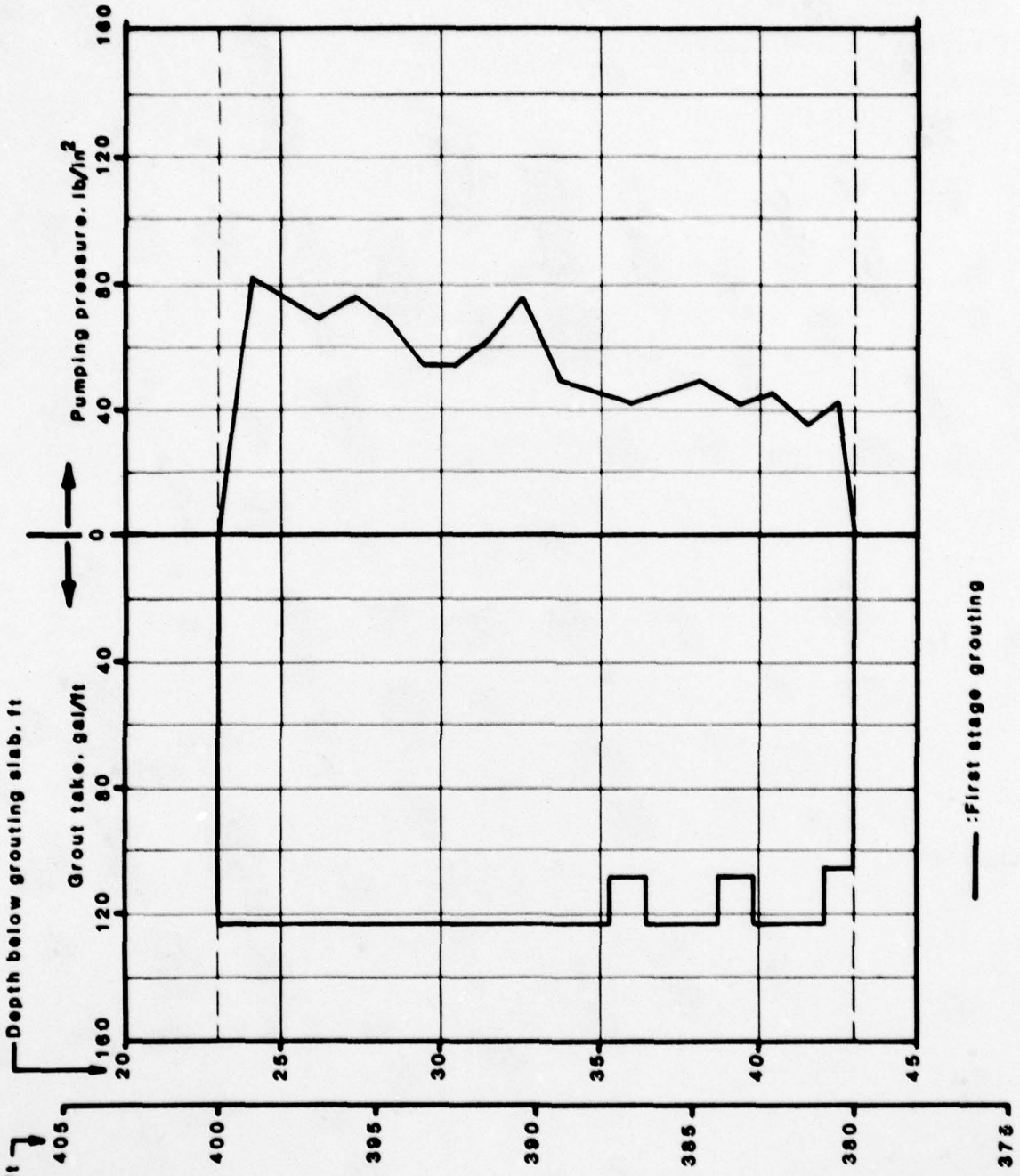
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 4-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.16

V7C026 Phase IX

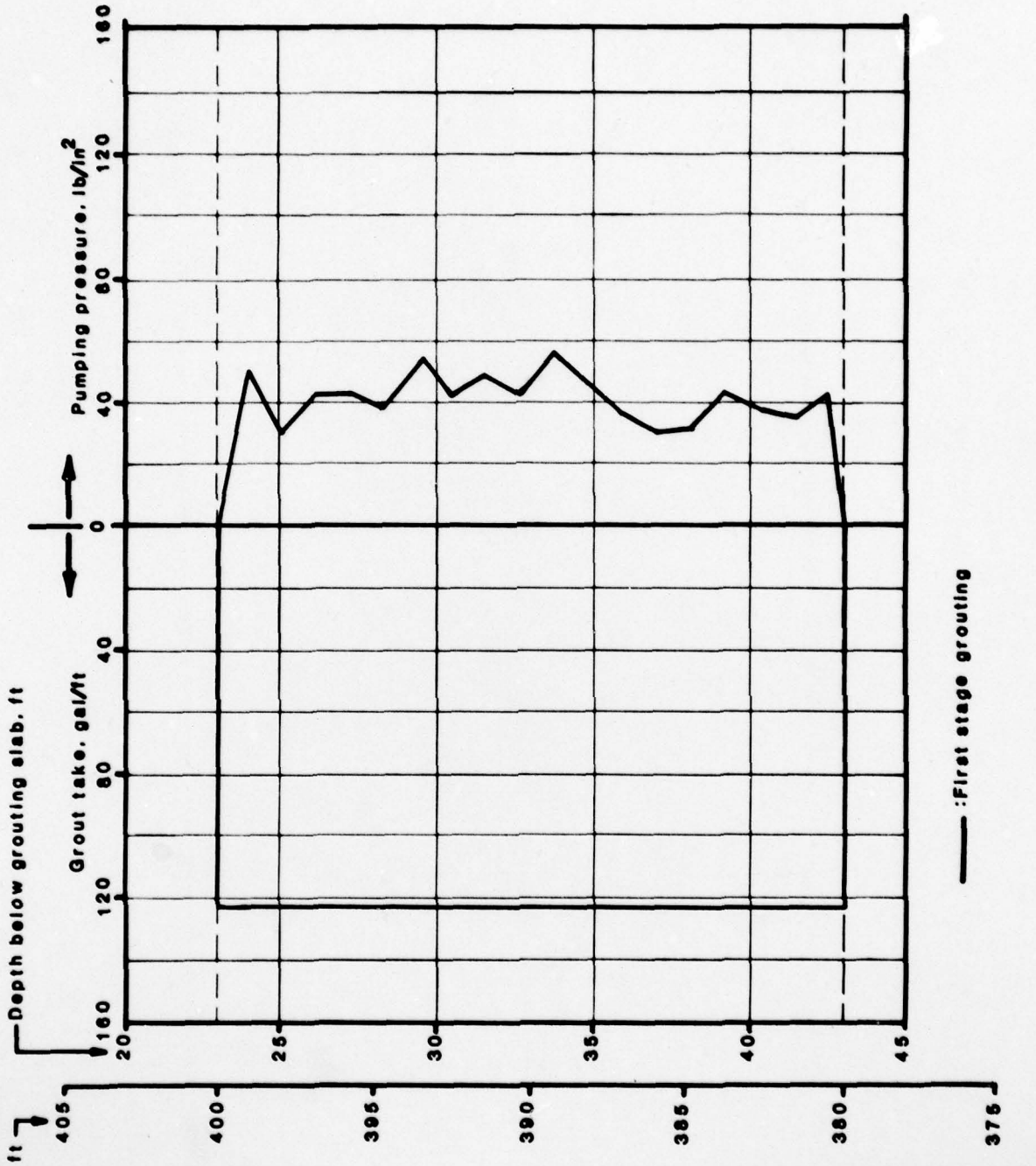


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 4-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.17



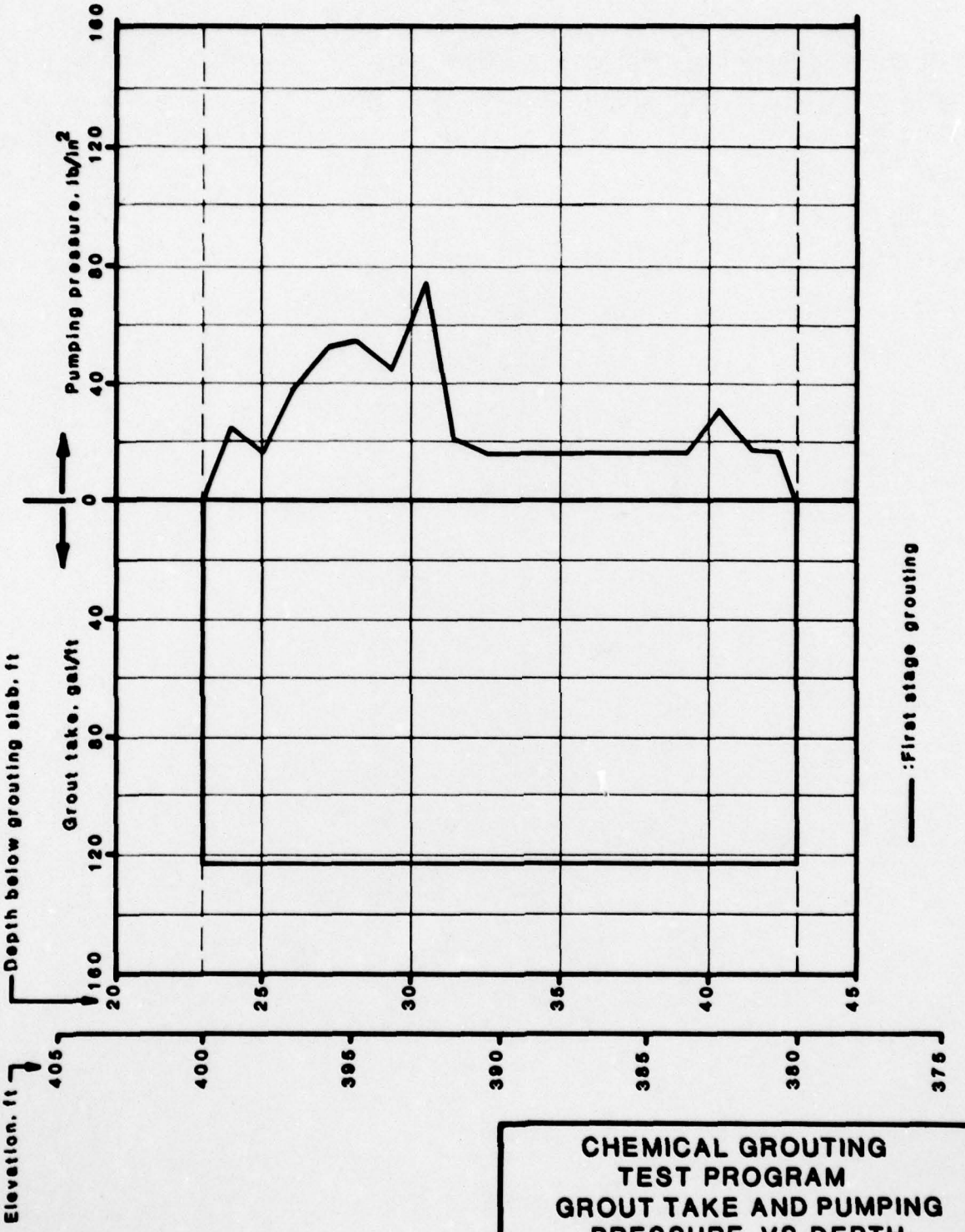
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 4-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.18

V7C626 Phase IX

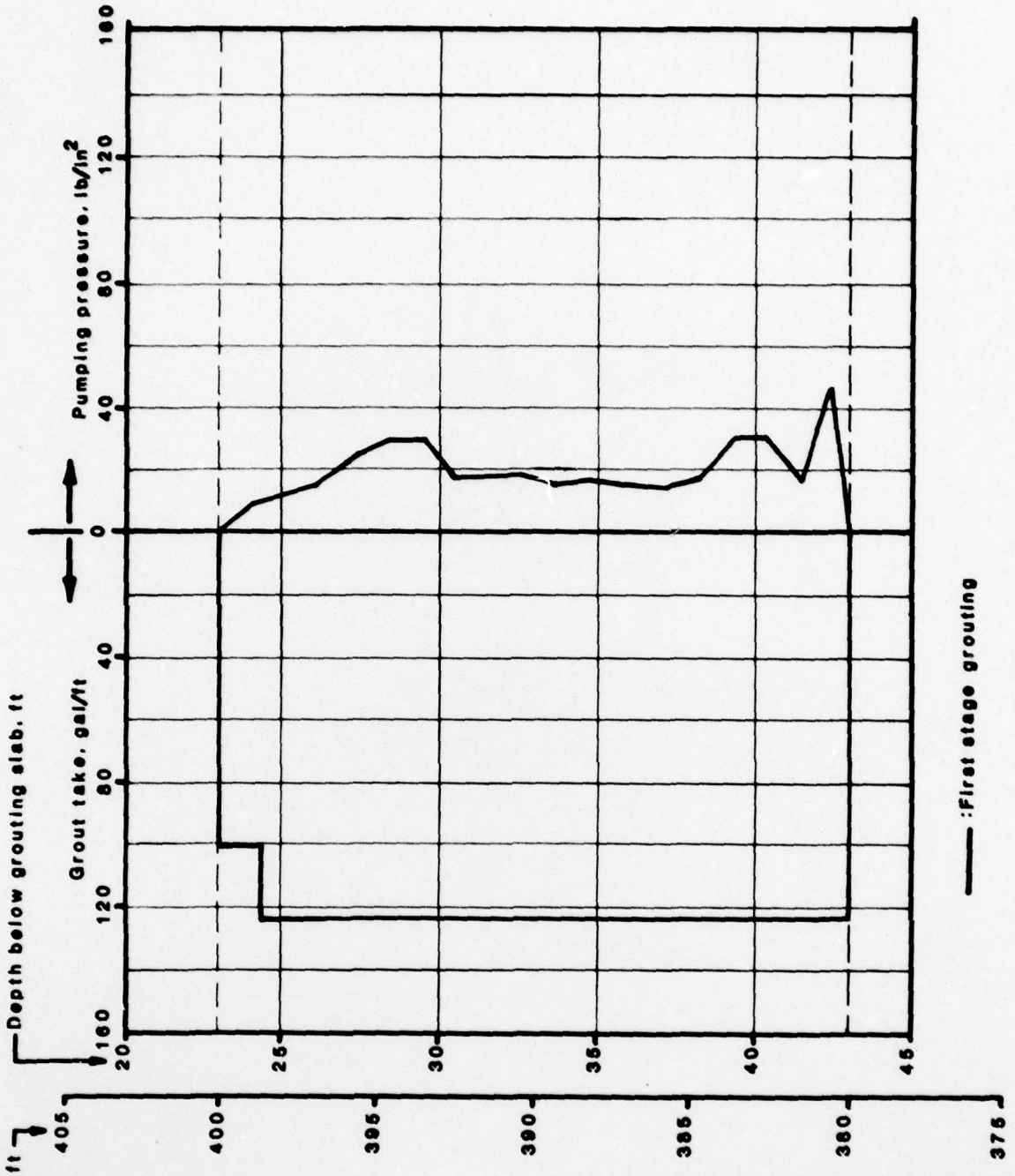


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 4-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants
Y7C026 Phase II

Fig. E.19



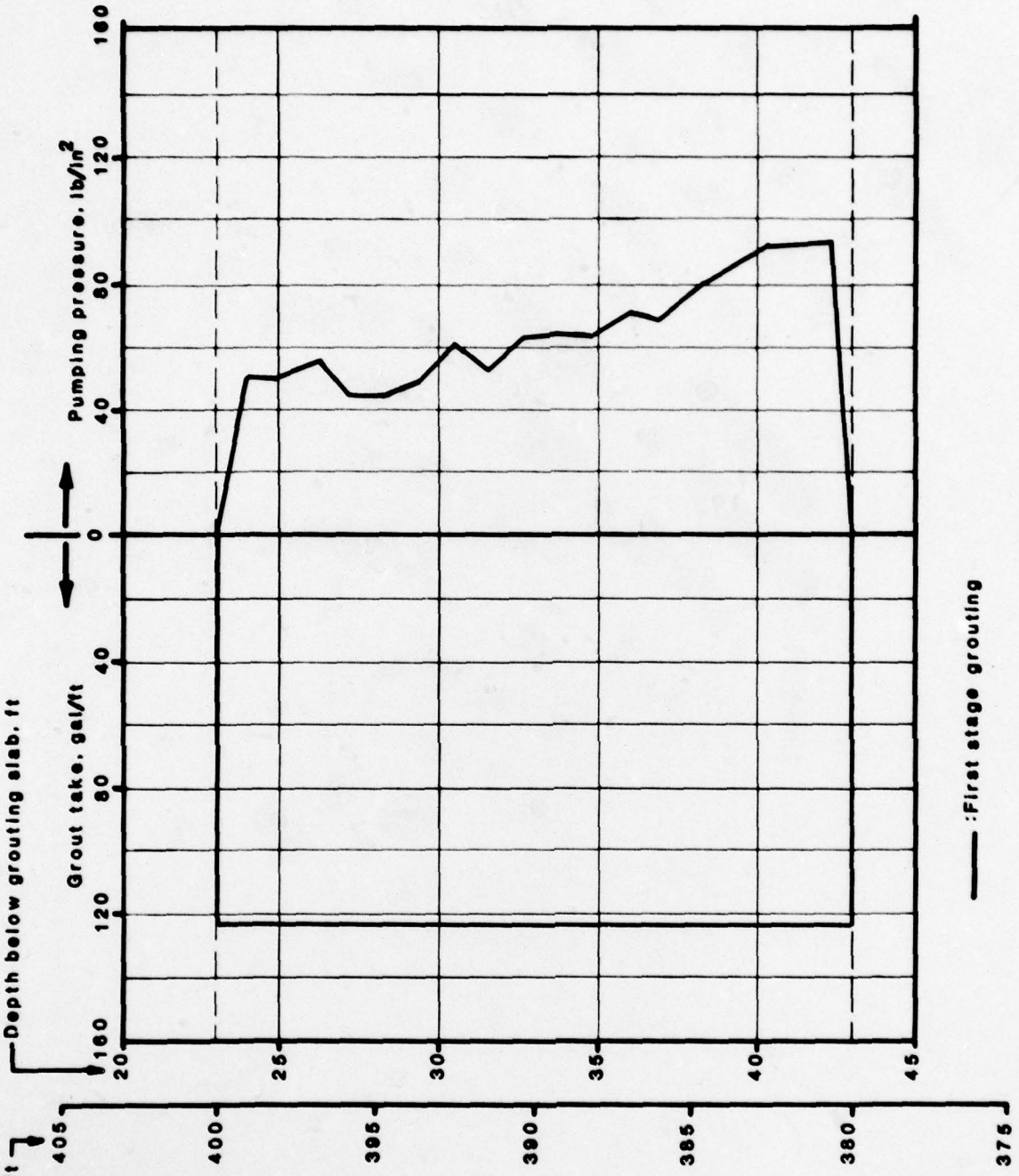
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 4-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig. E.20

Y7C826 Phase IX

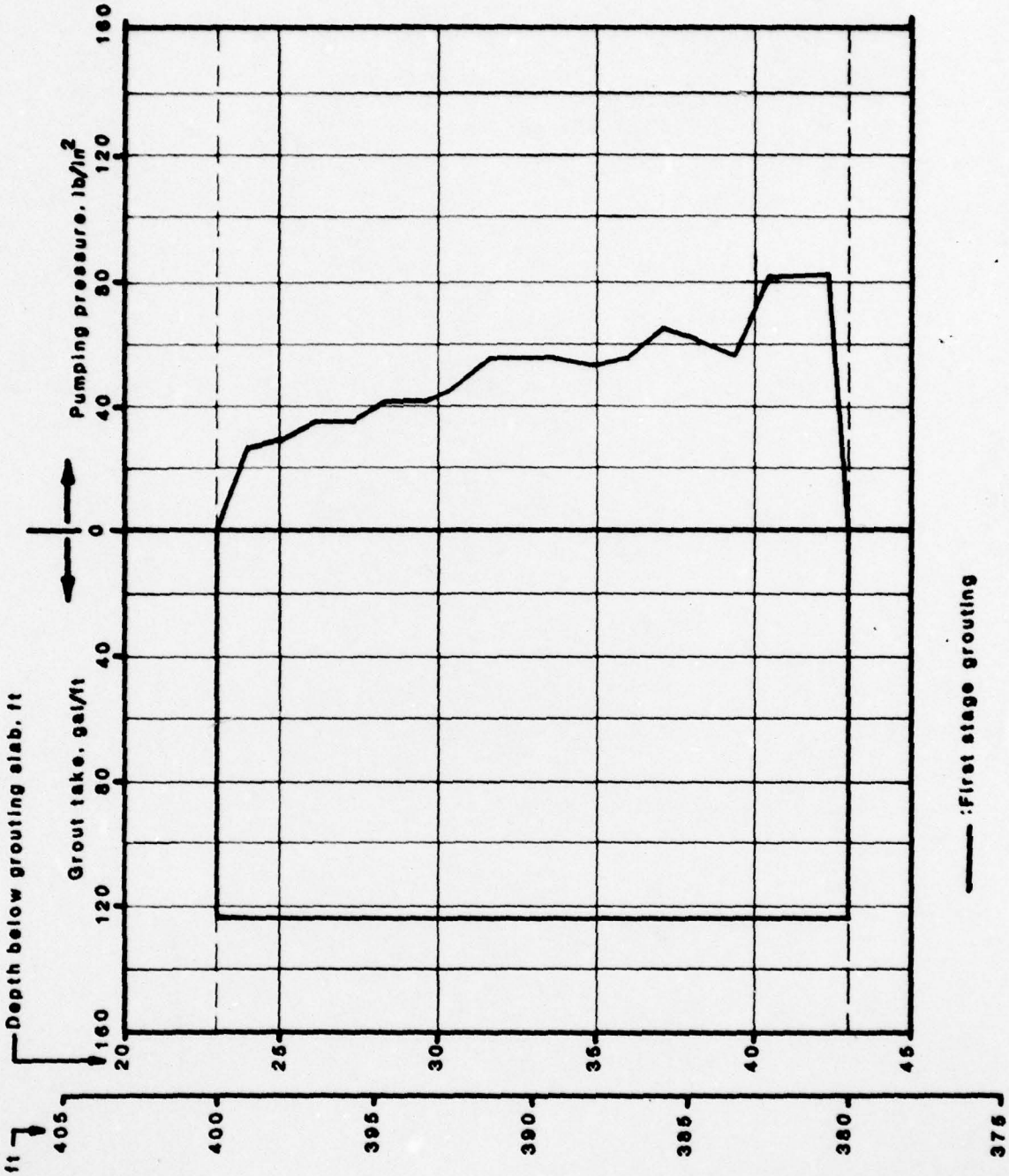


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 5-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants
Y7C826 Phase III

Fig. E.21



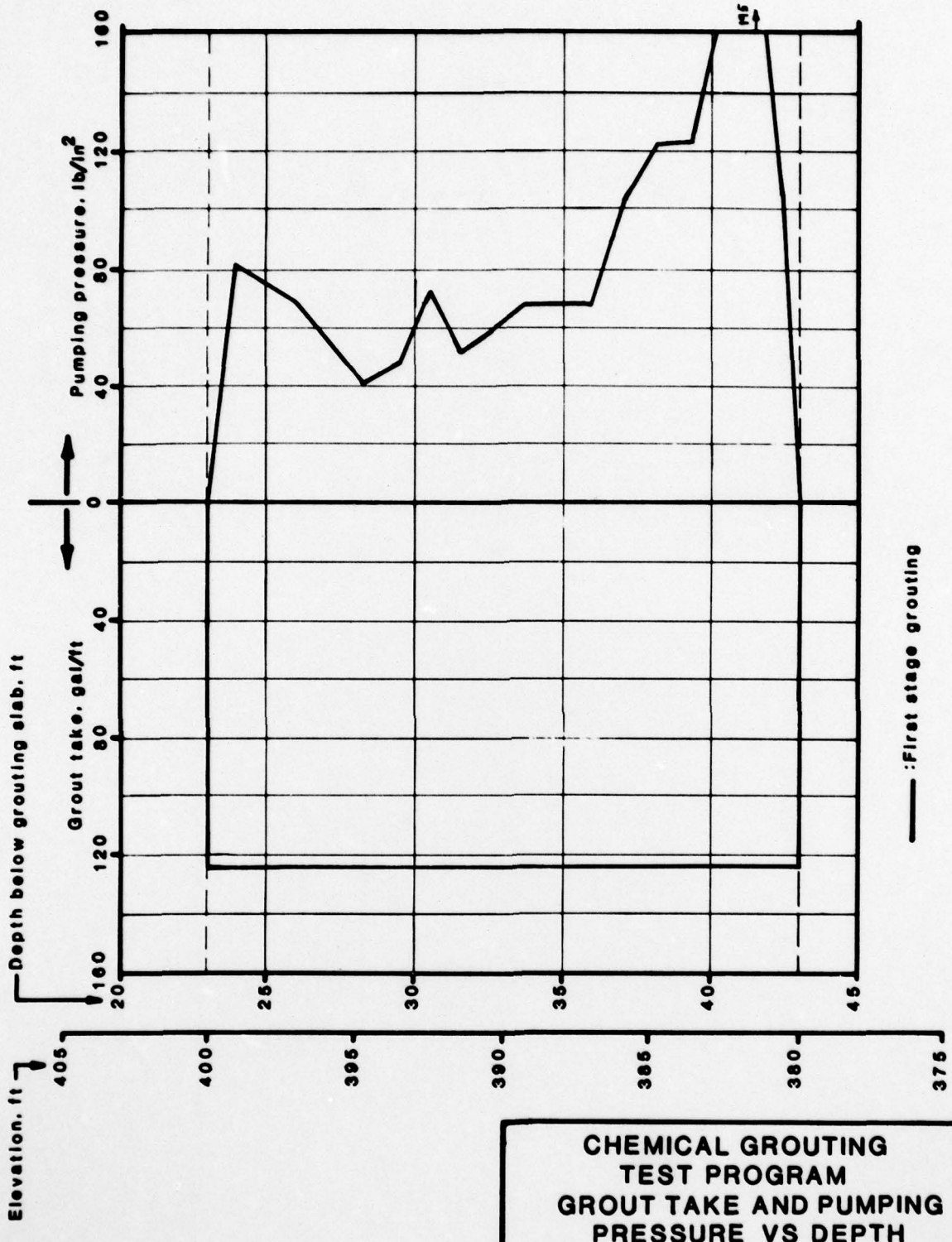
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 5-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-75-C-0005

Woodward-Clyde Consultants

Fig. E.22

V7C026 Phase IX

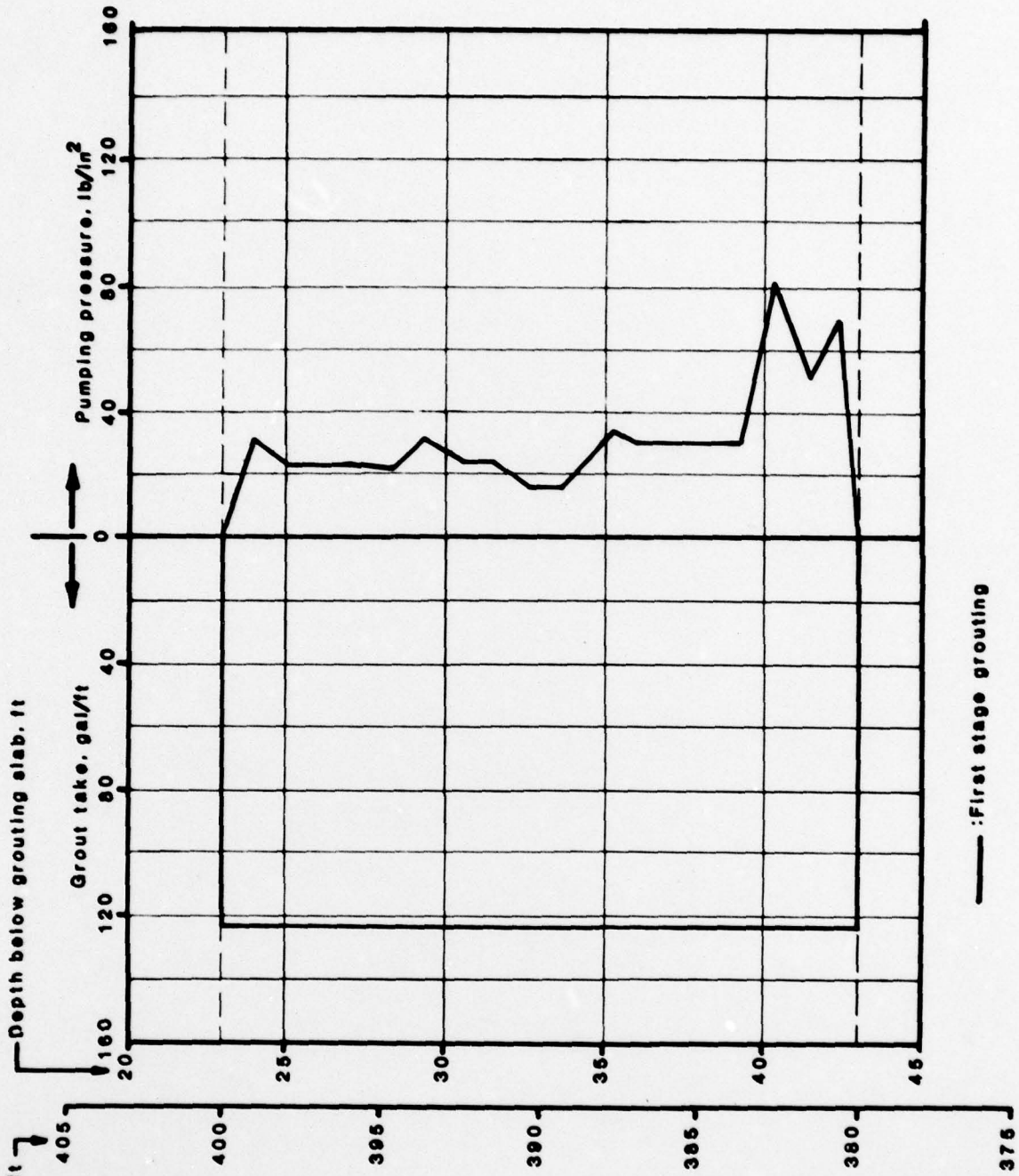


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 5-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0068

Woodward-Clyde Consultants
V7C826 Phase IX

Fig. E.23



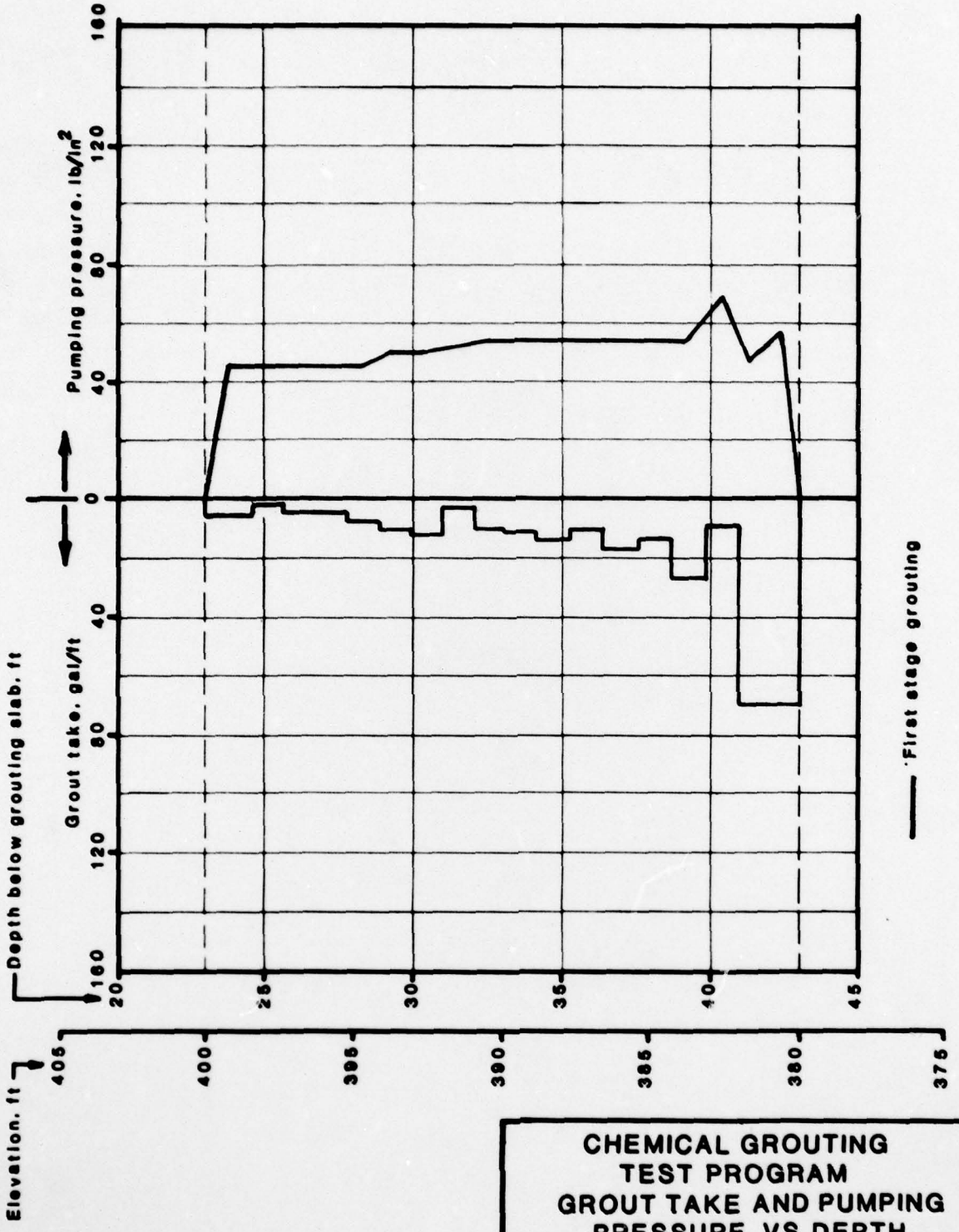
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 5-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

V7C826 Phase IX

Fig. E.24



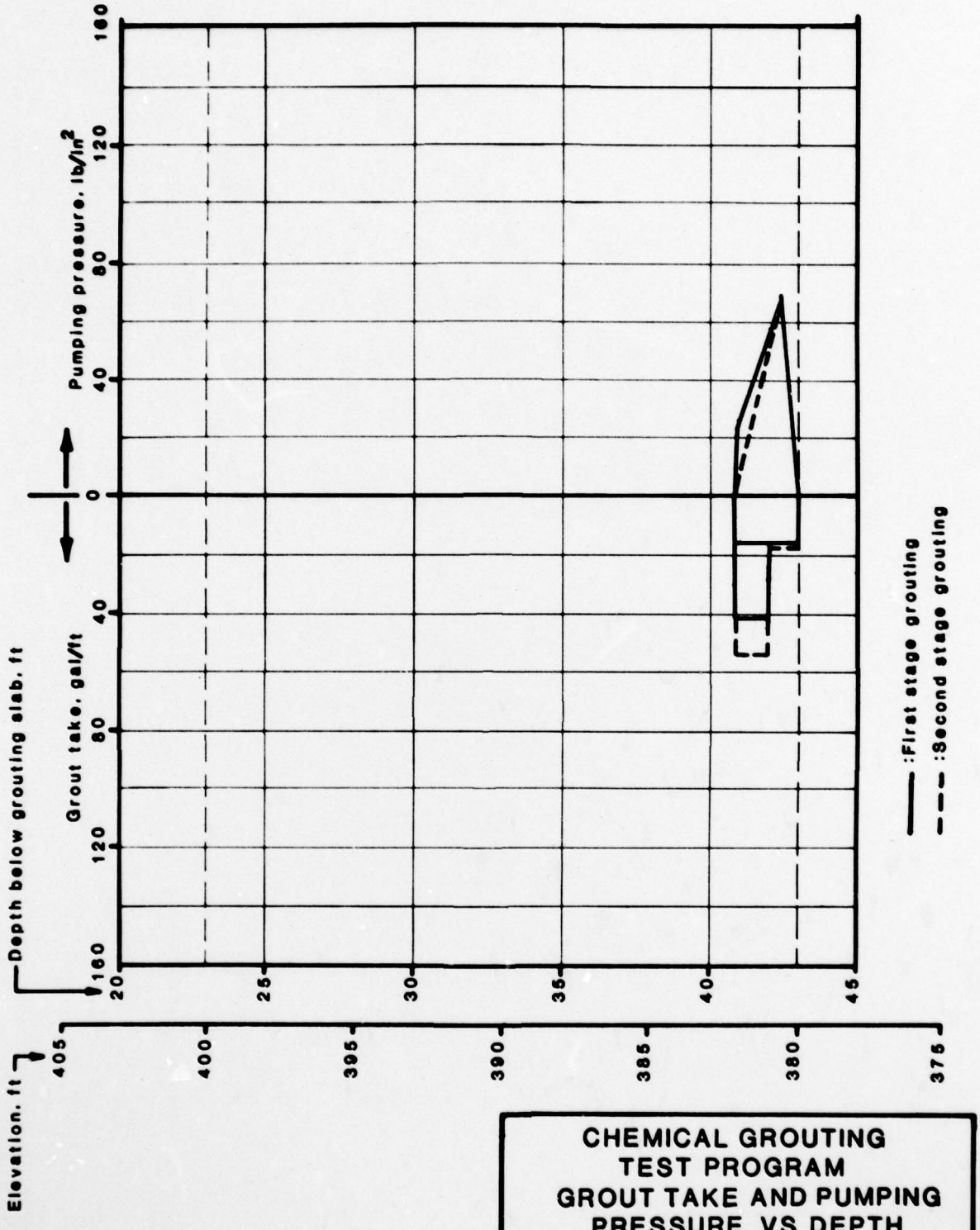
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 5a-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.25

V7C026 Phase III



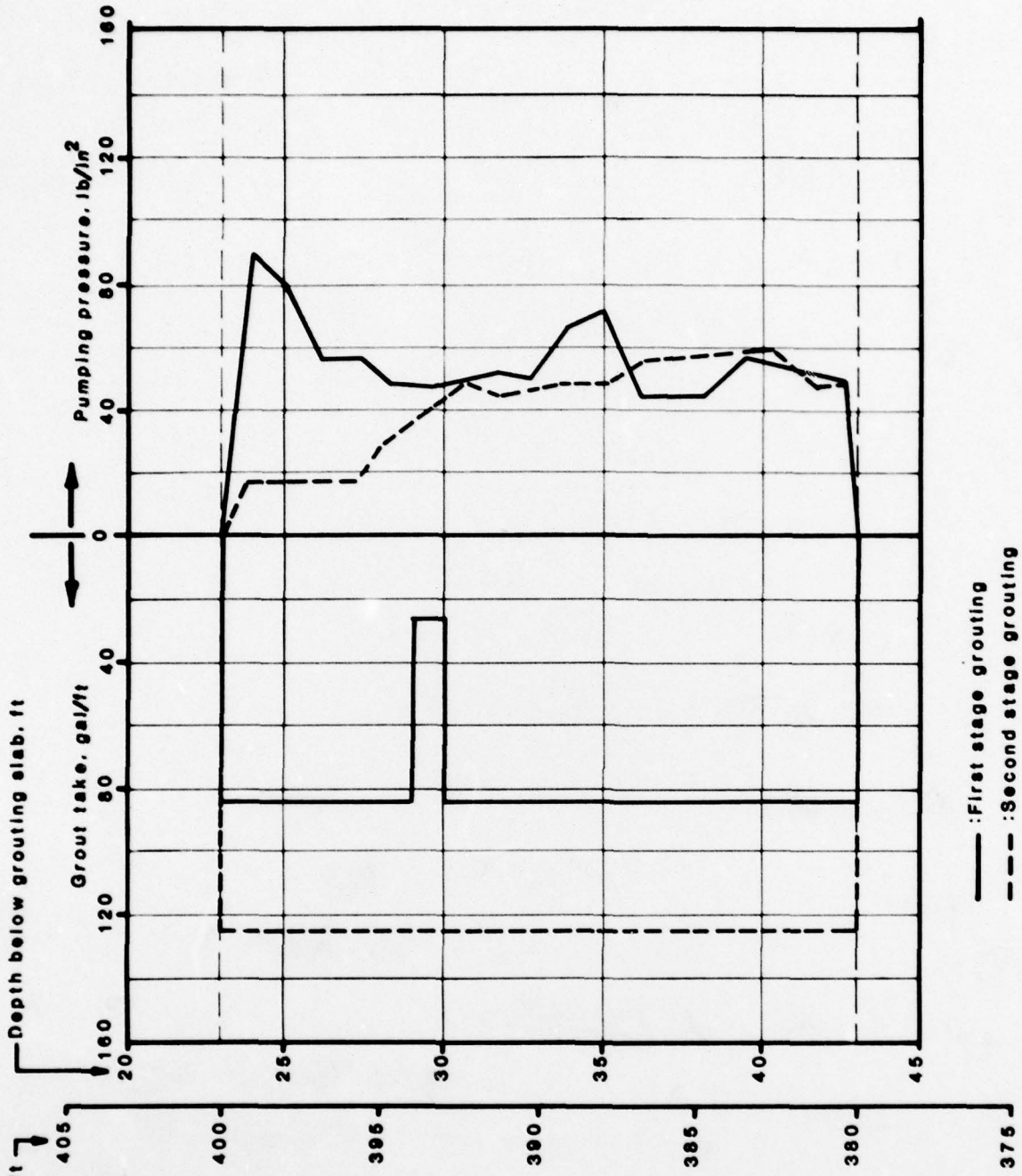
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 5a-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.26

Y7C826 Phase IX



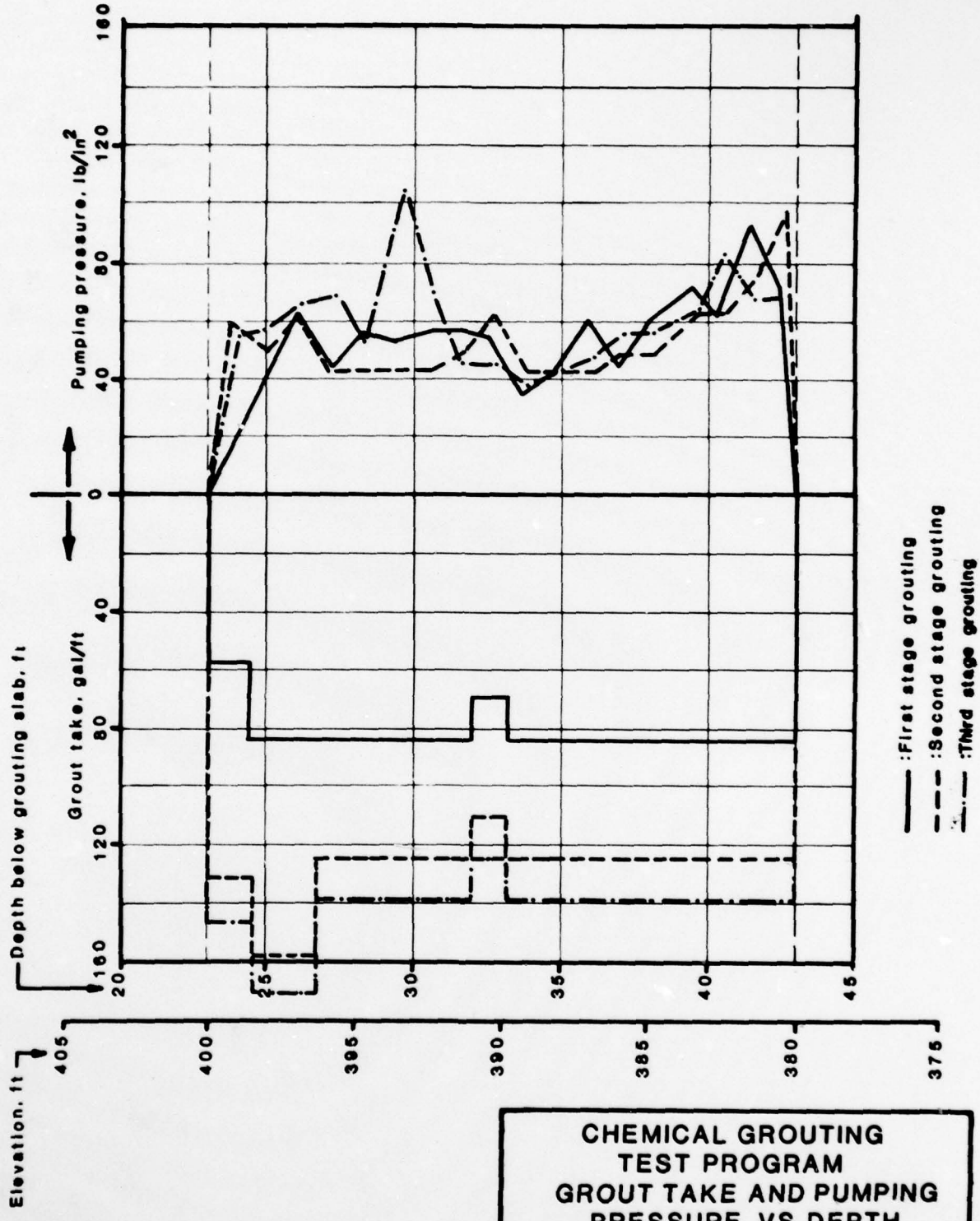
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No.6-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.27

Y7C025 Phase IX



CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No, 6-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

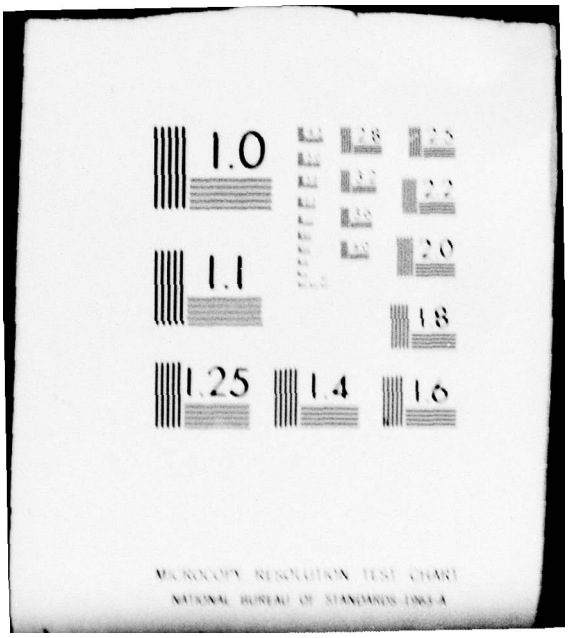
Woodward-Clyde Consultants

Fig. E.28

Y7C826 Phase IX

AD-A076 092 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM. E--ETC(U)
JUL 79 J PEREZ , Y LACROIX DACW43-78-C-0005
UNCLASSIFIED NL

2 OF 3
AD A076092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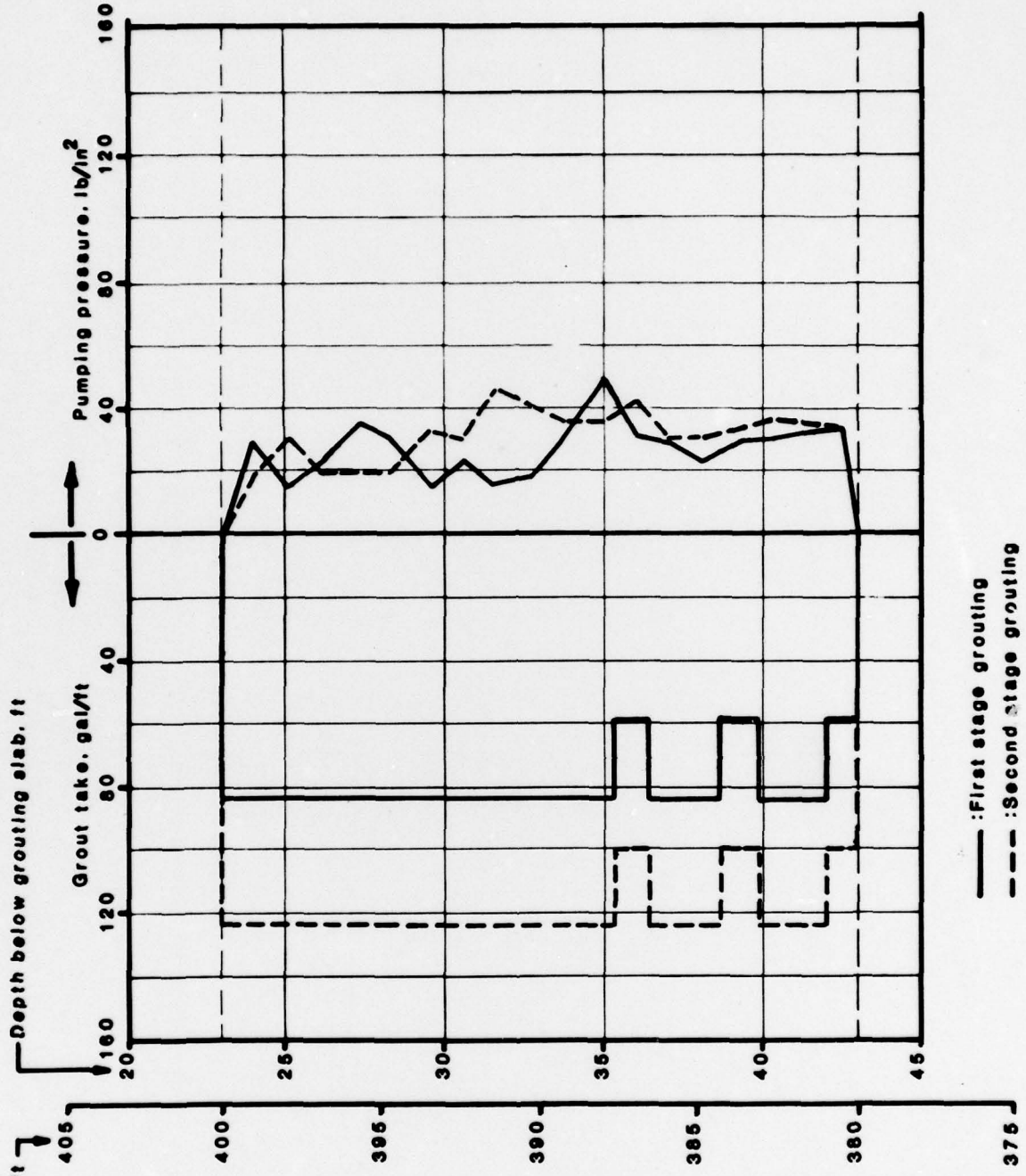
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A



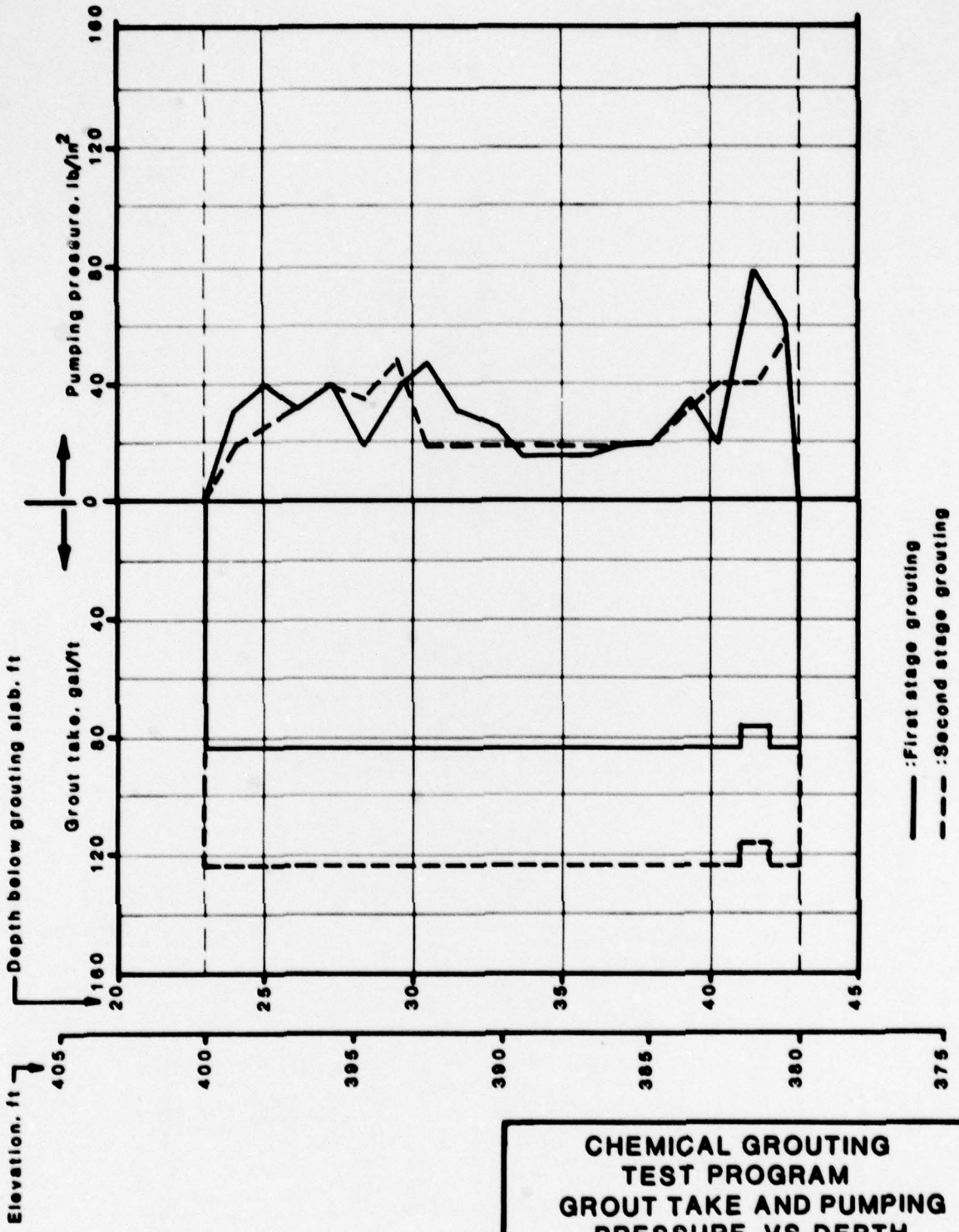
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 6-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.29

V7C026 Phase IX



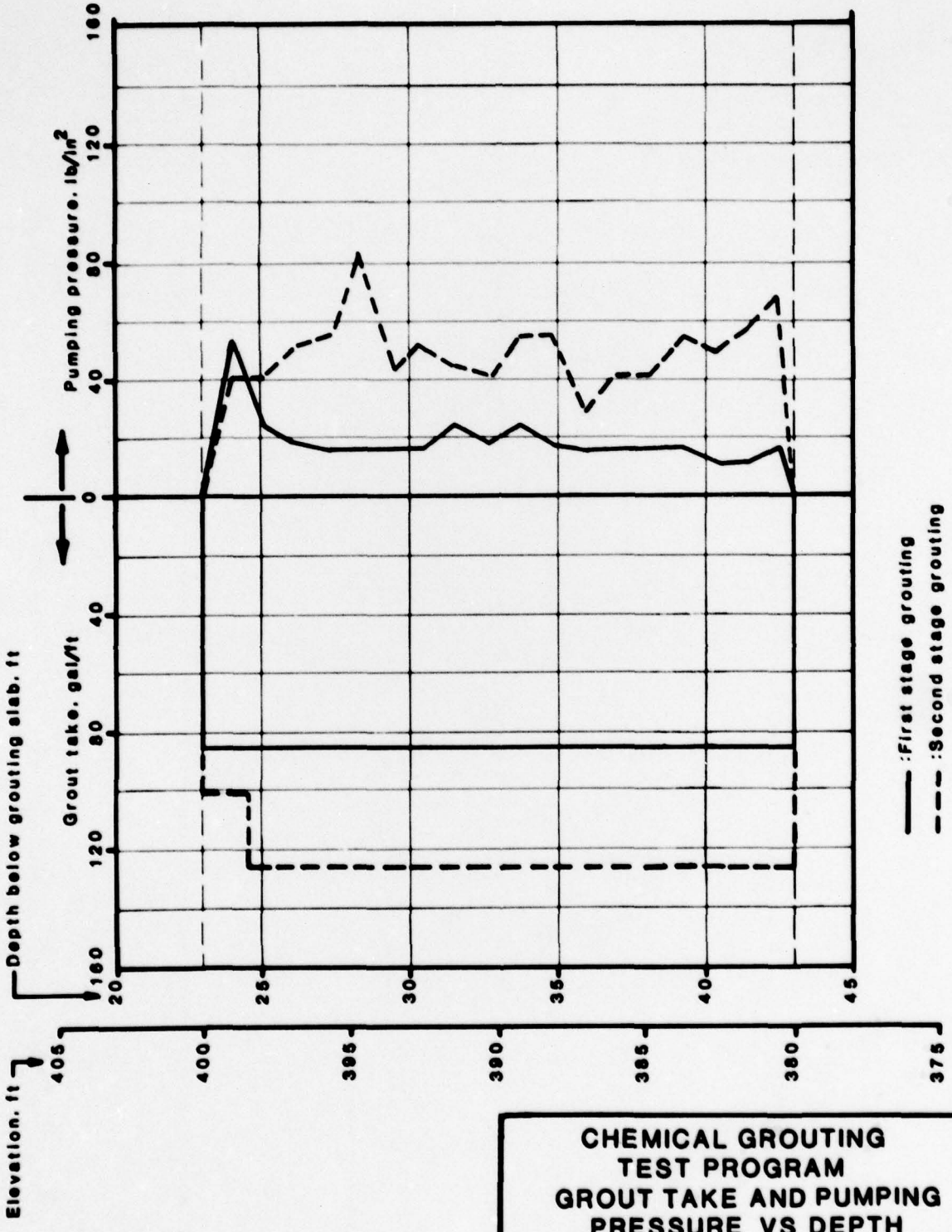
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 6-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.30

V7C026 Phase II



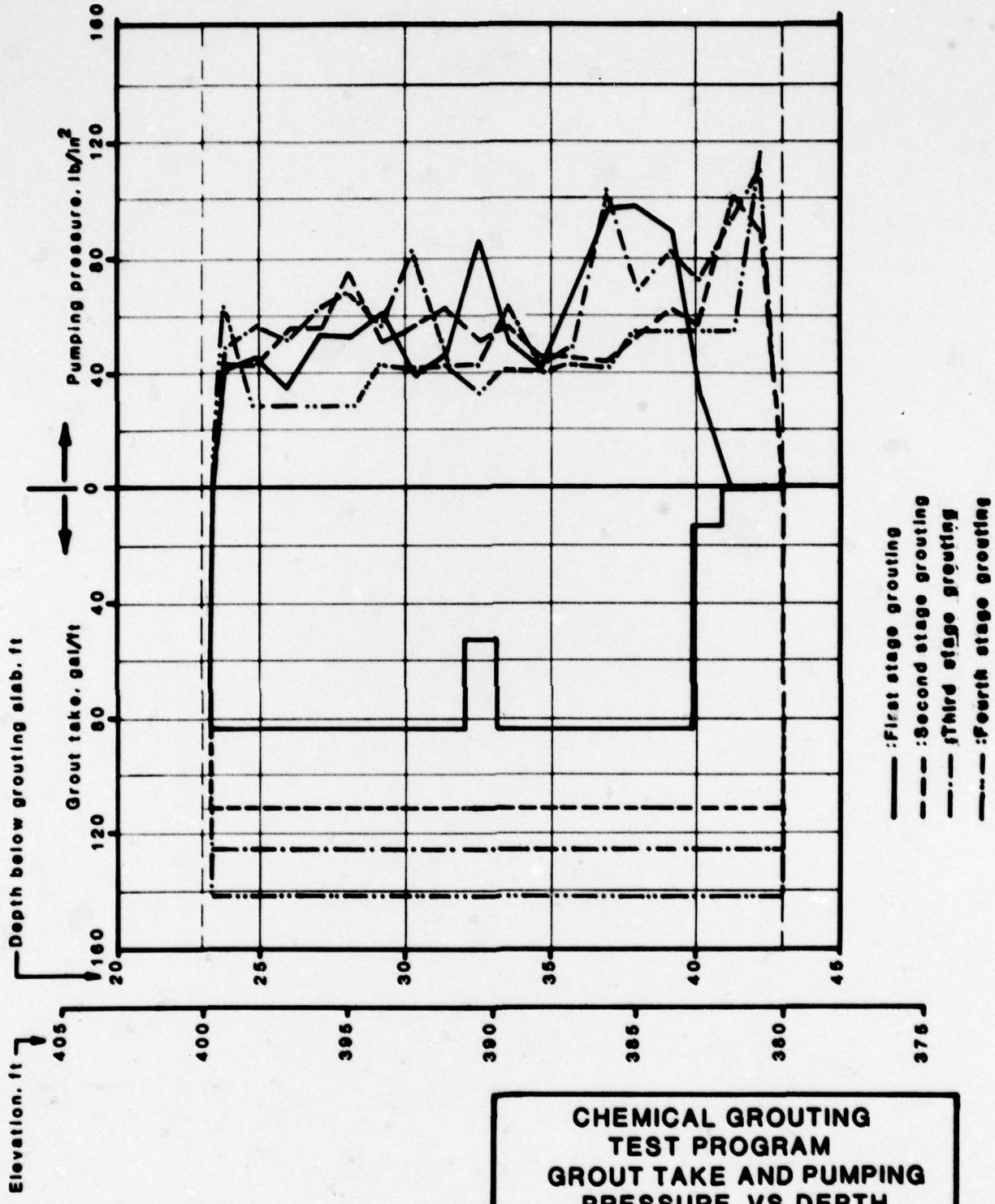
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 6-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.31

V7C026 Phase II



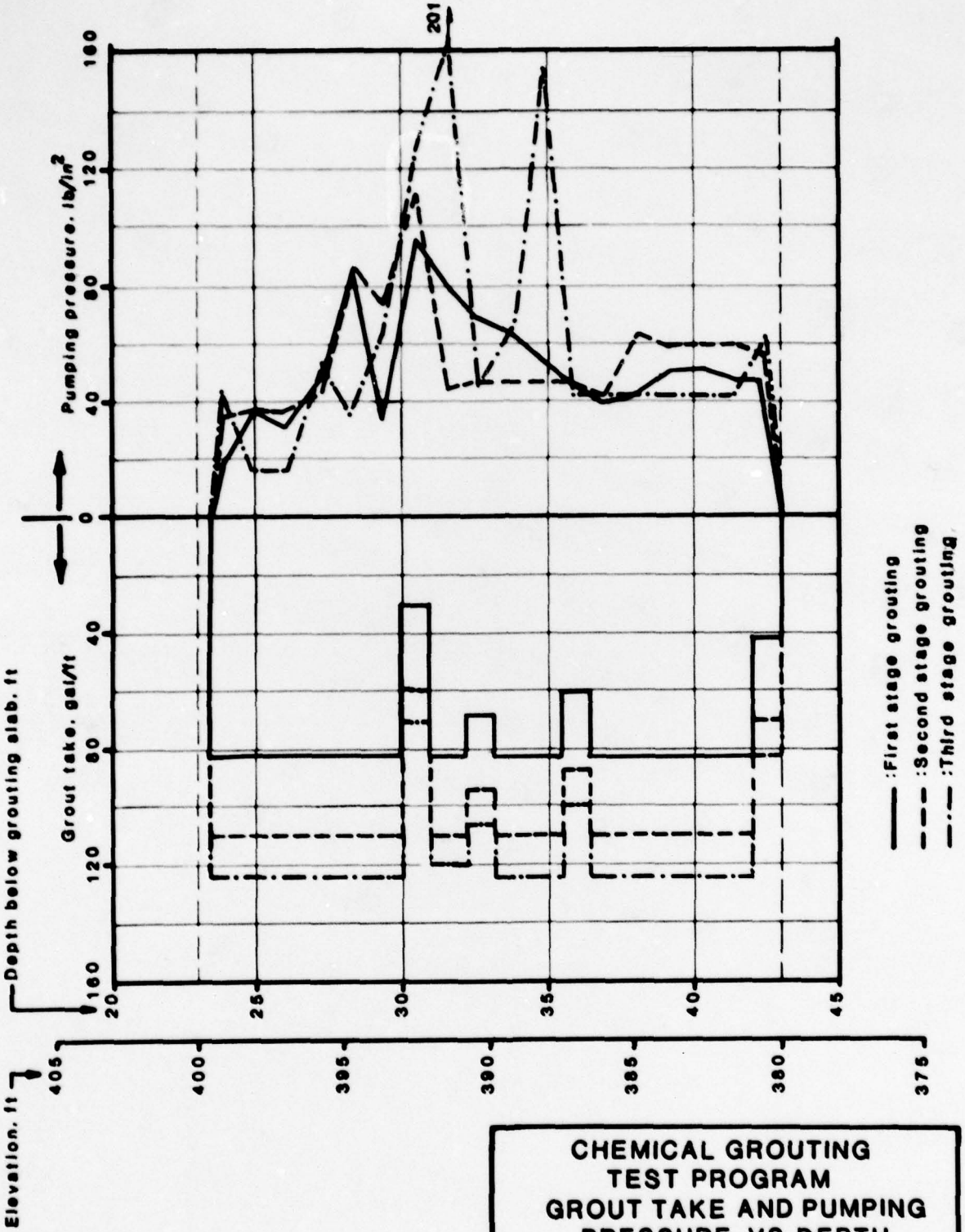
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 7-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.32

V7C026 Phase III



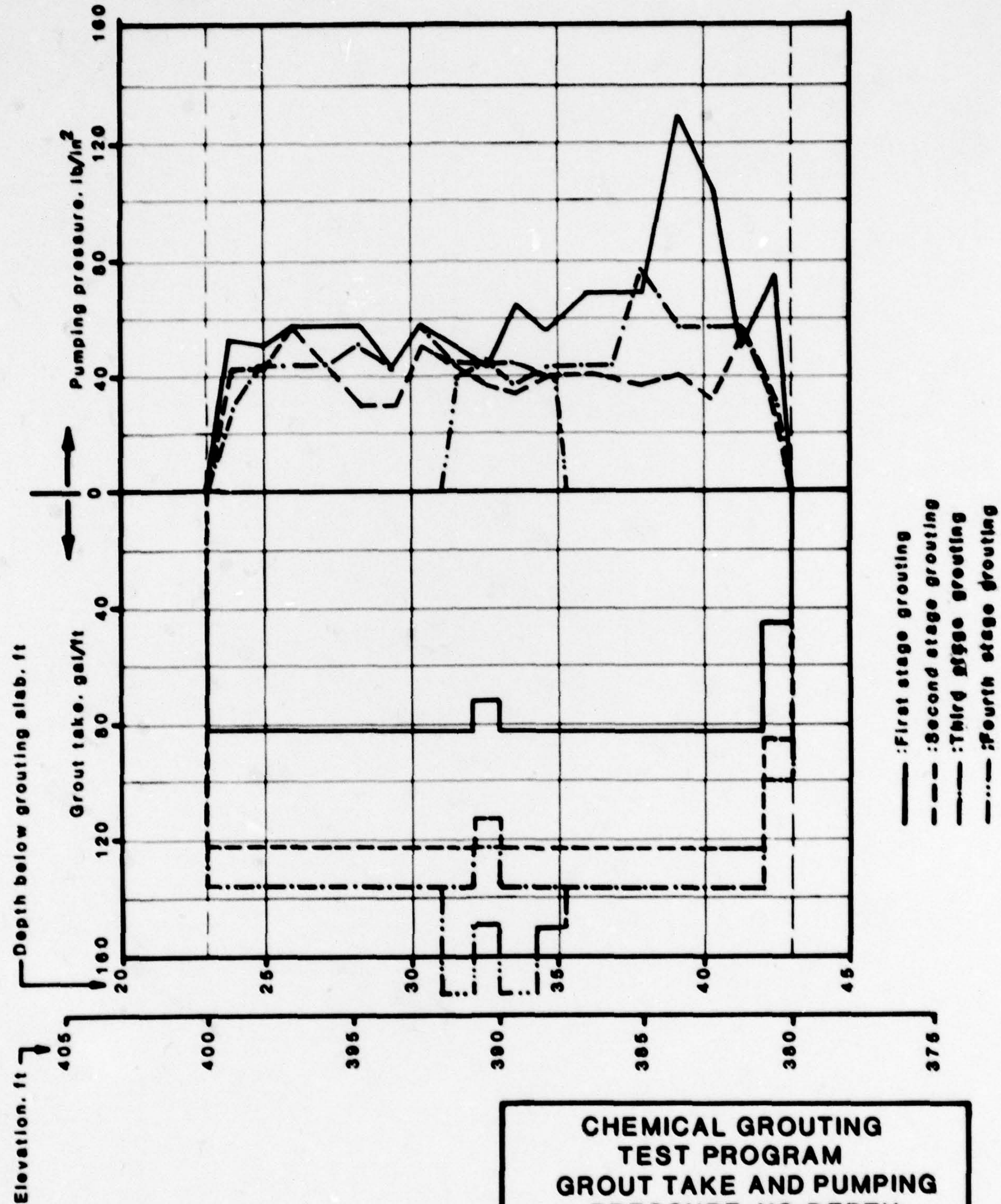
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 7-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

V7C825 Phase III

Fig. E.33



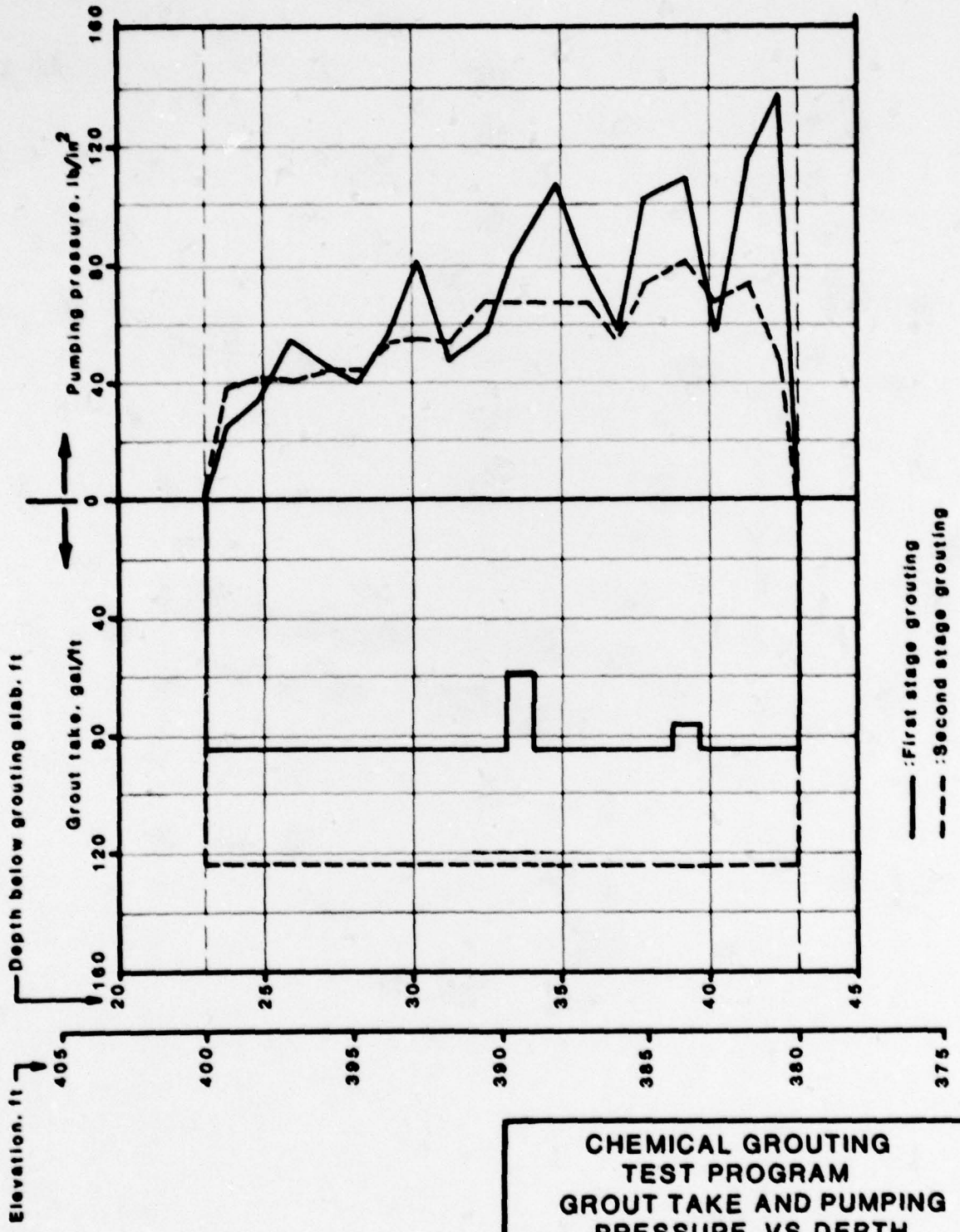
CHEMICAL GROUTING
TEST PROGRAM
GROUT TAKE AND PUMPING
PRESSURE VS DEPTH
GROUT HOLE No. 7-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

77C826 Phase III

Fig. E.34



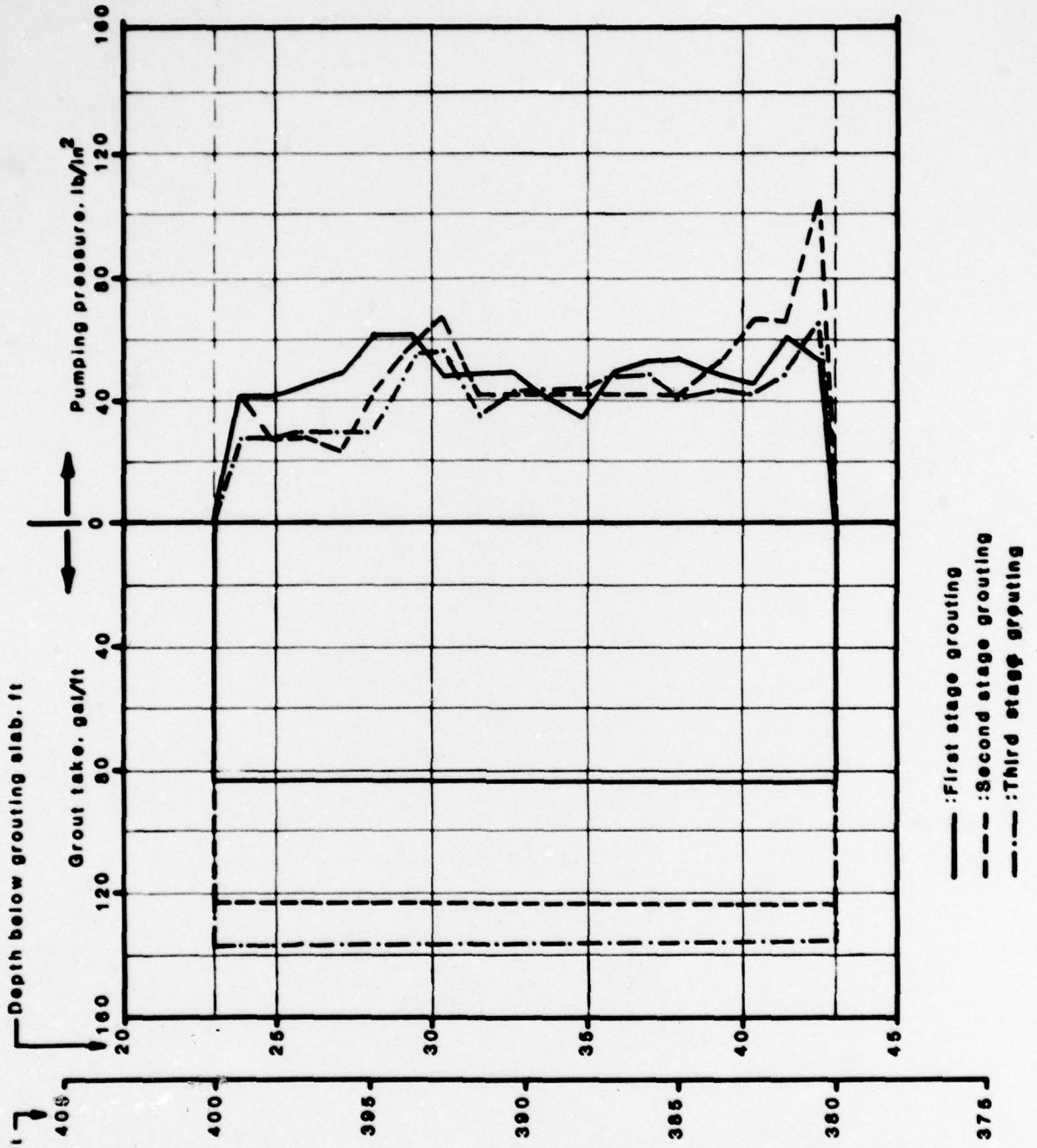
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 7-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.35

Y7C026 Phase III



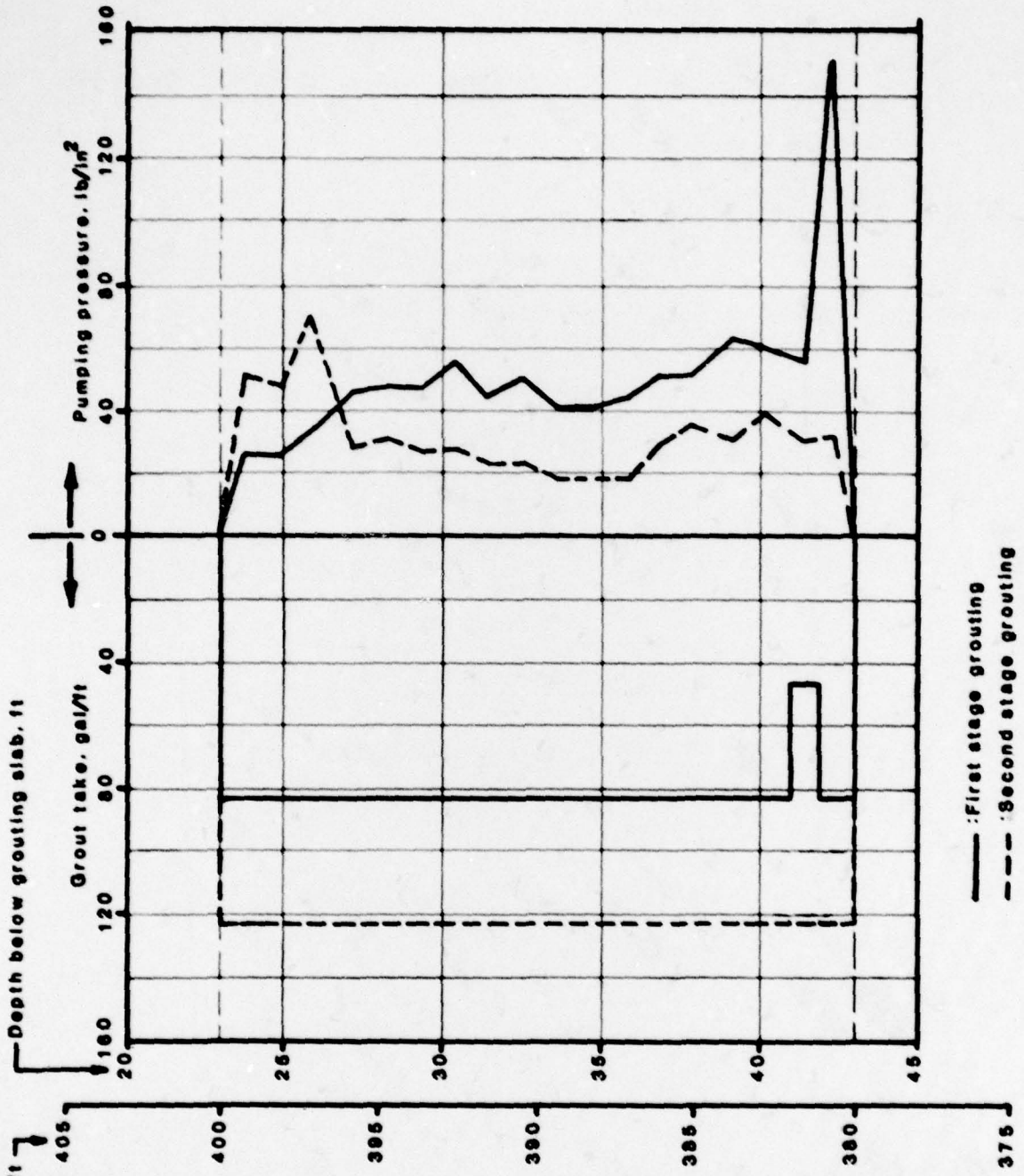
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 7-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.36

Y7C826 Phase IX



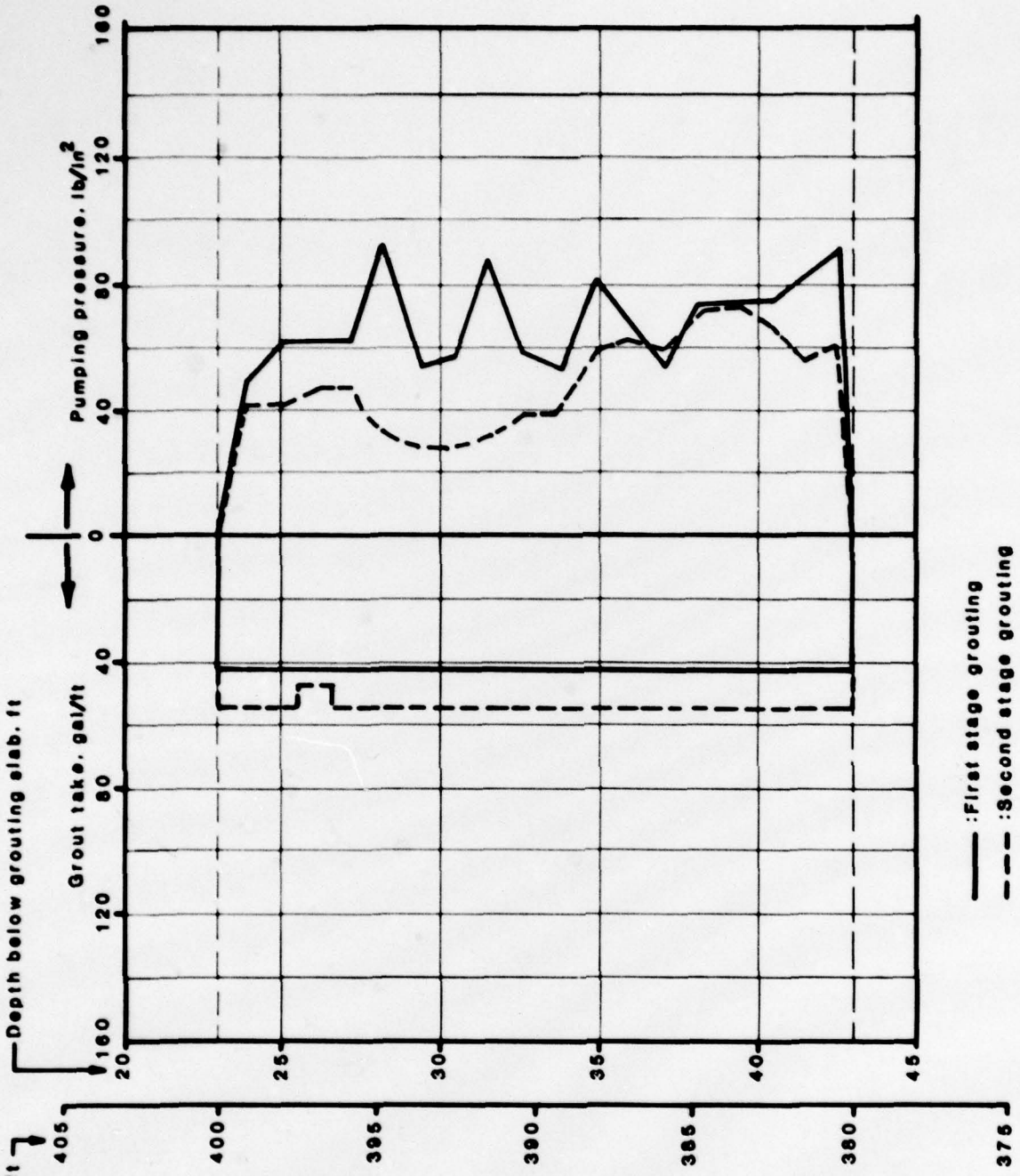
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 7-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.37

Y7C026 Phase II



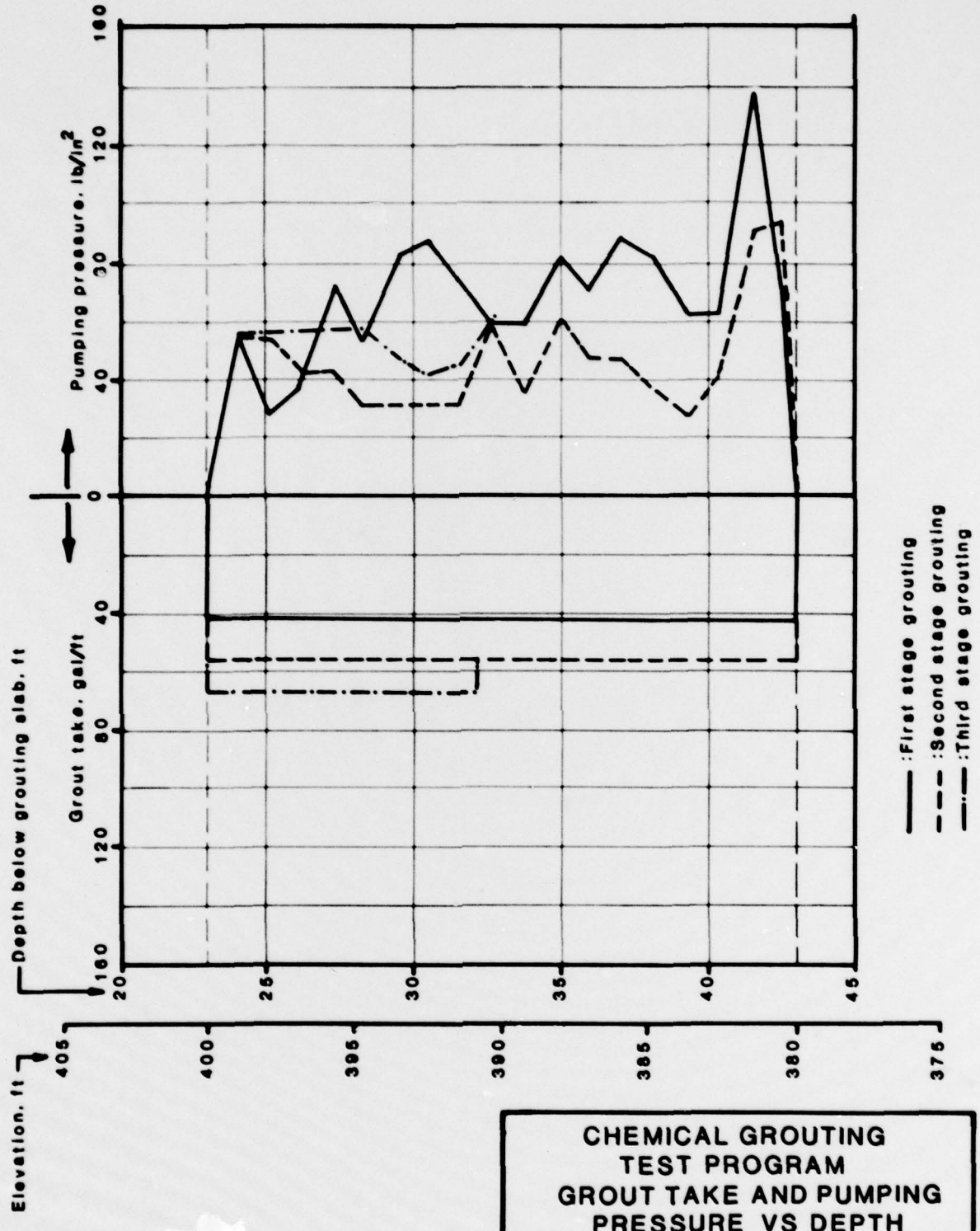
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Fig. E.38

Y7C826 Phase IX



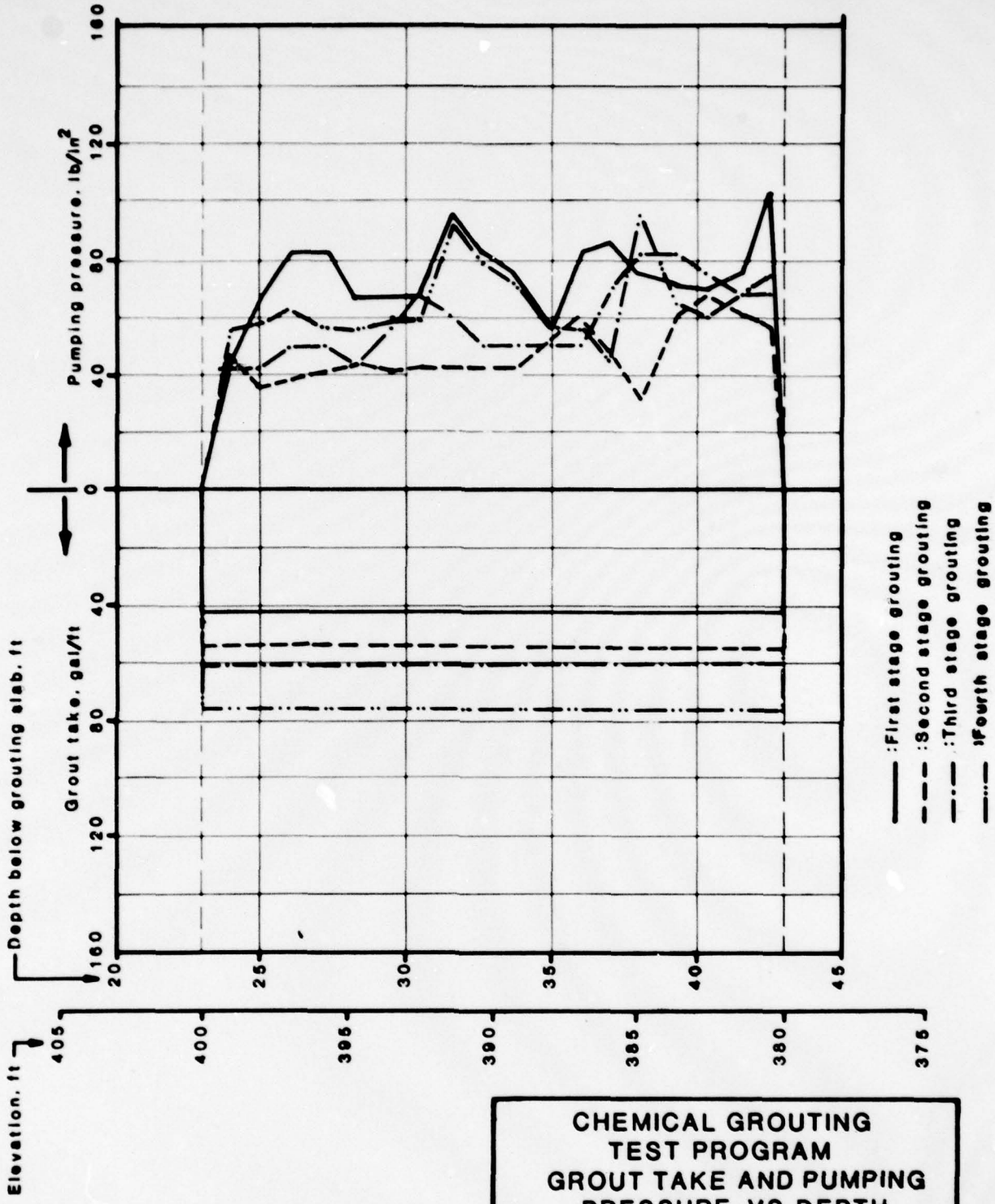
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.39

Y7C826 Phase IX



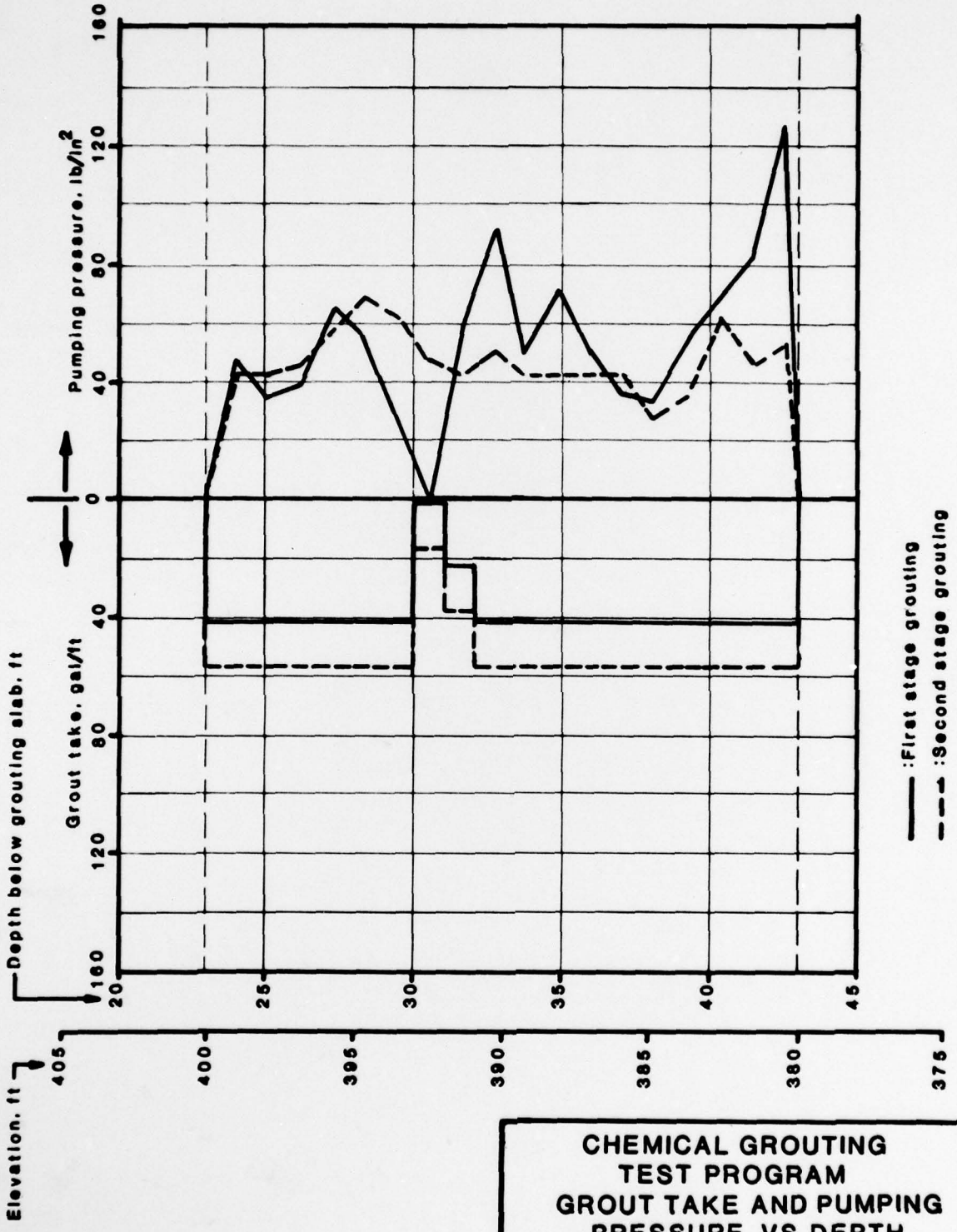
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Fig. E.40

V7C025 Phase IX



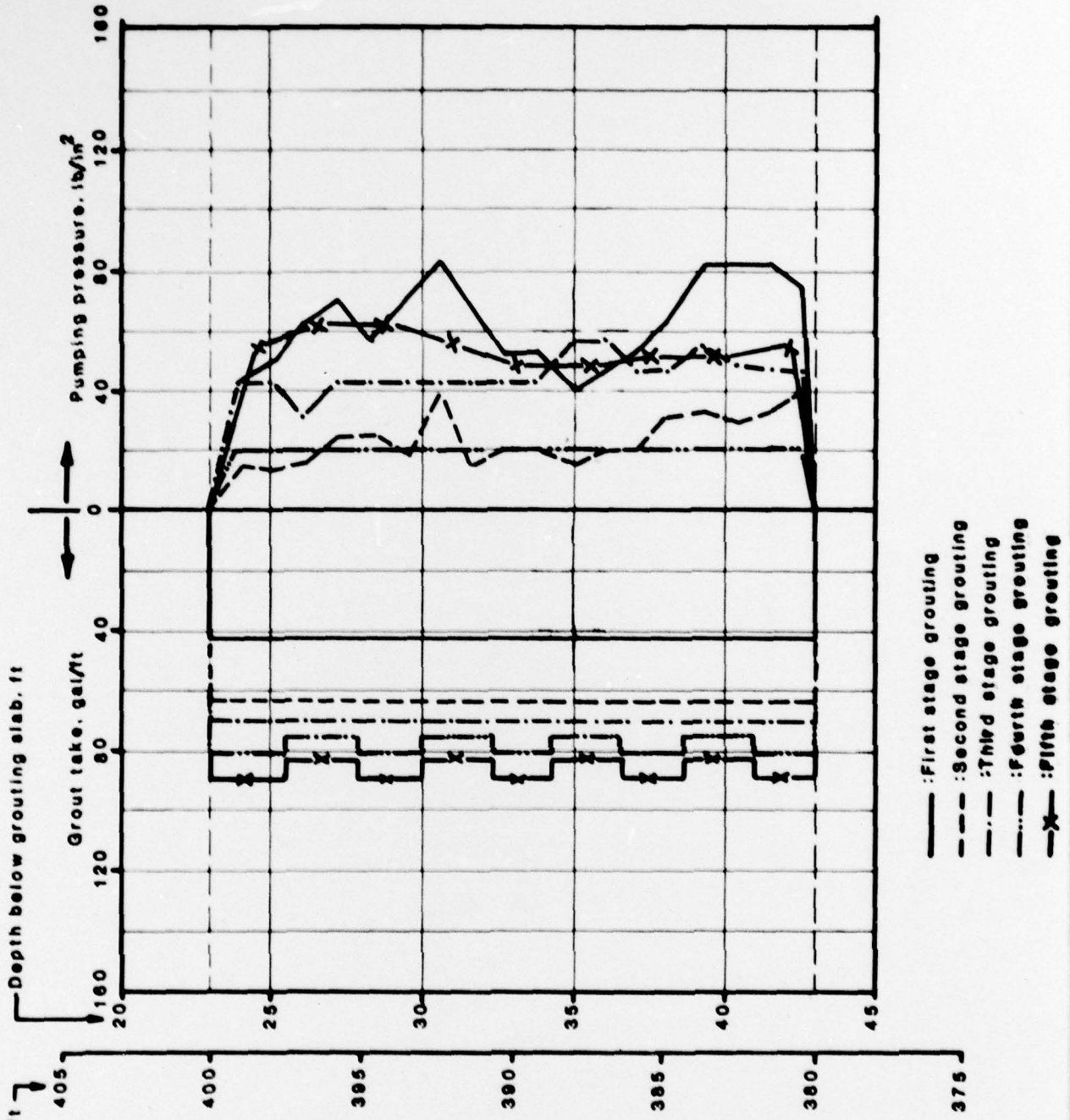
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

V7C825 Phase II

Fig. E.41

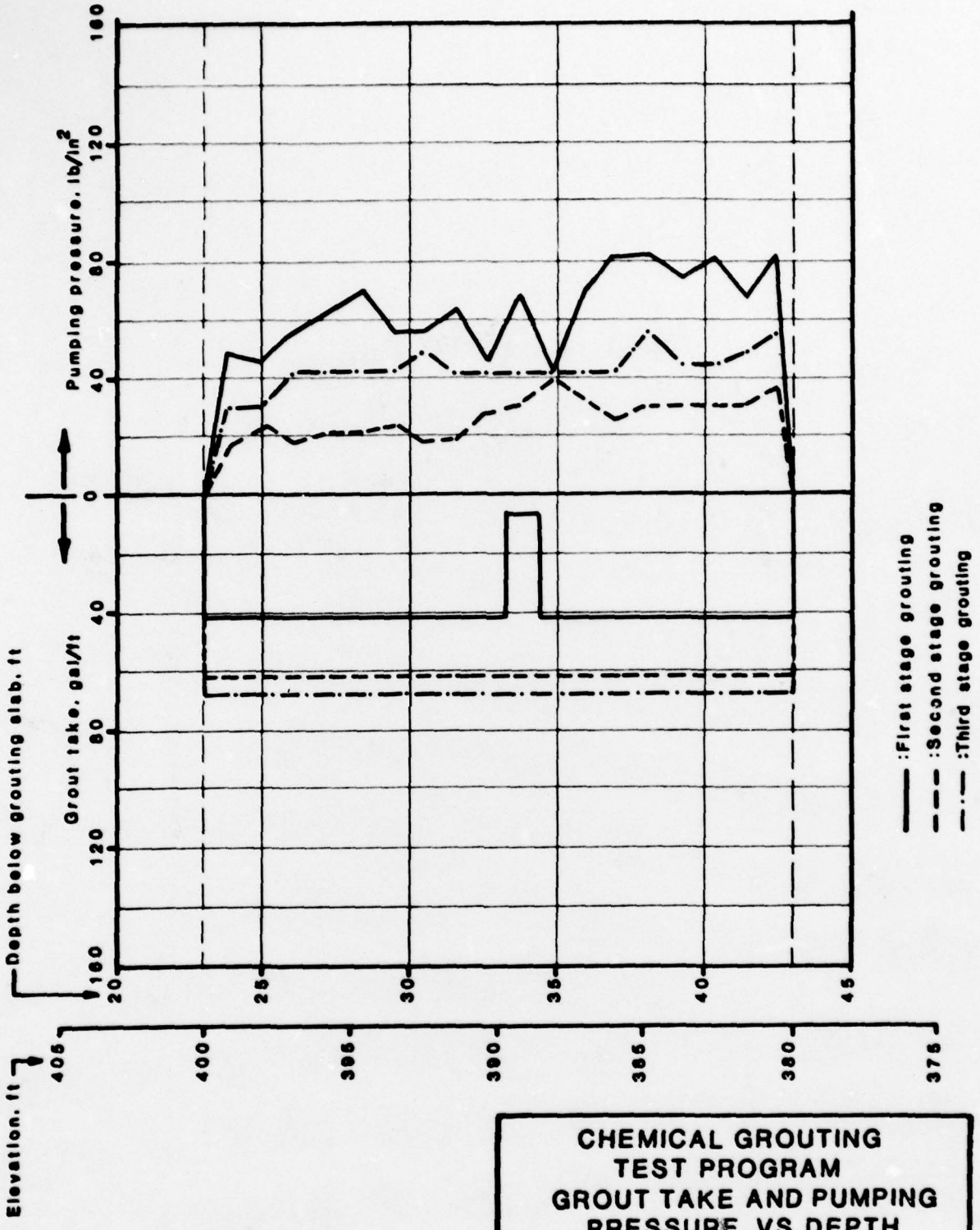


CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0009

Woodward-Clyde Consultants

Fig. E.42



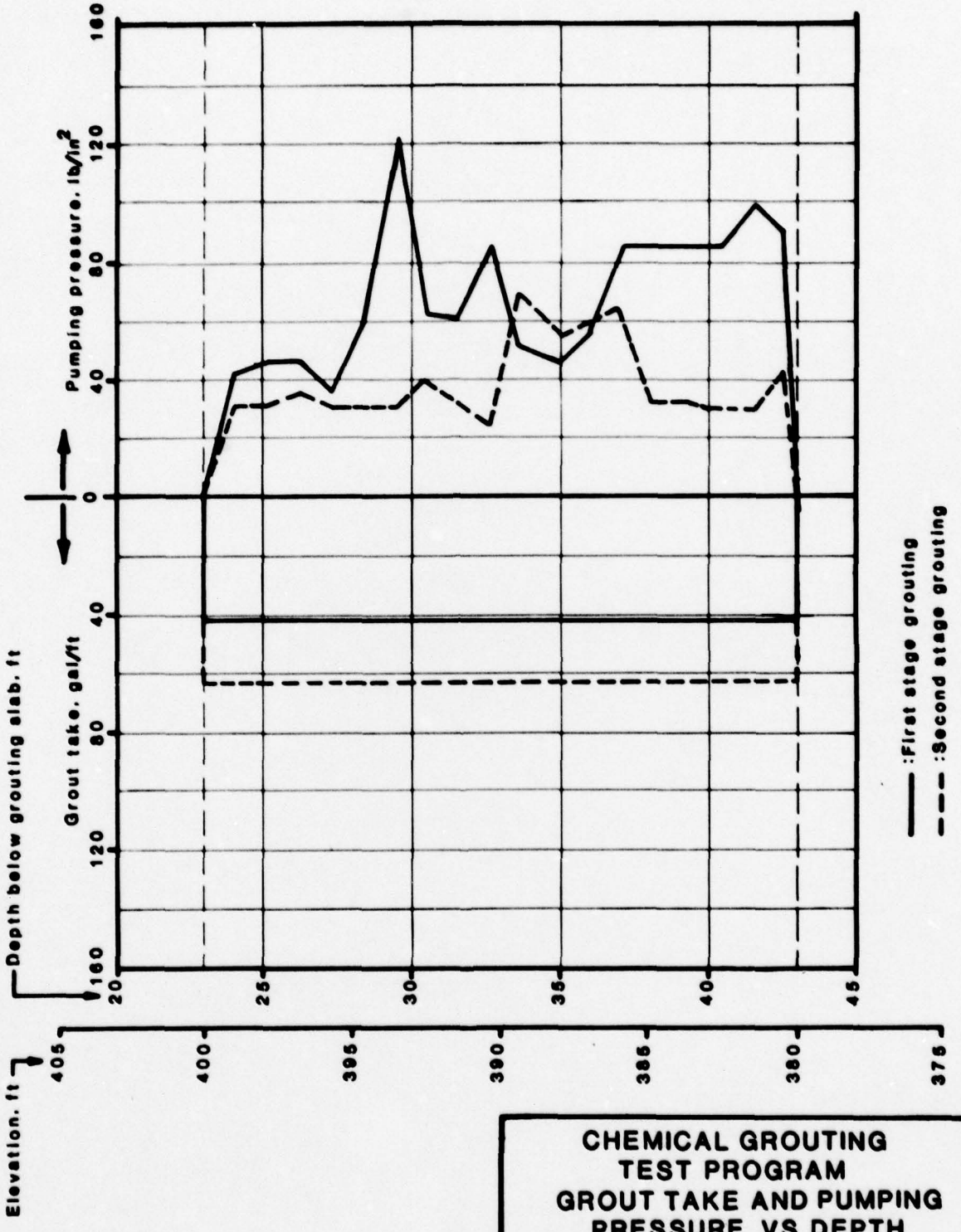
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Y7C026 Phase IX

Fig. E.43



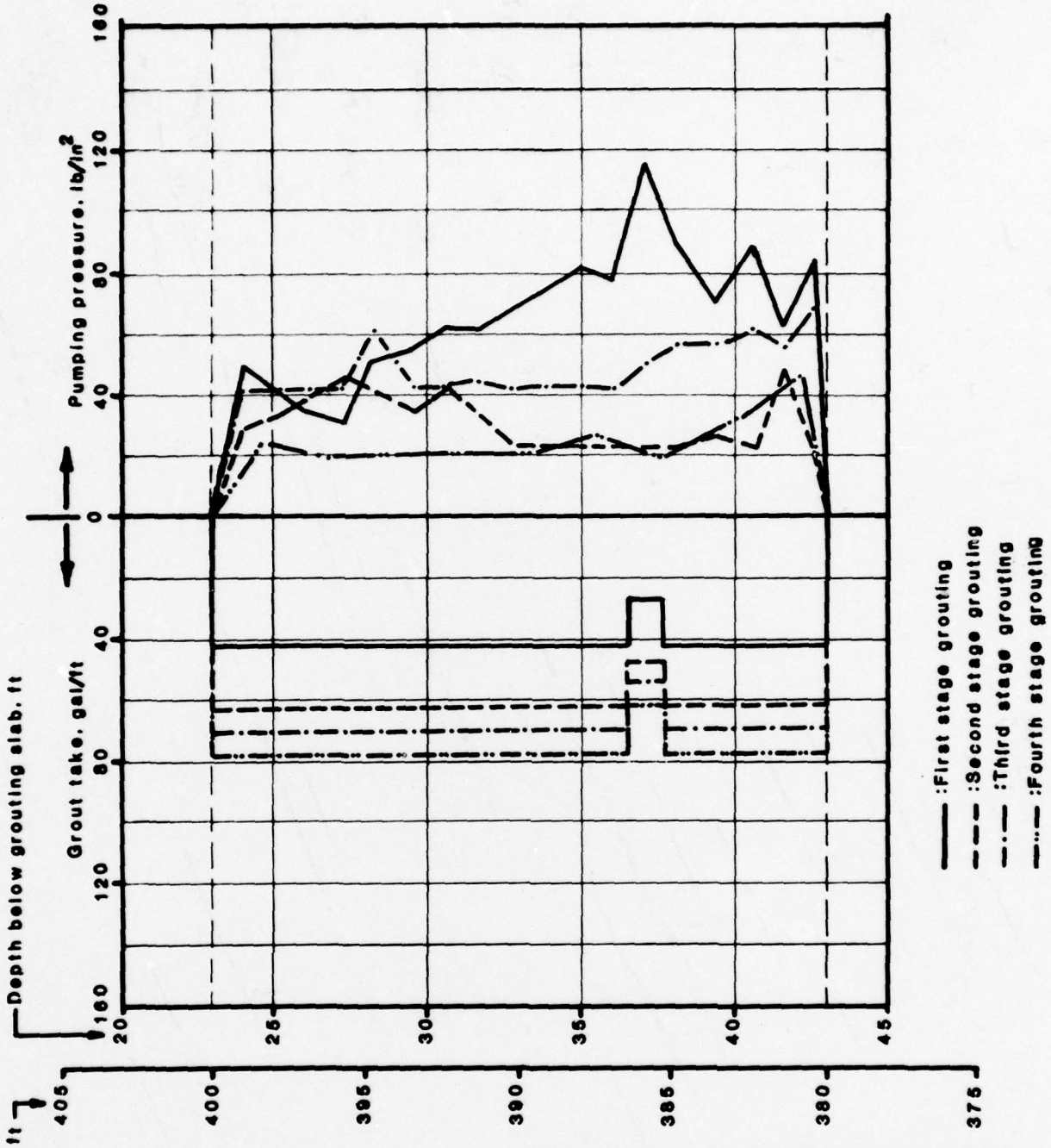
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Y7C026 Phase III

Fig. E.44



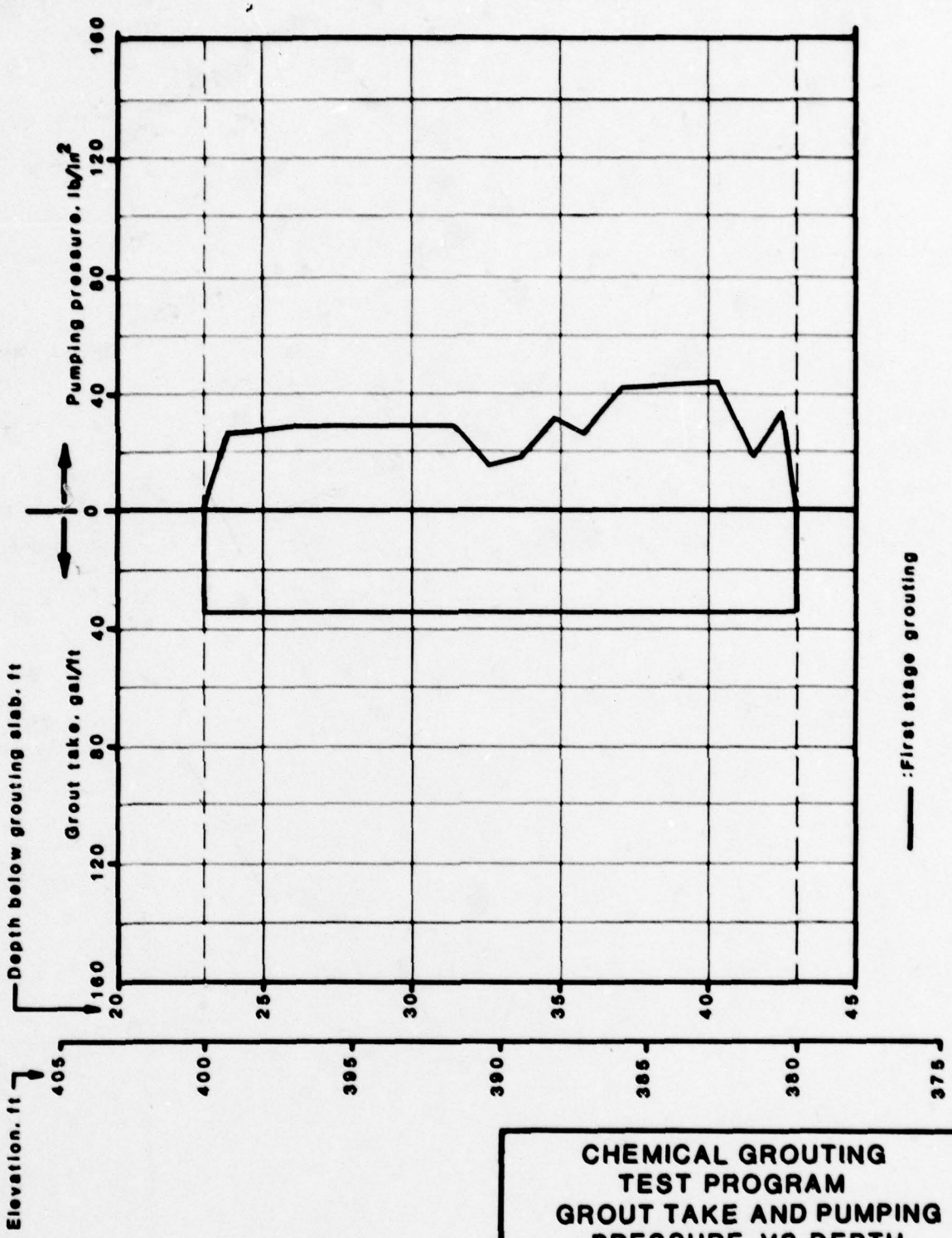
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 8-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Y7C825 Phase III

Fig. E.45



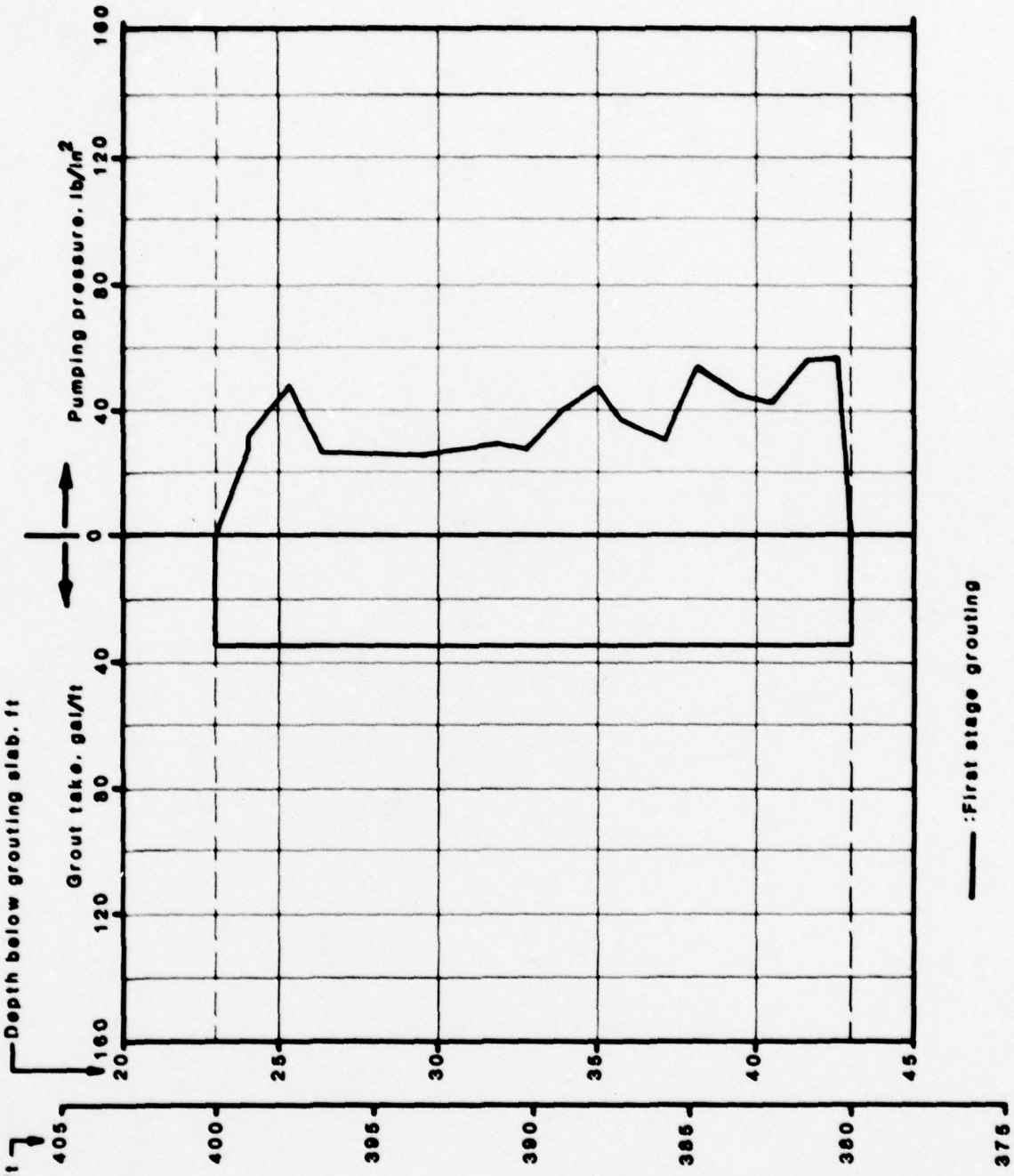
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 9-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-75-C-0005

Woodward-Clyde Consultants

Fig. E.46

V7C825 Phase IX



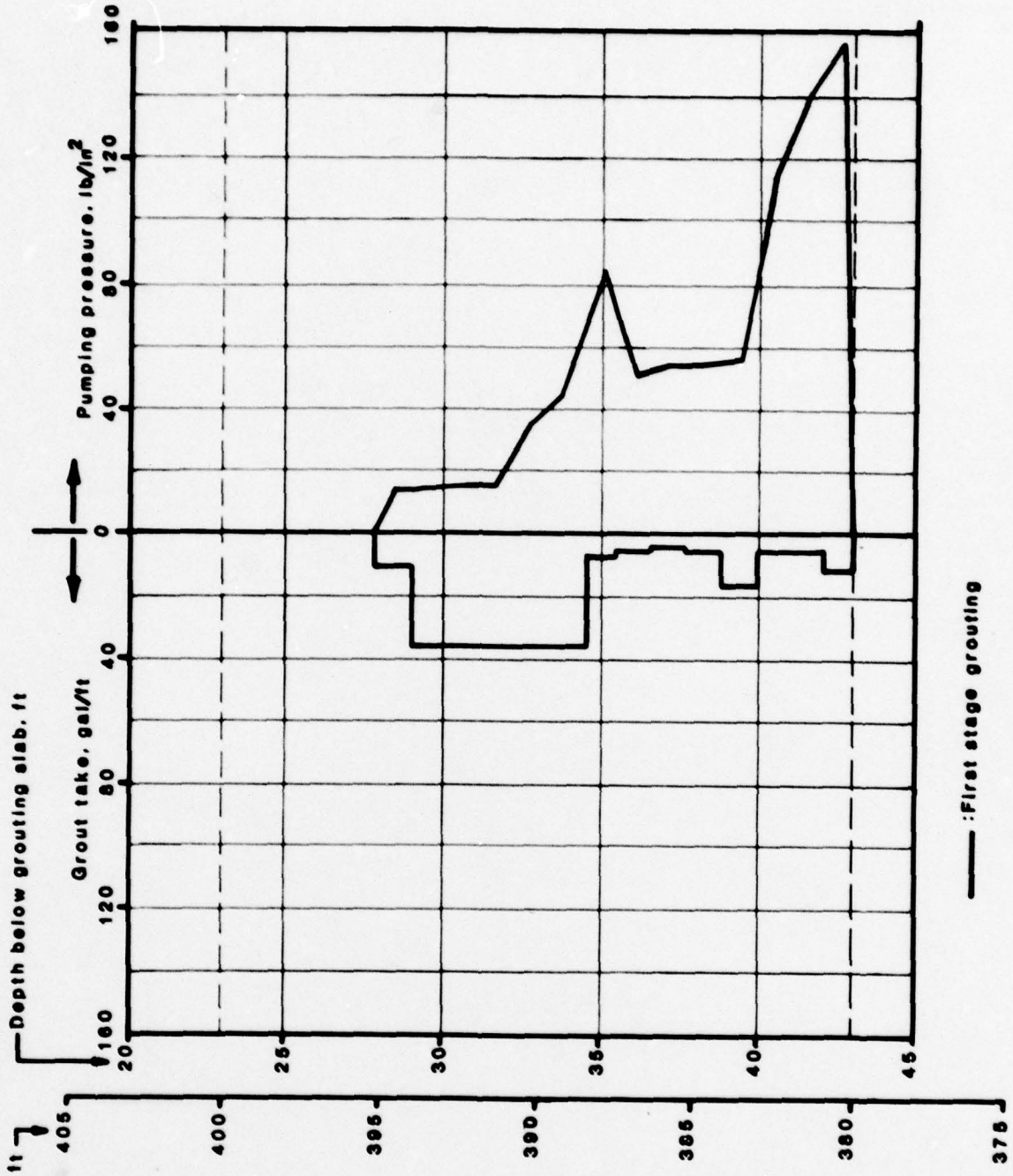
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 9-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.47

YYC626 Phase IX

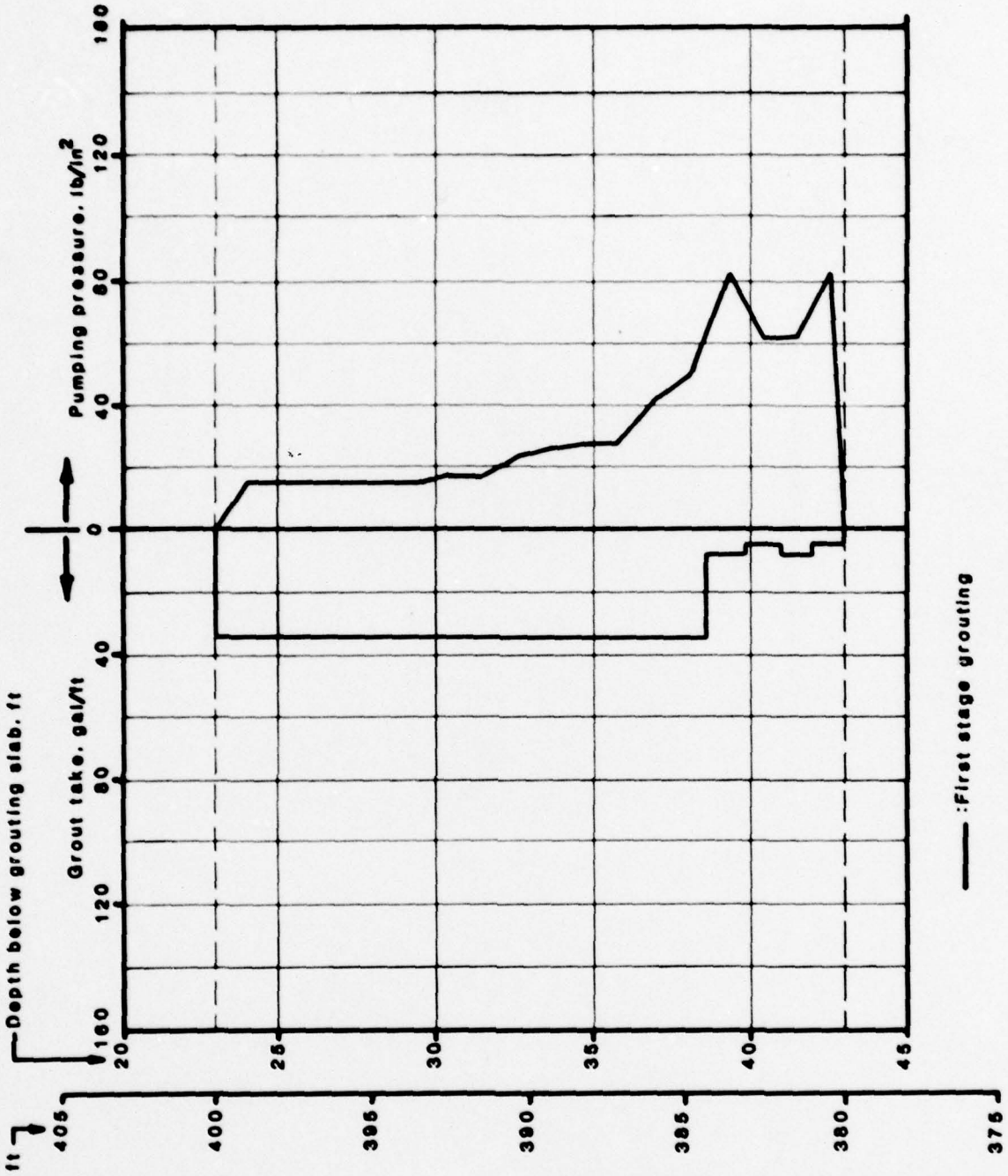


CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 9-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants
Y7C026 Phase IX

Fig. E.48



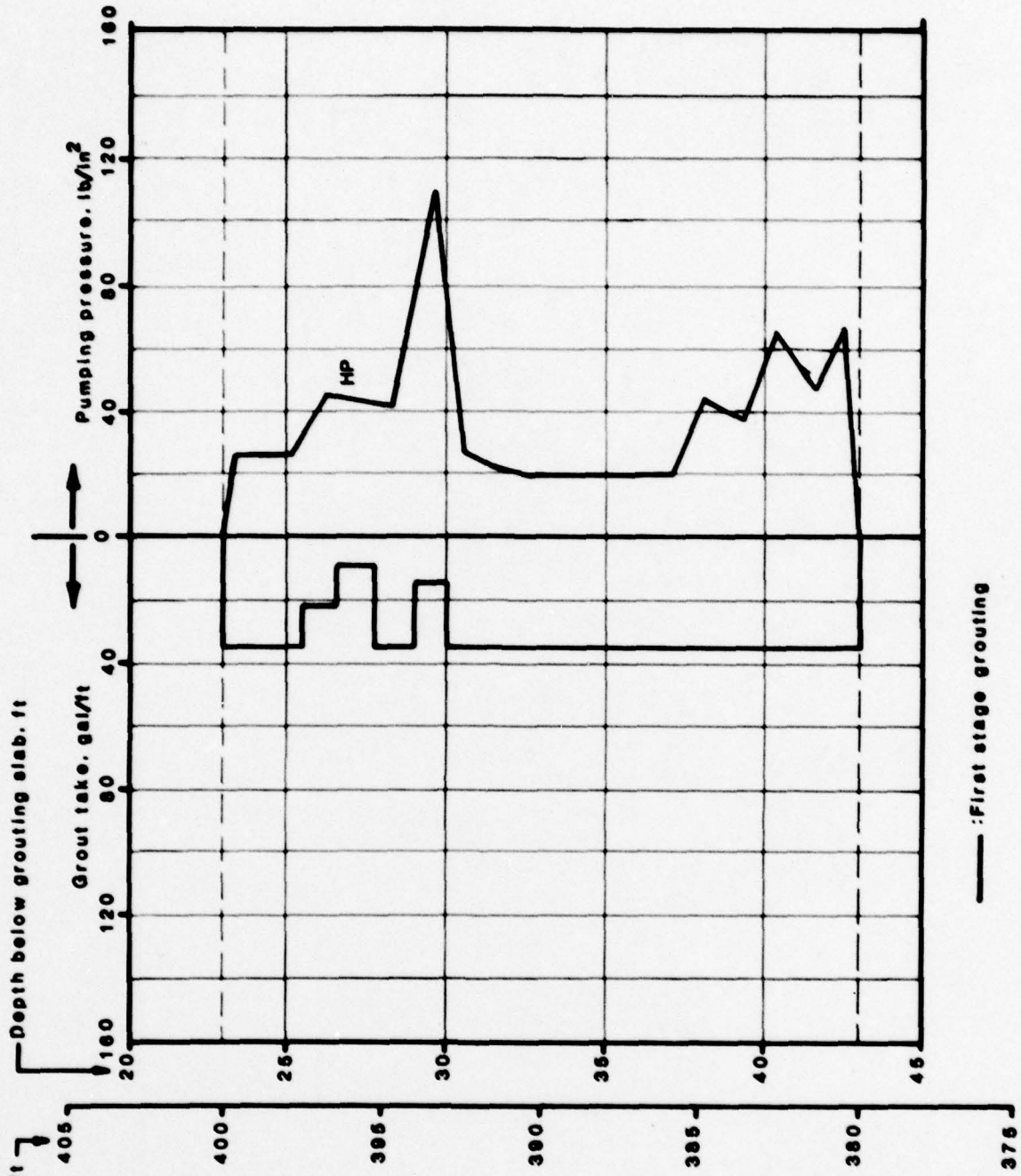
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 9-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.49

V7C025 Phase III



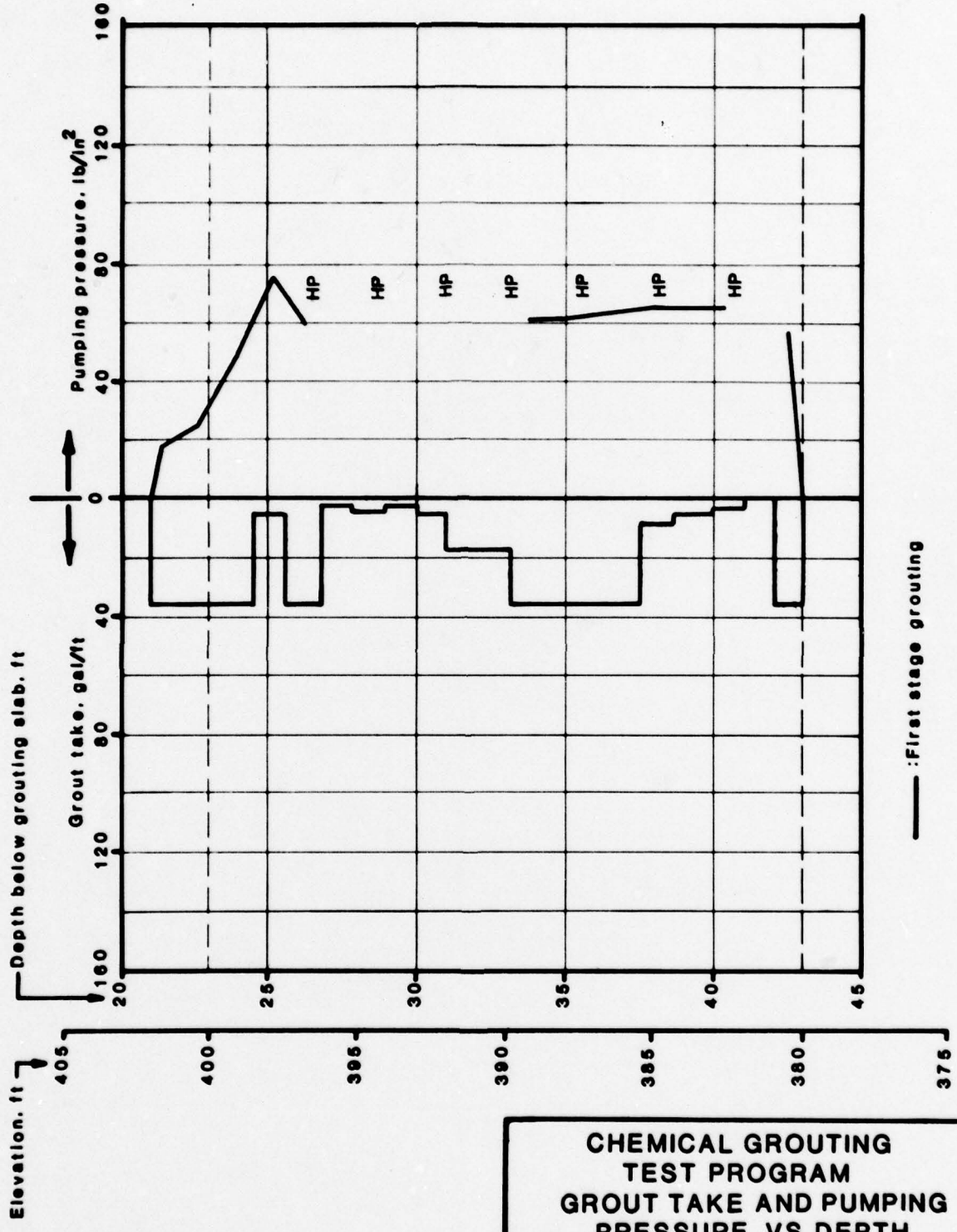
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No.9-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Fig. E.50

Y7C026 Photo 2



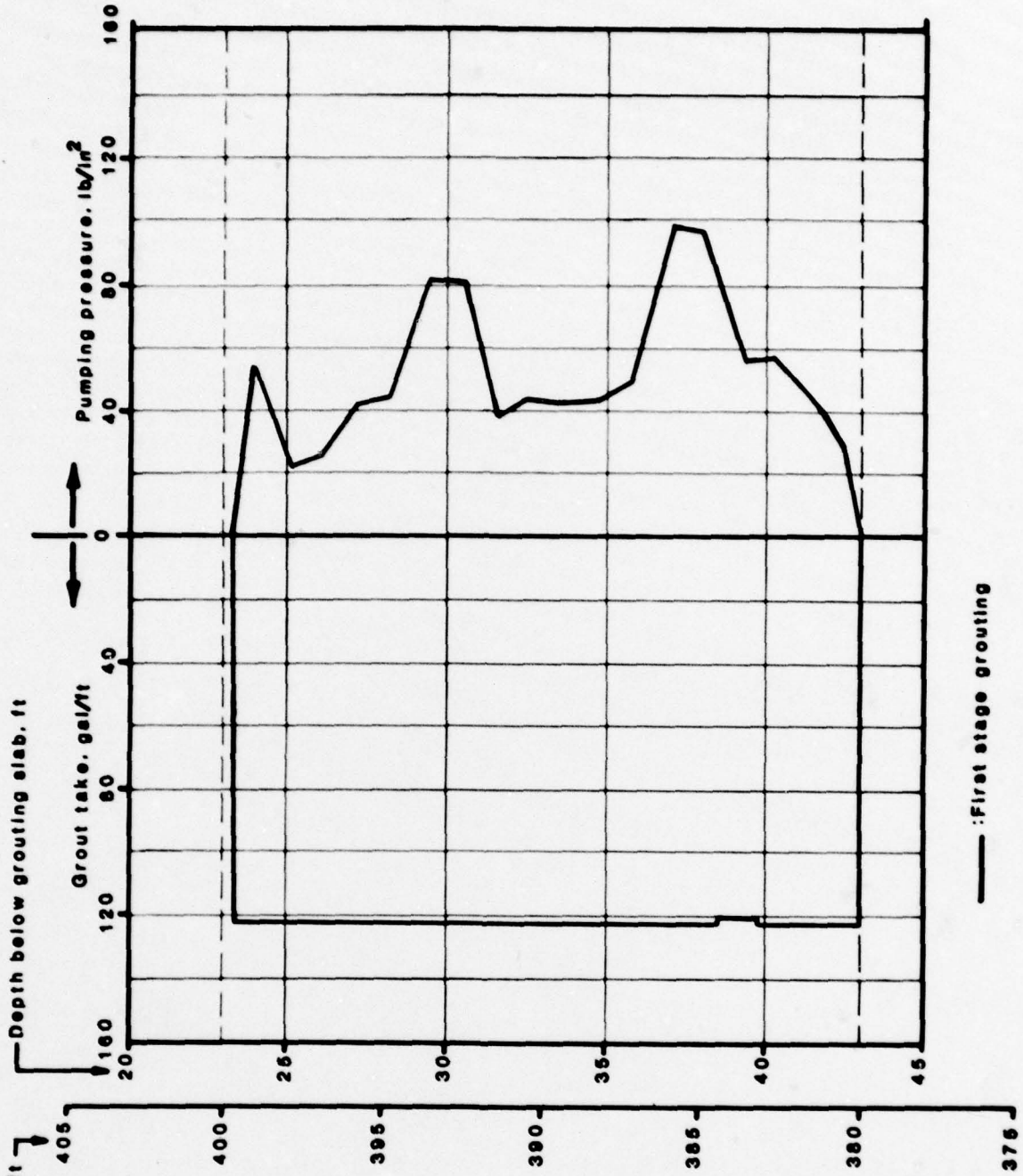
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 9-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Fig. E.51

Y7C826 Phase IX



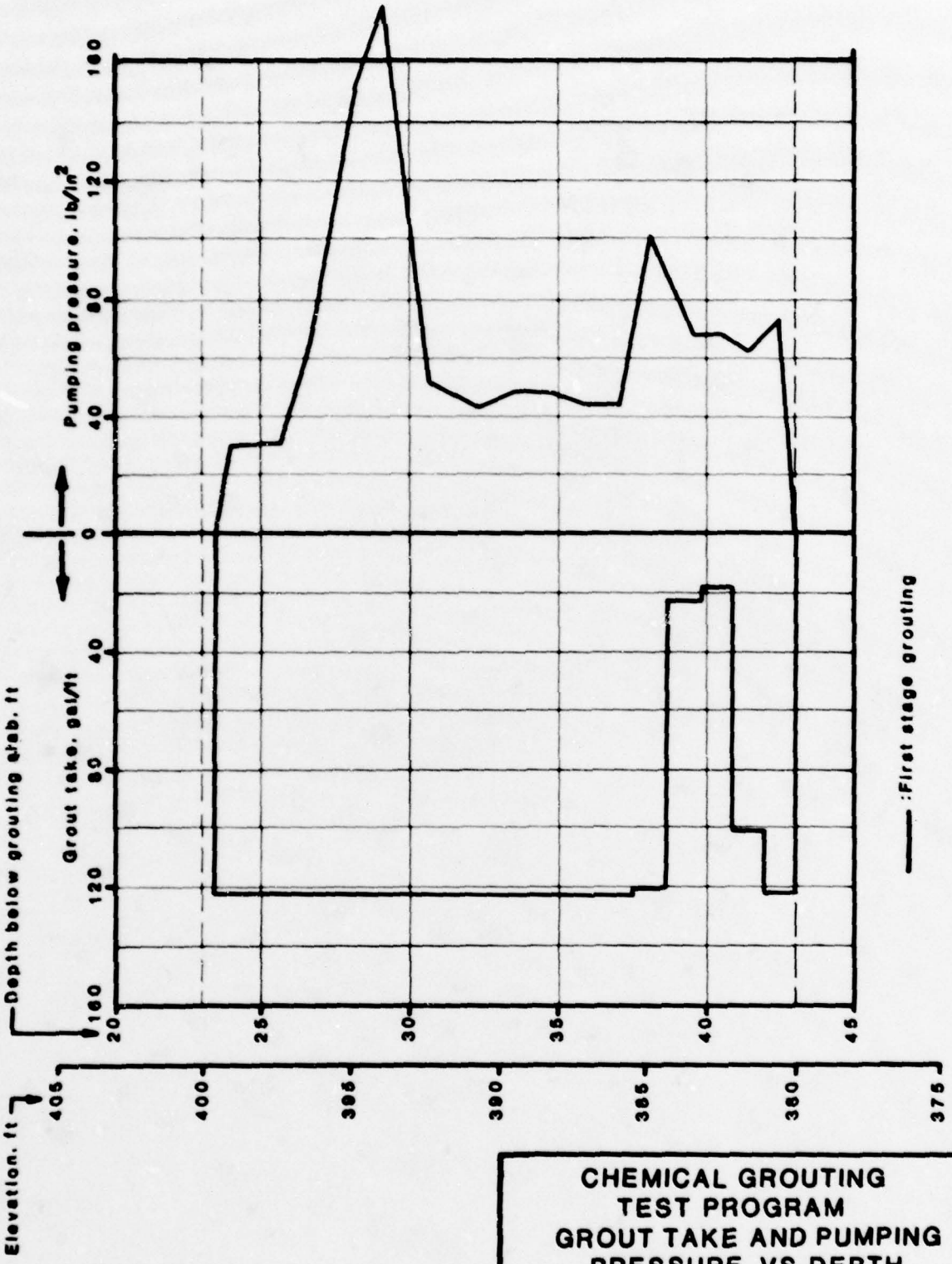
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 10-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

Fig. E.52

V7C826 Photo



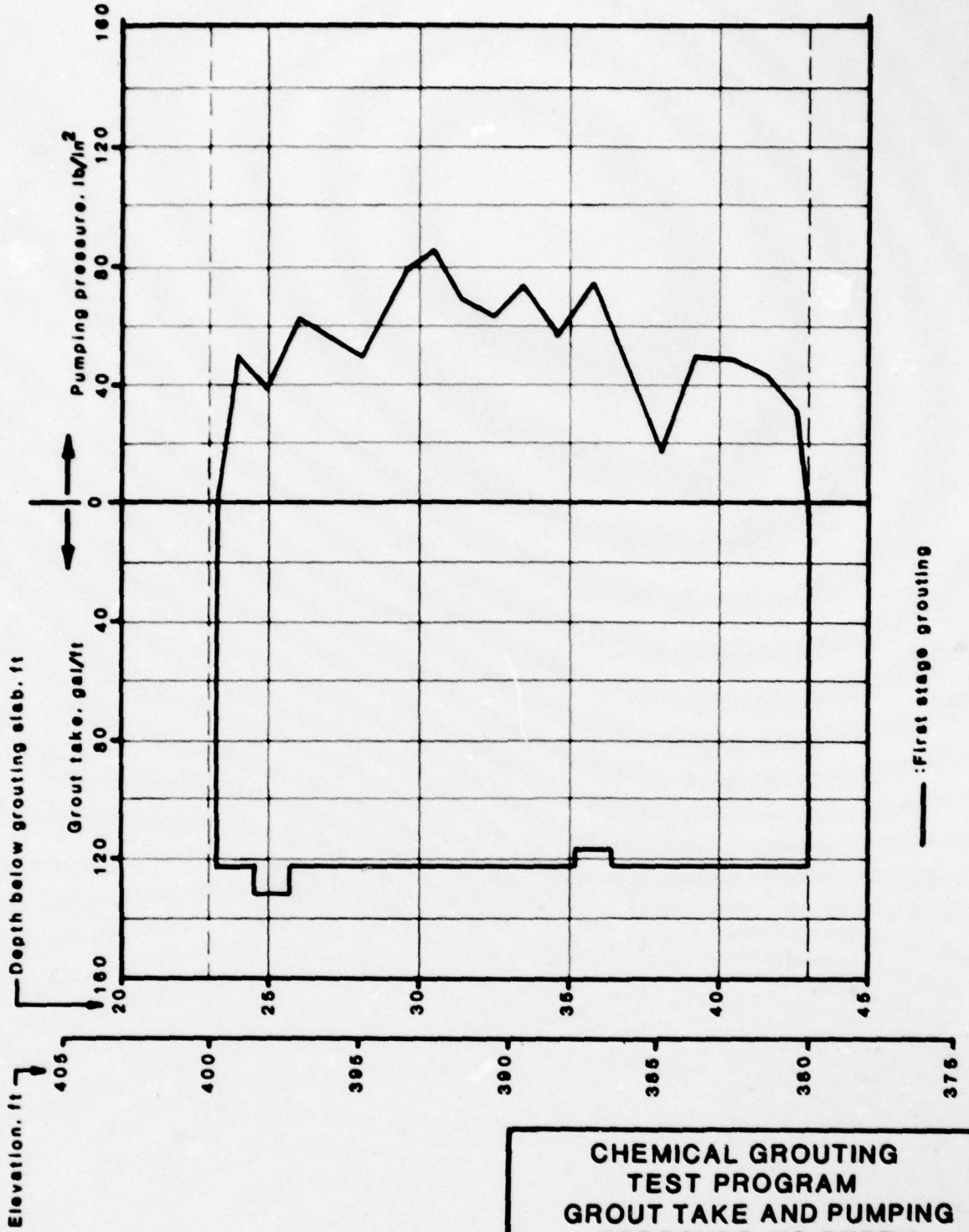
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 10-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Fig. E.53

V7C026 Phase III



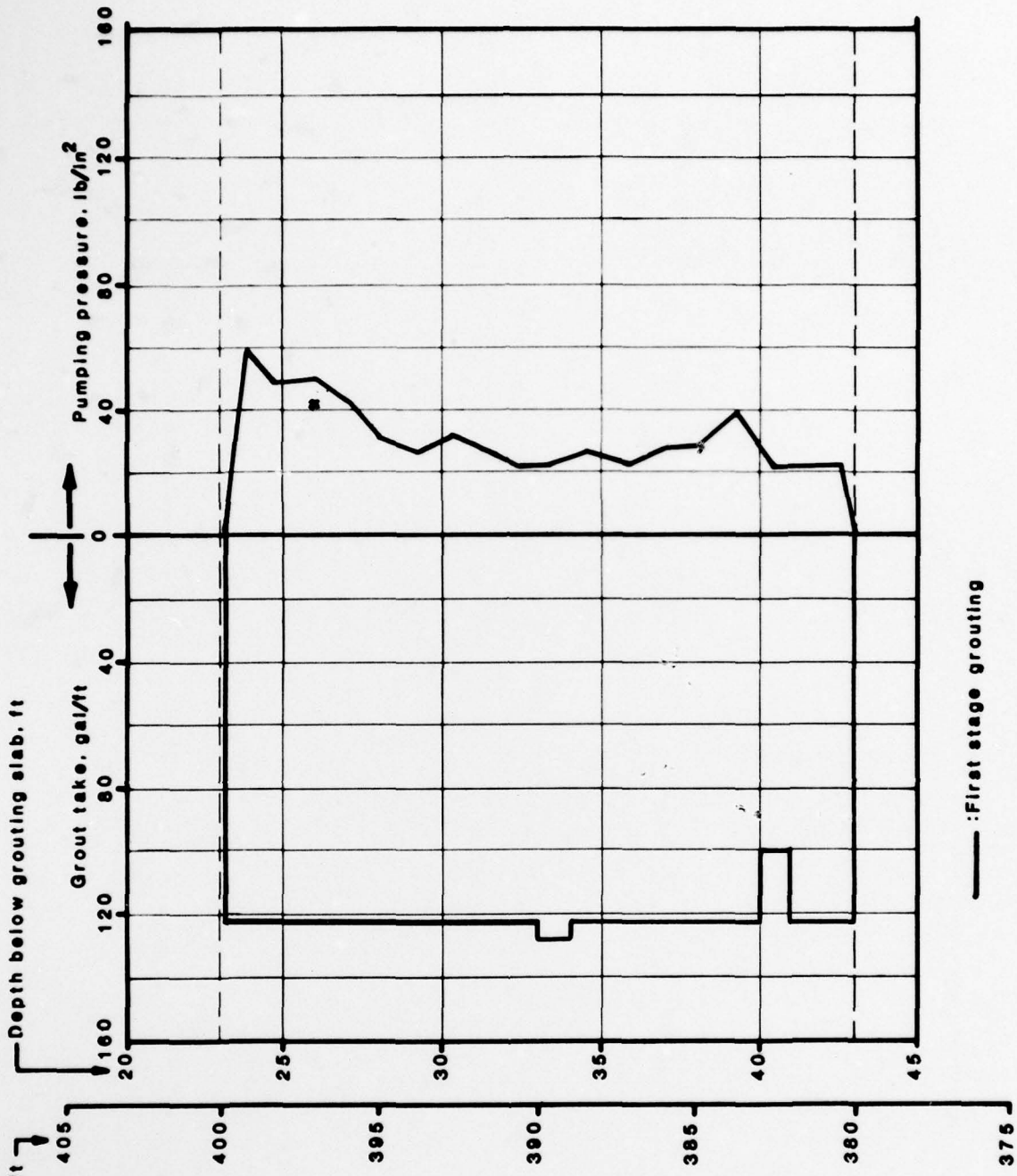
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 10-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Y7C626 Phase IX

Fig. E.54



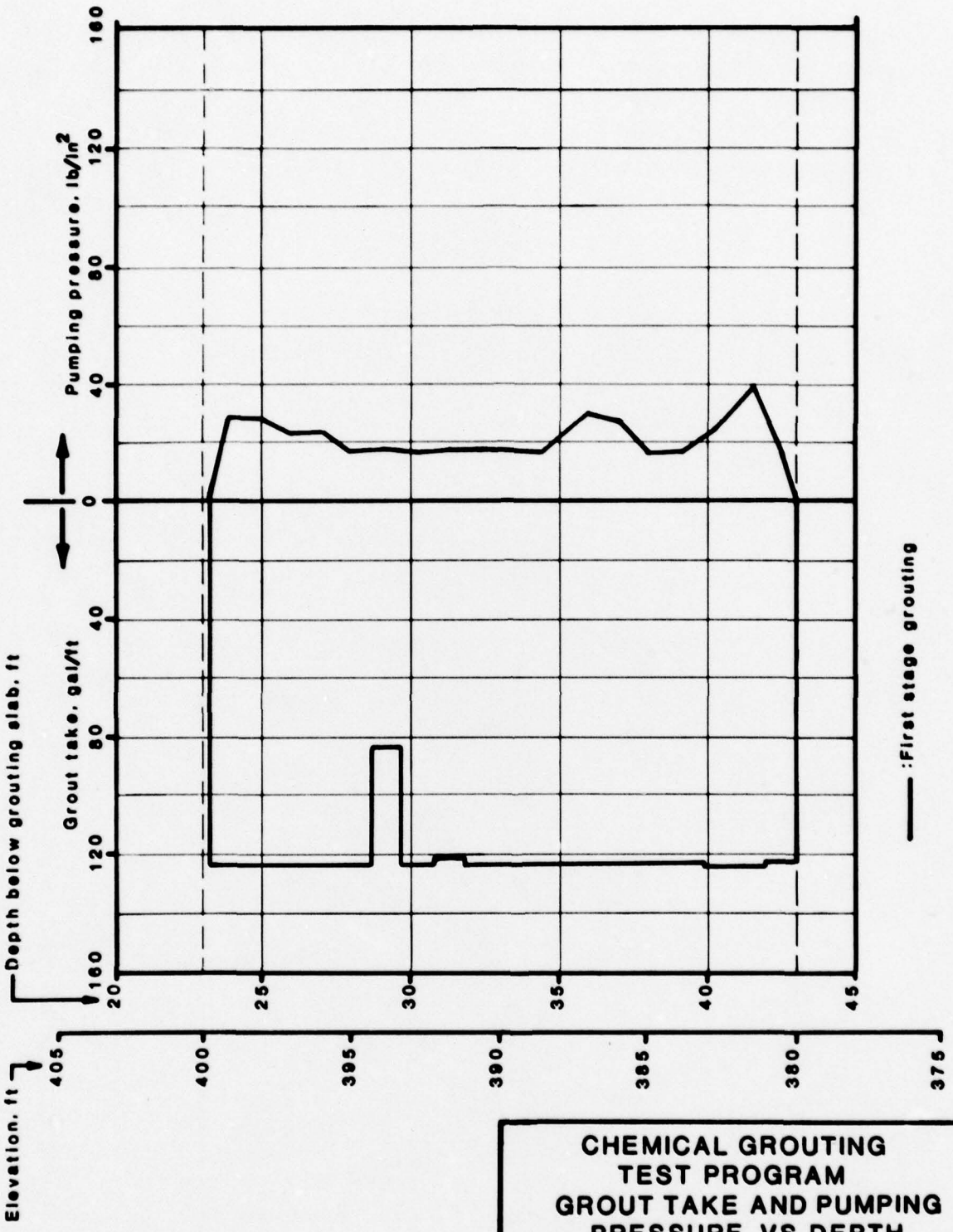
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 10-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Y7C826 Phase IX

Fig. E.55



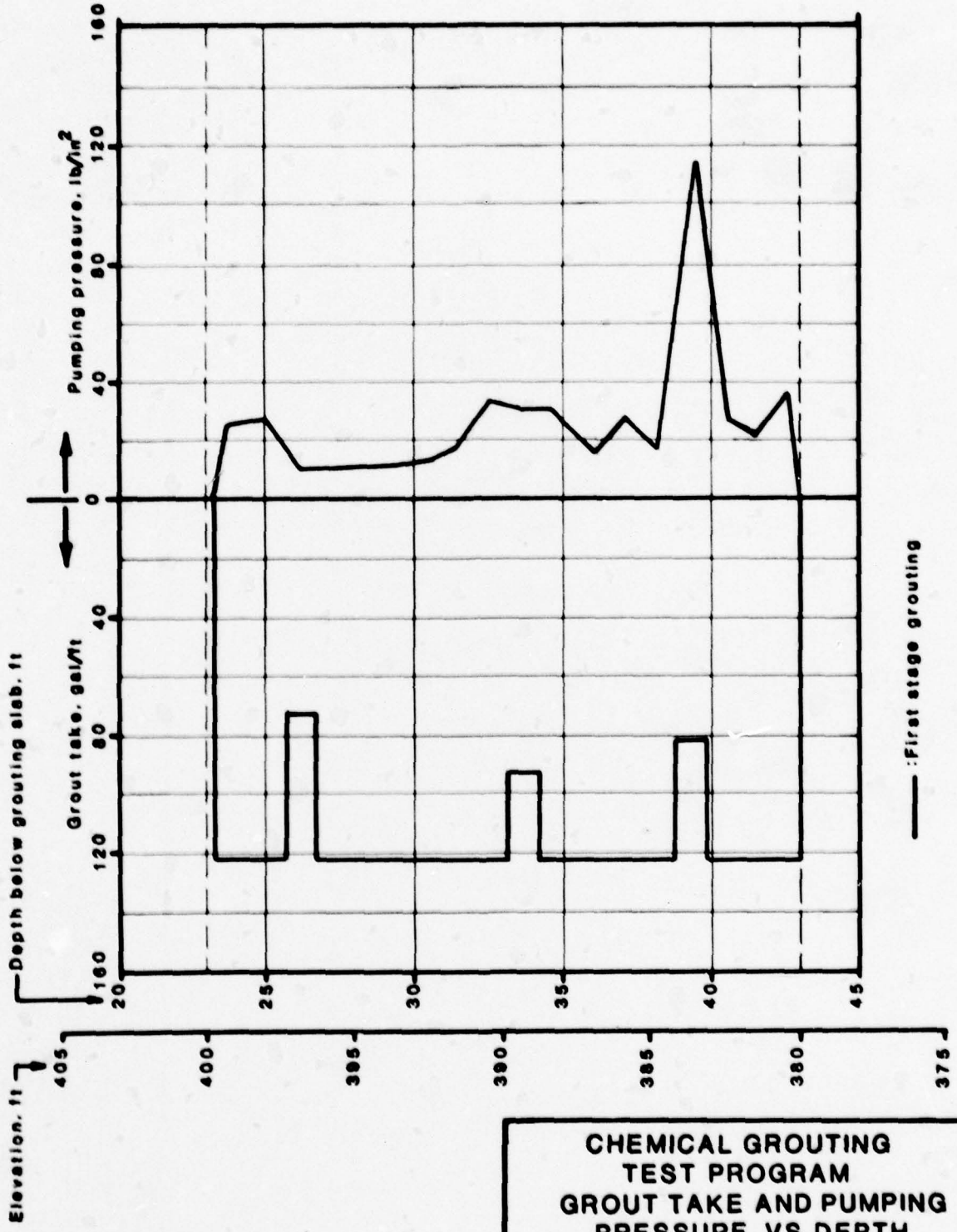
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 10-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0066

Woodward-Clyde Consultants

Y7C026 Phase IX

Fig. E.56



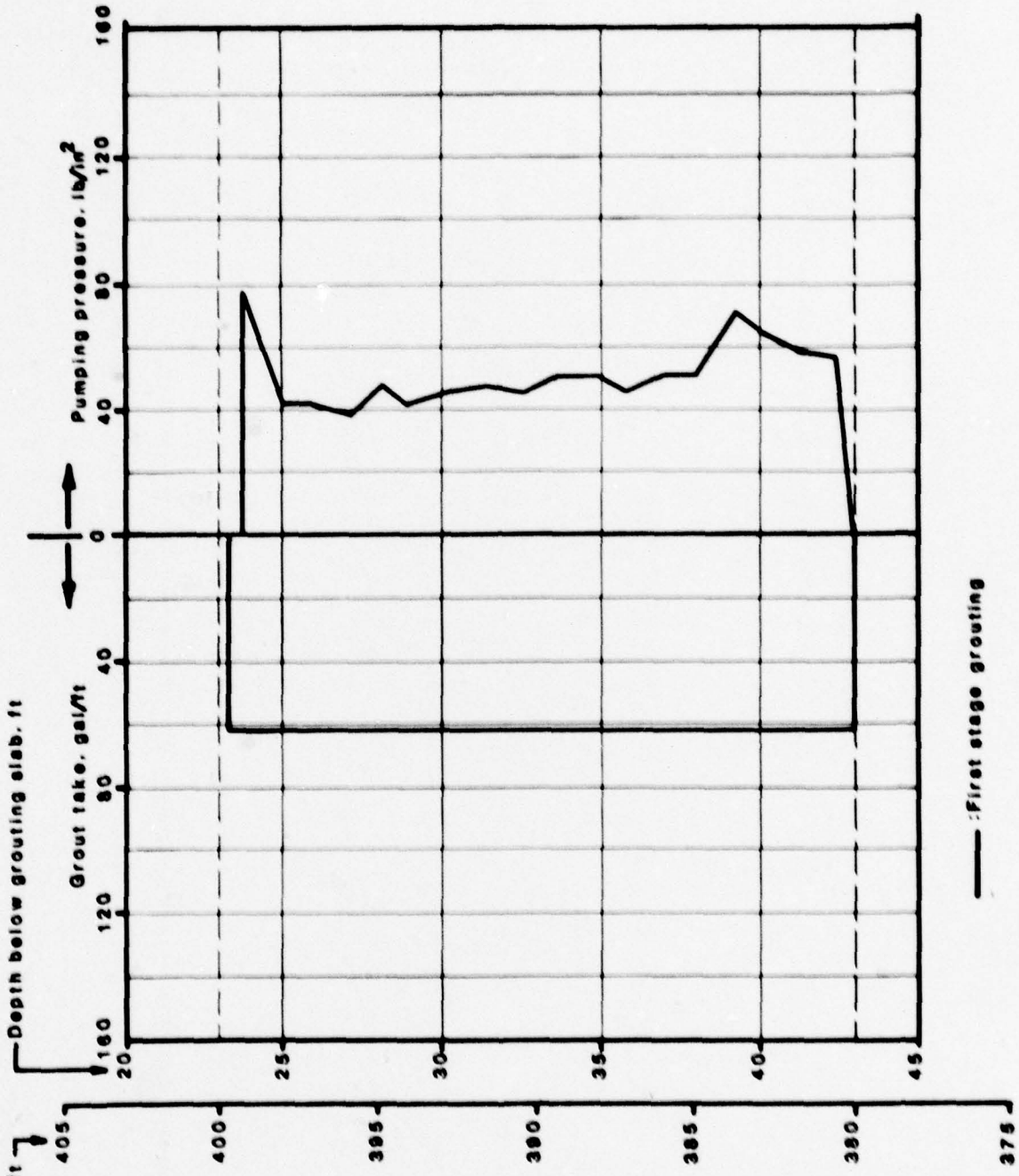
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 10-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.57

77C026 Phase III

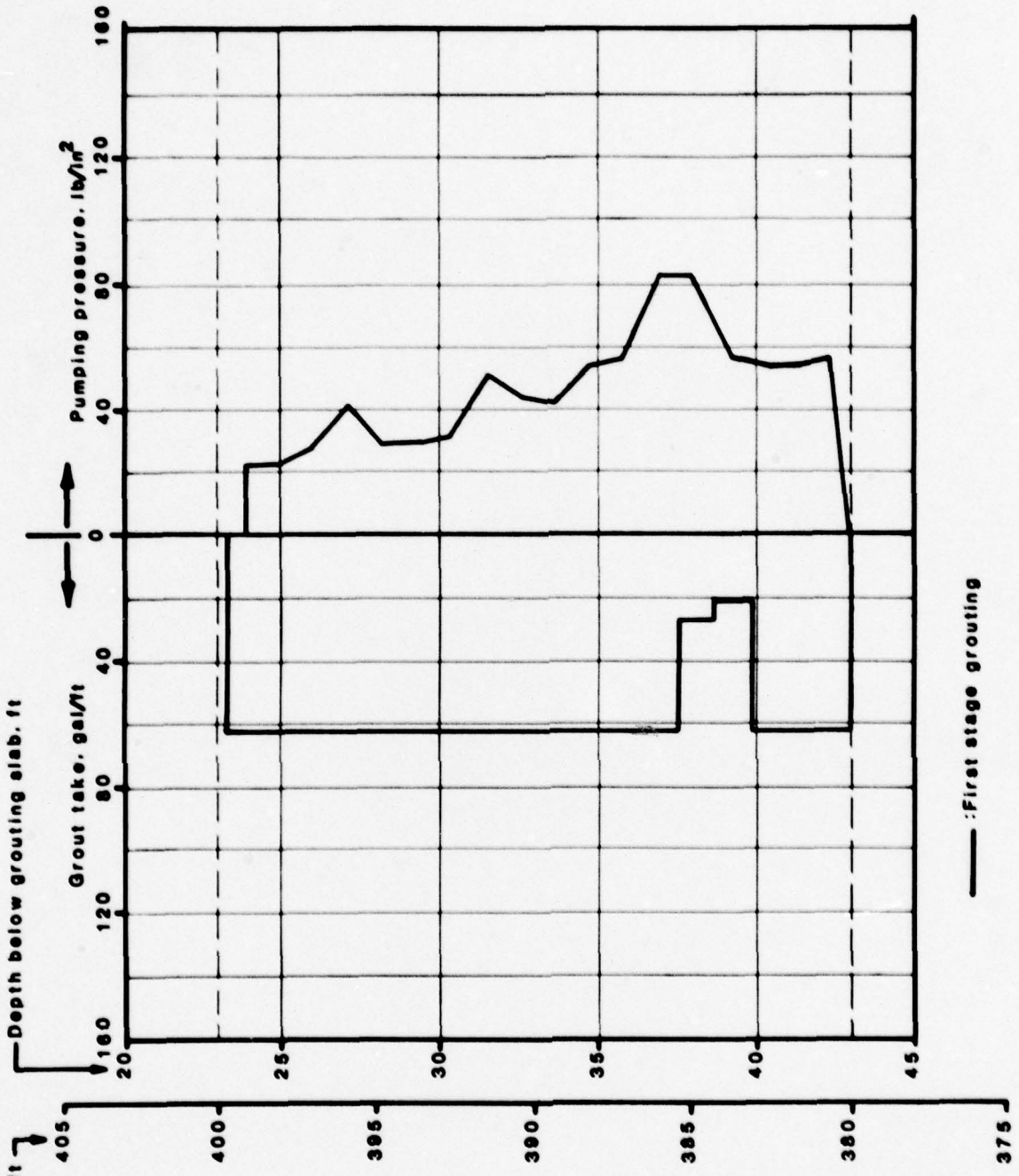


CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 11-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0068

Woodward-Clyde Consultants

Fig. E.58



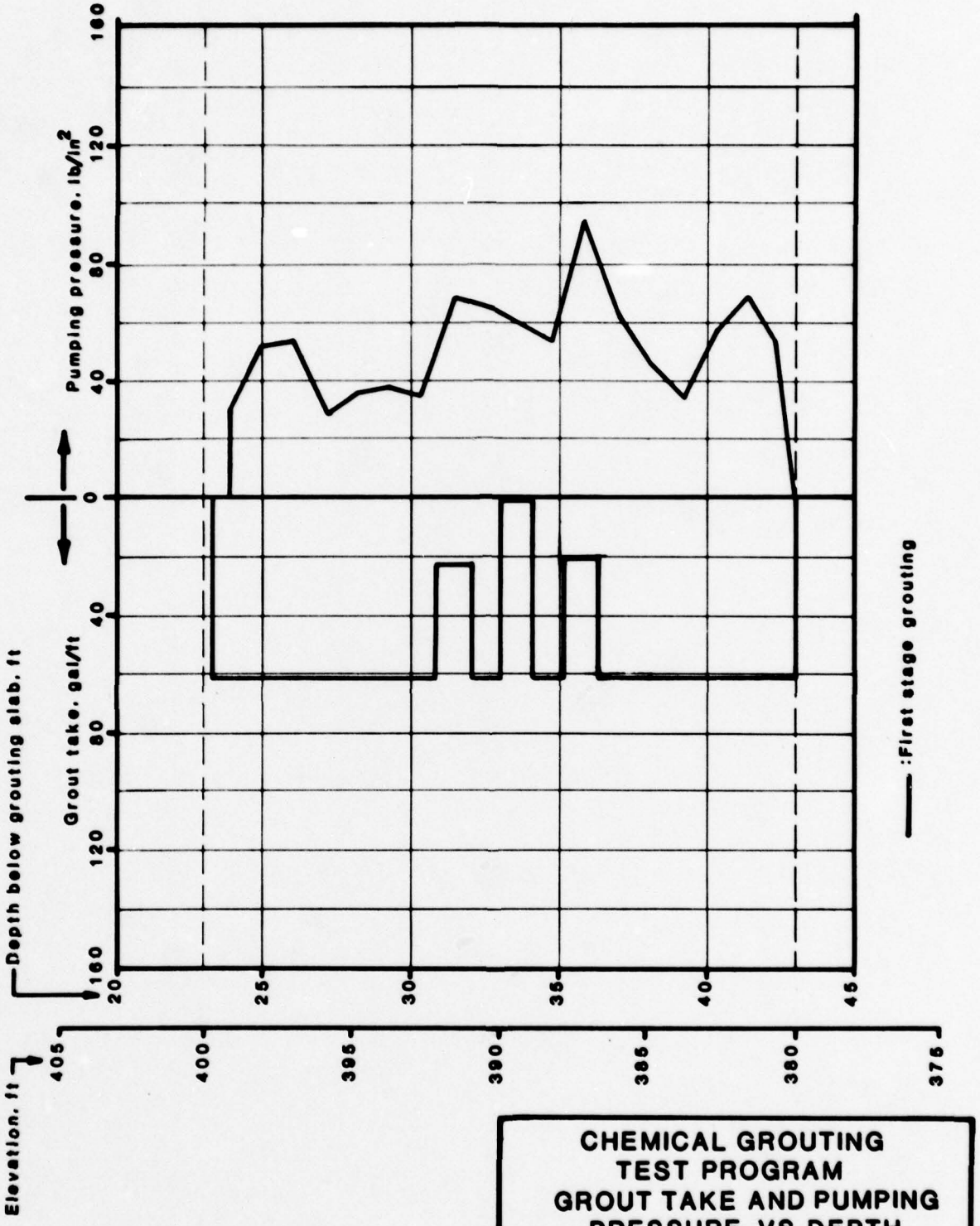
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 11-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0069

Woodward-Clyde Consultants

Fig. E.59

V7C026 Phase III



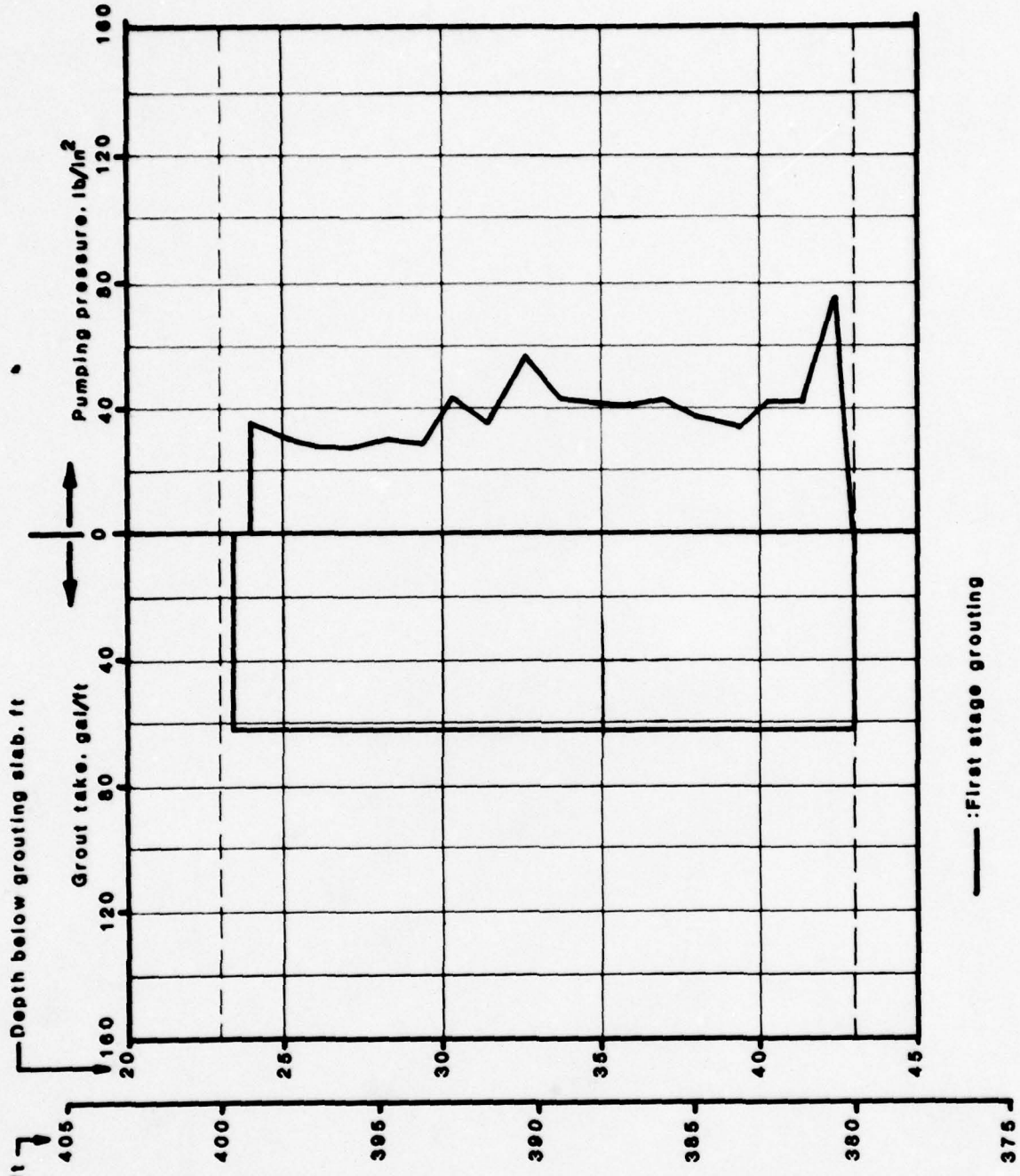
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 11-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

V7C026 Phase III

Fig. E.60



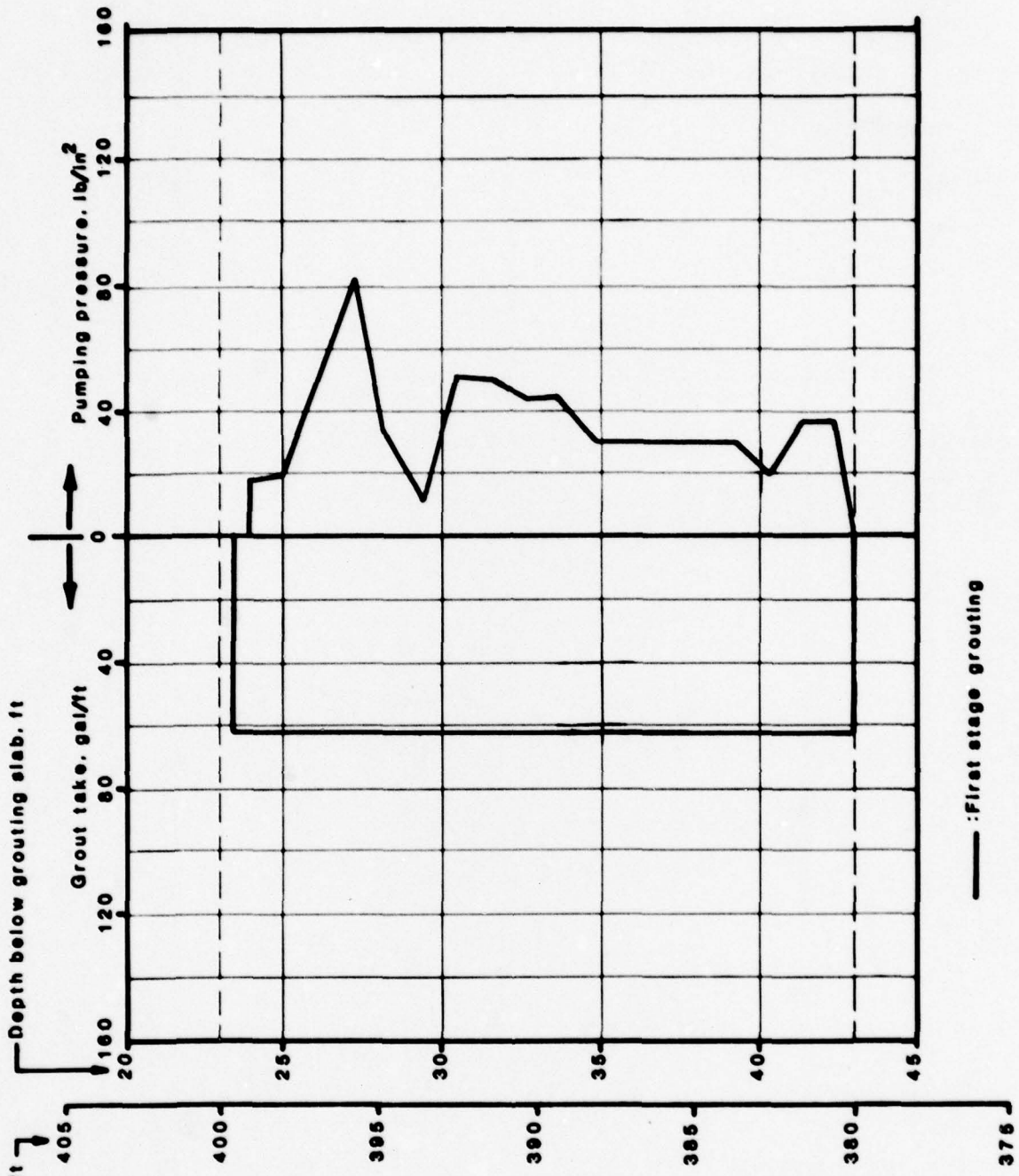
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 11-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Fig. E.61

V7C826 Phase IX



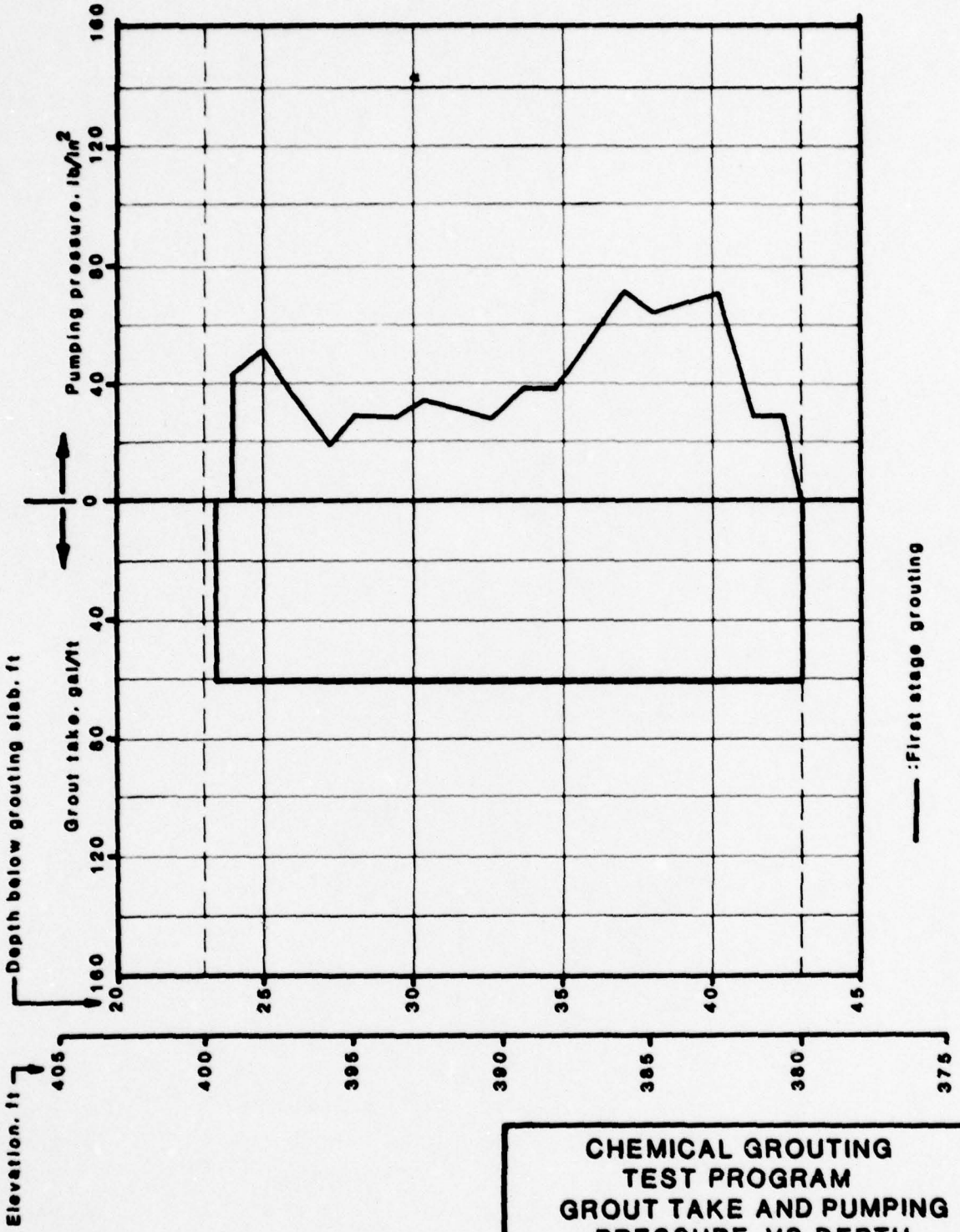
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 11-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. E.62

V7C025 Phase II



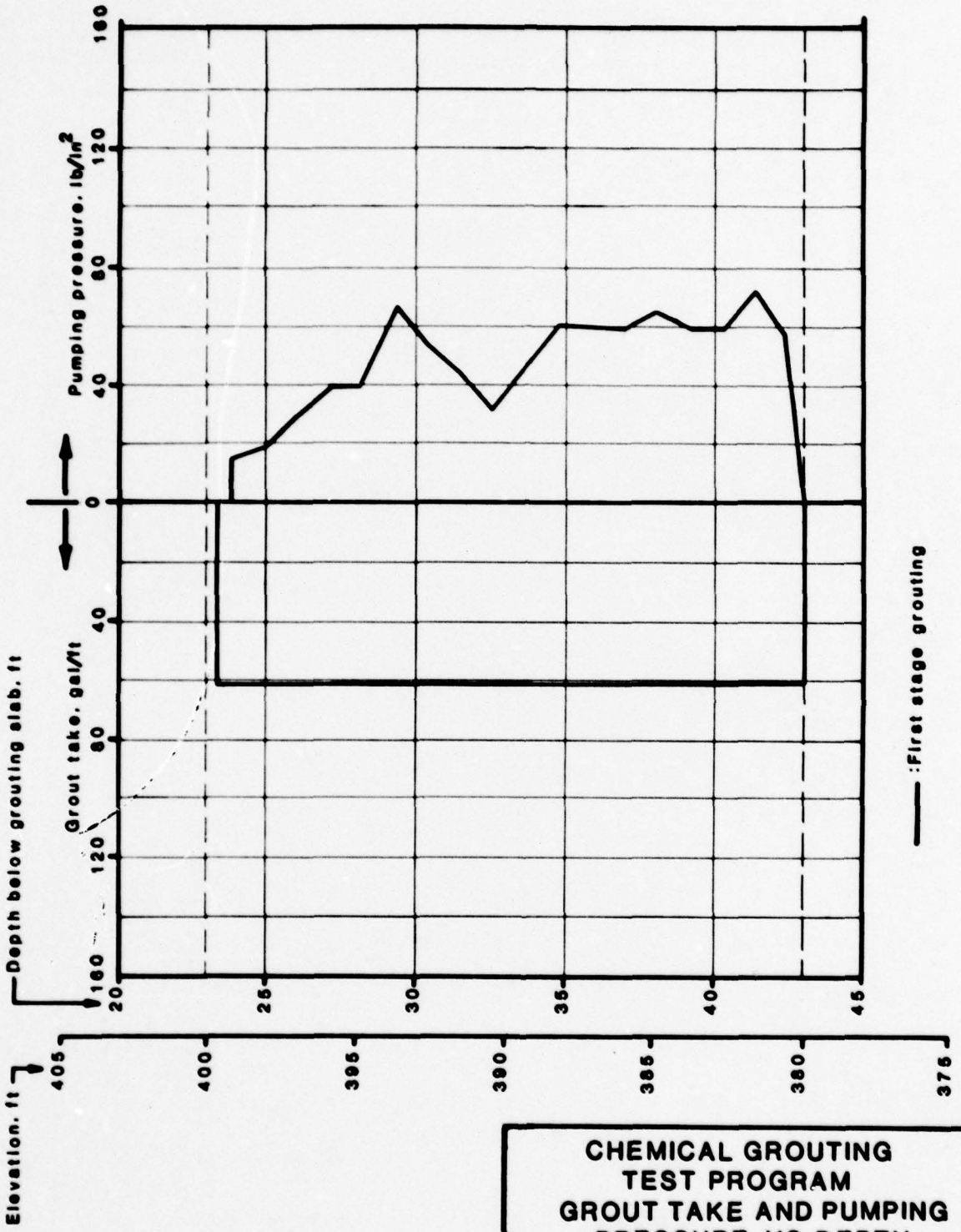
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 11-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0095

Woodward-Clyde Consultants

Fig. E.63

V7C026 Phase III



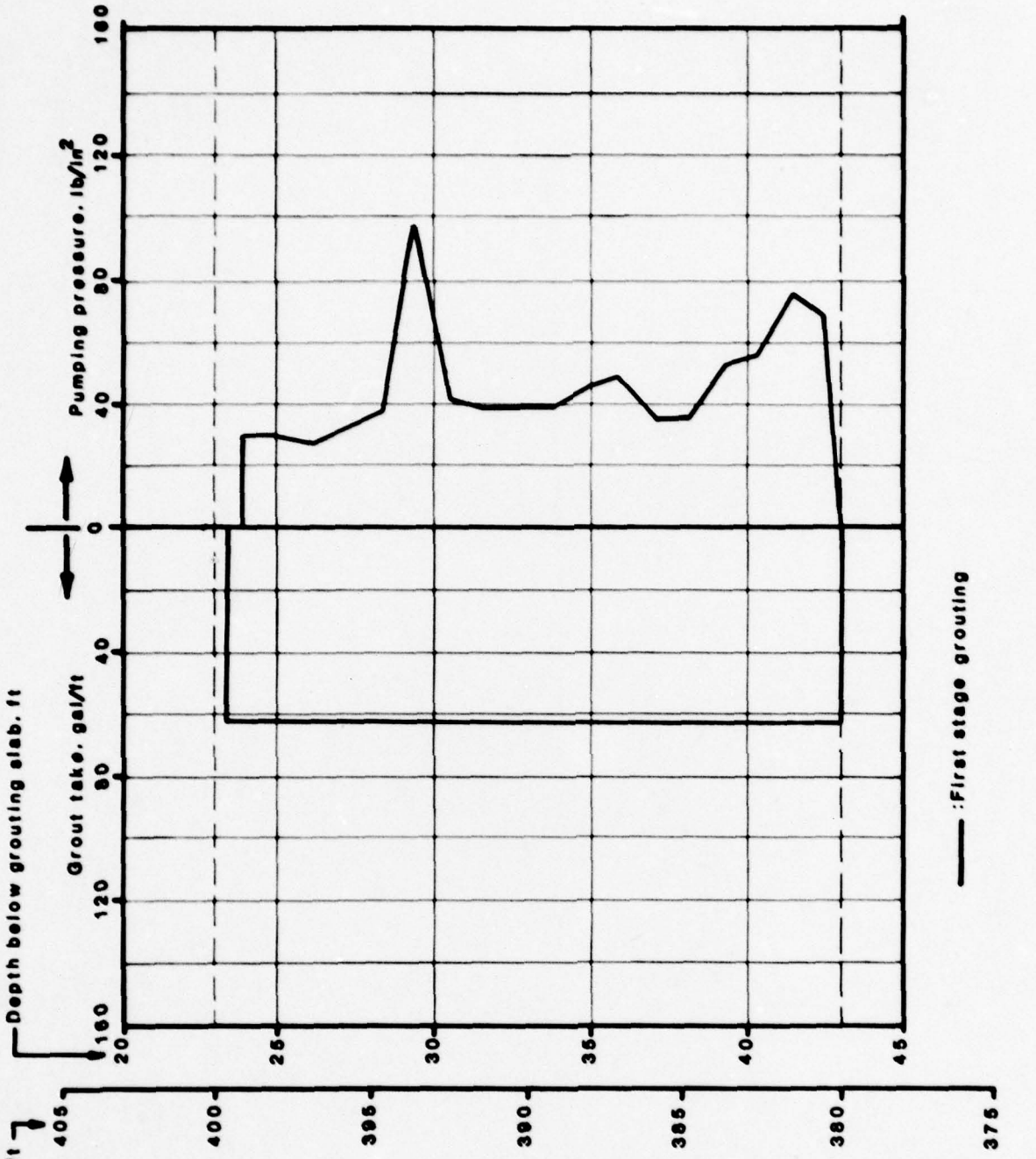
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 11-7

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig. E.64

YYC026 Phase IX



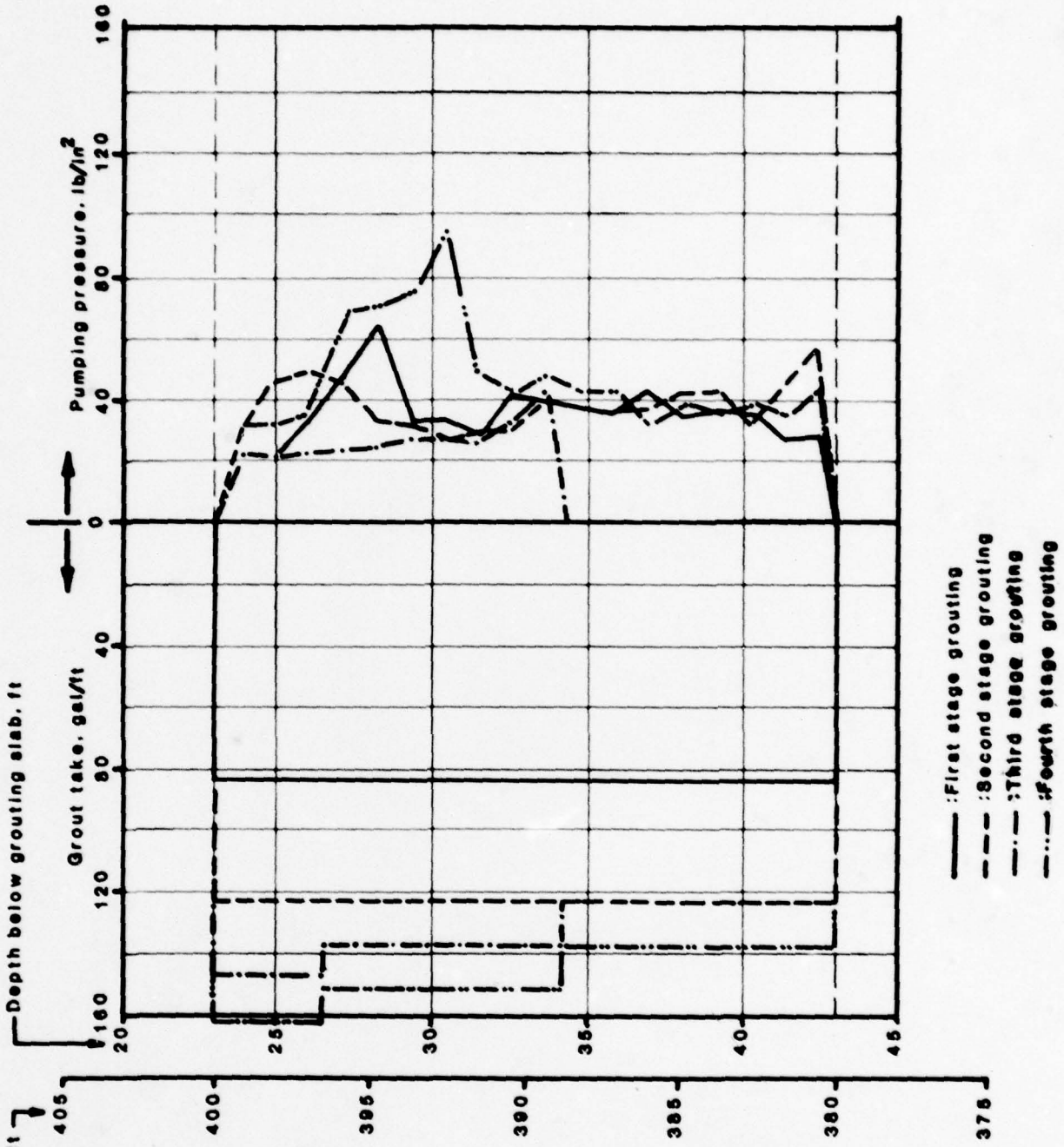
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 11-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.65

YYC626 Phase IX



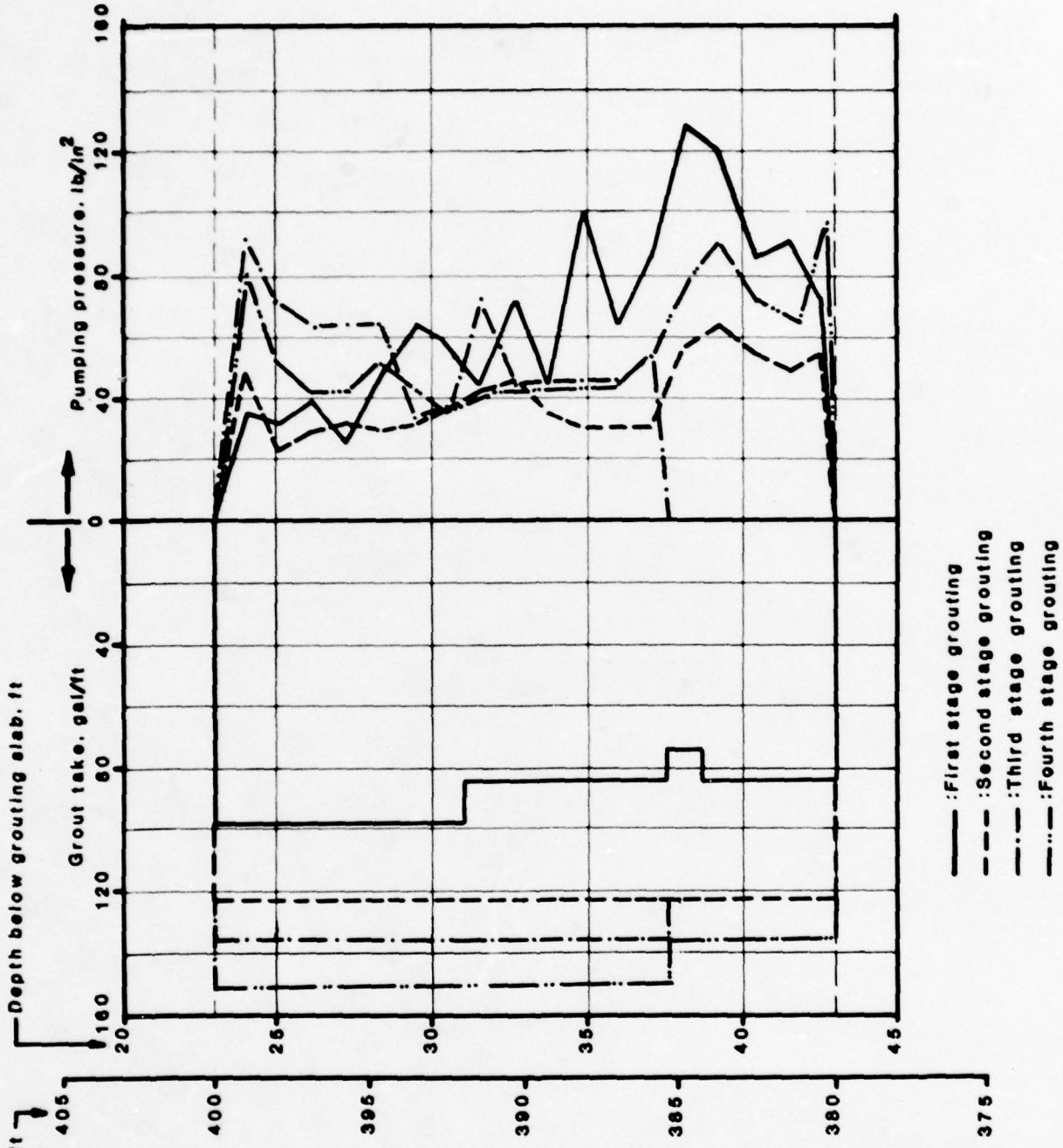
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 12-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig. E.66

Y7C026 Phase IX



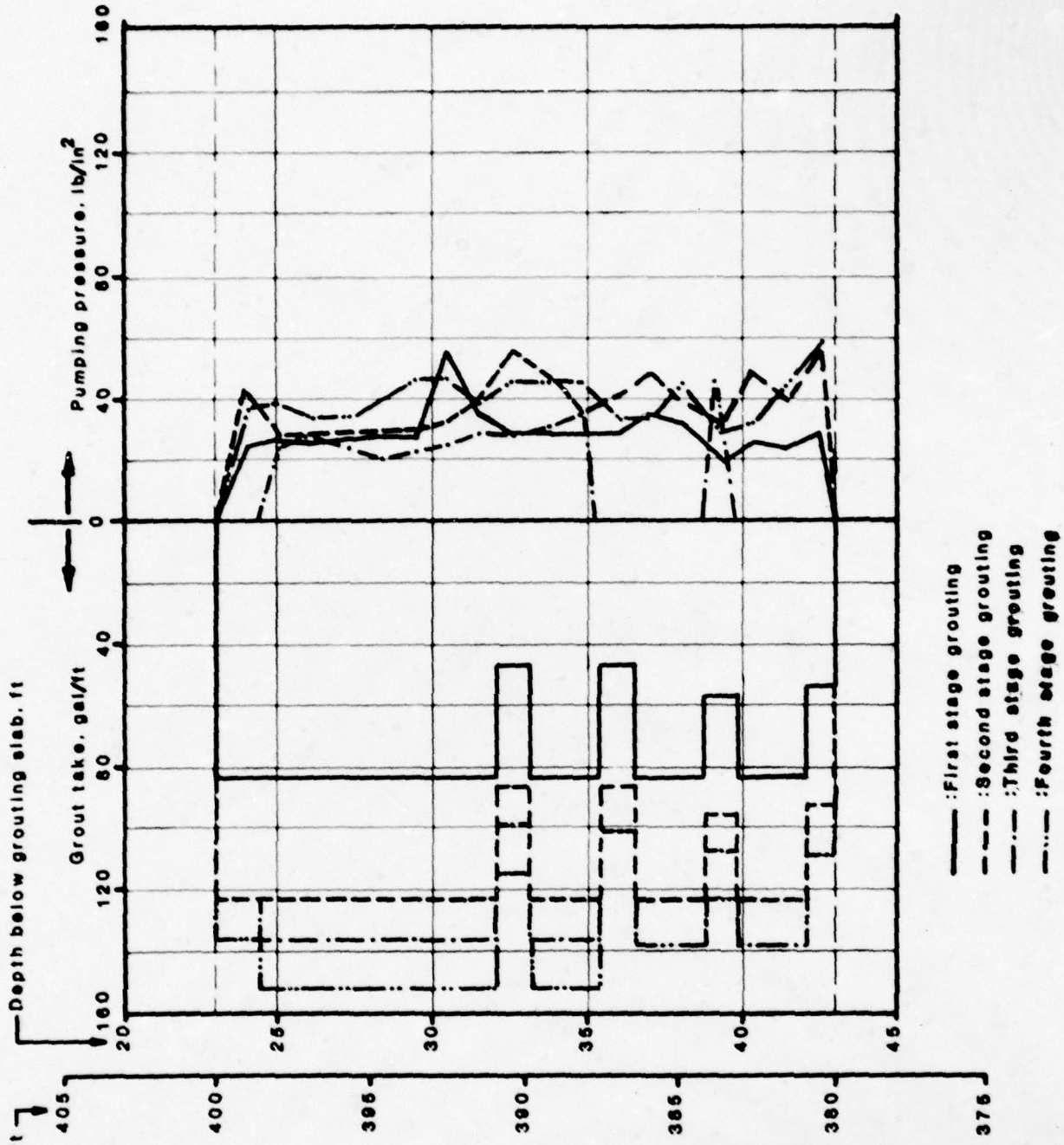
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 12-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Y7C826 Phase IX

Fig. E.67



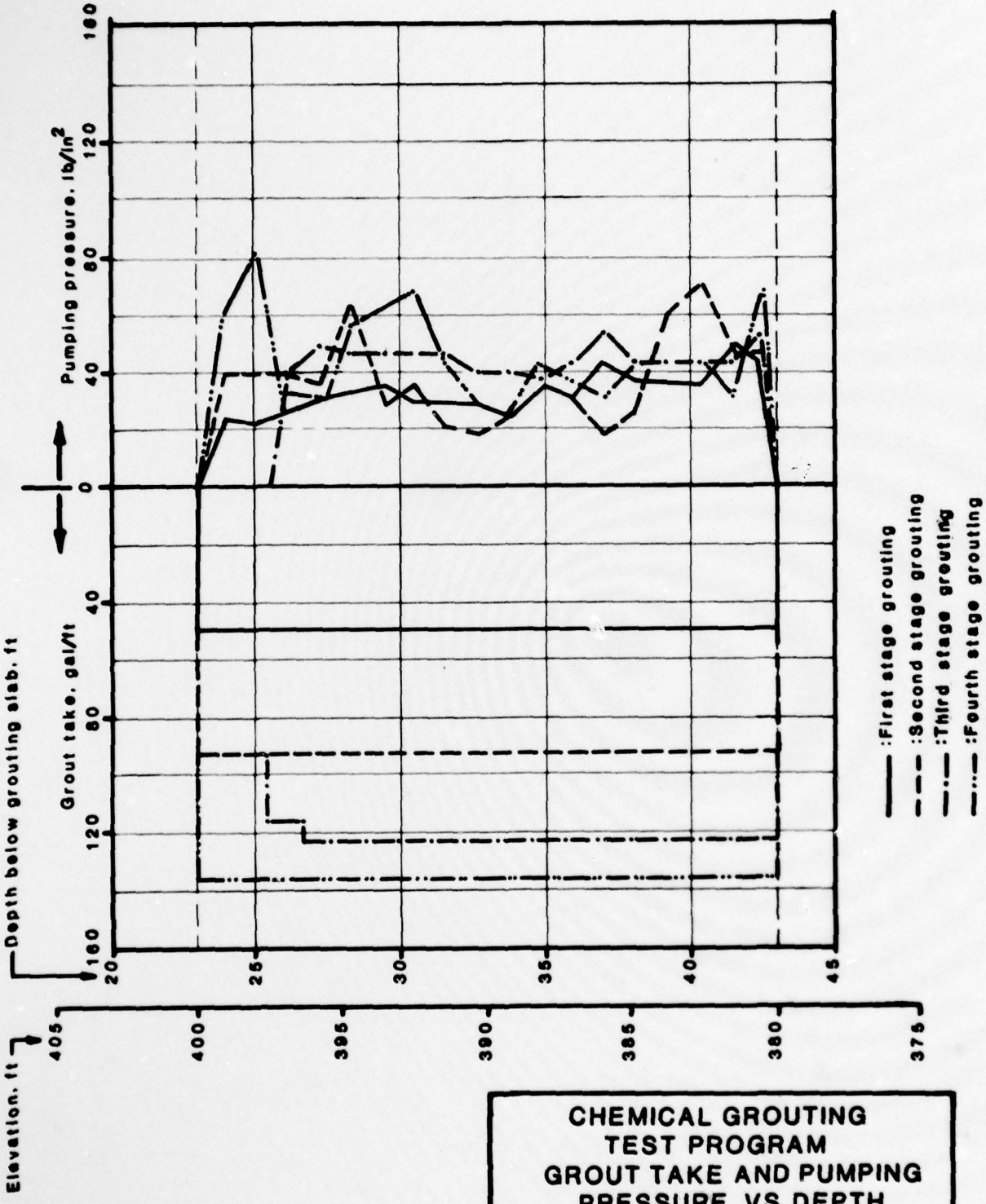
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 12-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

VTC825 Phase III

Fig. E.68



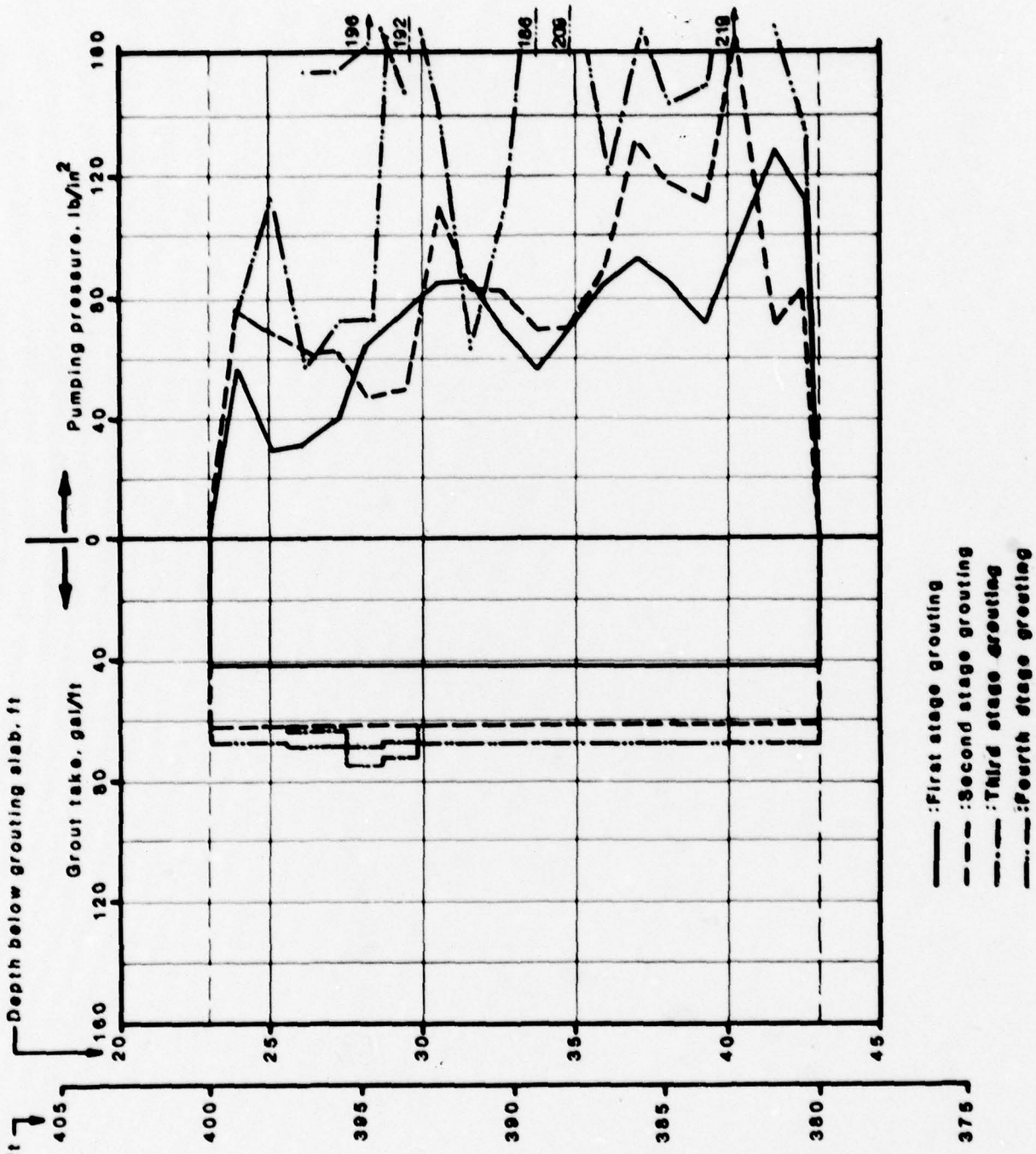
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 12-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. E.69

V7C826 Phase III



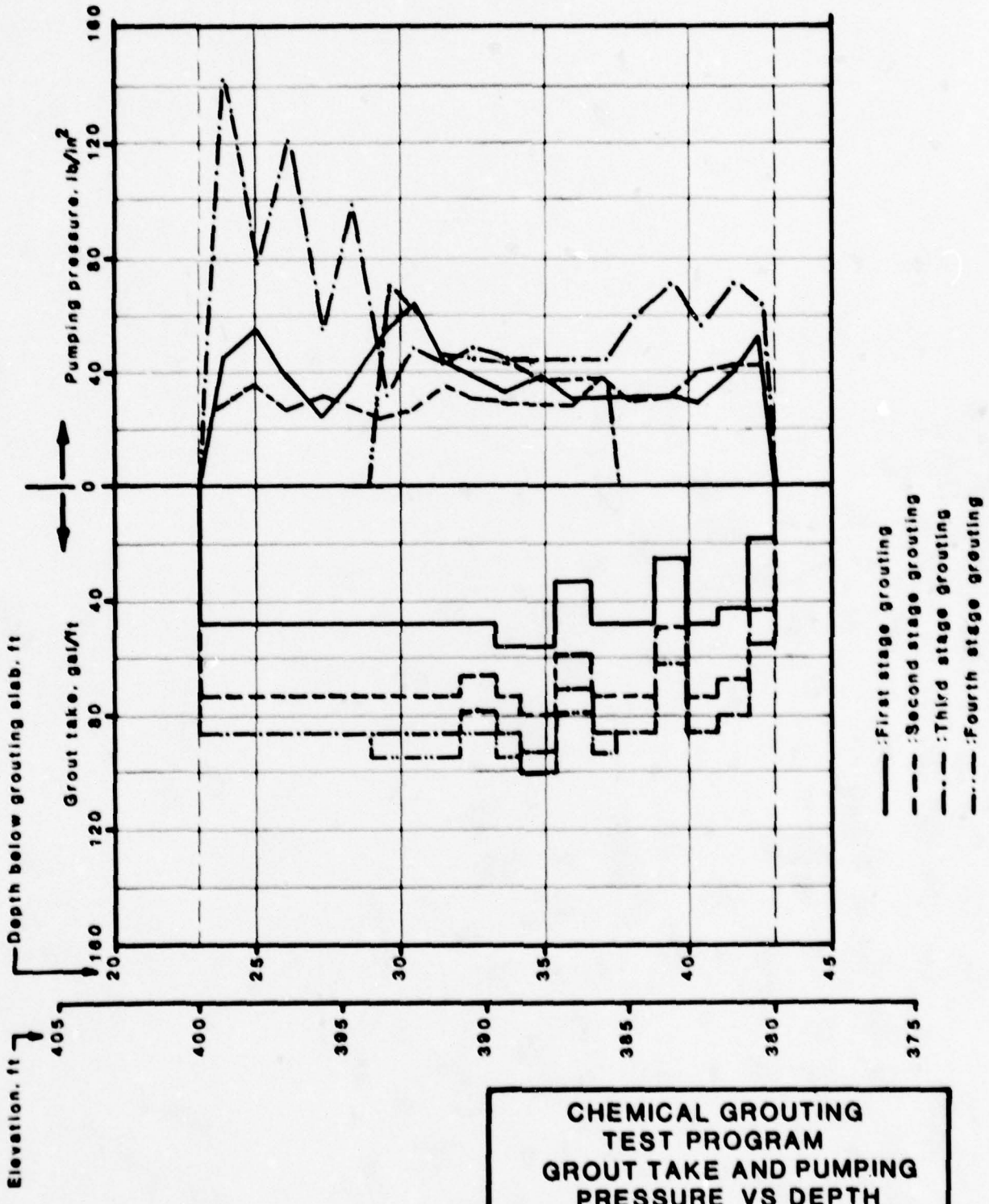
CHEMICAL GROUTING TEST PROGRAM
GROUT TAKE AND PUMPING PRESSURE VS DEPTH
GROUT HOLE No. 13-1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0068

Woodward-Clyde Consultants

Fig. E.70

V7C026 Phase III

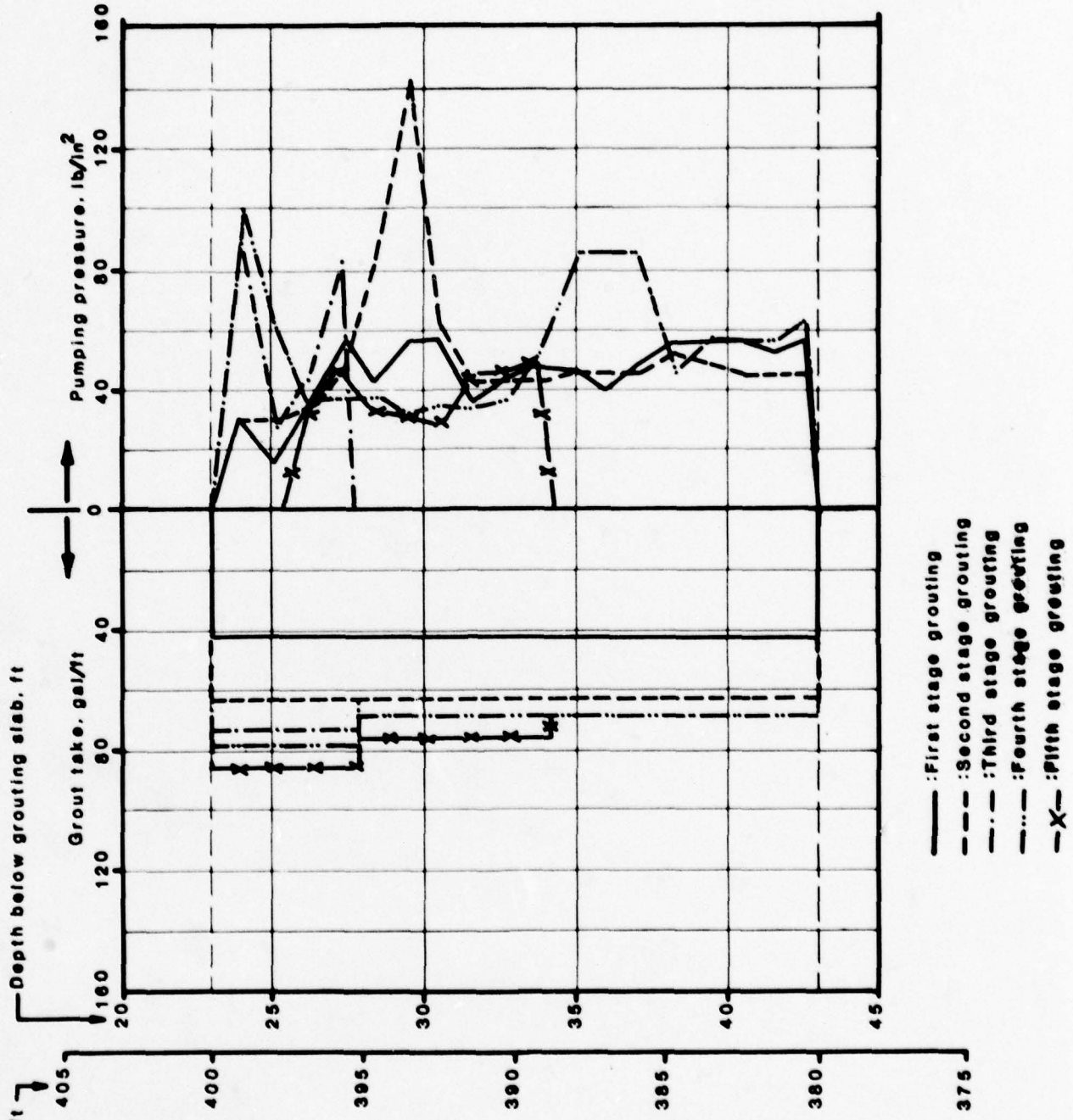


CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 13-2

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.71



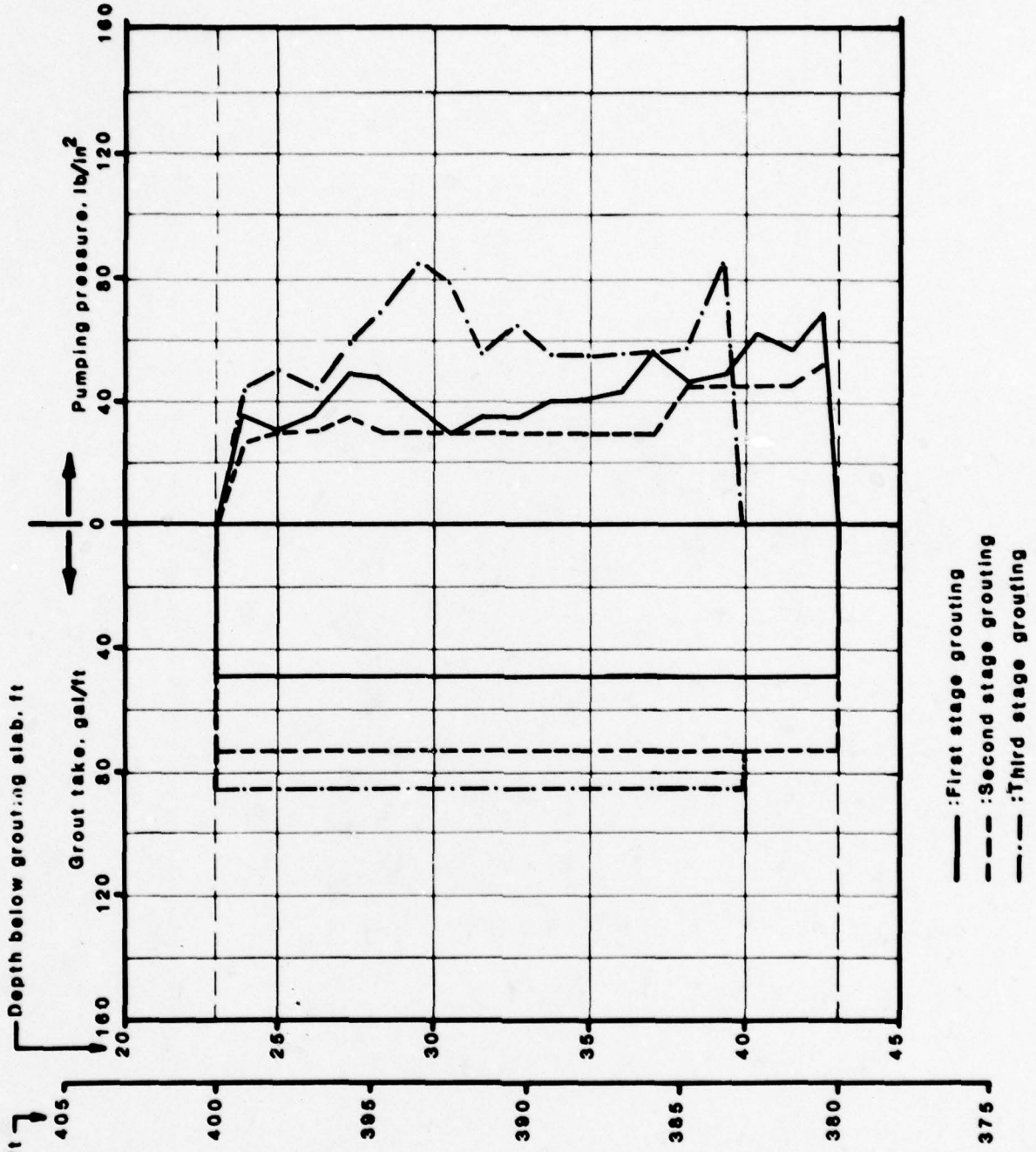
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 13-3

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0068

Woodward-Clyde Consultants

Y7C026 Phase III

Fig. E.72



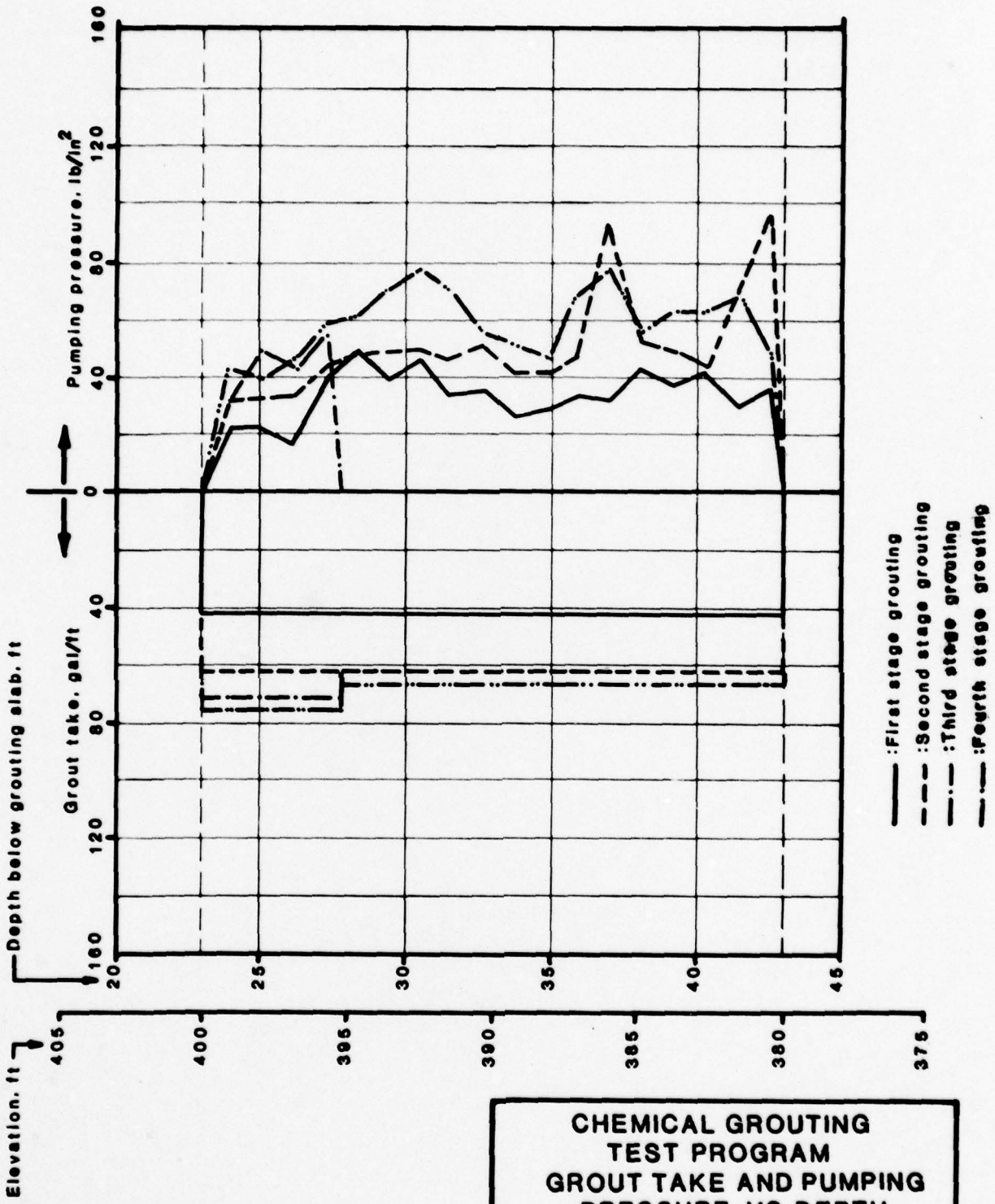
CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 13-4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. E.73

V7C026 Phase III



CHEMICAL GROUTING TEST PROGRAM GROUT TAKE AND PUMPING PRESSURE VS DEPTH GROUT HOLE No. 13-5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

V7C826 Phase IX

Fig. E.74

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

APPENDIX F

EFFECTS OF GROUTING

APPENDIX F

EFFECTS OF GROUTING

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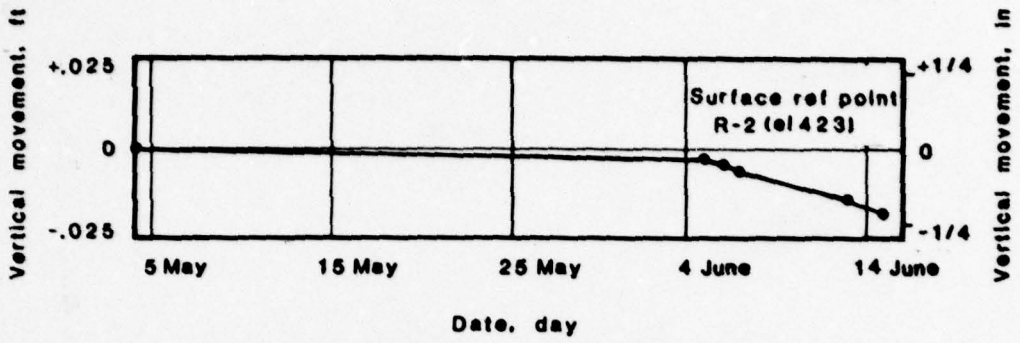
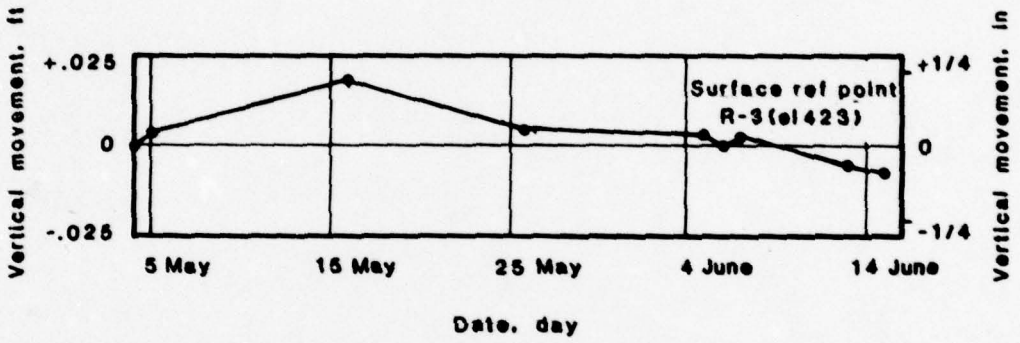
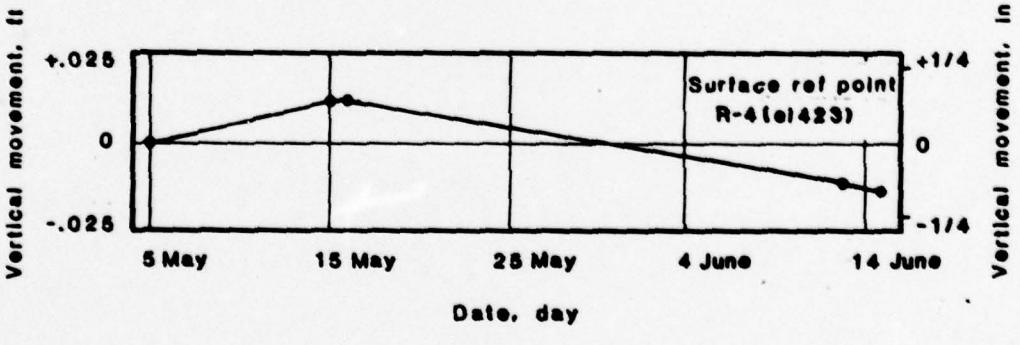






CHEMICAL GROUTING TEST PROGRAM

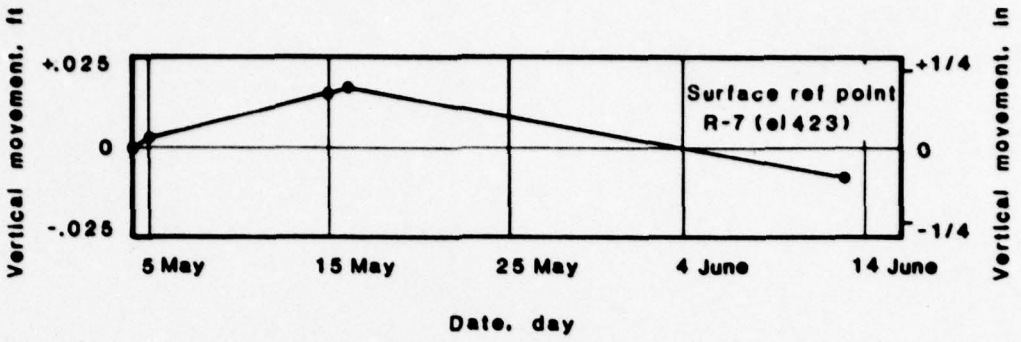
RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-2, R-3, R-4

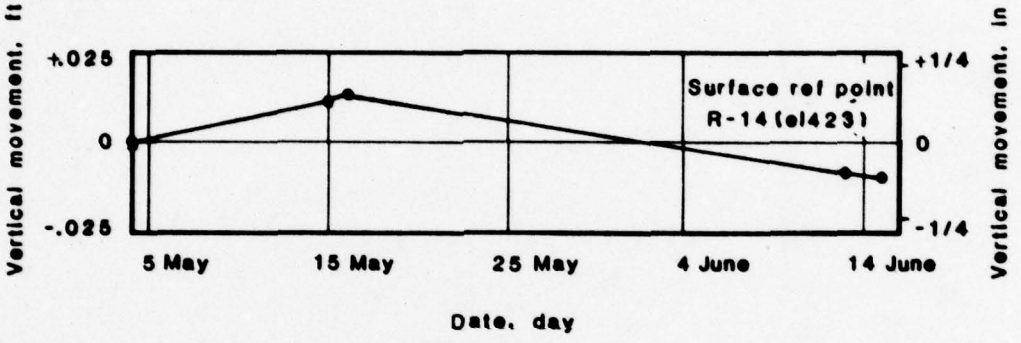
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS,
DACW43-78-C-0068

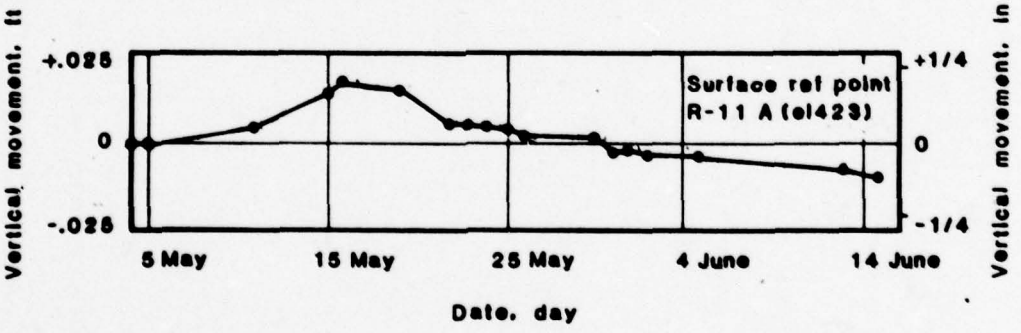
Woodward-Clyde Consultants

Y7C835 Phase II

Fig. F.1







CHEMICAL GROUTING TEST PROGRAM

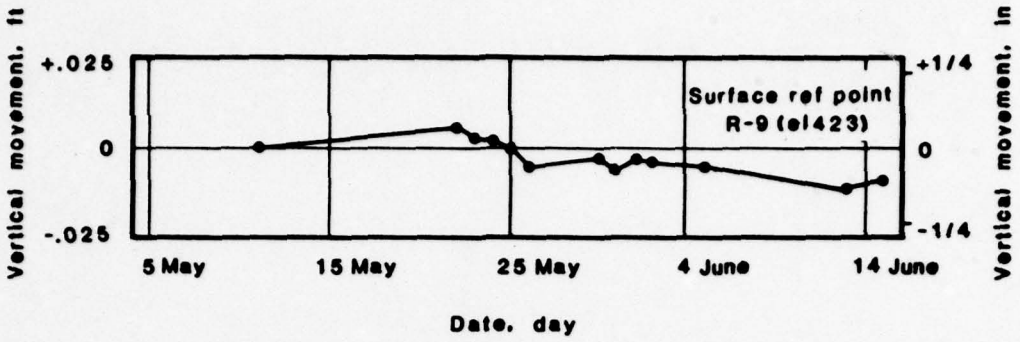
RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-7, R-14, R-11A

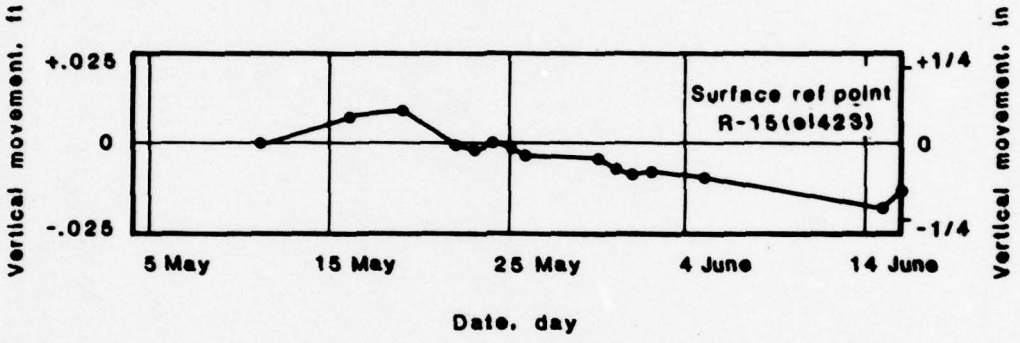
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0065

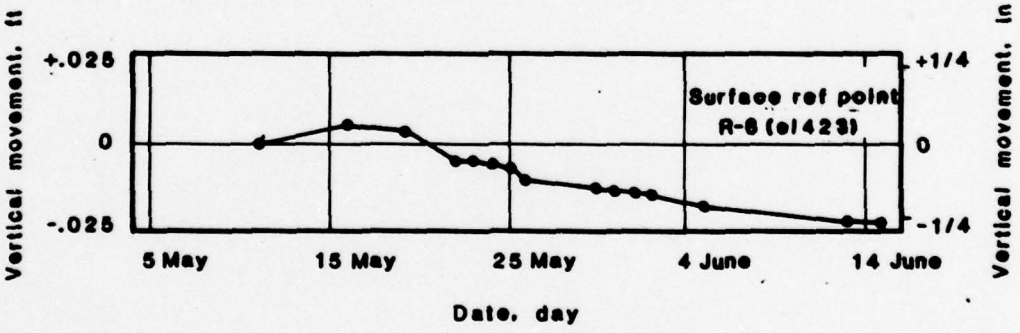
Woodward-Clyde Consultants

Y7C025 Phase IX

Fig. F.2







CHEMICAL GROUTING TEST PROGRAM

RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-9, R-15, R-8

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

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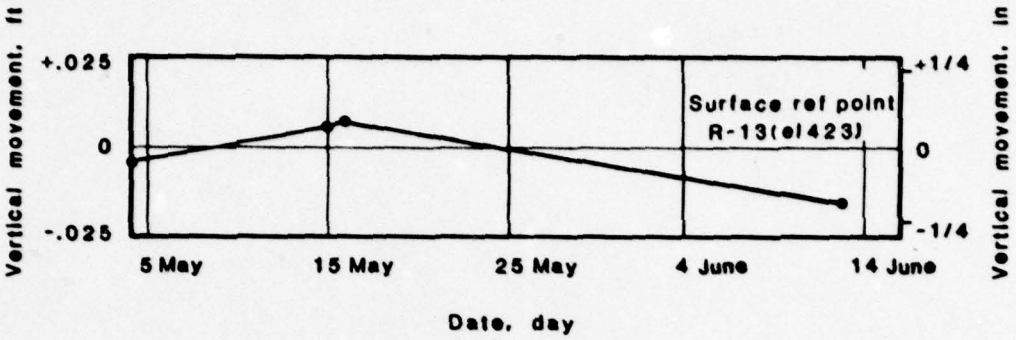
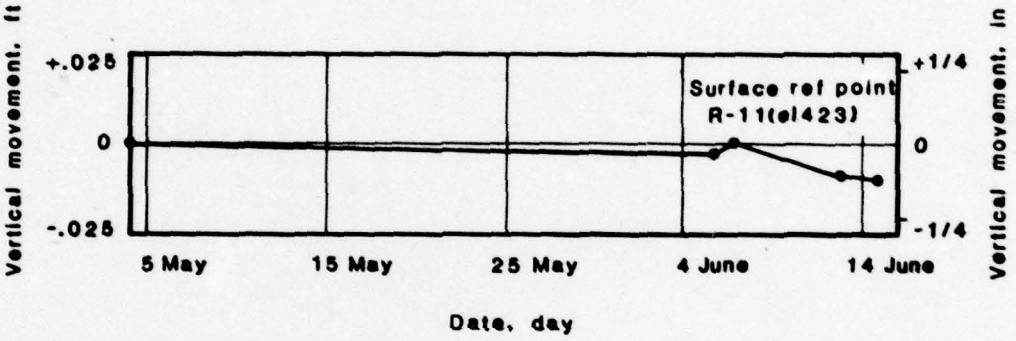
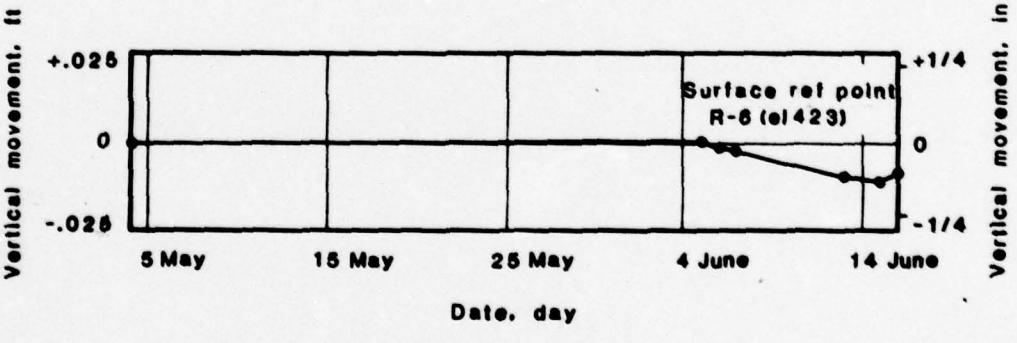
Fig. F.3

Y7C826 Phase IX







CHEMICAL GROUTING TEST PROGRAM

RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-13, R-11, R-6

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

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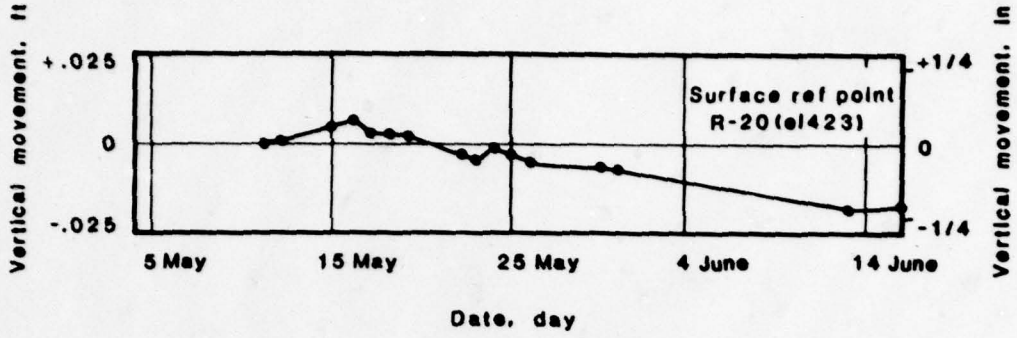
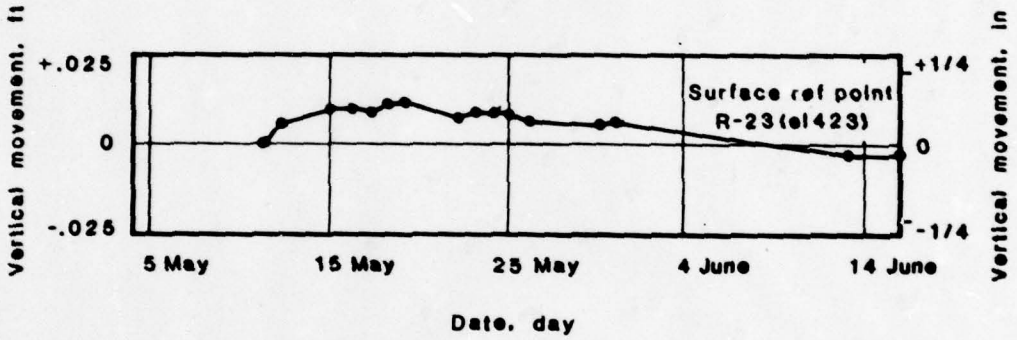
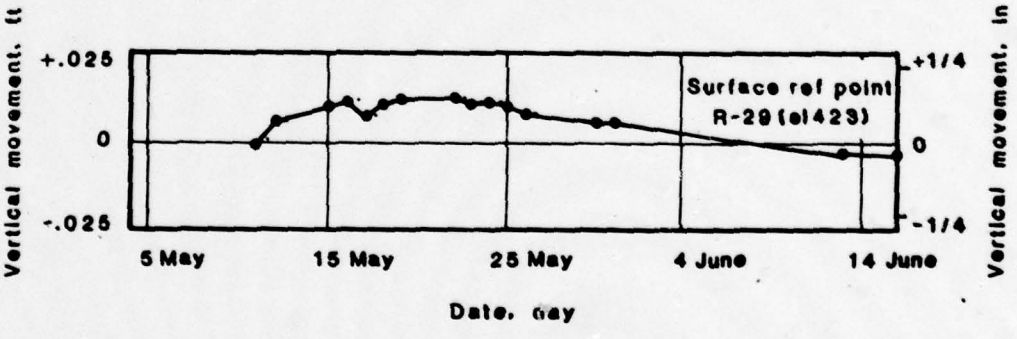
Y7C826 Phase IX

Fig. F.4







CHEMICAL GROUTING TEST PROGRAM

RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-20, R-23, R-29

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

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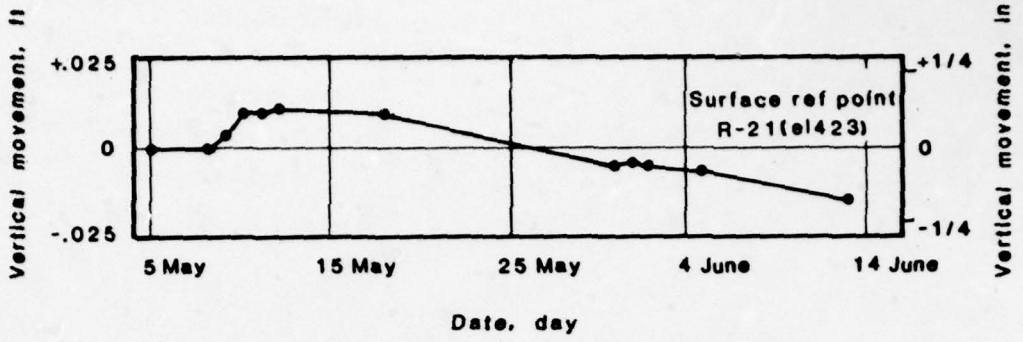
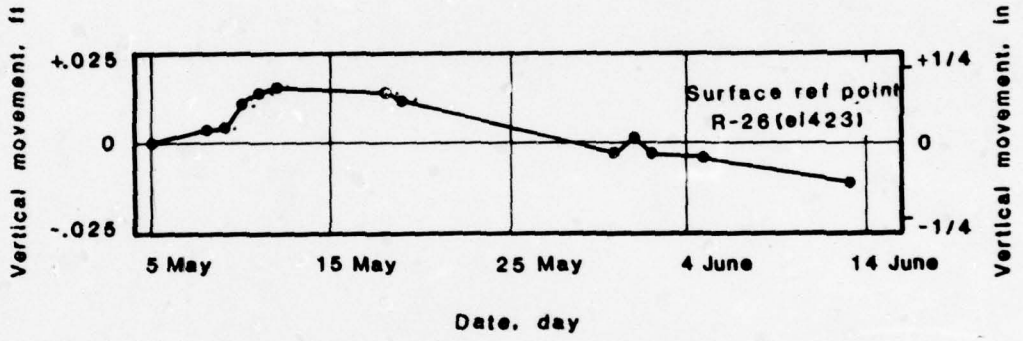
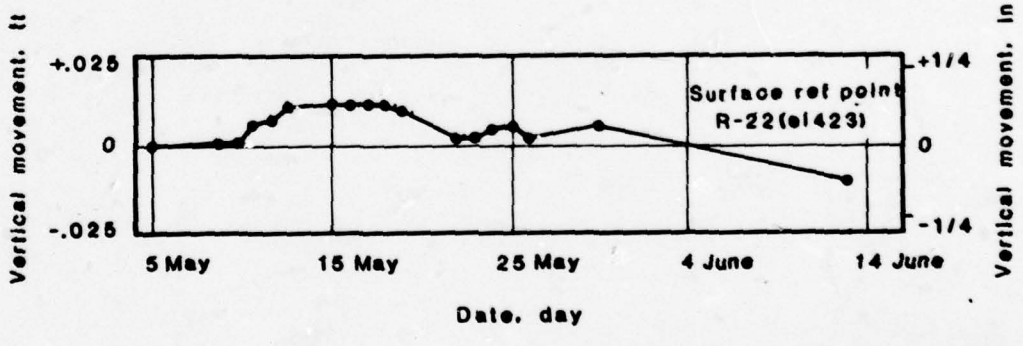
Y7C825 Phase IX

Fig. F.5







CHEMICAL GROUTING TEST PROGRAM

RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-21, R-26, R-22

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

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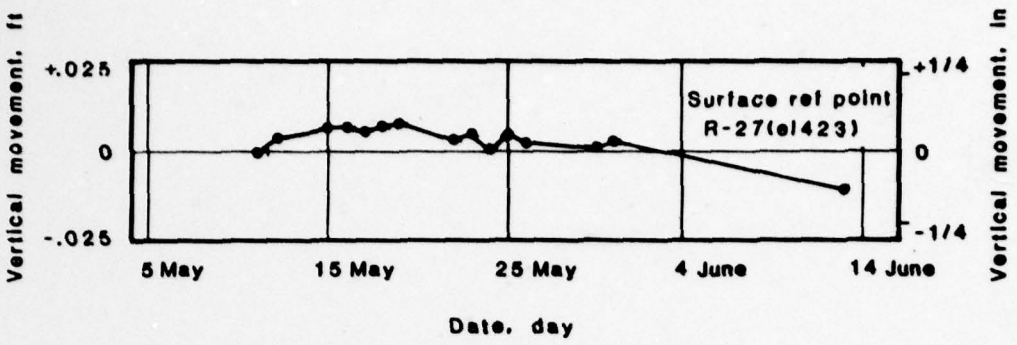
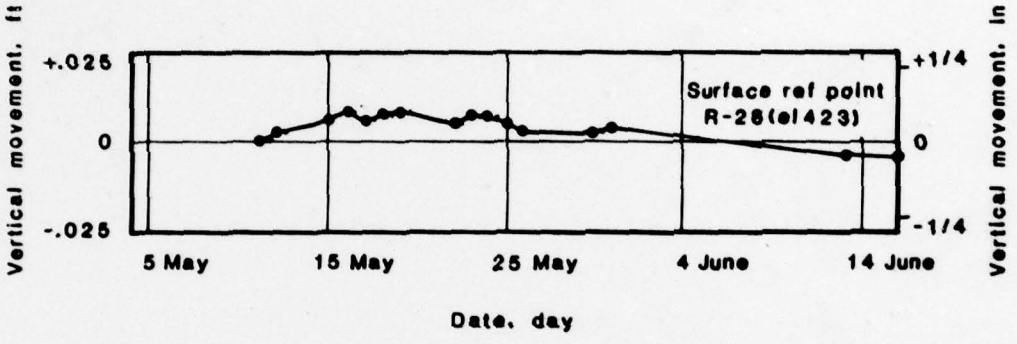
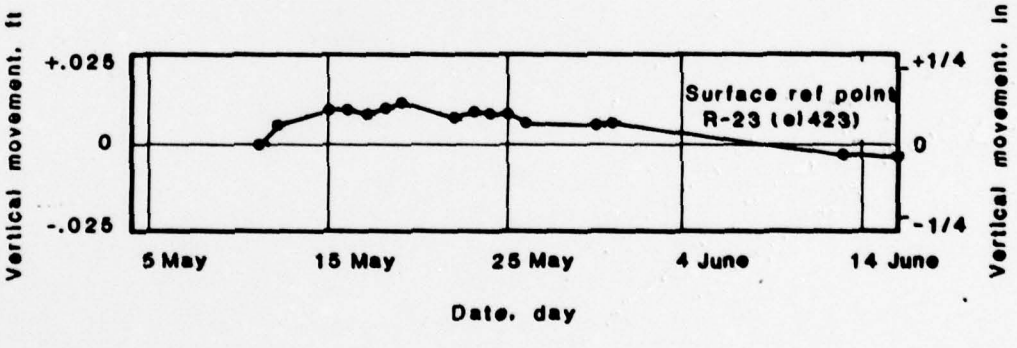
Y7C825 Phase IX

Fig. F.6







CHEMICAL GROUTING TEST PROGRAM

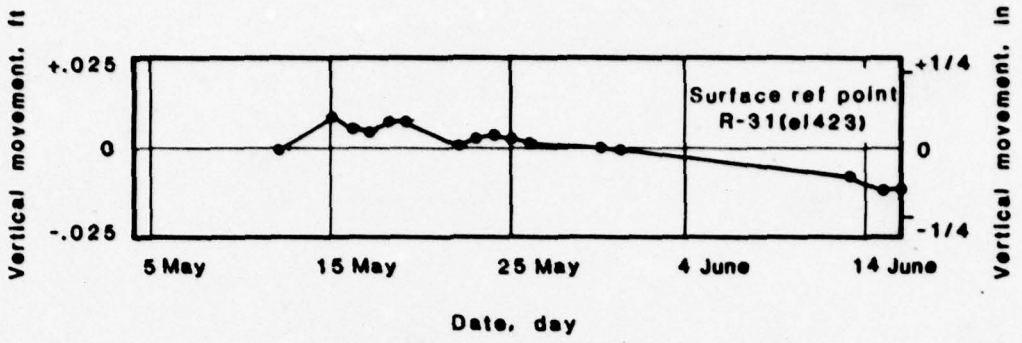
RESULTS OF VERTICAL MOVEMENT MEASURMENTS SURFACE REFERENCE POINTS R-27 R-28, R-23

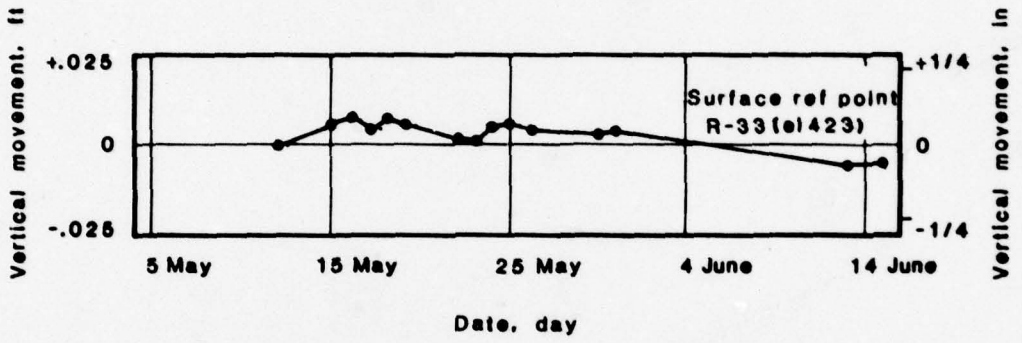
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

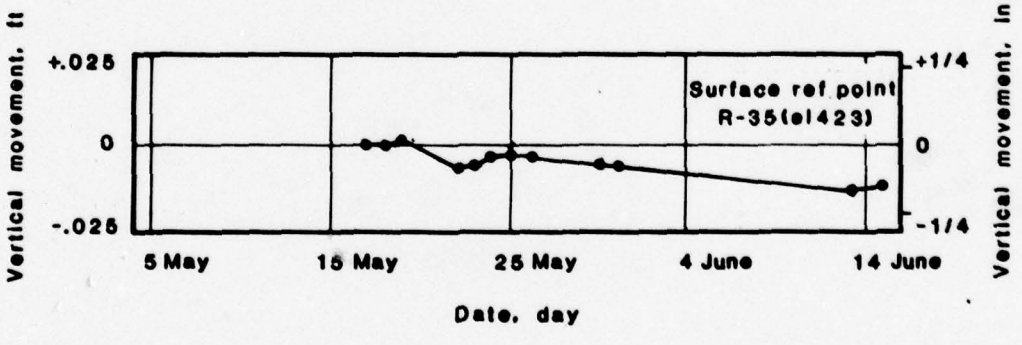
Woodward-Clyde Consultants

Fig. F.7

Y7C826 Phase IX







CHEMICAL GROUTING TEST PROGRAM

RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-31, R-33, R-35

FOUNDATION INVESTIGATION AND TEST PROGRAM
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ST LOUIS DISTRICT, CORPS OF ENGINEERS,
DACW43-78-C-0008

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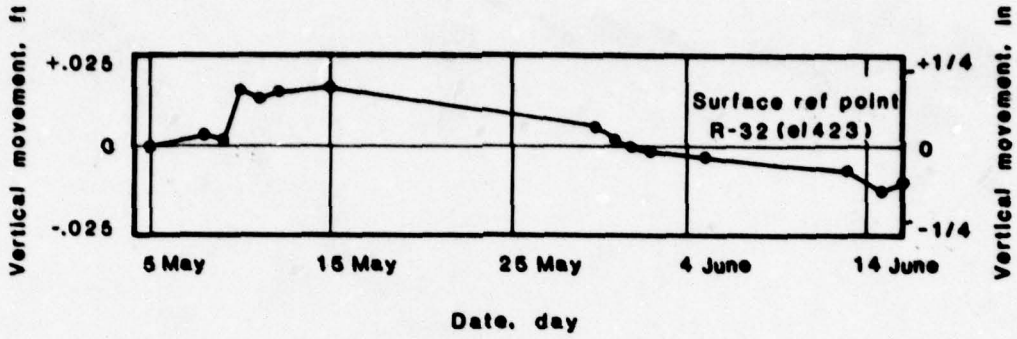
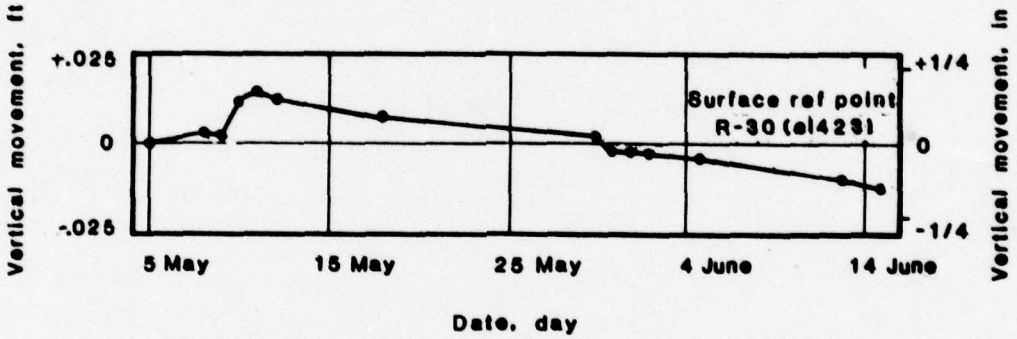
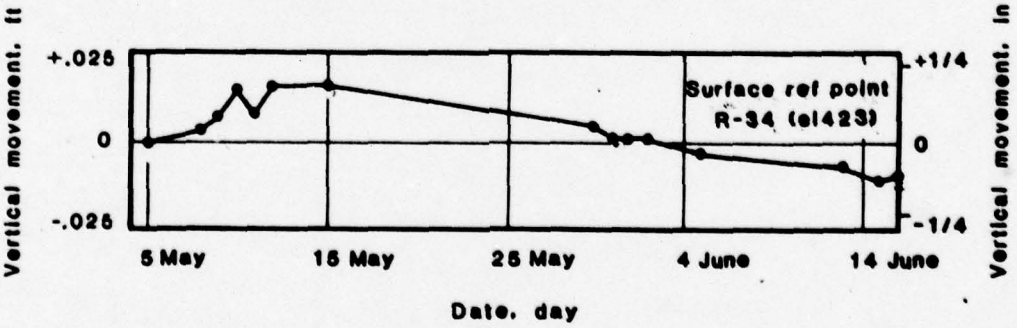
V7C026 Phase IX

Fig. F.8







CHEMICAL GROUTING TEST PROGRAM

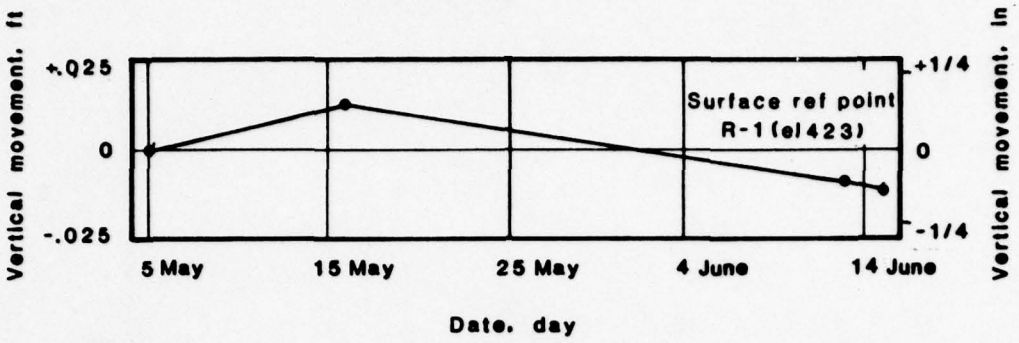
RESULTS OF VERTICAL MOVEMENT MEASUREMENTS SURFACE REFERENCE POINTS R-32, R-30, R-34

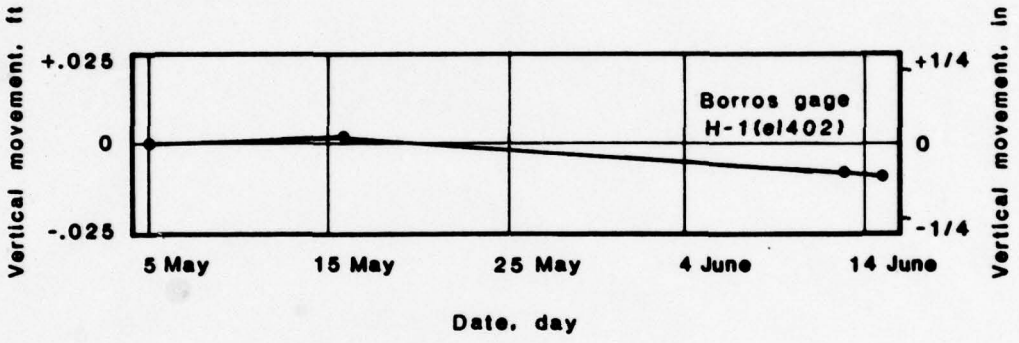
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0095

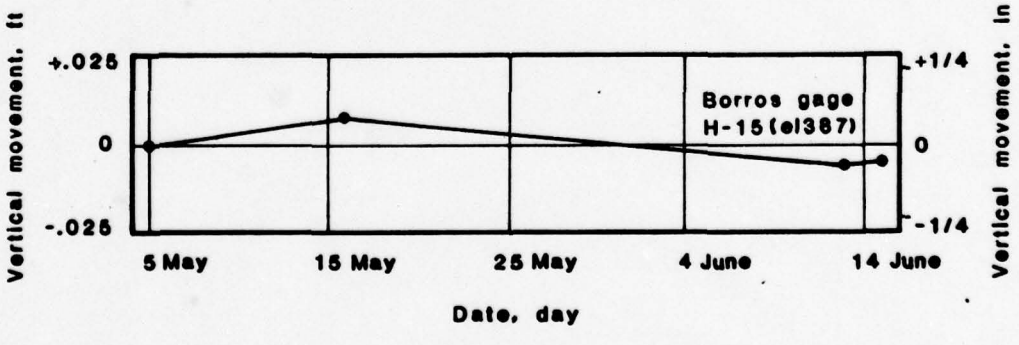
Woodward-Clyde Consultants

Fig. F.9

YYC626 Phase IX







CHEMICAL GROUTING TEST PROGRAM

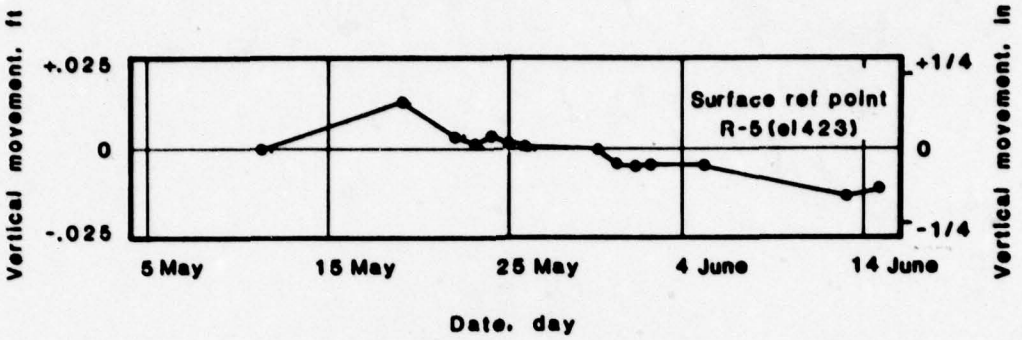
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

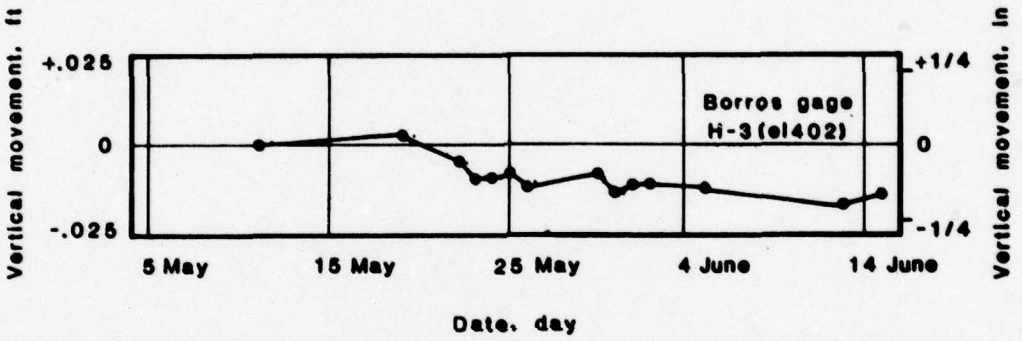
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

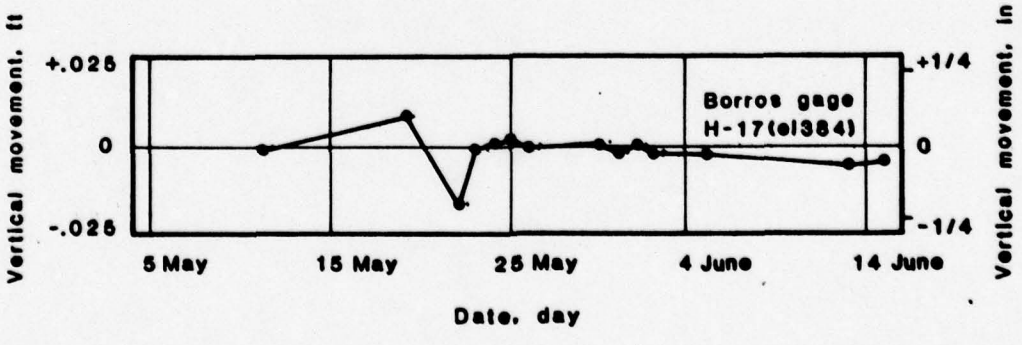
Woodward-Clyde Consultants

Y7C625 Phase IX

Fig. F.10







CHEMICAL GROUTING TEST PROGRAM

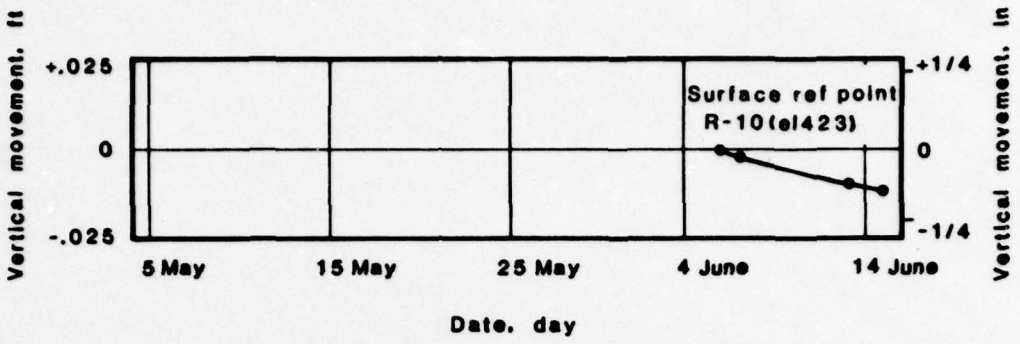
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

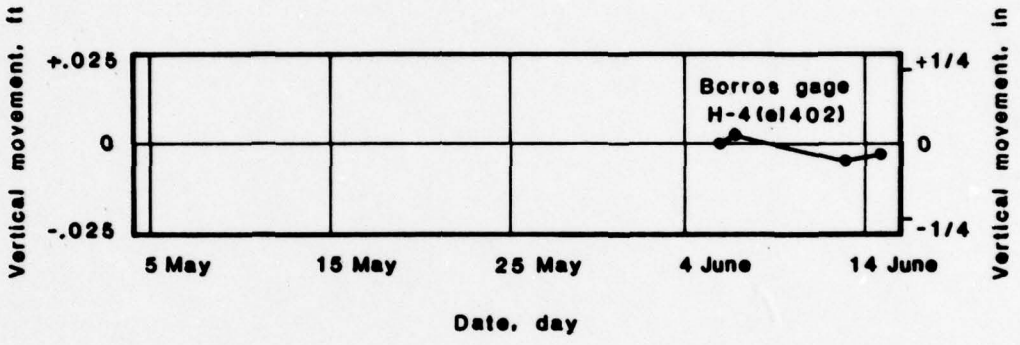
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

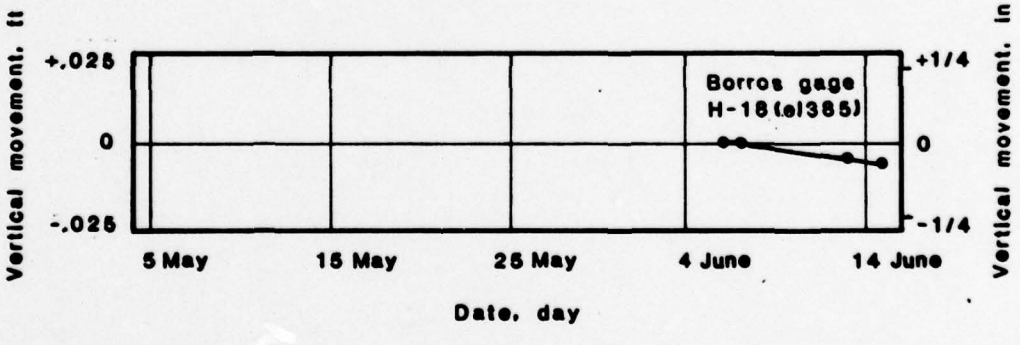
Woodward-Clyde Consultants

Y7C626 Phase IX

Fig. F.11







CHEMICAL GROUTING TEST PROGRAM

COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

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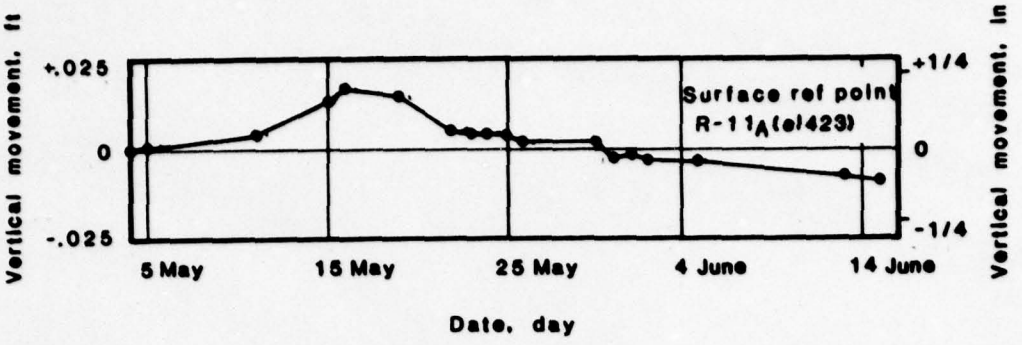
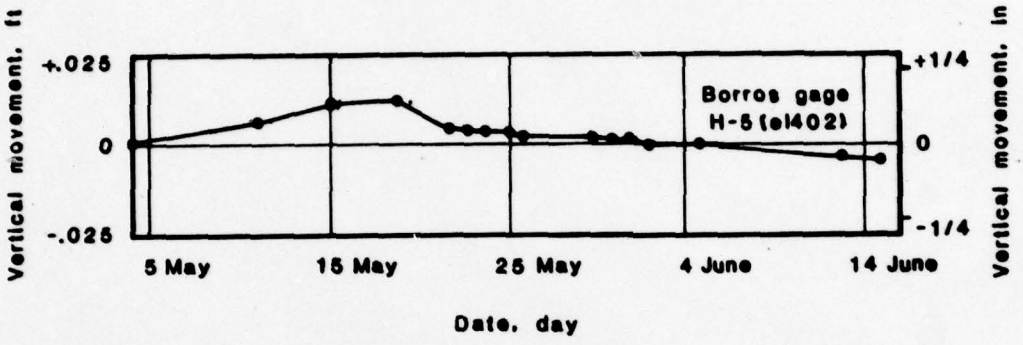
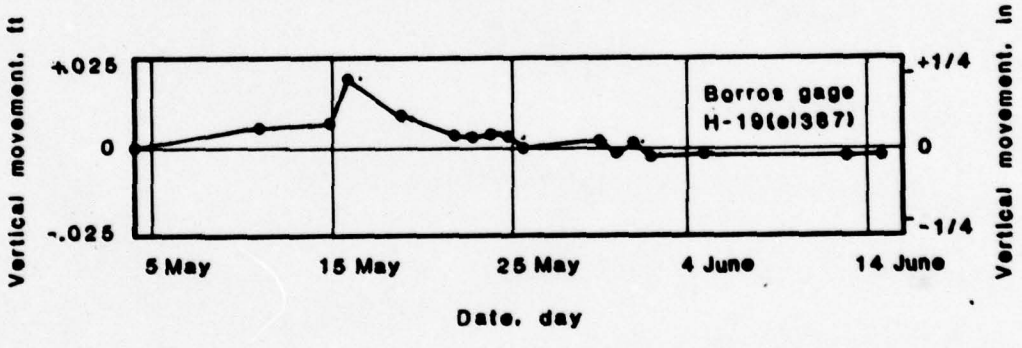
Fig. F.12

Y7C825 Phase IX







CHEMICAL GROUTING TEST PROGRAM

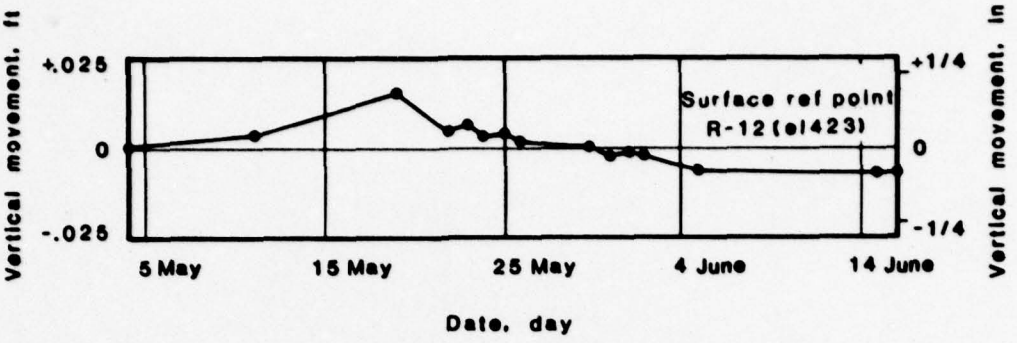
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

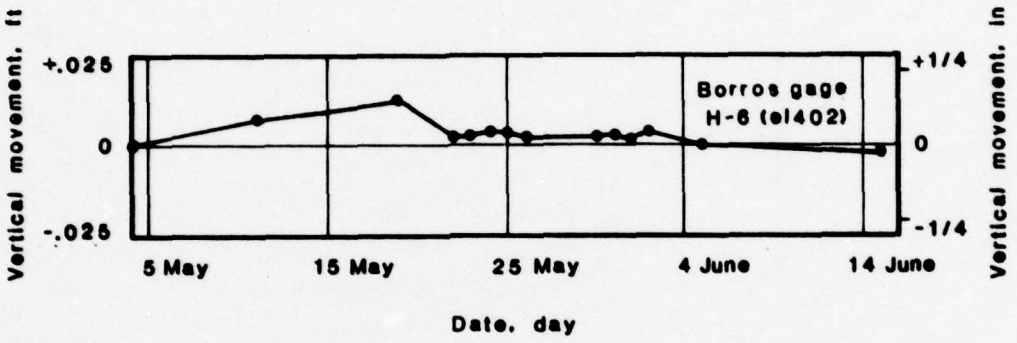
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

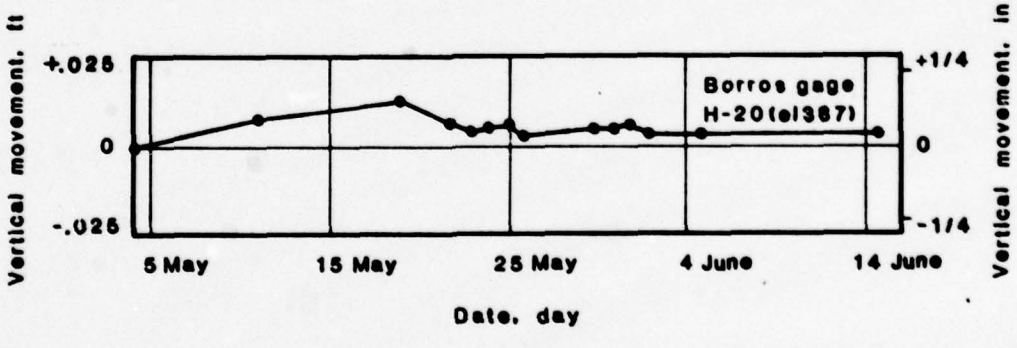
Woodward-Clyde Consultants

Fig. F.13

Y7C825 Phase IX







CHEMICAL GROUTING TEST PROGRAM

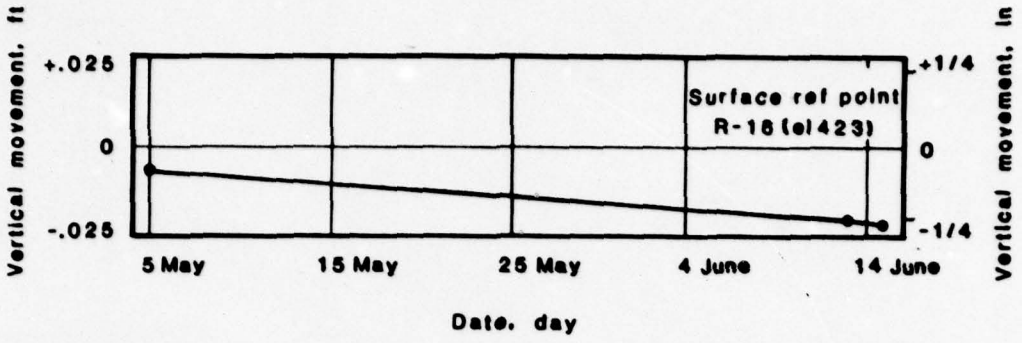
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

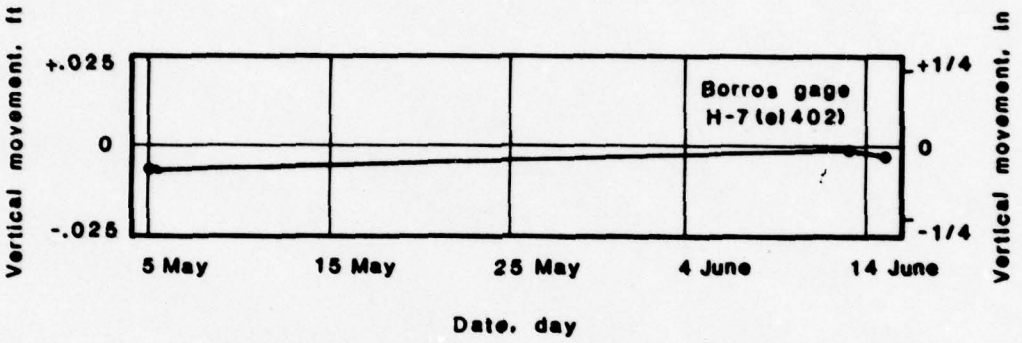
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

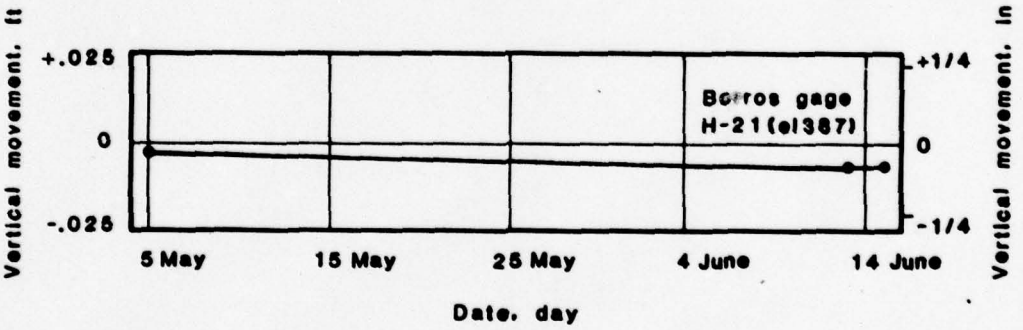
Woodward-Clyde Consultants

Fig. F.14

V7C025 Phase IX







CHEMICAL GROUTING TEST PROGRAM

COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

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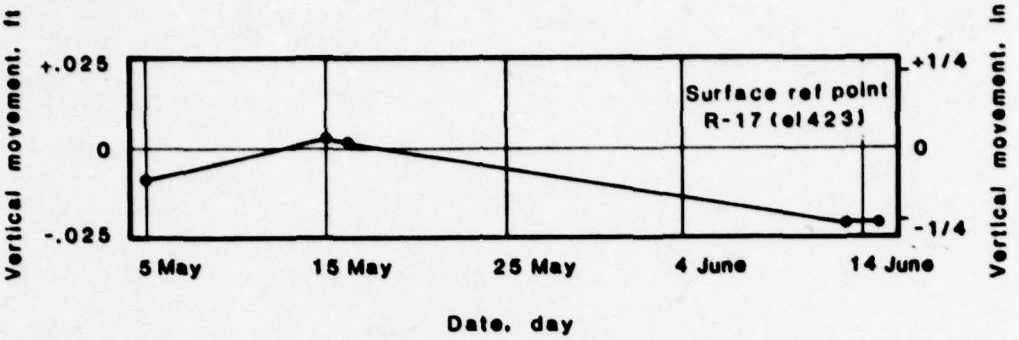
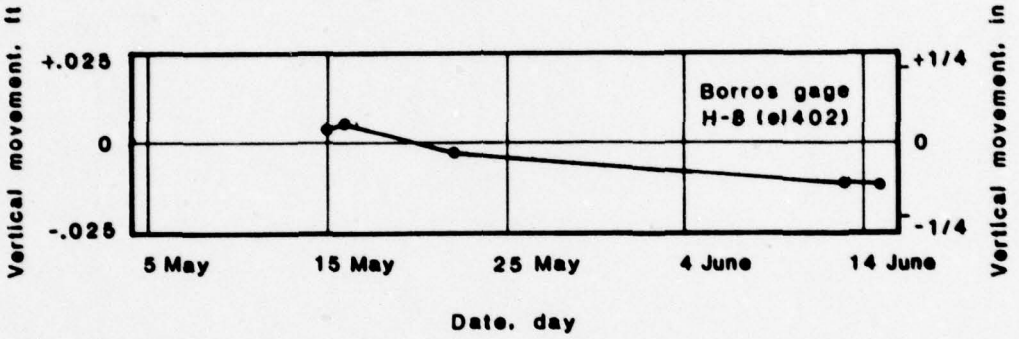
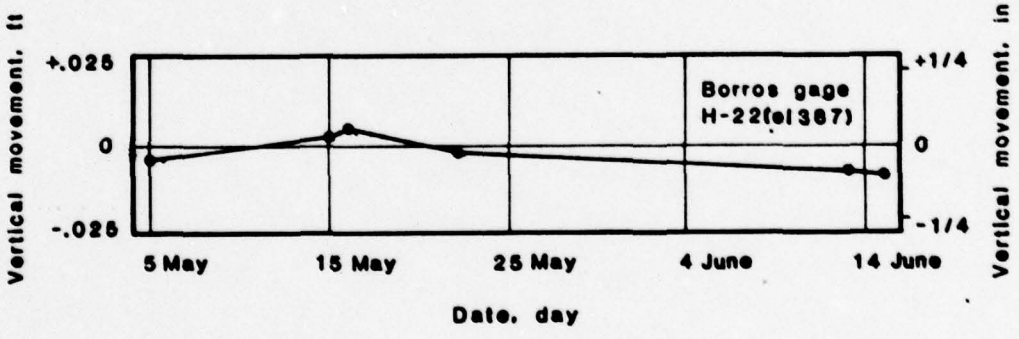
Fig. F.15

V7C825 Photo IX







CHEMICAL GROUTING TEST PROGRAM

COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS,
DACW43-76-C-0095

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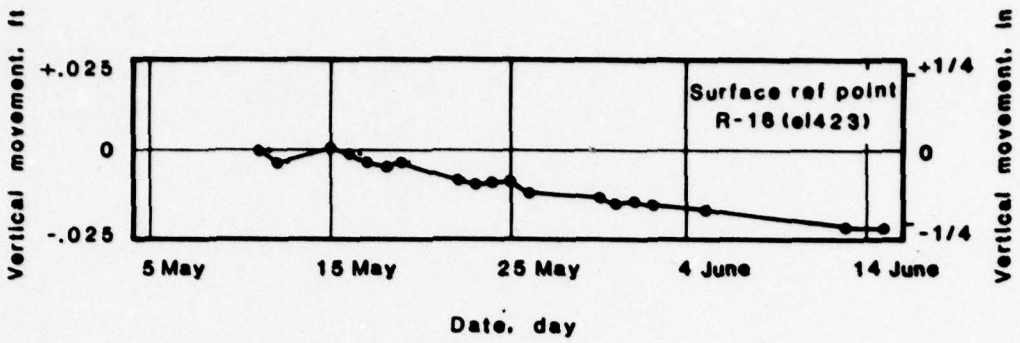
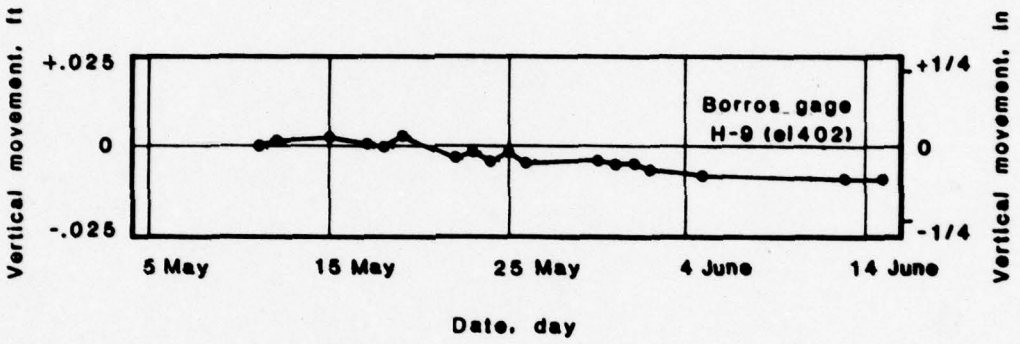
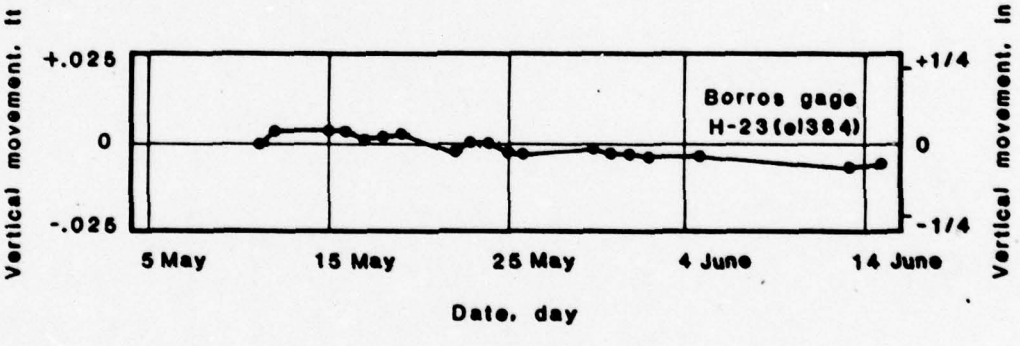
Y7C825 Phase IX

Fig. F.16







CHEMICAL GROUTING TEST PROGRAM

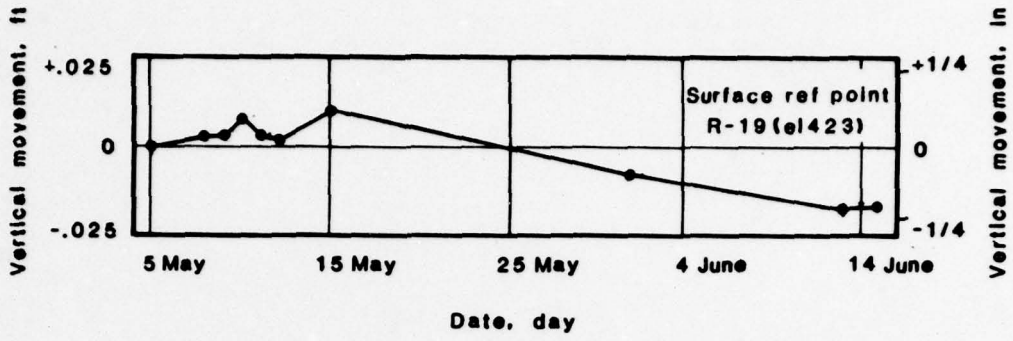
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

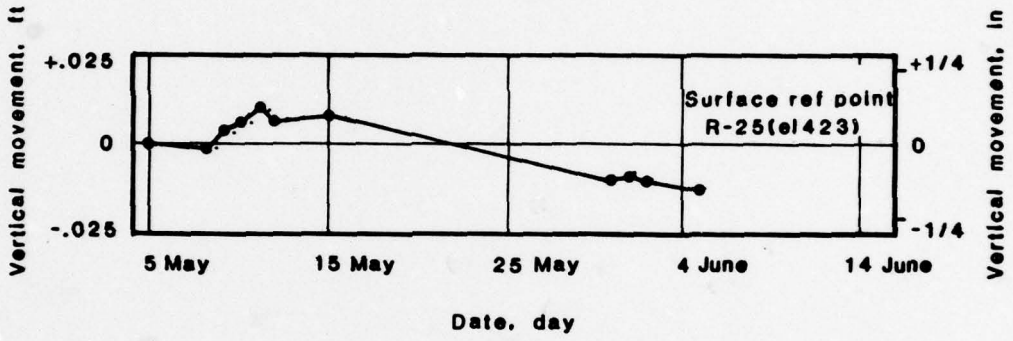
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

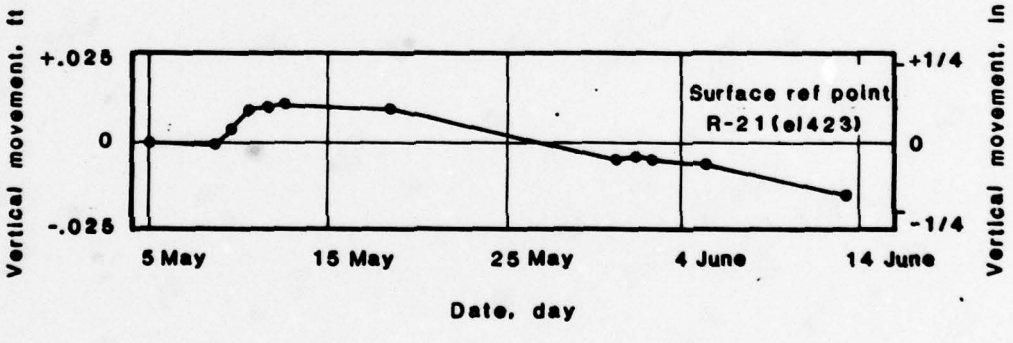
Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. F.17







CHEMICAL GROUTING TEST PROGRAM

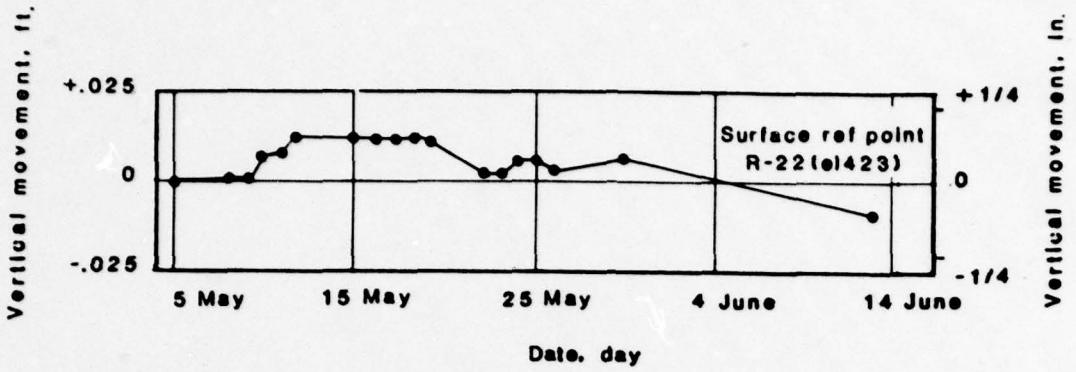
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

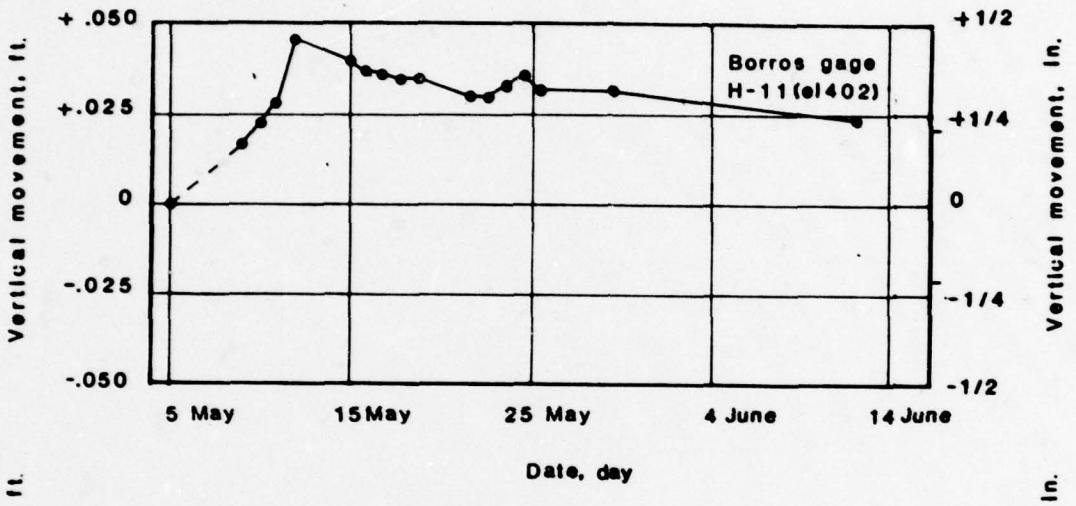
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0065

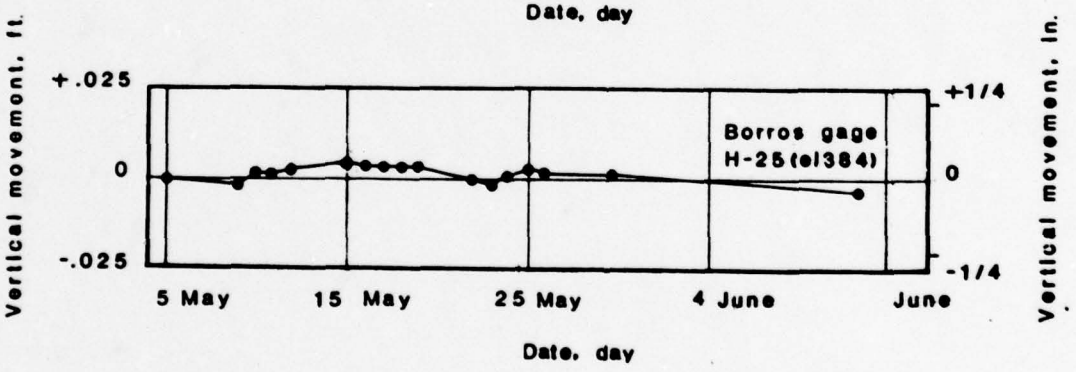
Woodward-Clyde Consultants

Y7C625 Phase IX

Fig. F.18







CHEMICAL GROUTING TEST PROGRAM

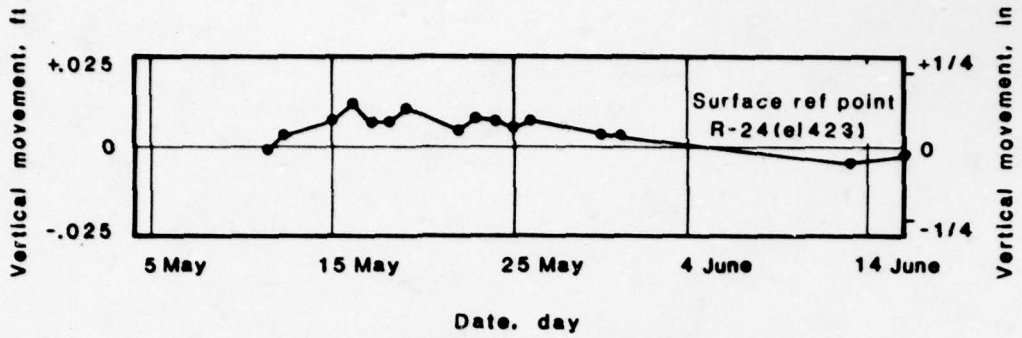
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

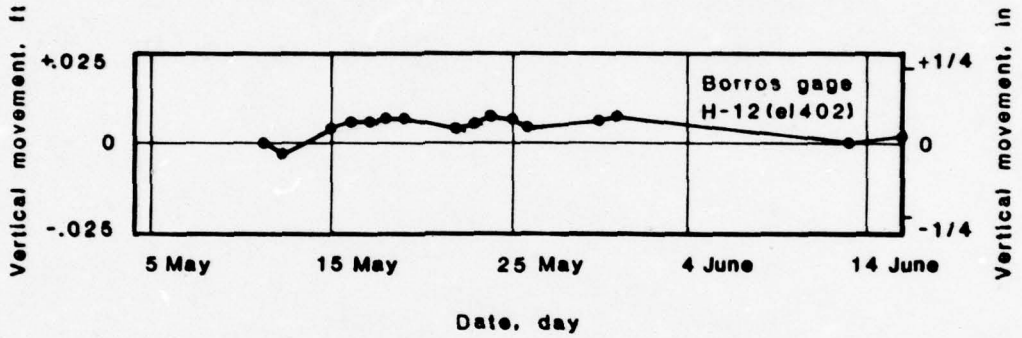
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

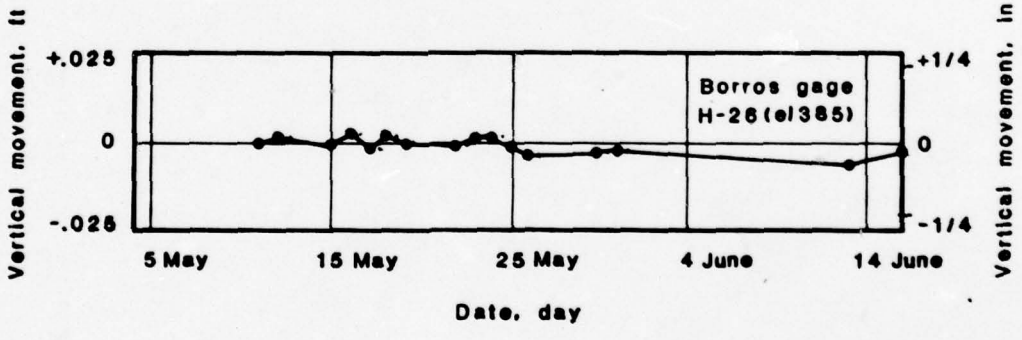
Woodward-Clyde Consultants

Y7CB25 Phase IX

Fig. F.19







CHEMICAL GROUTING TEST PROGRAM

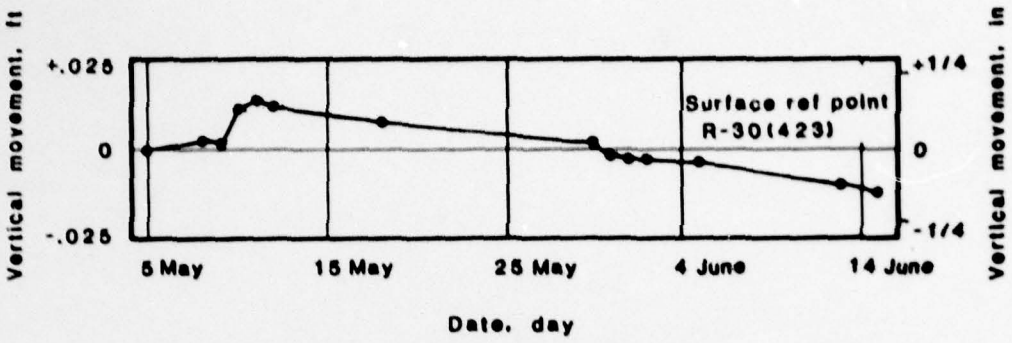
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

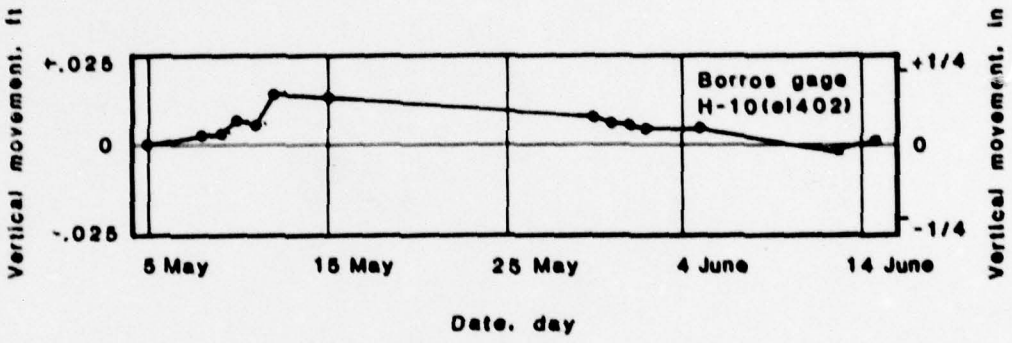
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

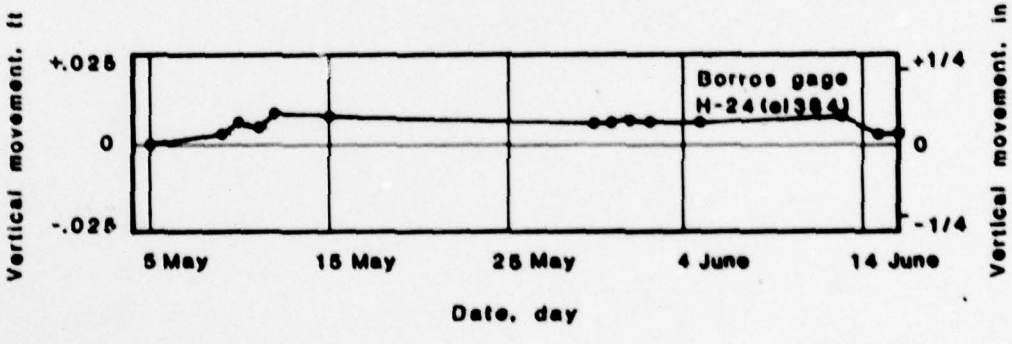
Woodward-Clyde Consultants

Fig. F.20

Y7C825 Phase IX







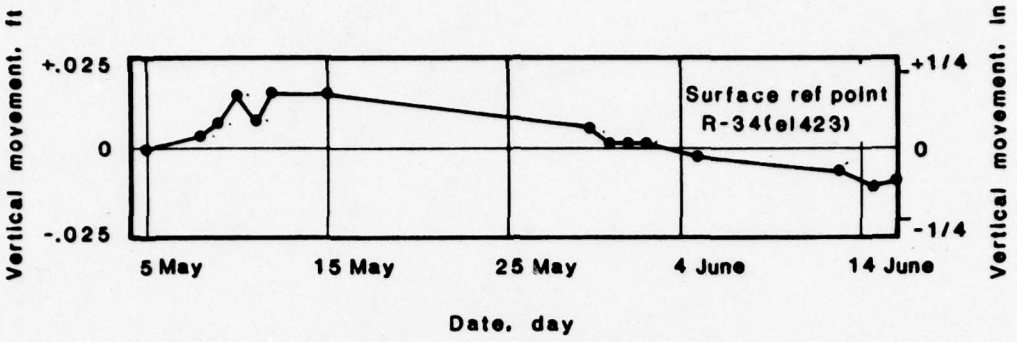
CHEMICAL GROUTING TEST PROGRAM

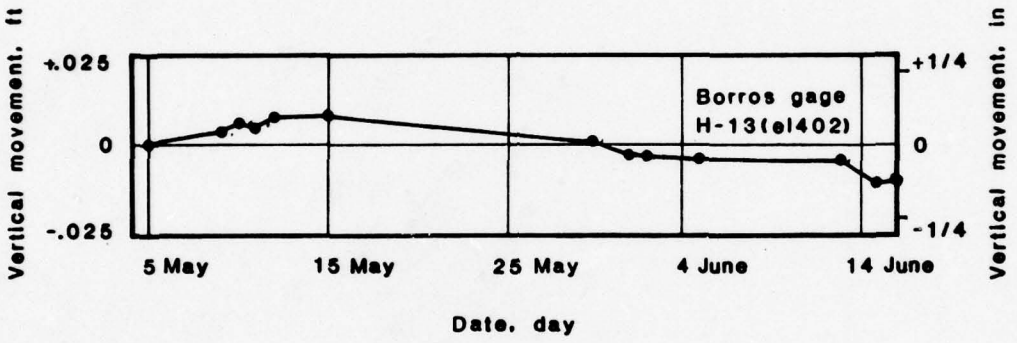
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

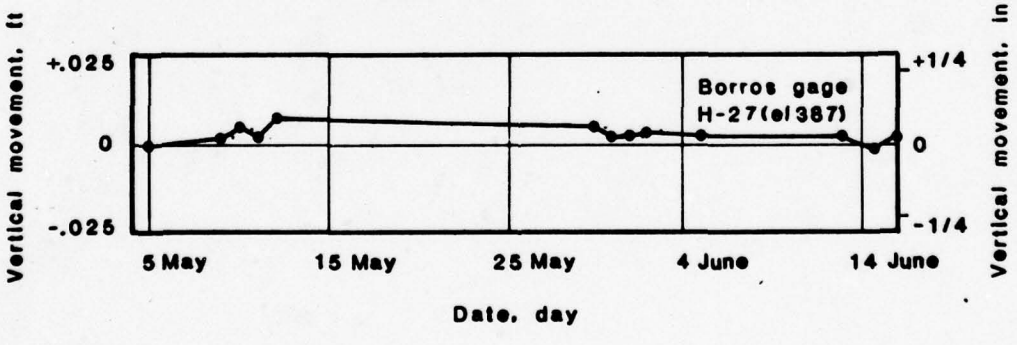
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. F.21







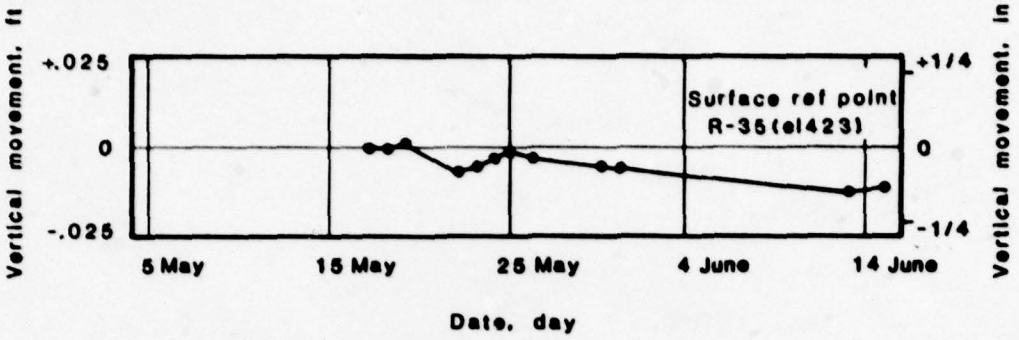
CHEMICAL GROUTING TEST PROGRAM

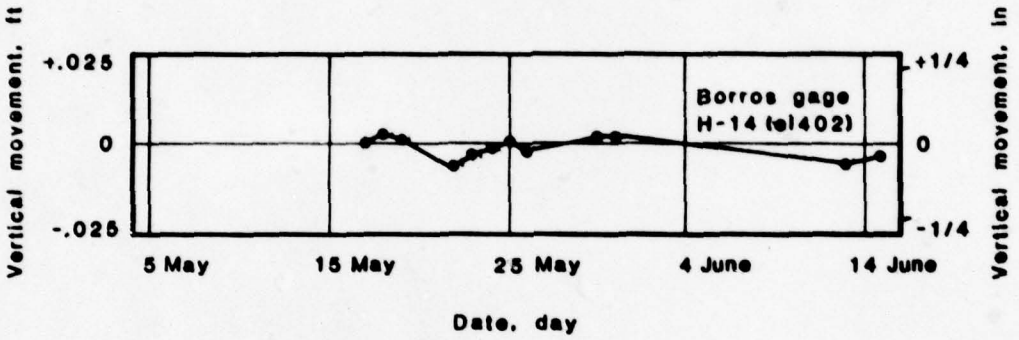
COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

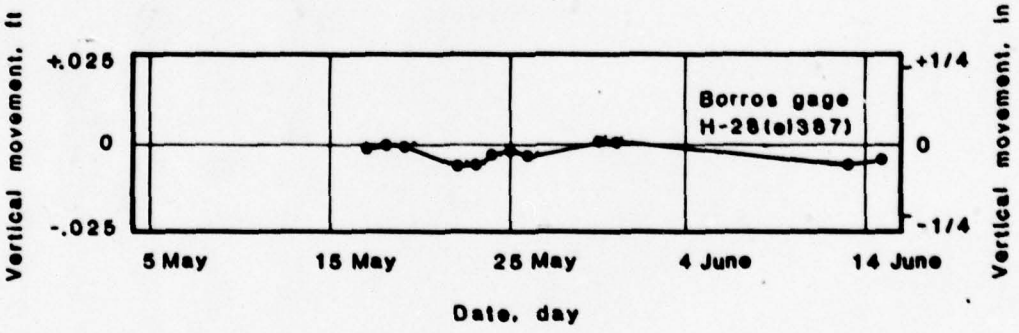
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants
Y7C825 Phase IX

Fig. F.22







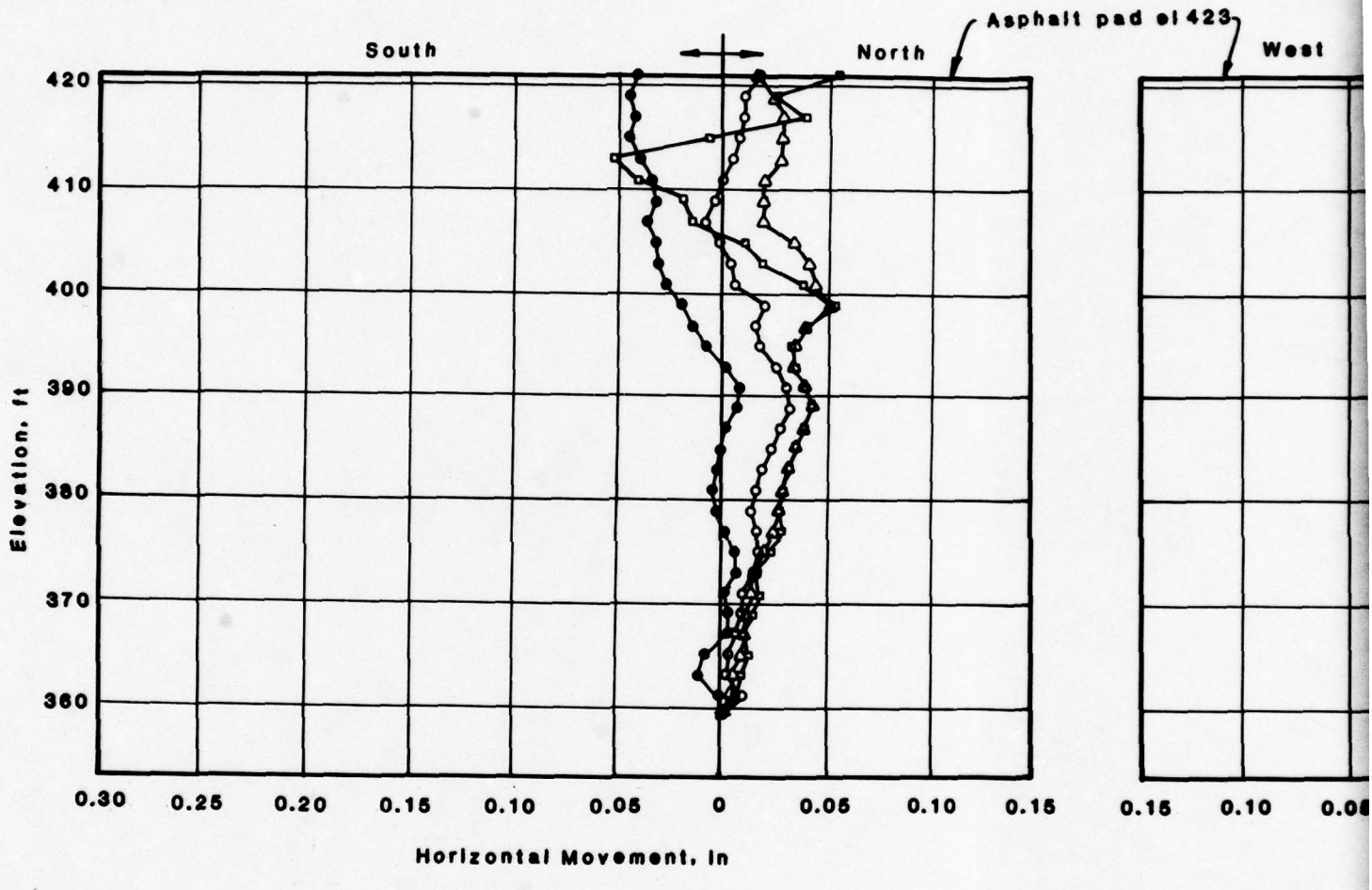
CHEMICAL GROUTING TEST PROGRAM

COMPARISON BETWEEN RESULTS OBTAINED WITH BORROS GAGES AND SURFACE REFERENCE POINT

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

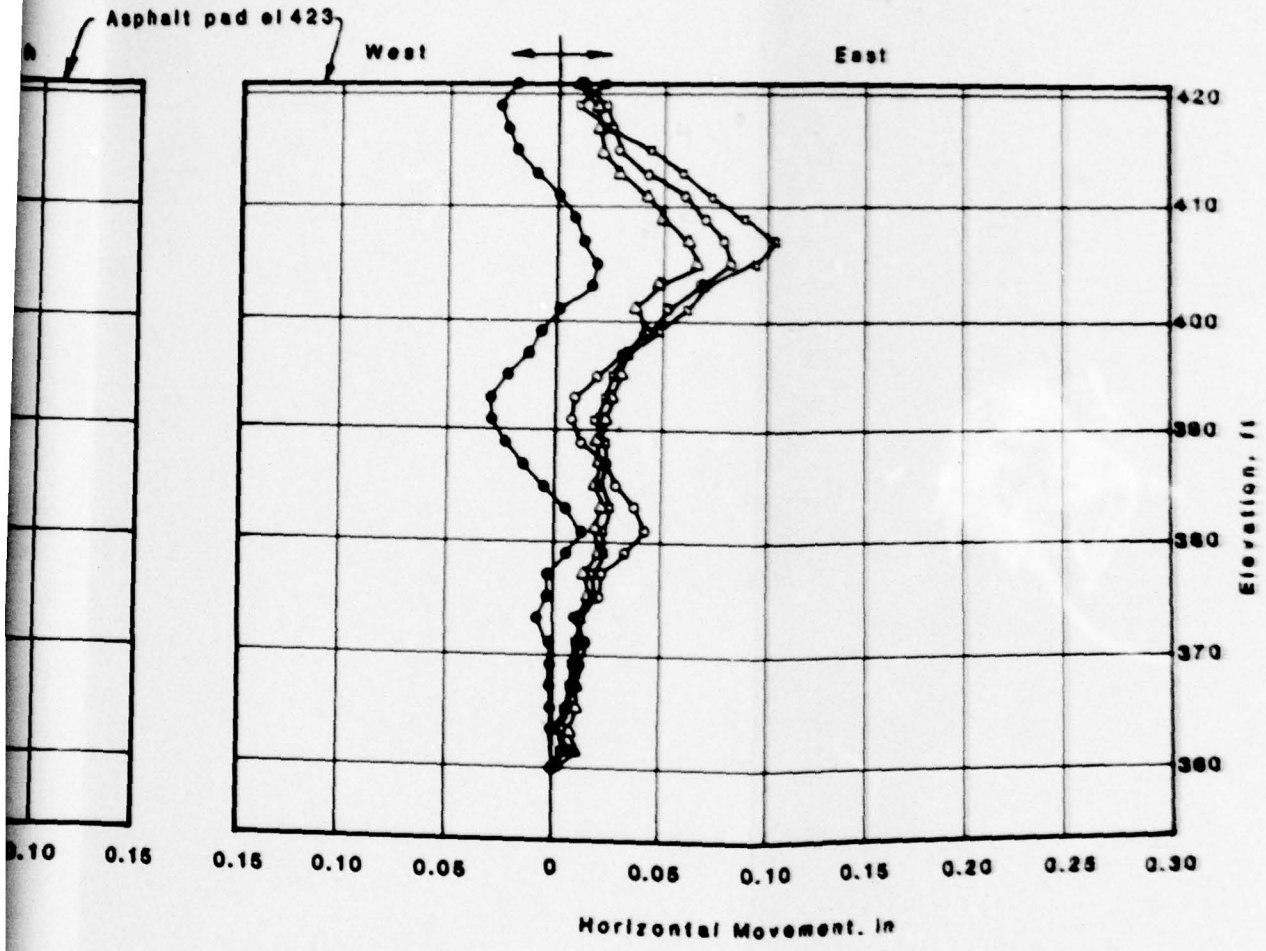
Woodward-Clyde Consultants

Fig. F.23



Legend

Symbol	Date of reading
○	1 May 1978
●	5 May 1978
○	8 May 1978
△	9 May 1978



CHEMICAL GROUTING TEST PROGRAM

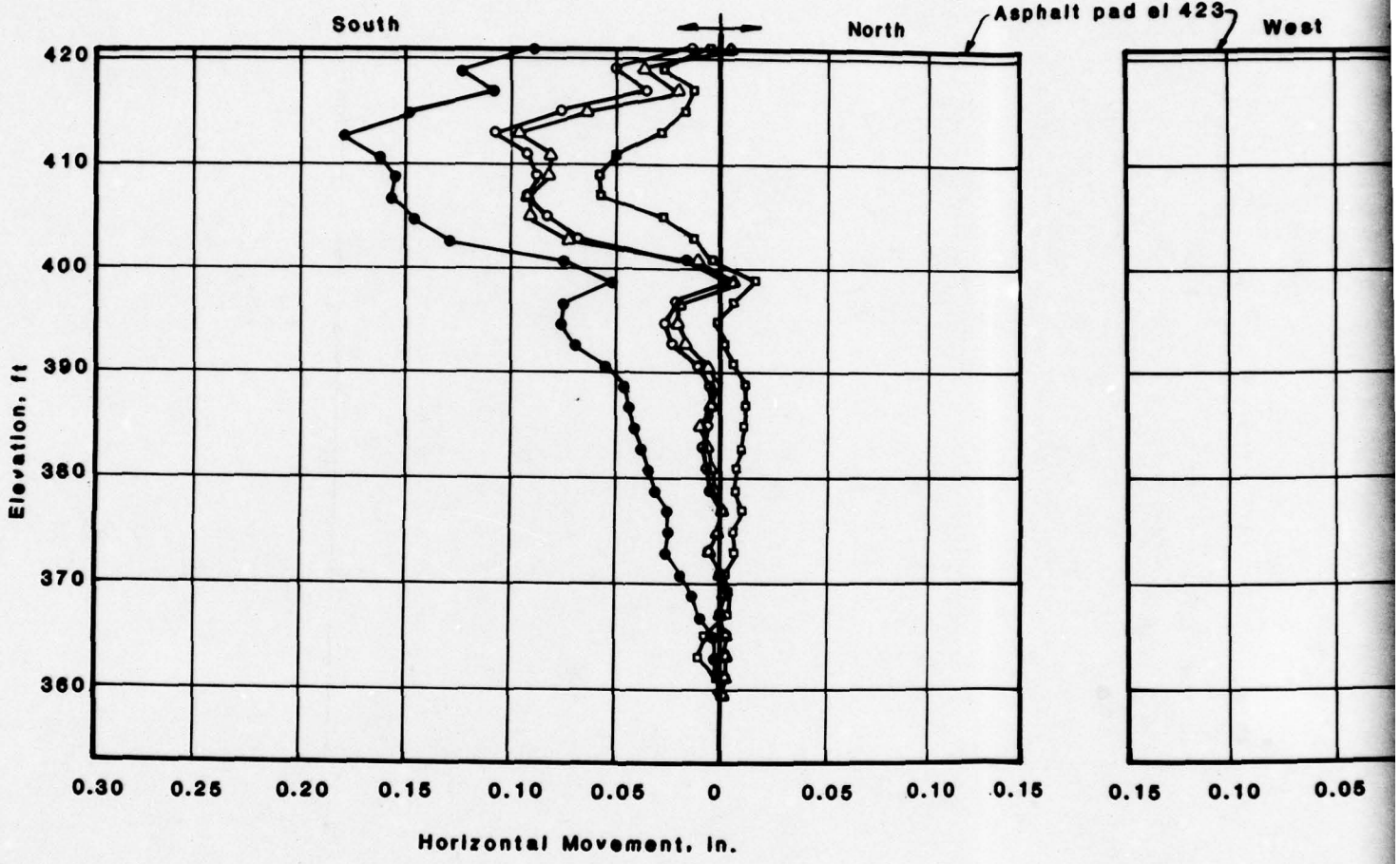
RESULTS OF INCLINOMETER I-6 MEASUREMENTS
1 MAY THROUGH 9 MAY 1978

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

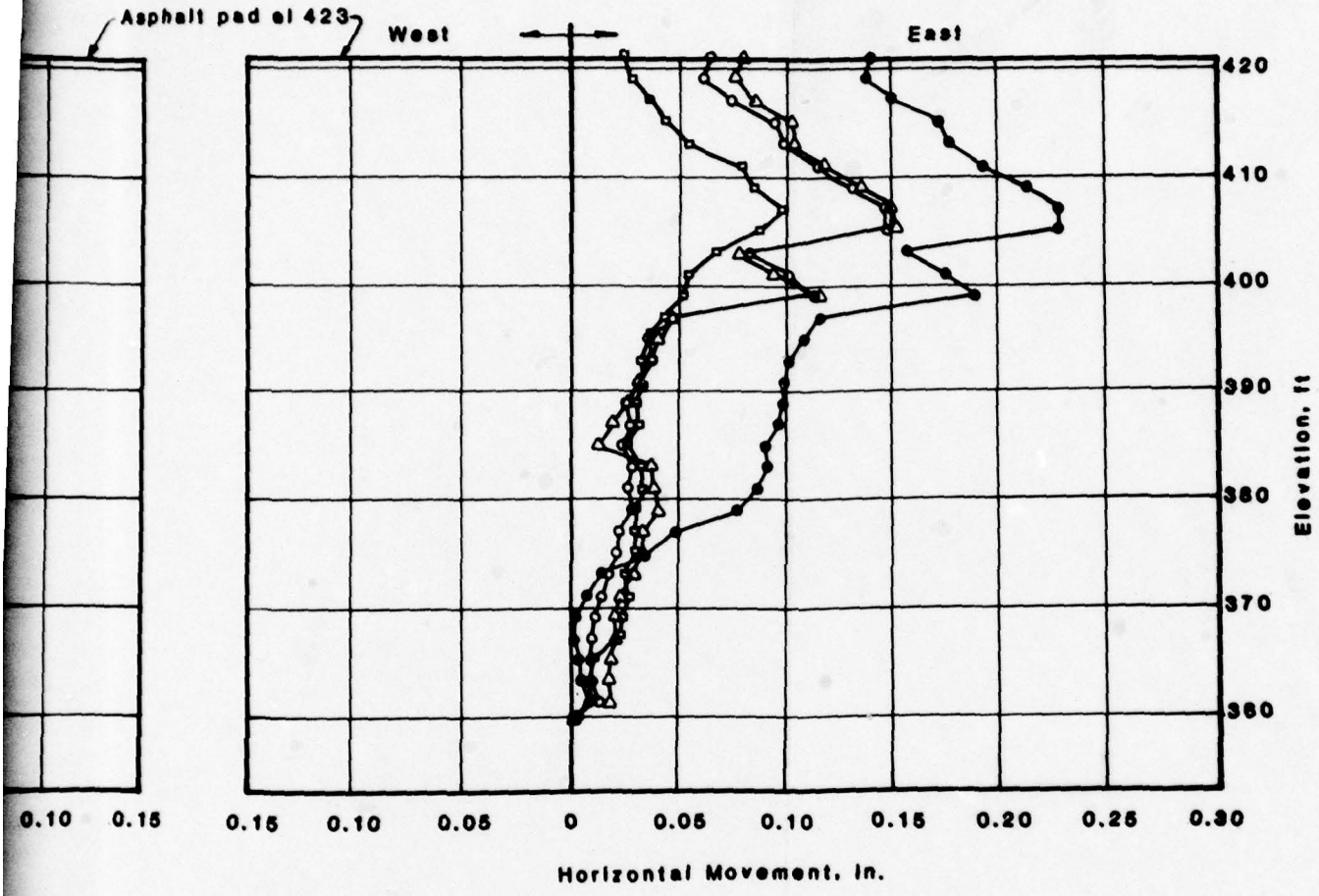
Fig. F.24

YYC825 Phase III



Legend

Symbol	Date of reading
▫	10 May 1978
●	15 May 1978
○	16 May 1978
△	17 May 1978



2

CHEMICAL GROUTING TEST PROGRAM

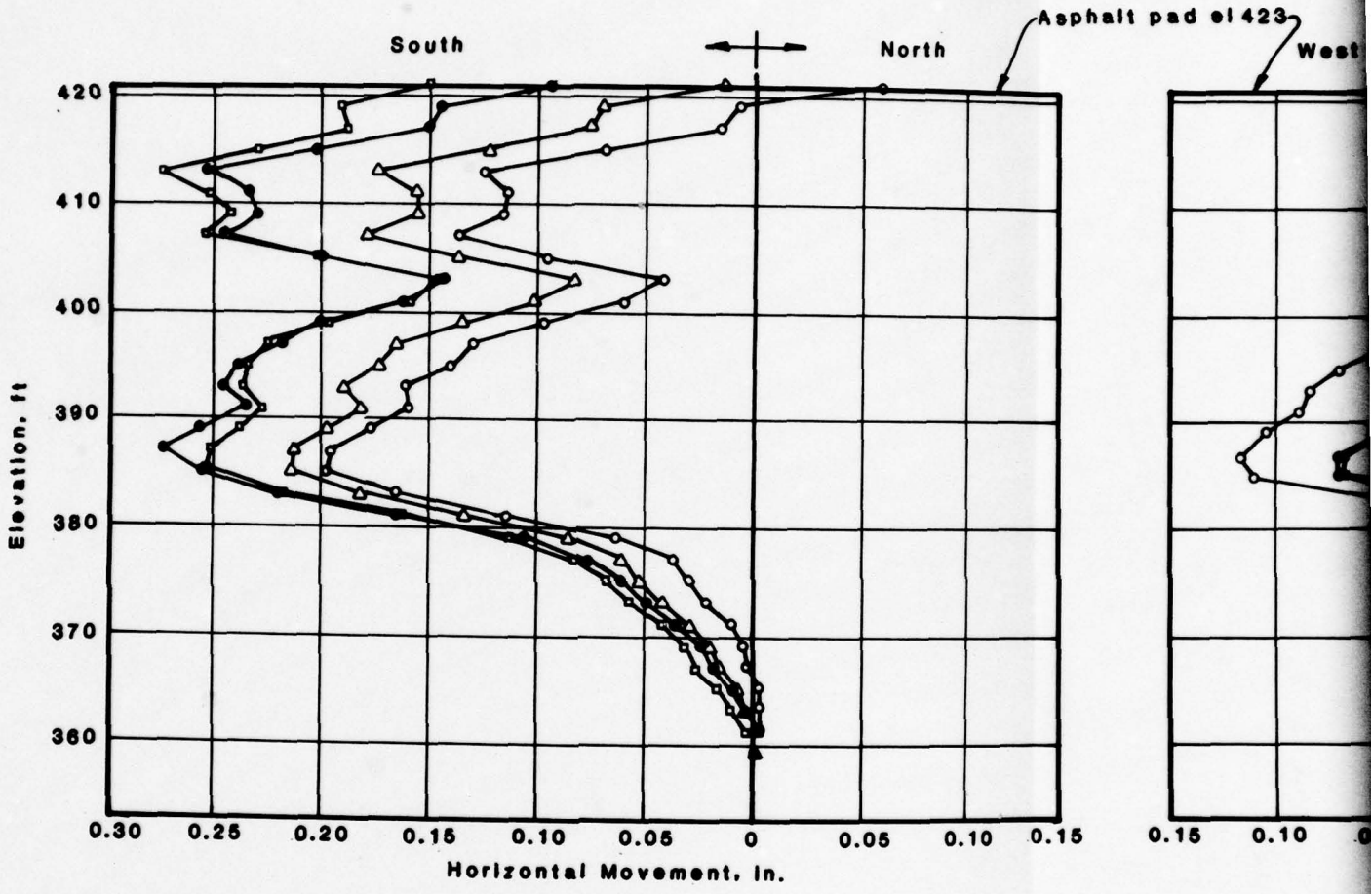
RESULTS OF INCLINOMETER I-6 MEASUREMENTS 10 MAY THROUGH 17 MAY 1978

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0006

Woodward-Clyde Consultants

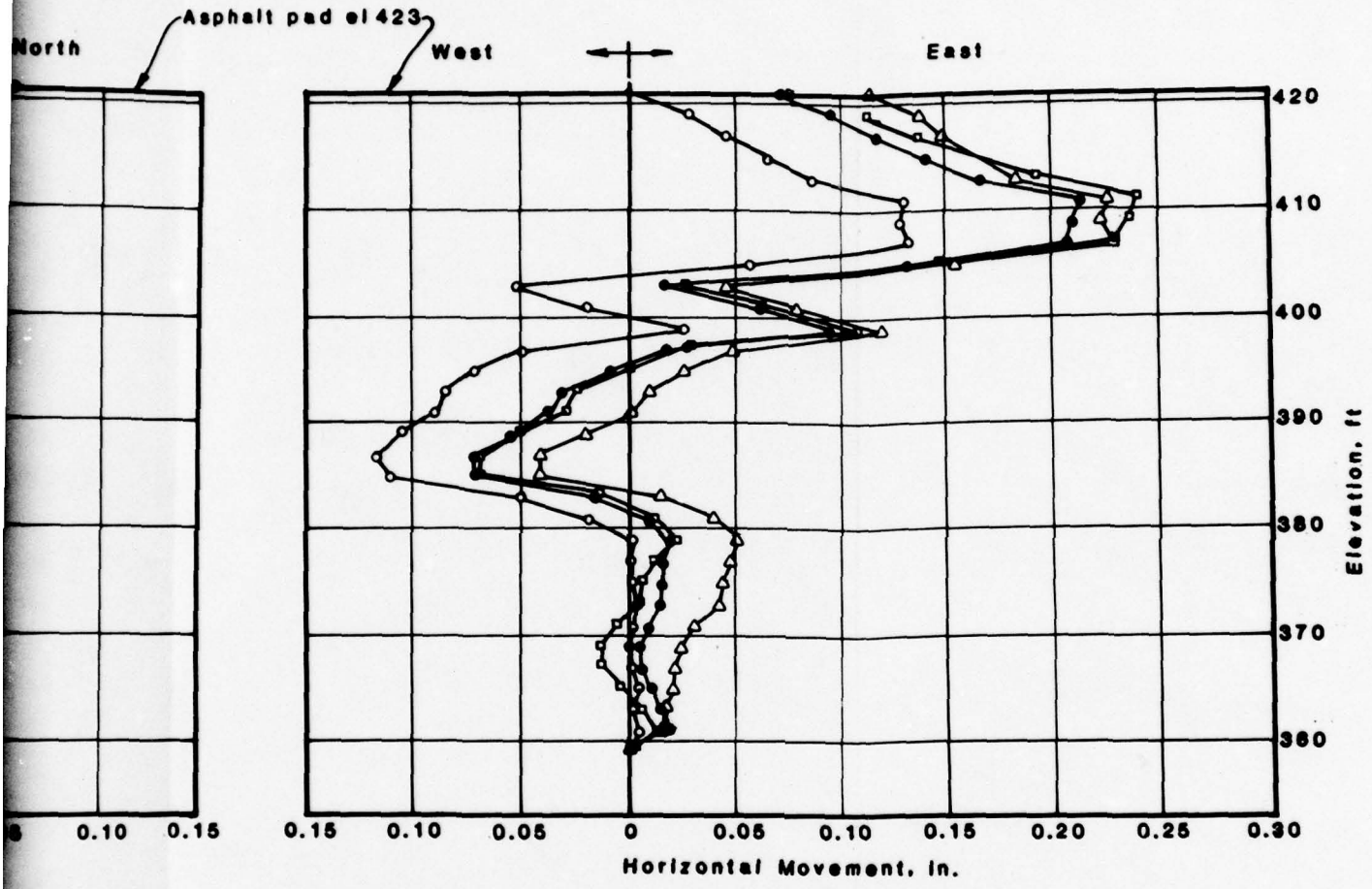
Y7C625 Phase IX

Fig. F.25



Legend

Symbol	Date of reading
▫	18 May 1978
●	19 May 1978
○	22 May 1978
△	23 May 1978



2

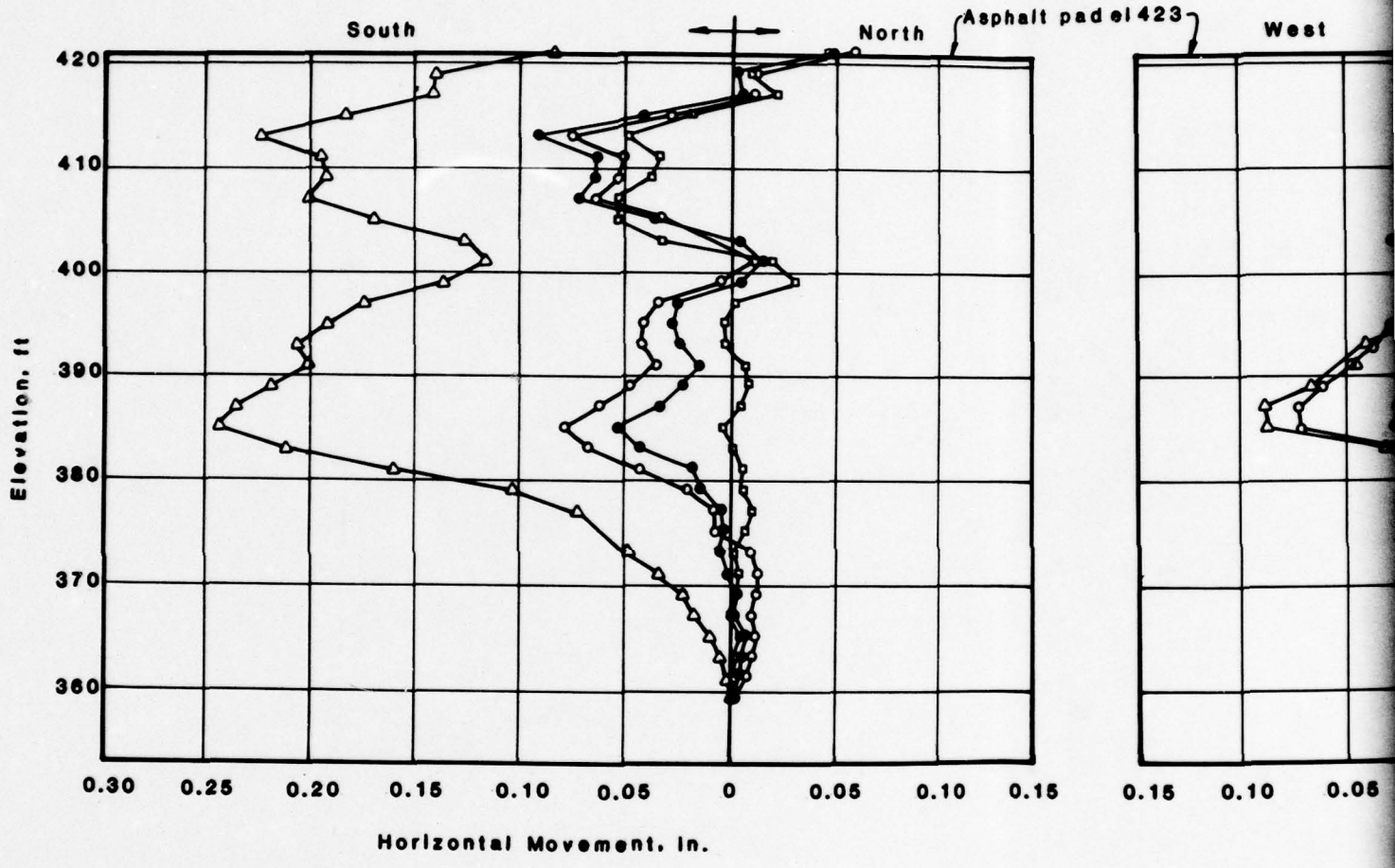
CHEMICAL GROUTING TEST PROGRAM

RESULTS OF INCLINOMETER I-6 MEASUREMENTS 18 MAY THROUGH 23 MAY 1978

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS,
DACW43-76-C-0006

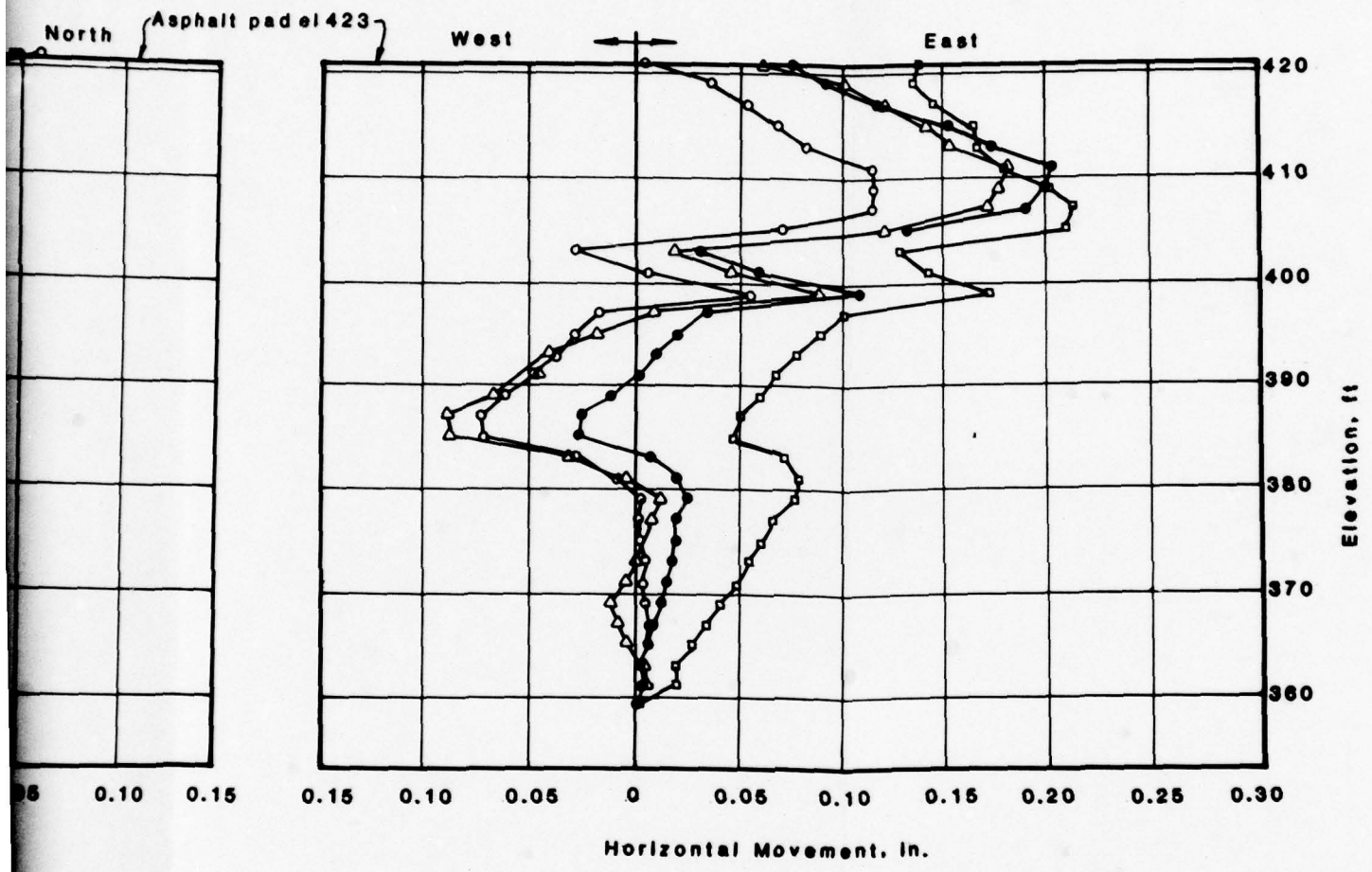
Woodward-Clyde Consultants
Y7C626 Phase IX

Fig. F.26



Legend

Symbol	Date of reading
□	25 May 1978
●	26 May 1978
○	31 May 1978
△	14 June 1978



2

CHEMICAL GROUTING TEST PROGRAM

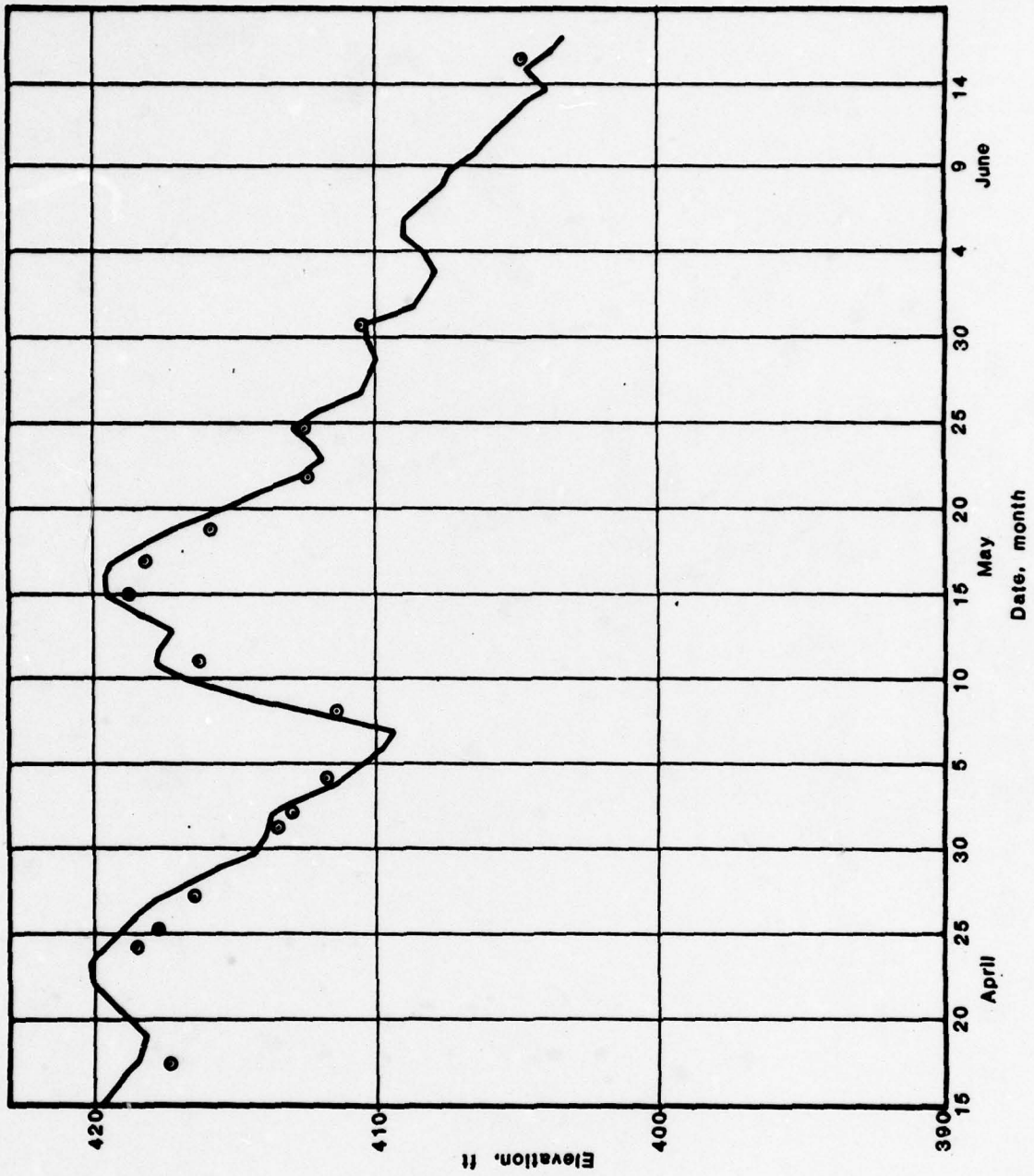
RESULTS OF INCLINOMETER I-6 MEASUREMENTS 25 MAY THROUGH 14 JUNE 1978

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. F.27



Legend

—— Tail water elevation at Locks and Dam No. 26

○ Piezometric head in P-1

CHEMICAL GROUTING TEST PROGRAM

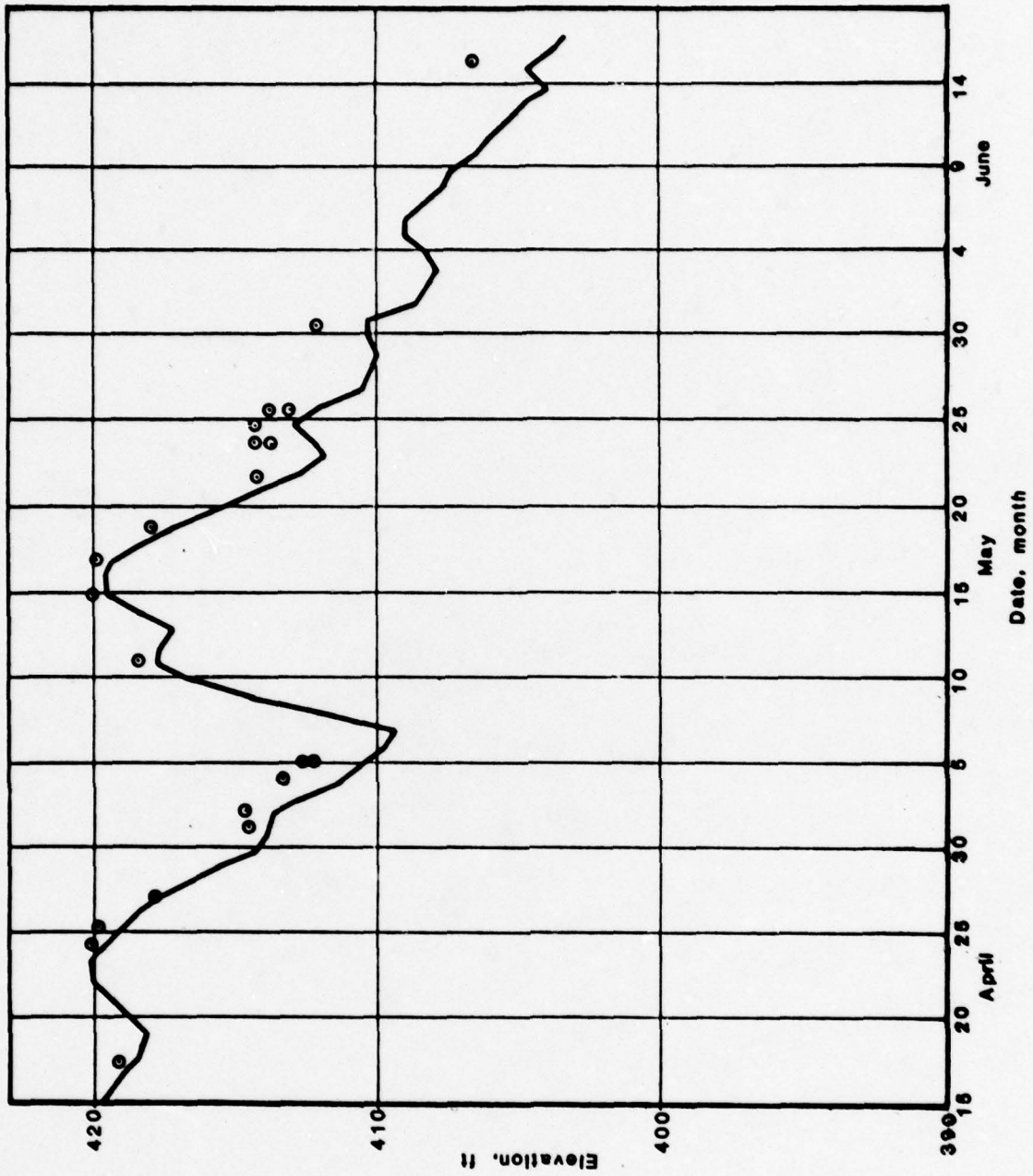
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Y7C525 Phase III

Fig.F.28



Legend

—— Tail water elevation at Locks and Dam No. 26

o Piezometric head in P-2

CHEMICAL GROUTING TEST PROGRAM

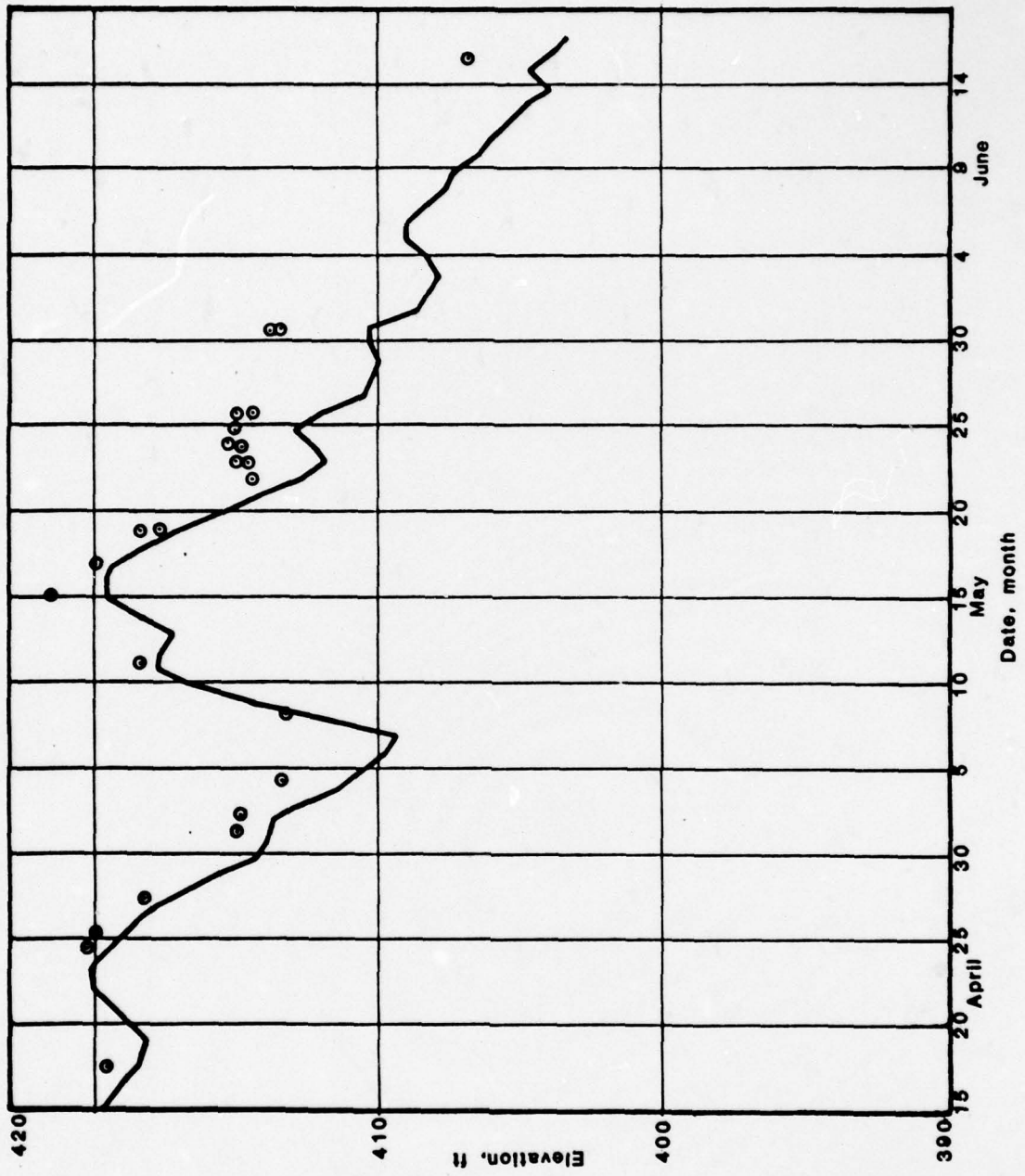
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. F.29



Legend

——— Tail water elevation at Locks and Dam No. 26.

o Piezometric head in P-3

CHEMICAL GROUTING TEST PROGRAM

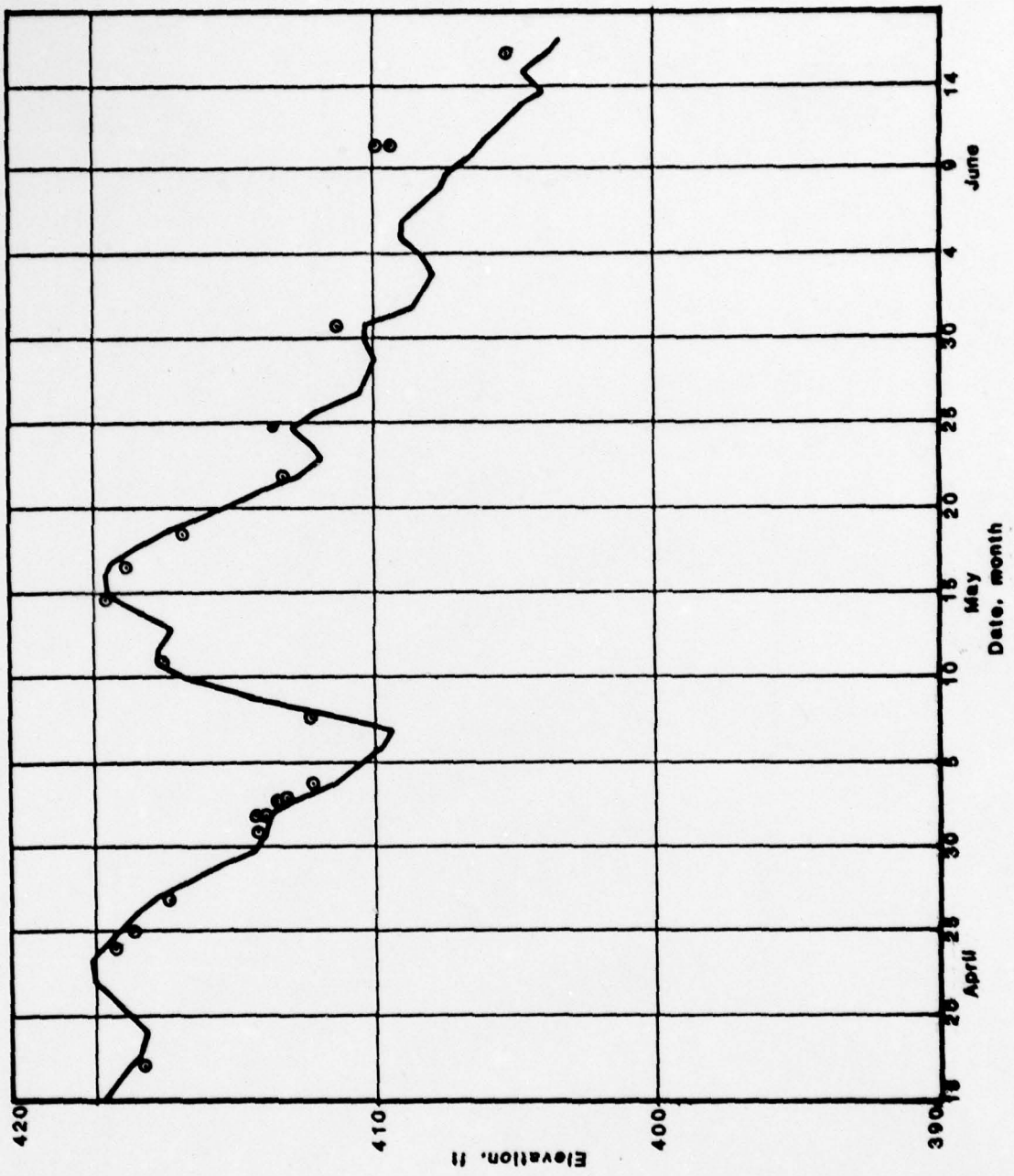
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO.

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. F.30



Legend

—— Tail water elevation at Locks and Dam No. 26

o Piezometric head in P-4

CHEMICAL GROUTING TEST PROGRAM

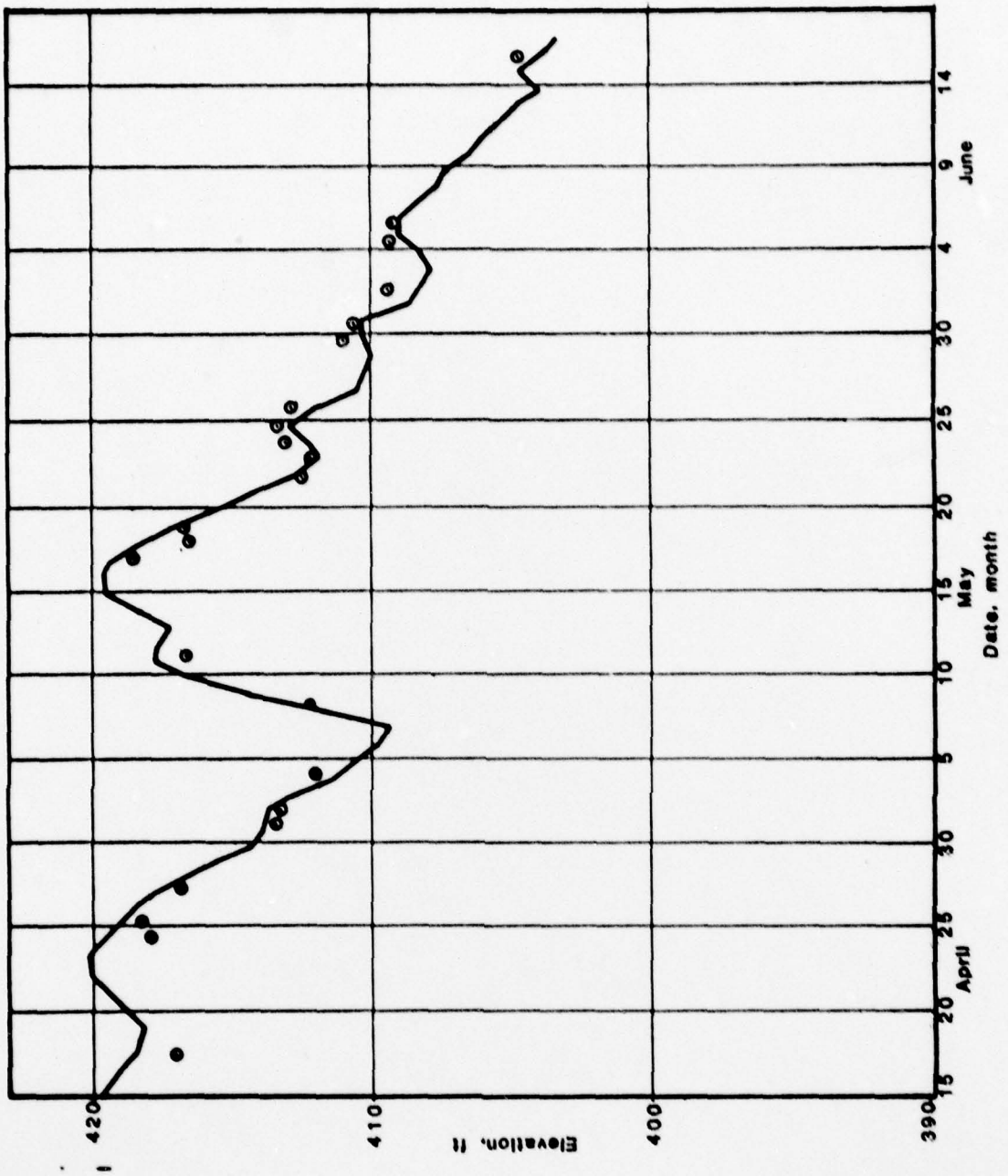
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig.F.31

Y7C825 Phase IX



Legend

—— Tail water elevation at Locks and Dam No. 26

o Piezometric head in P-6

CHEMICAL GROUTING TEST PROGRAM

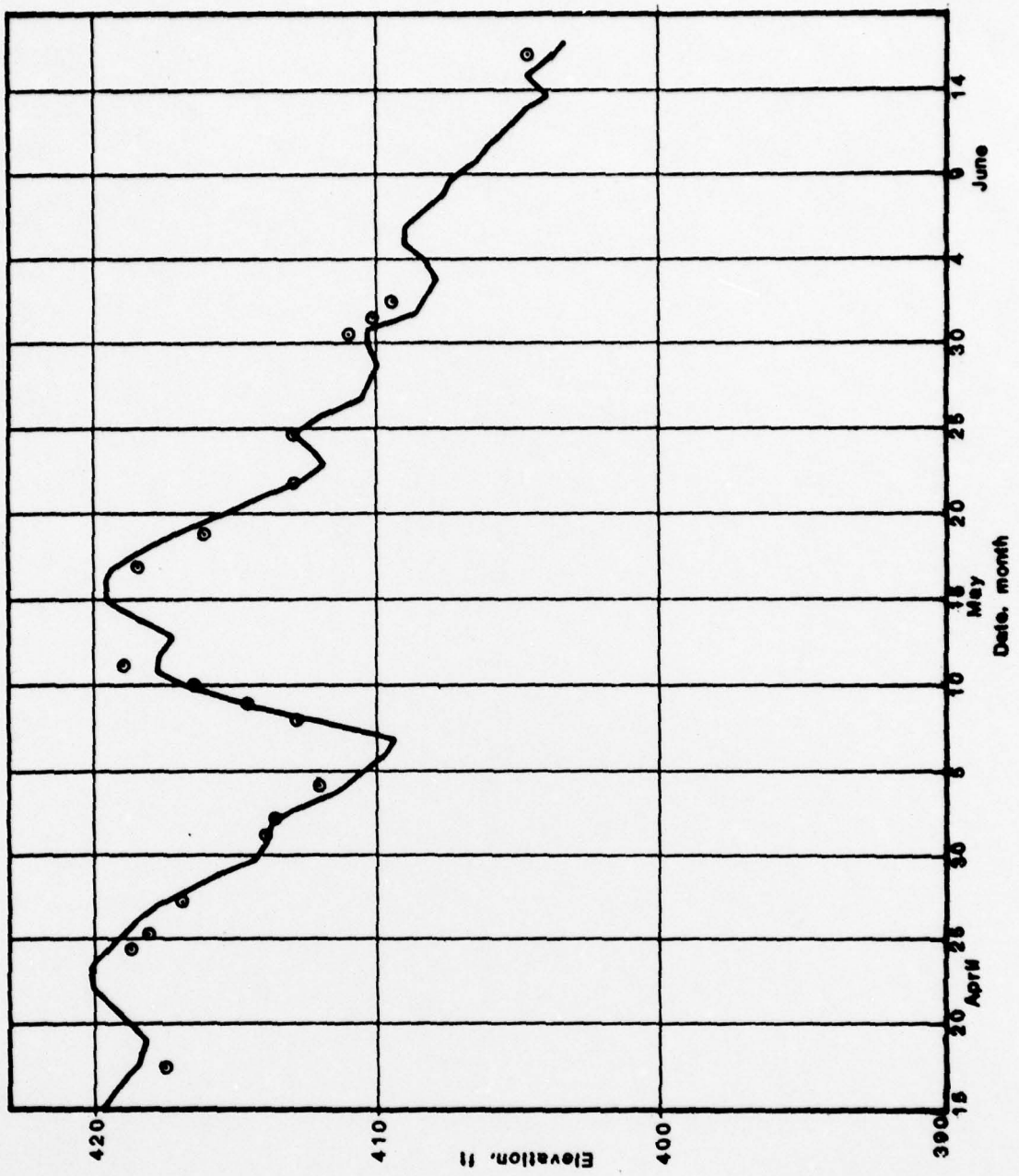
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0008

Woodward-Clyde Consultants

Fig. F.32

Y7C825 Phase IV



Legend

——— Tail water elevation at Locks and Dam No. 26

O Piezometric head in P-6

CHEMICAL GROUTING TEST PROGRAM

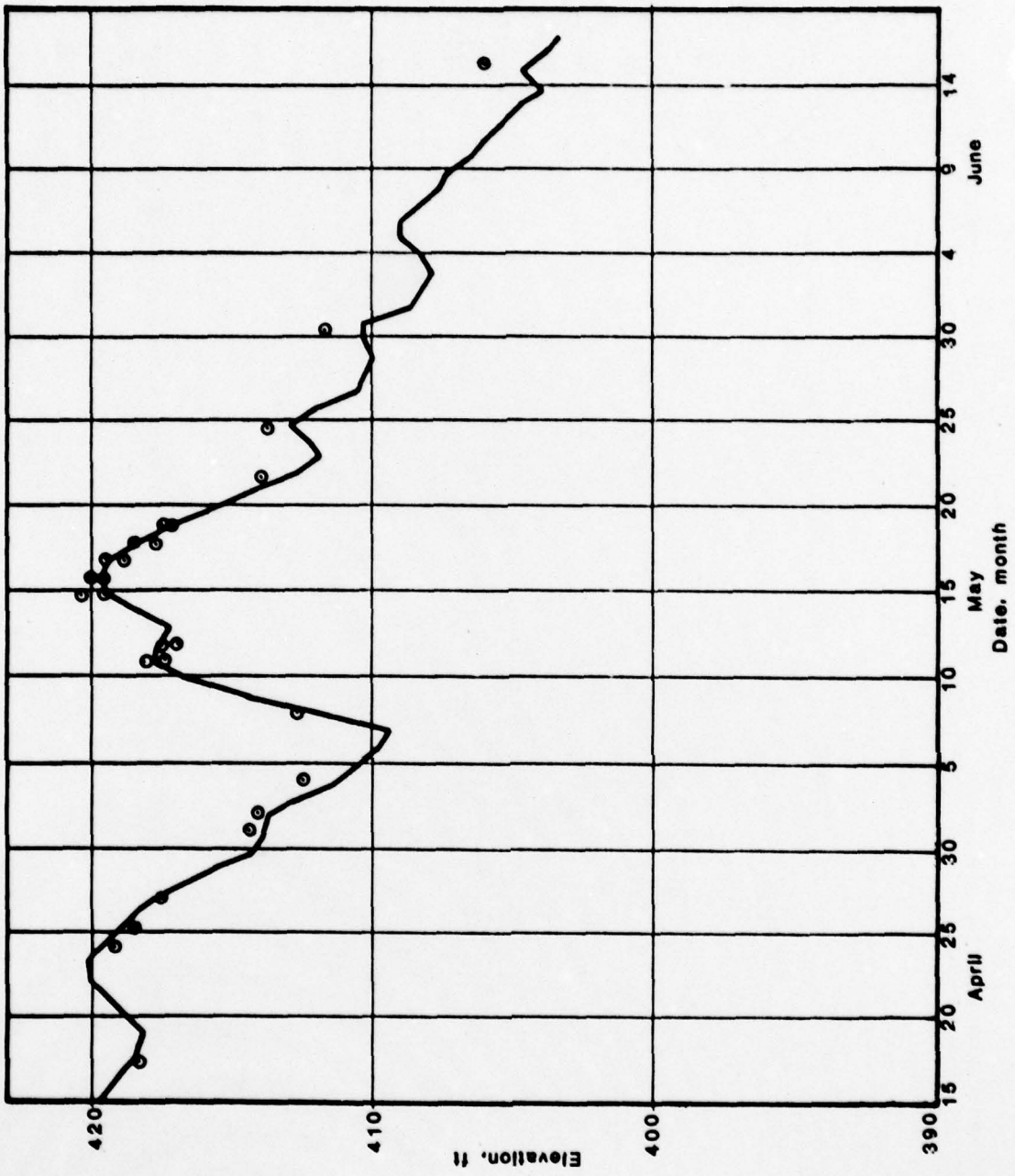
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26.

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

Woodward-Clyde Consultants

Fig. F.33

Y7C825 Phase IX



Legend

—— Tail water elevation at Locks and Dam No. 26

O Piezometric head in P-7

CHEMICAL GROUTING TEST PROGRAM

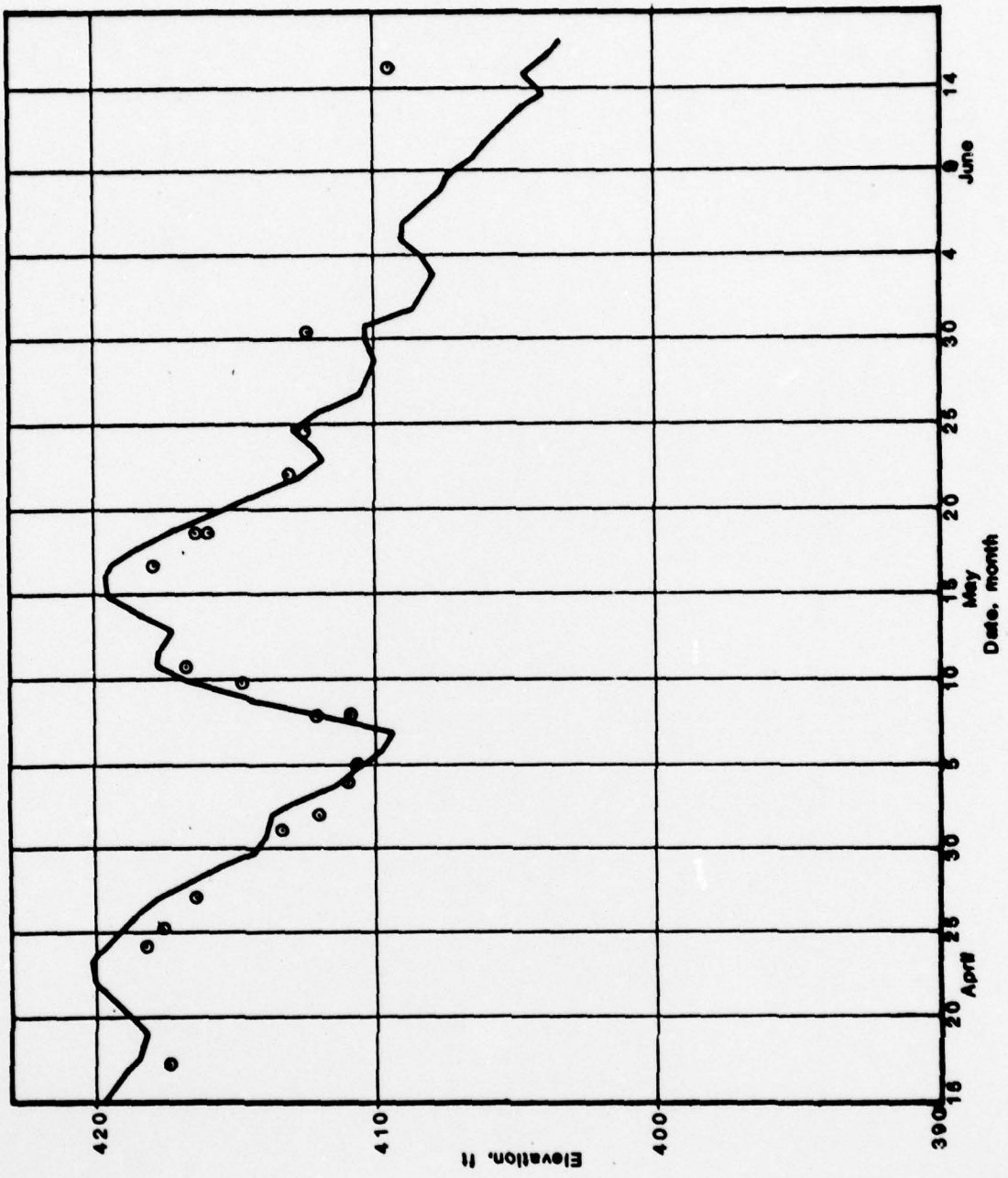
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0009

Woodward-Clyde Consultants

Y7C826 Phase IX

Fig. F.34



Legend

—— Tail water elevation at Locks and Dam No. 26

O Piezometric head in P-8

CHEMICAL GROUTING TEST PROGRAM

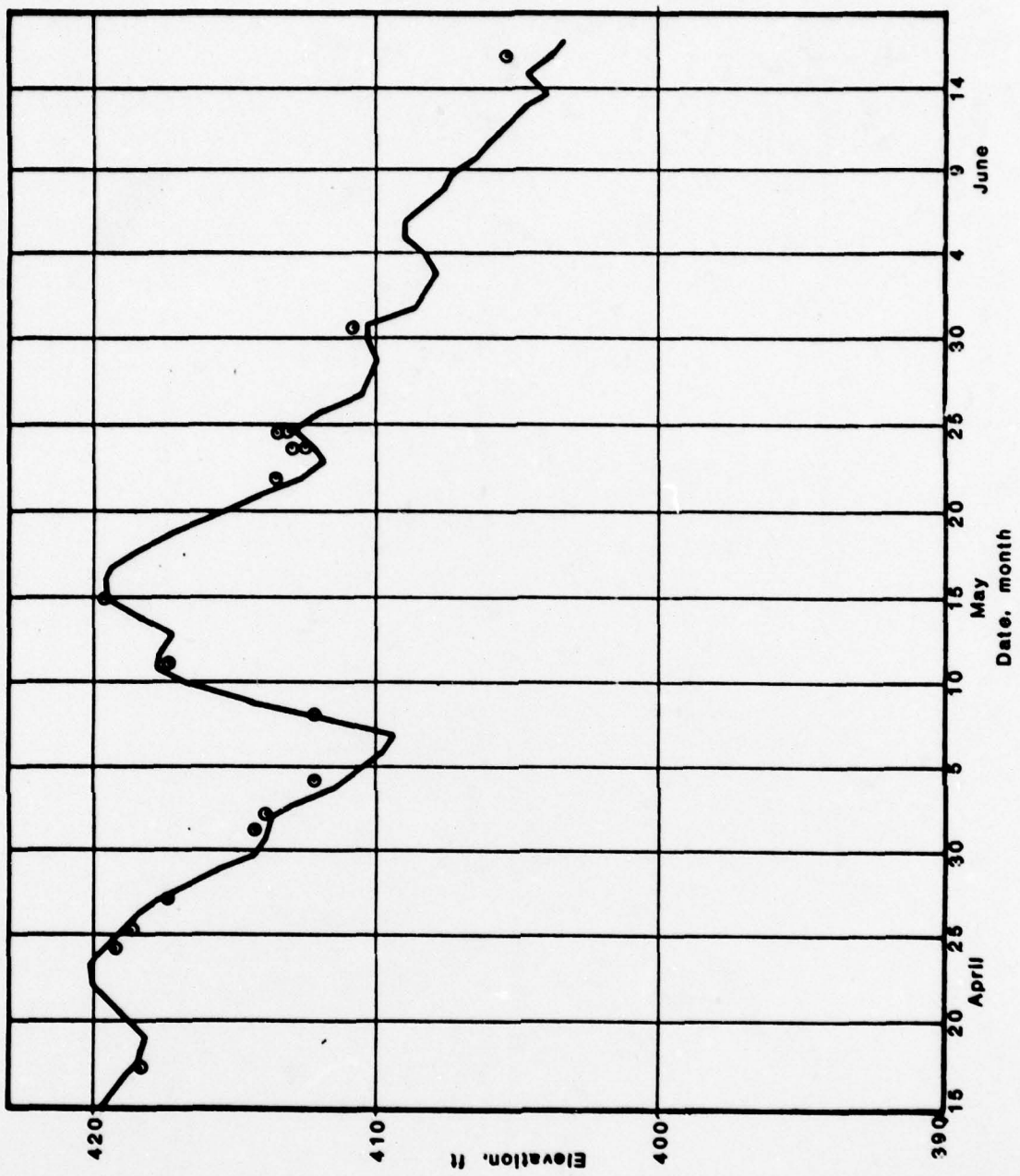
PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. F.35

Y7C826 Phase IX



Legend

—— Tail water elevation at Locks and Dam No. 26

o Piezometric head in P-9

CHEMICAL GROUTING TEST PROGRAM

PIEZOMETRIC HEAD COMPARED TO TAILWATER ELEVATION AT LOCKS AND DAM NO. 26

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0095

Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. F.36

PHASE IV REPORT

VOLUME IIA

RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM

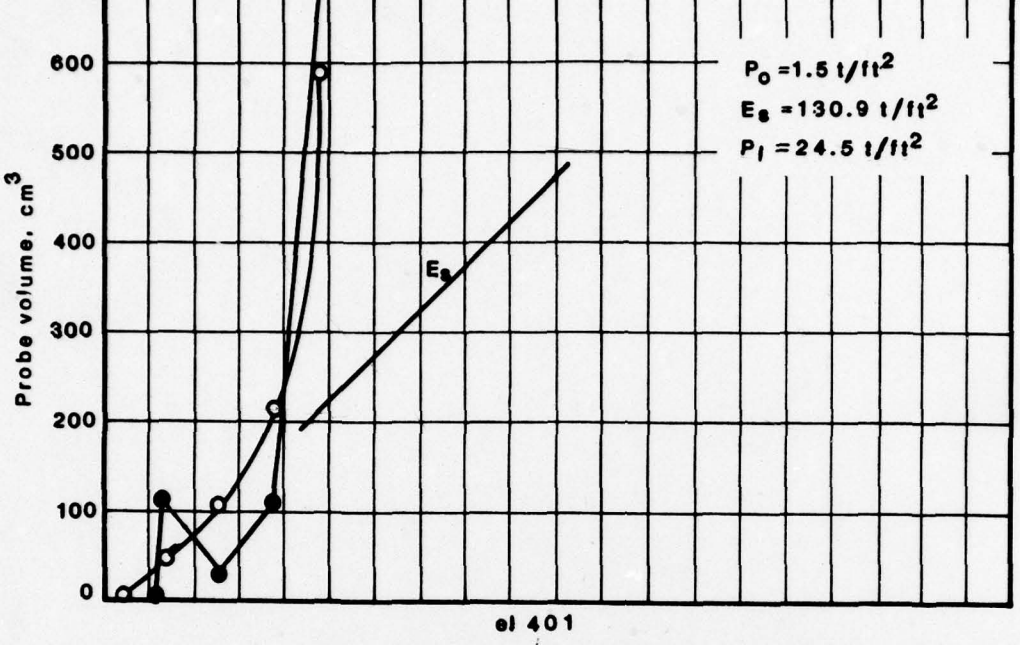
APPENDIX G

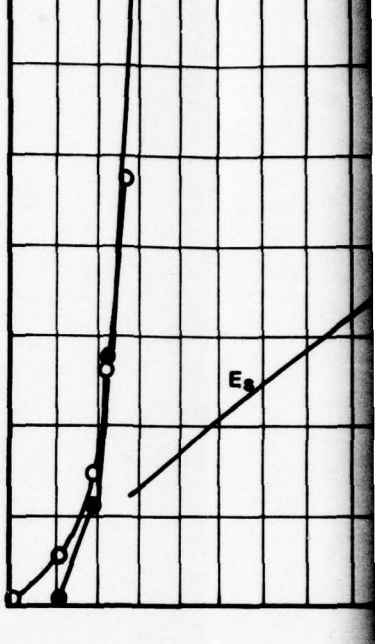
EVALUATION OF GROUTING RESULTS

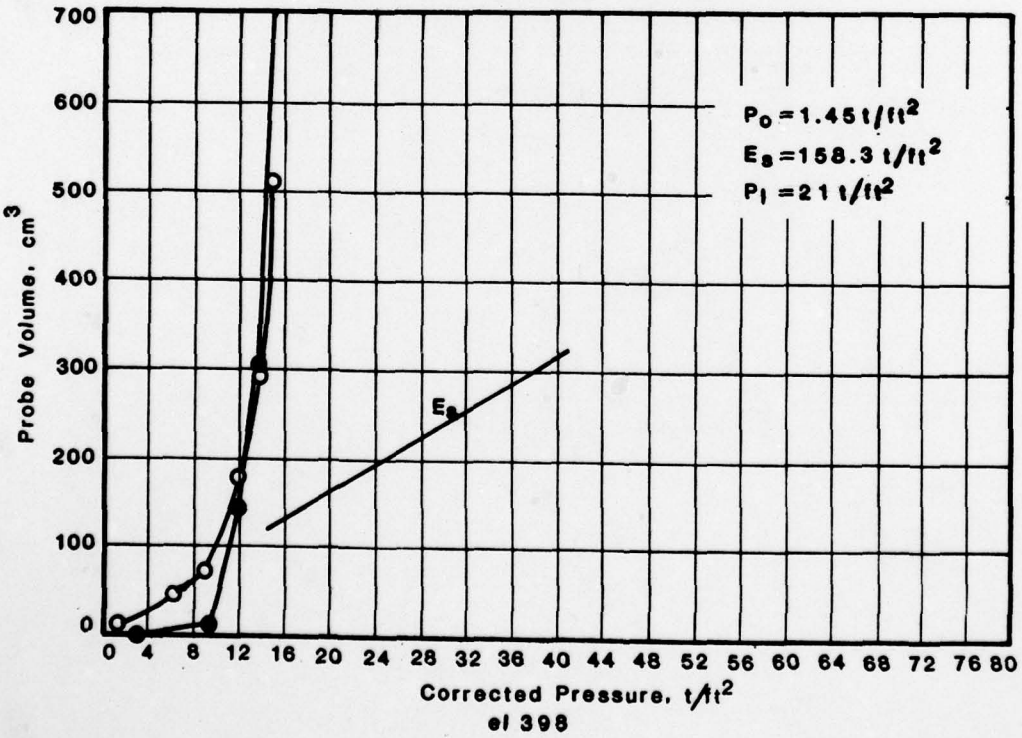
APPENDIX G

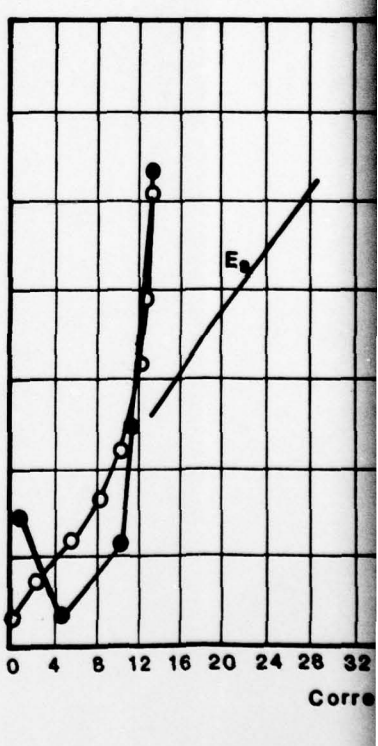
EVALUATION OF GROUTING RESULTS

TABLE OF CONTENTS

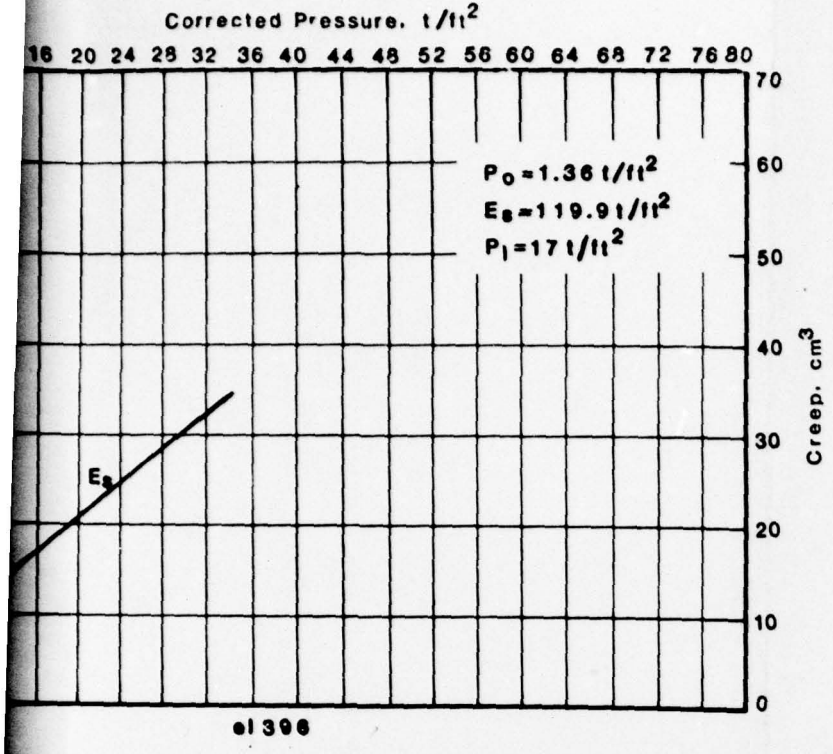


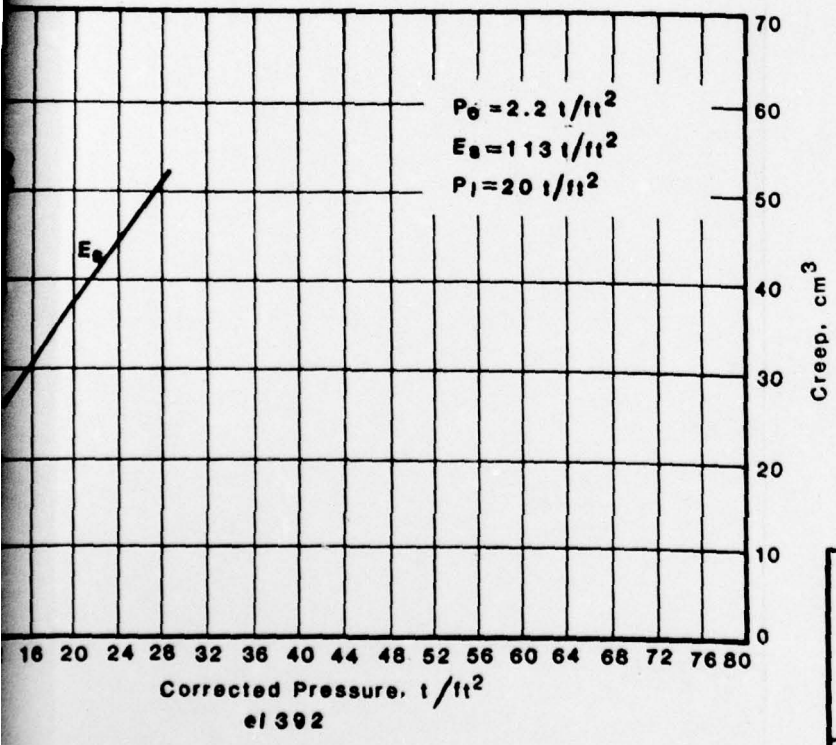






Test results obtained from boring AG-A1-5





Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

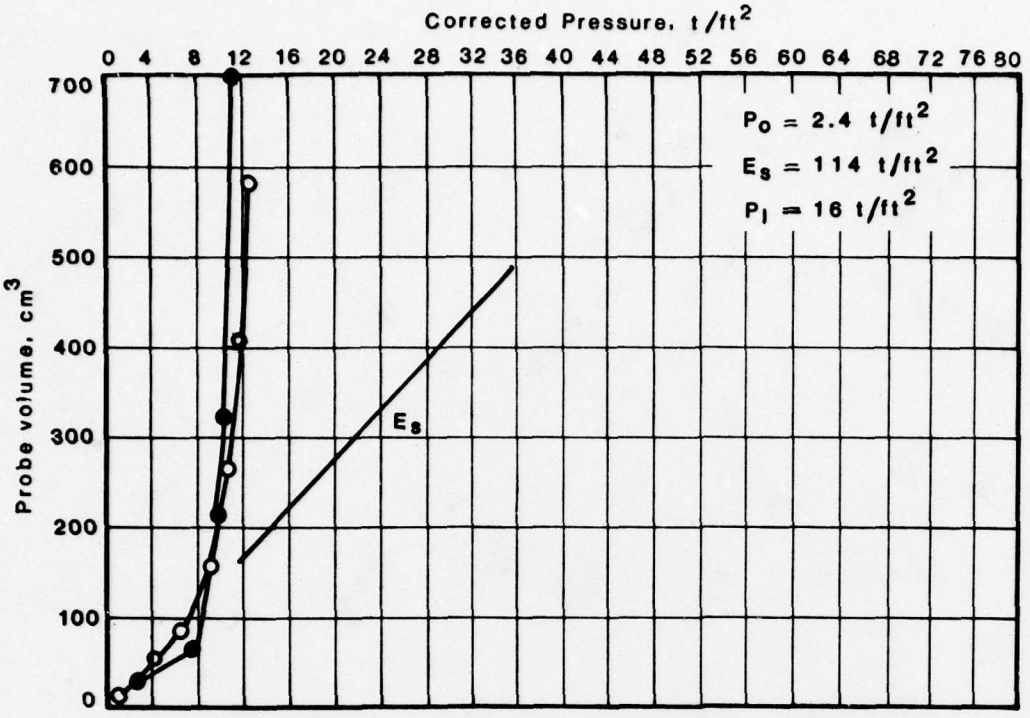
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

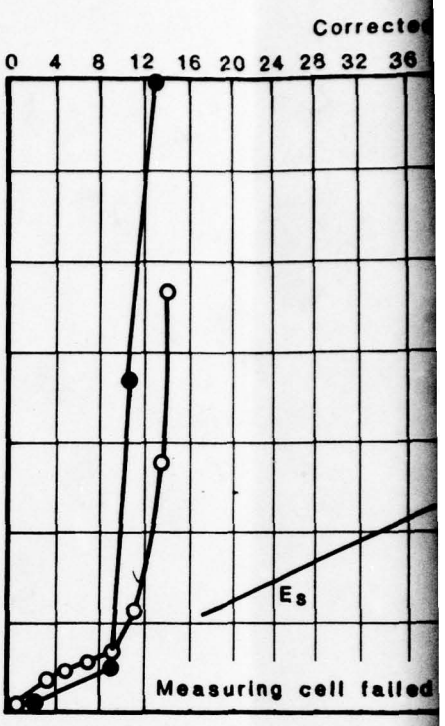
Woodward-Clyde Consultants

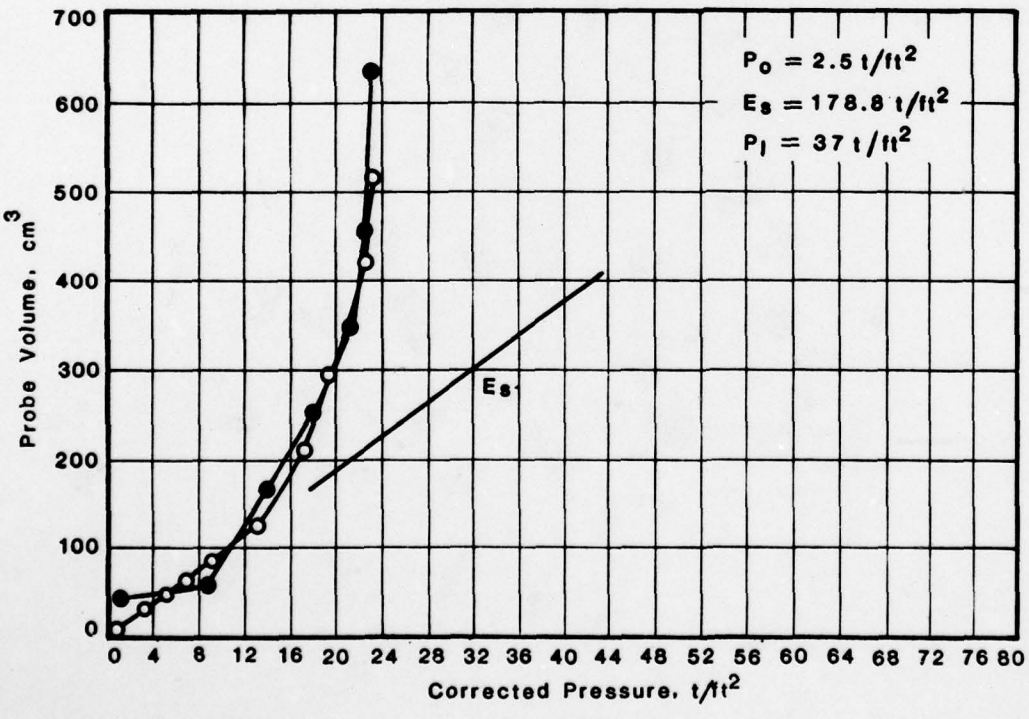
Fig. G.1

Y7CS25 Phase IX



el 386





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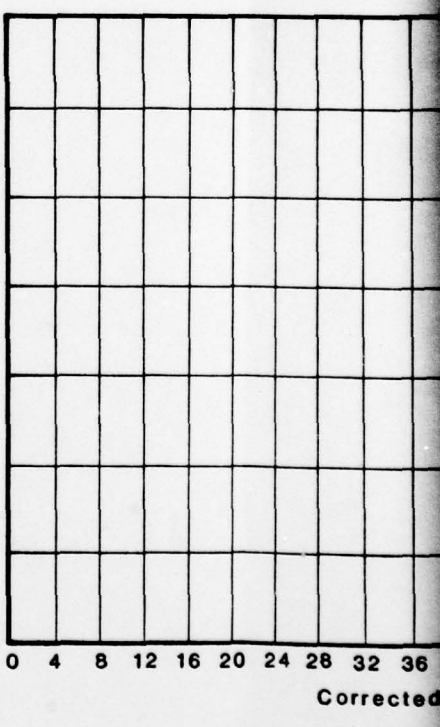
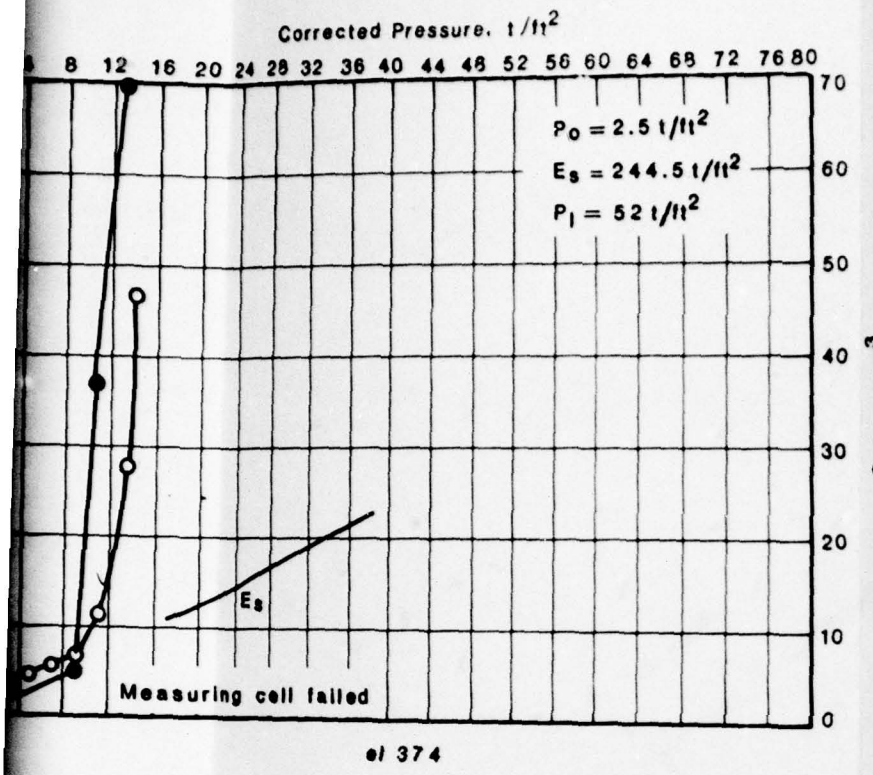
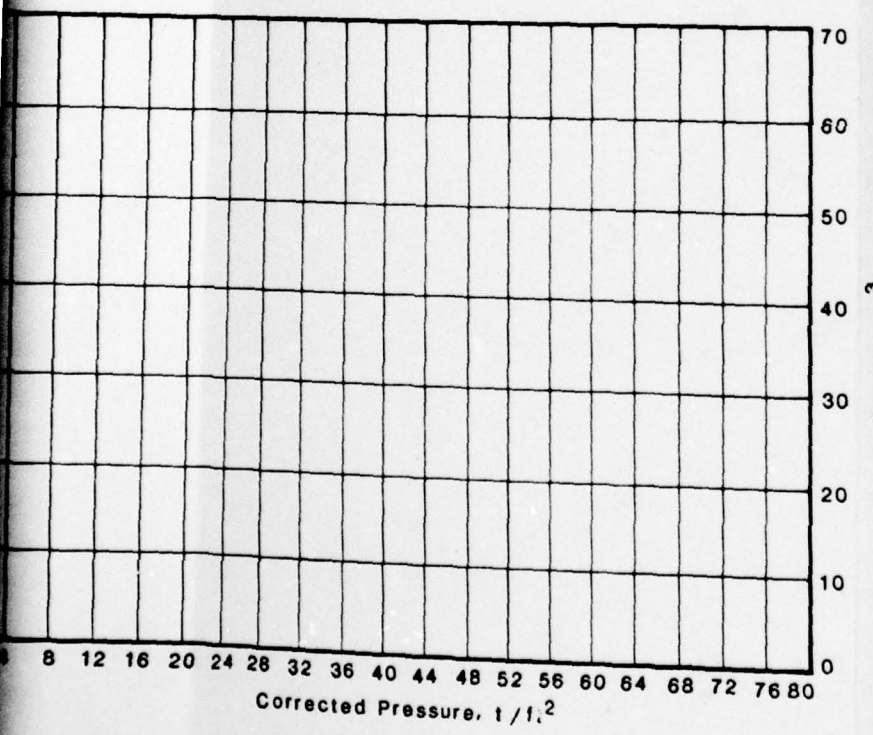


Test results obtained from boring AG-A1-5



el 374



m boring AG-A1-5

Legend

- O Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

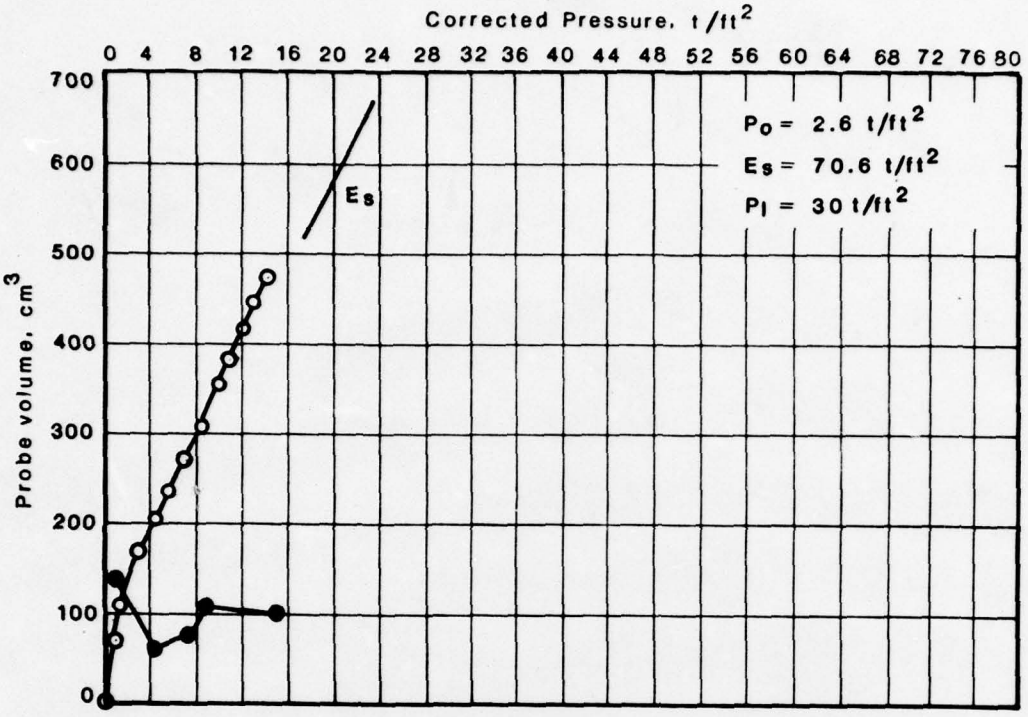
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 1

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

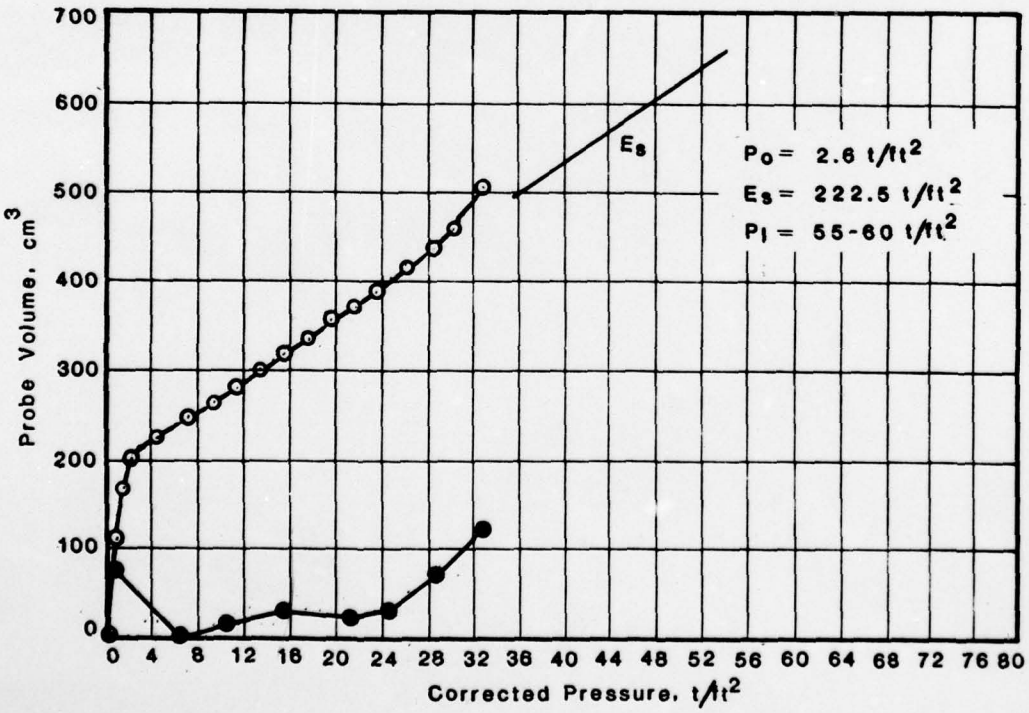
Woodward-Clyde Consultants

Fig. G.2

Y7C825 Phase IV

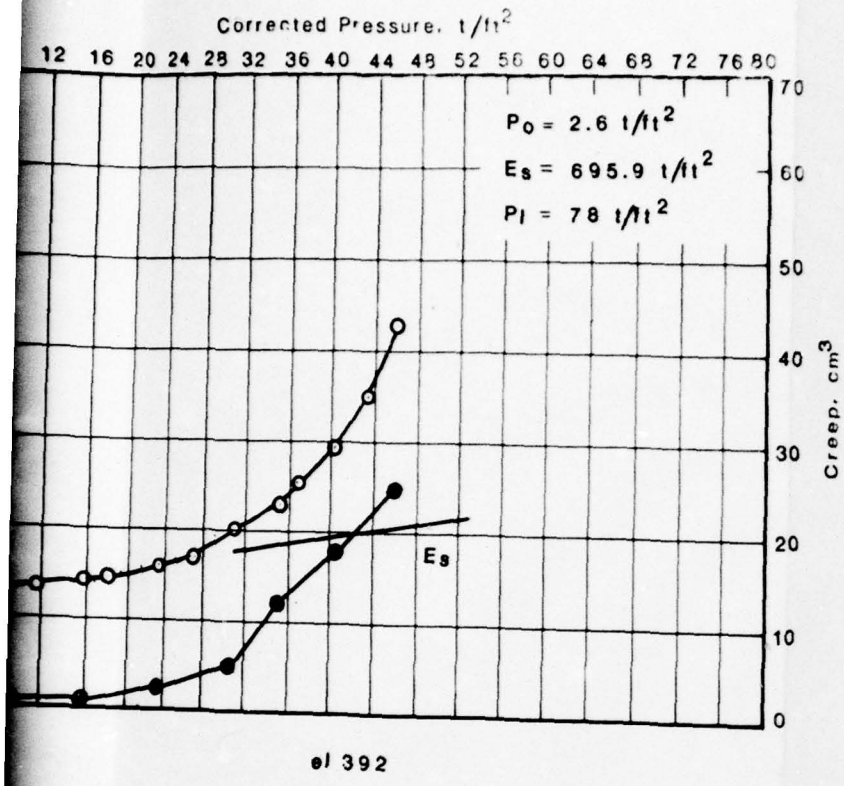


el 397

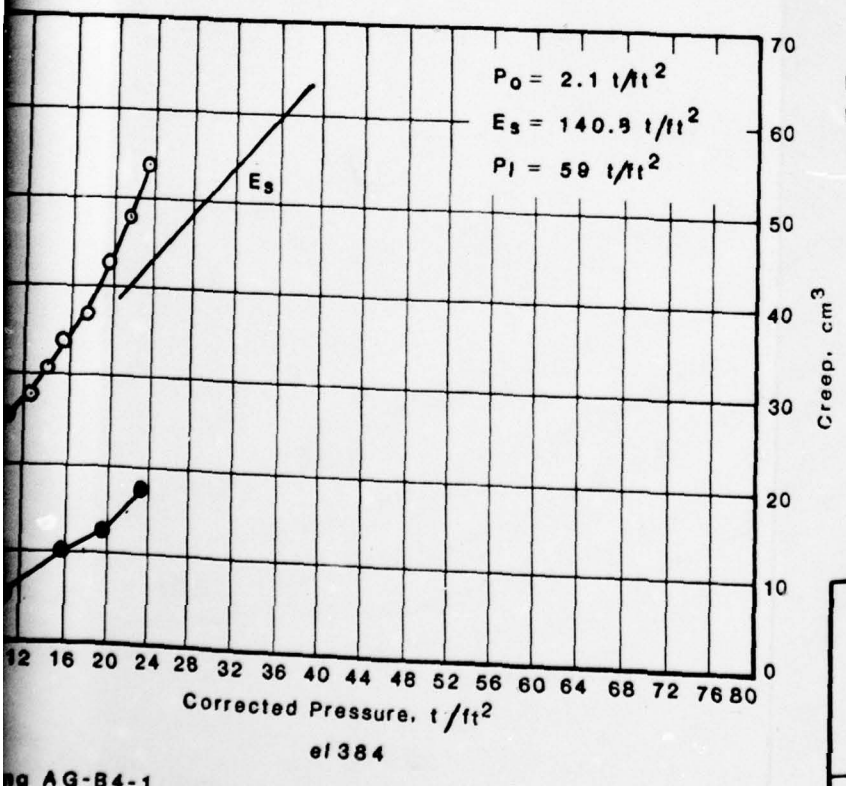


el 394

Test results obtained from boring AG-B4-1



el 392



el 384

ng AG-B4-1

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

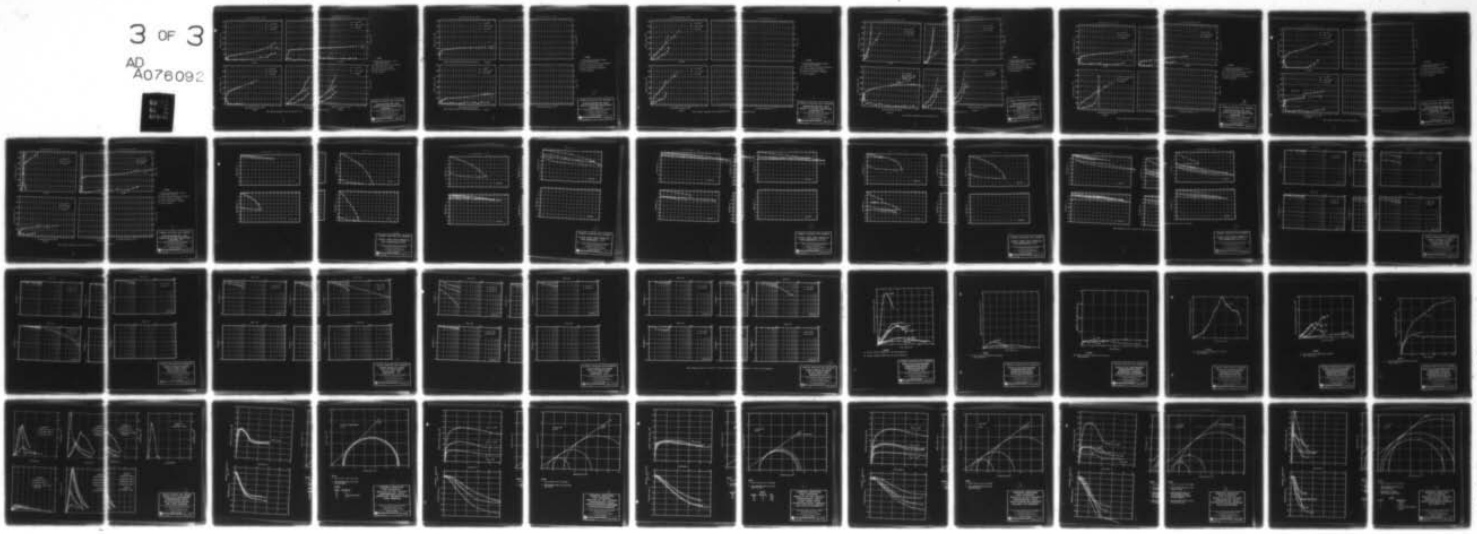
Woodward-Clyde Consultants

Y7C825 Phase IV

Fig. G.3

AD-A076 092 WOODWARD-CLYDE CONSULTANTS CHICAGO IL F/G 13/2
RESULTS AND INTERPRETATION OF CHEMICAL GROUTING TEST PROGRAM. E--ETC(U)
JUL 79 J PEREZ , Y LACROIX DACW43-78-C-0005
UNCLASSIFIED NL

3 OF 3
AD
A076092



END
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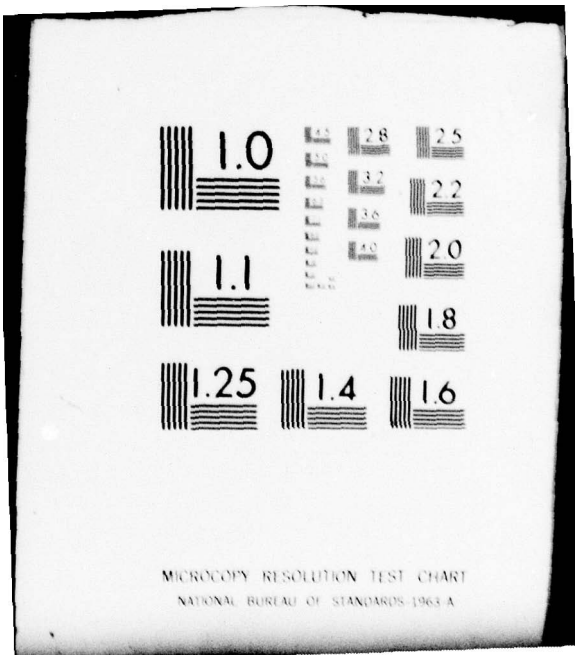
1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
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2.5
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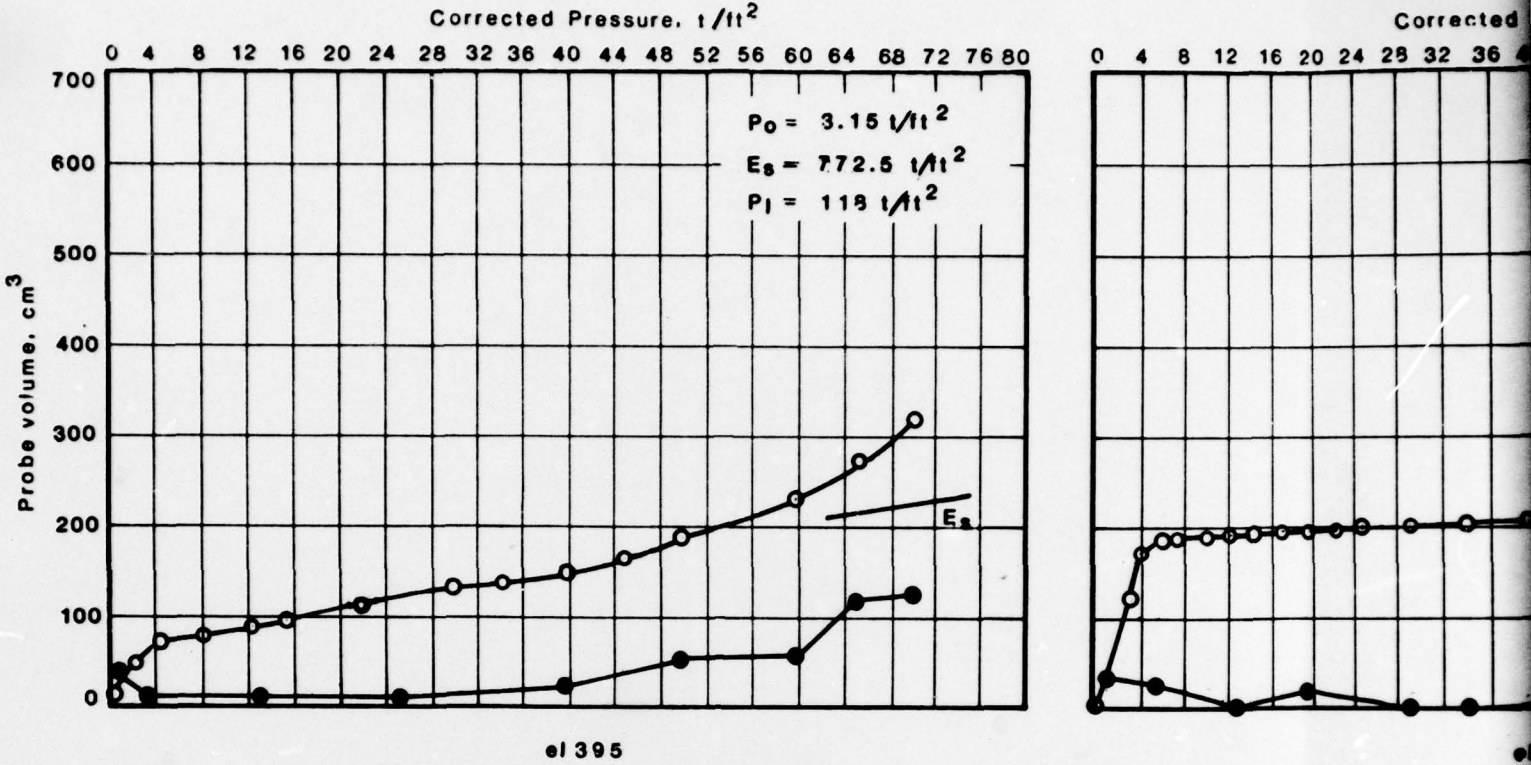
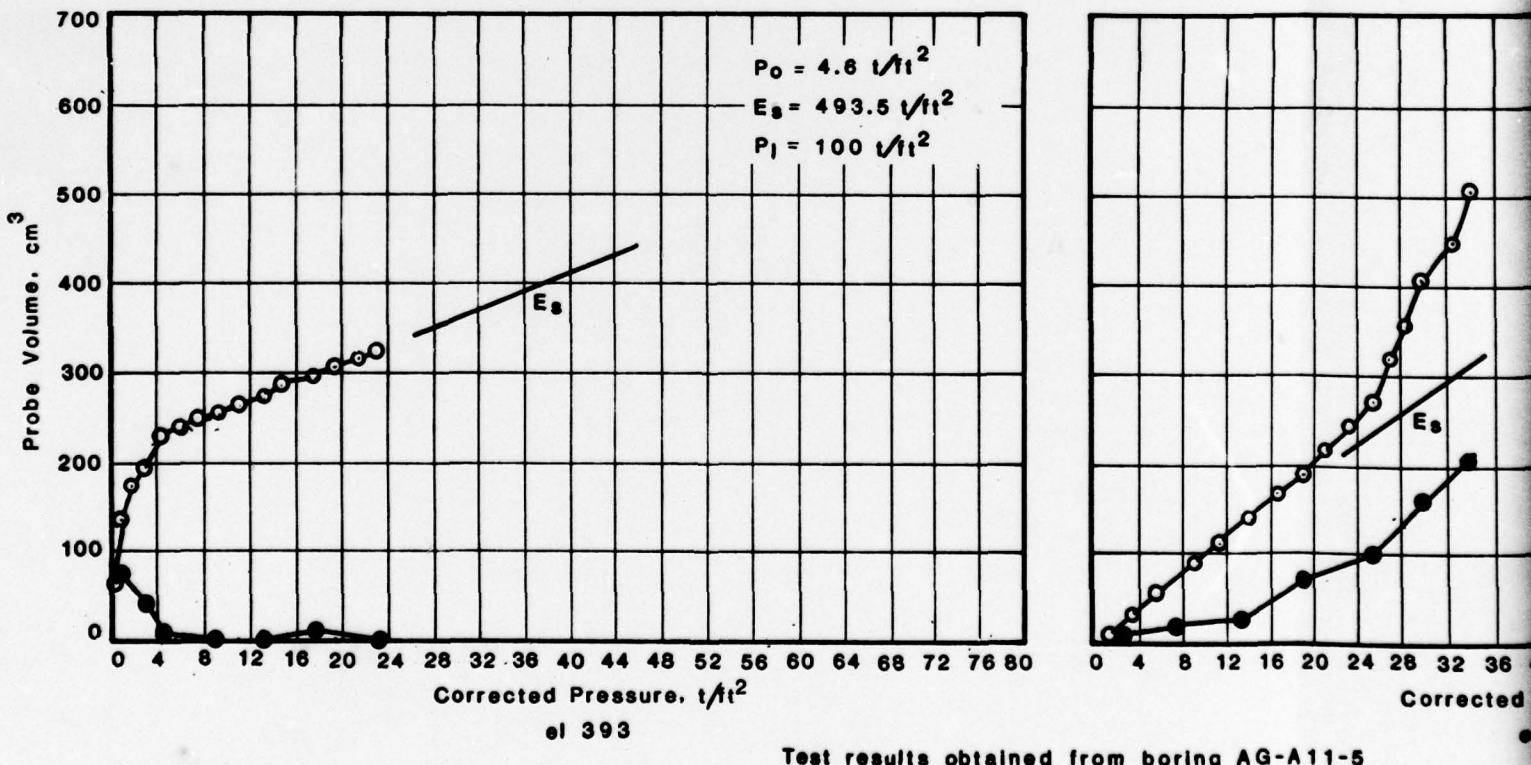
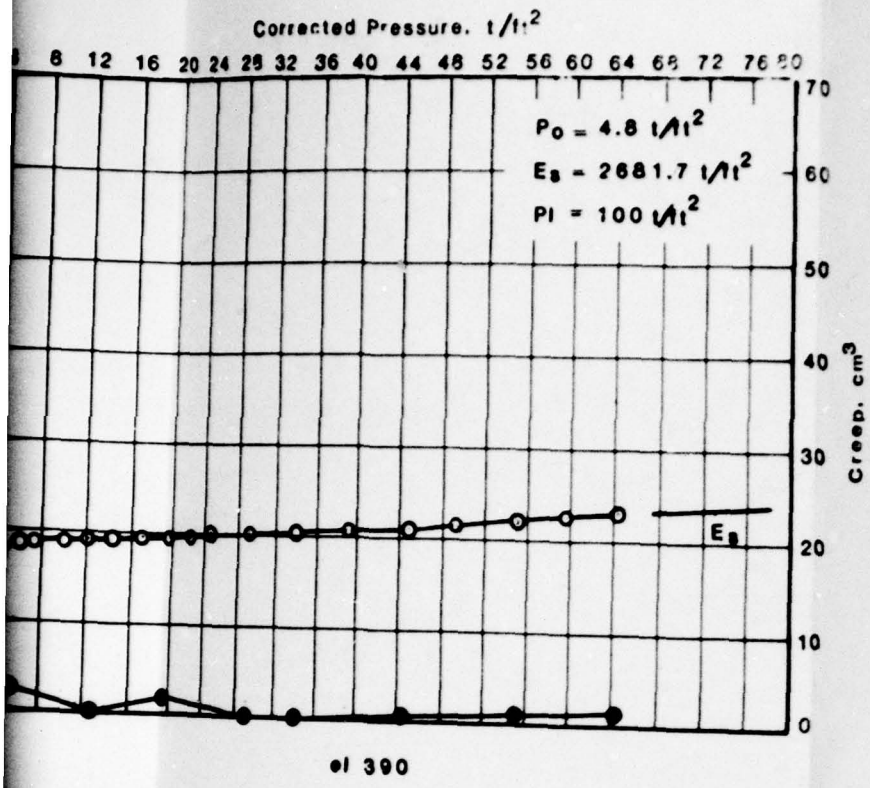
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

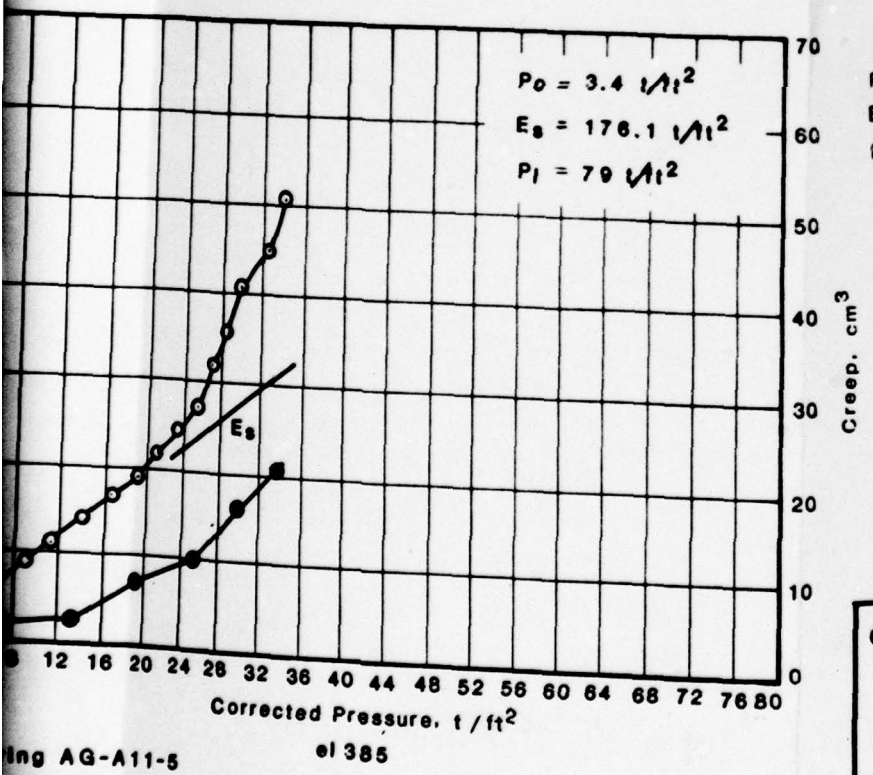




Test results obtained from boring AG-A11-5



el 390



ing AG-A11-5

el 385

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

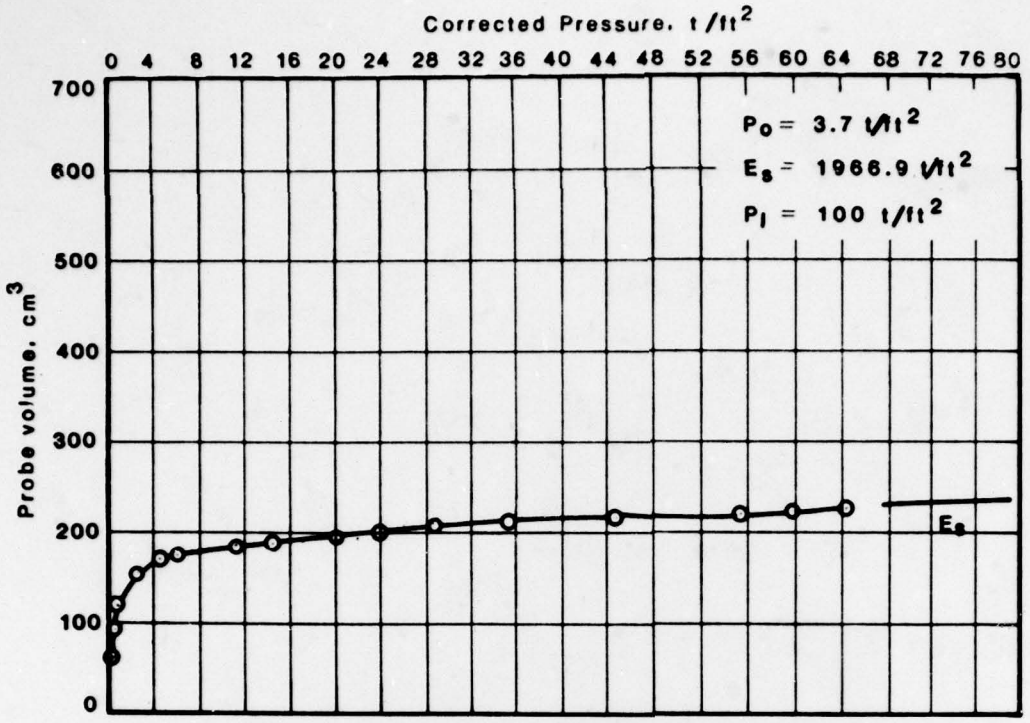
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

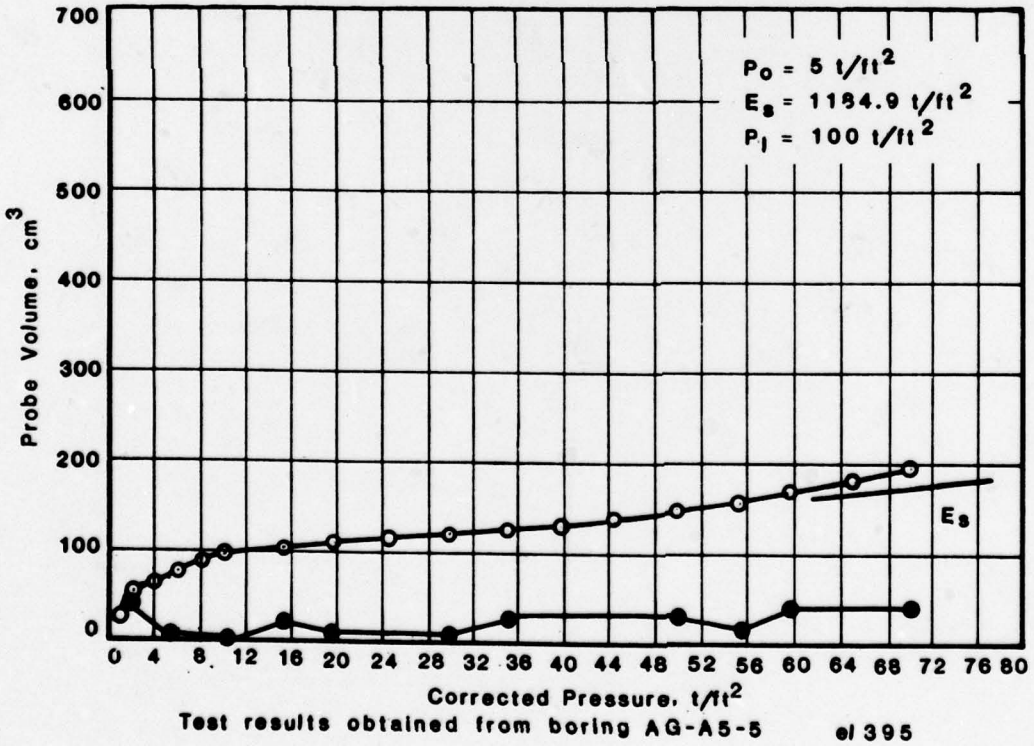
Woodward-Clyde Consultants

Fig. G.4

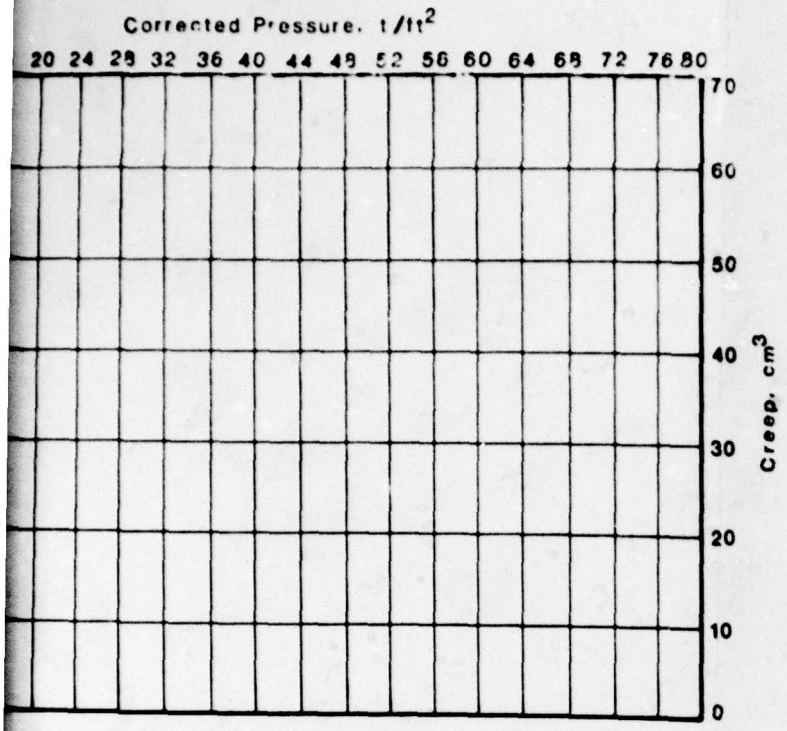
Y7C825 Phase IV

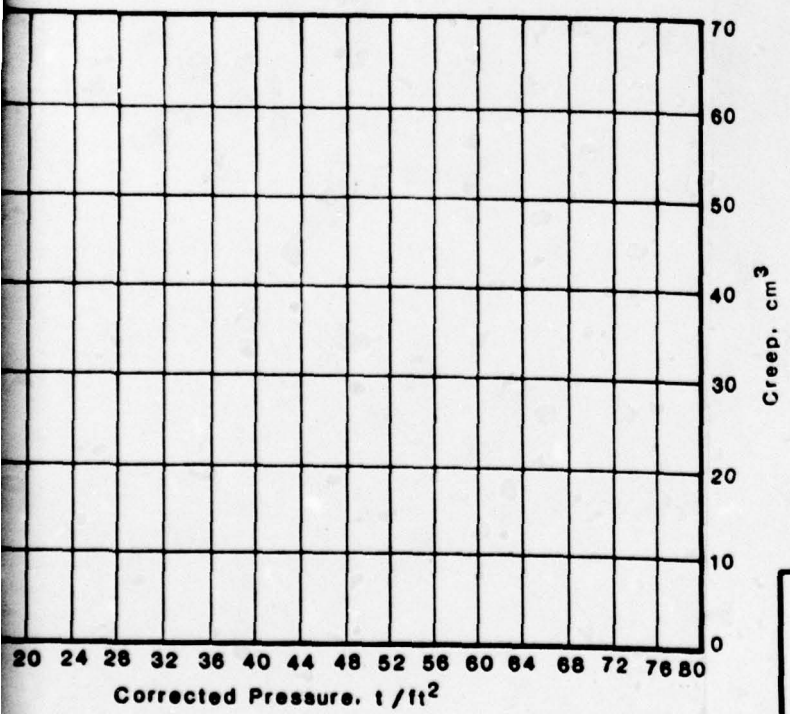


Test results obtained from boring AG-B5-1 el 388



Test results obtained from boring AG-A5-5 el 395





Legend

- ○ Probe Volume Change versus *Corrected Pressure*
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s *Elastic Deformation* Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

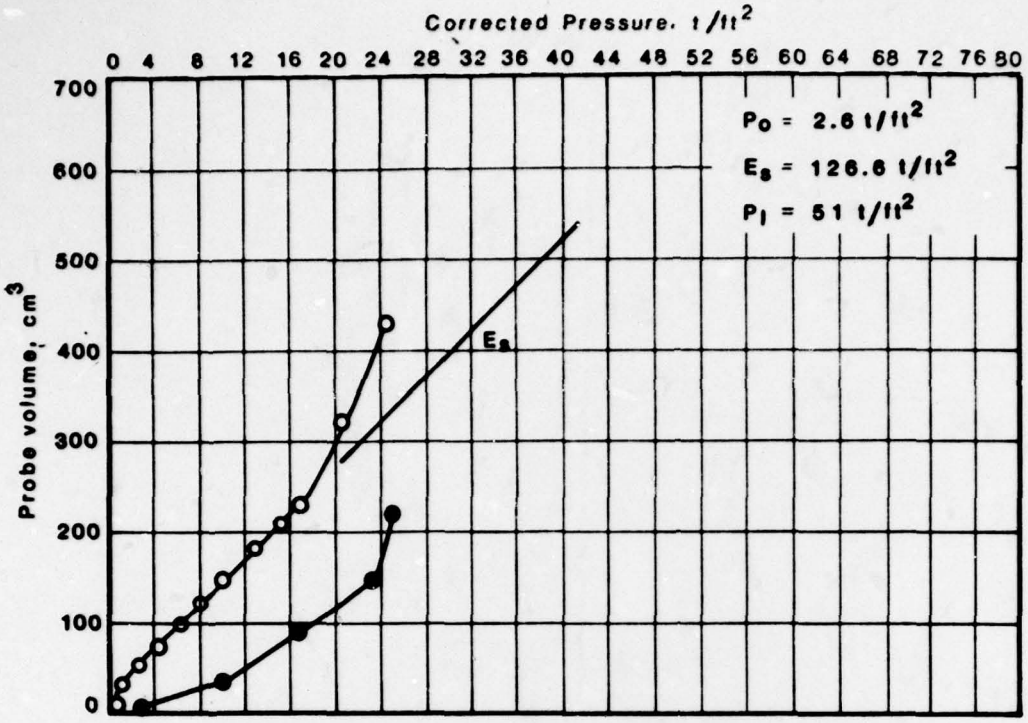
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 5

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

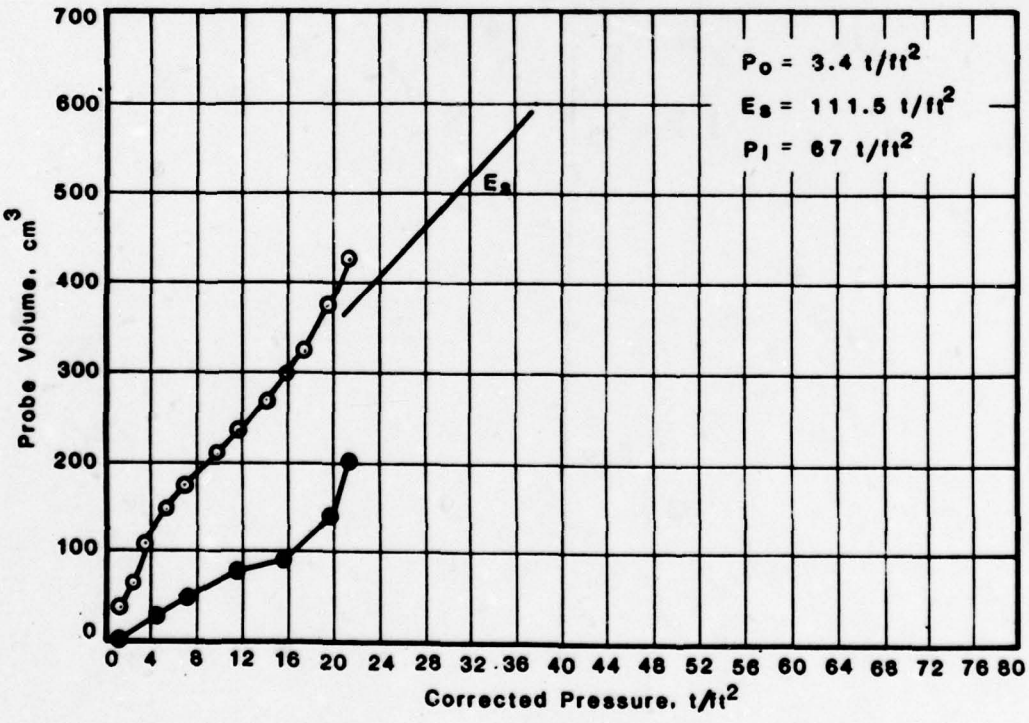
Woodward-Clyde Consultants

Fig. G.5

Y7C825 Phase IX

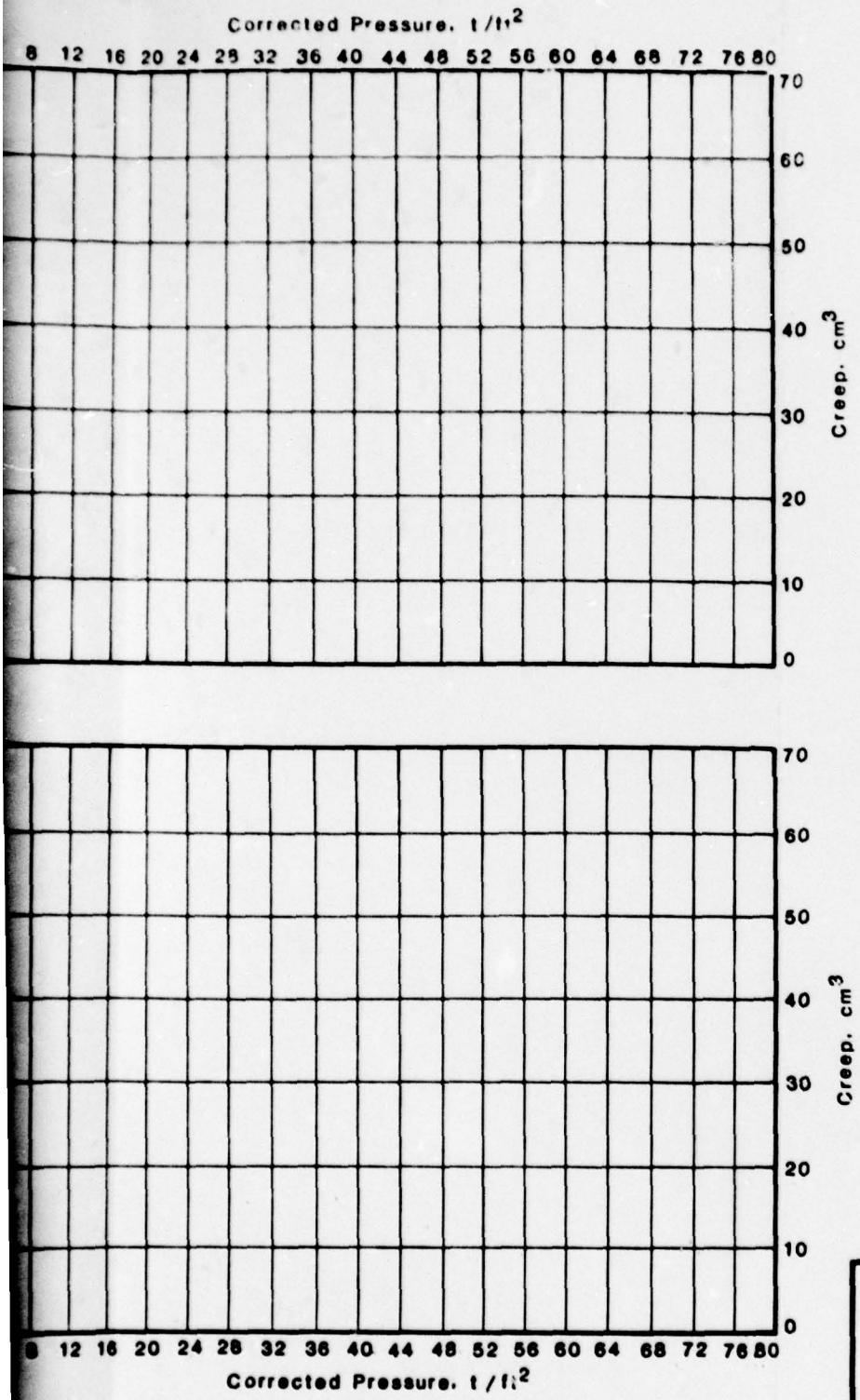


el 399



el 395

Test results obtained from boring AG-A8-2



Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

Boring AG-A9-2

2

CHEMICAL GROUTING TEST PROGRAM

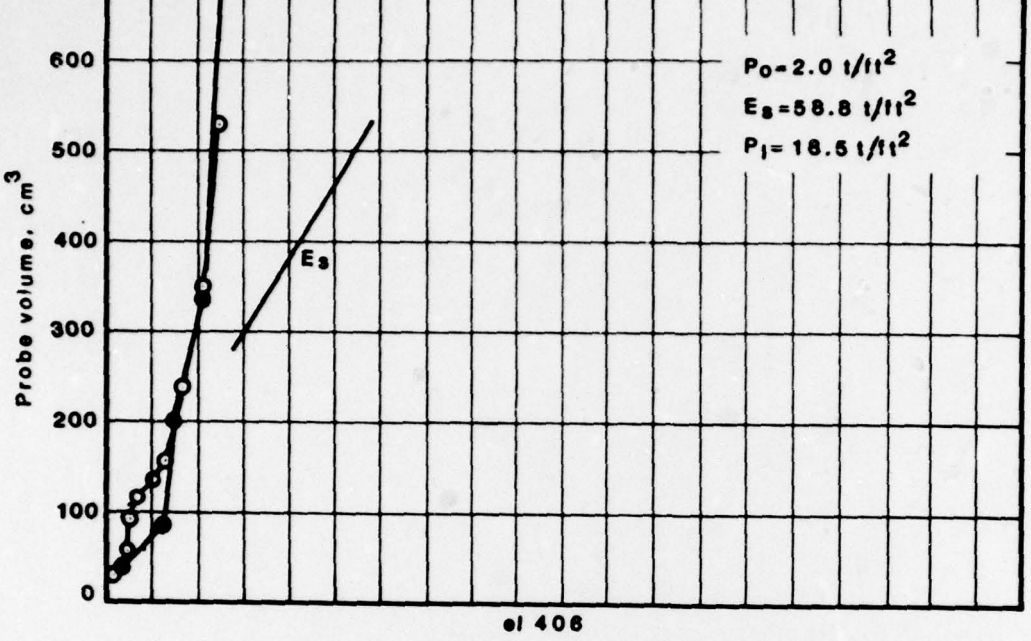
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 8

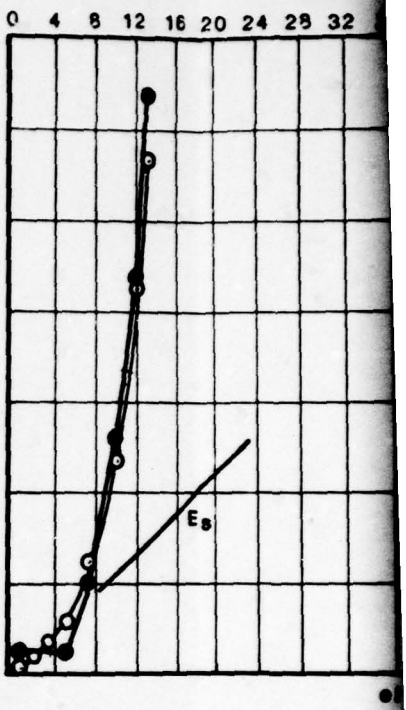
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

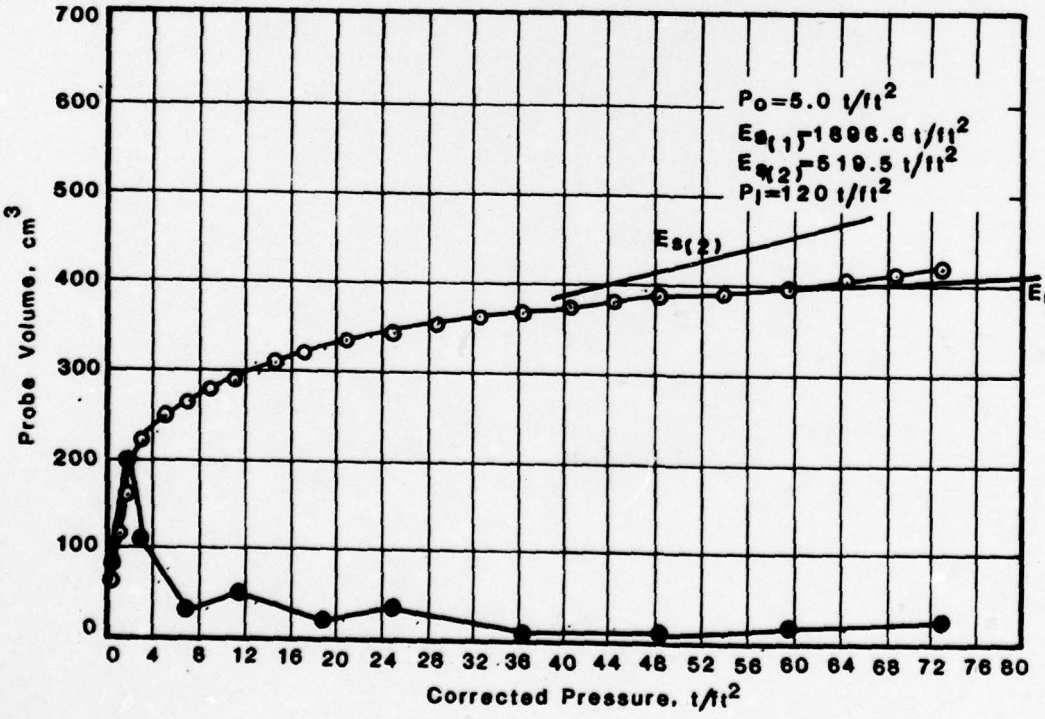
Woodward-Clyde Consultants

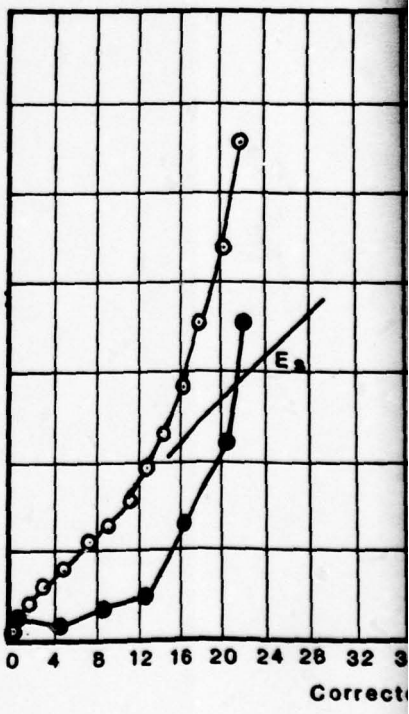
Y7C825 Phase IX

Fig. G.6

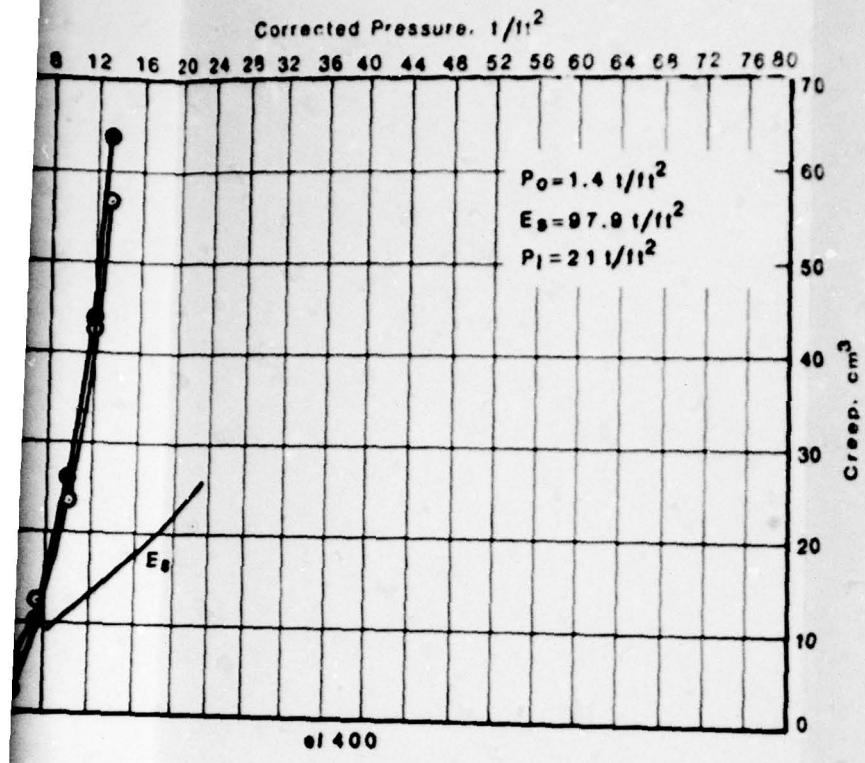




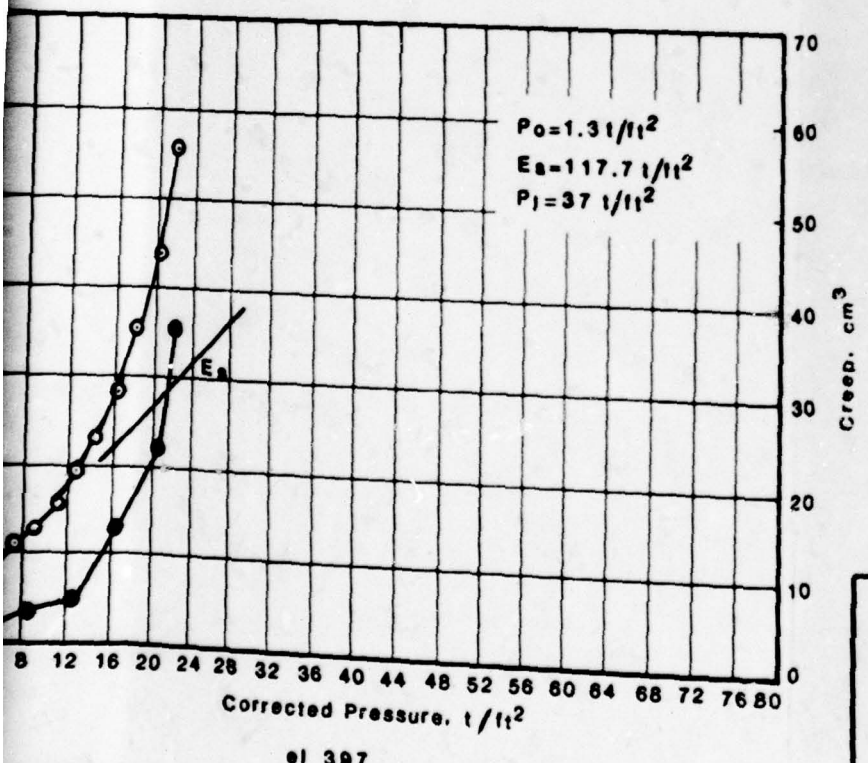




Test results obtained from boring AG-A11-5



el 400



el 397

ring AG-A11-5

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

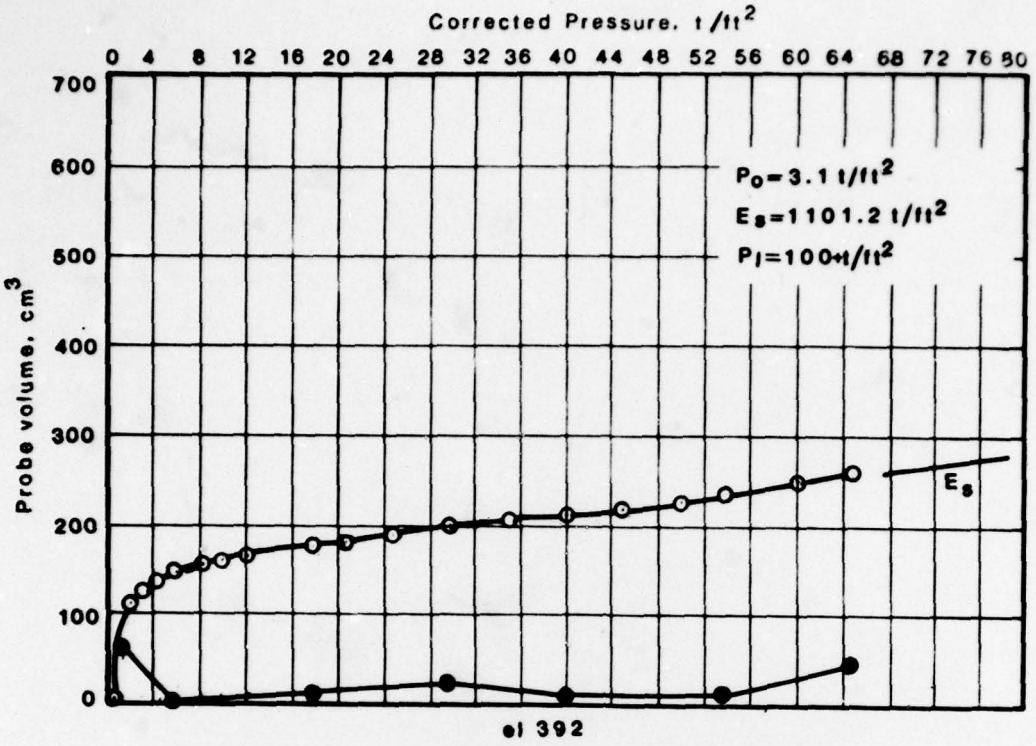
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 11

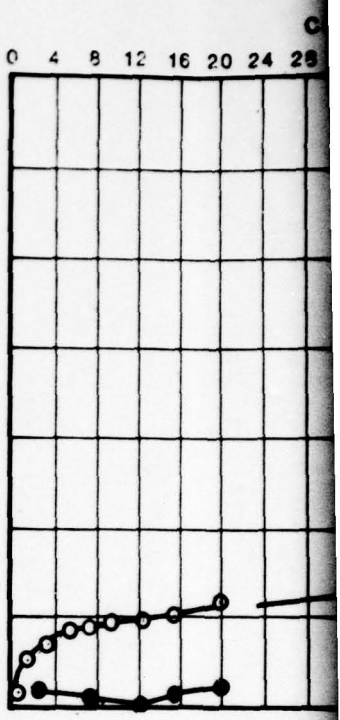
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

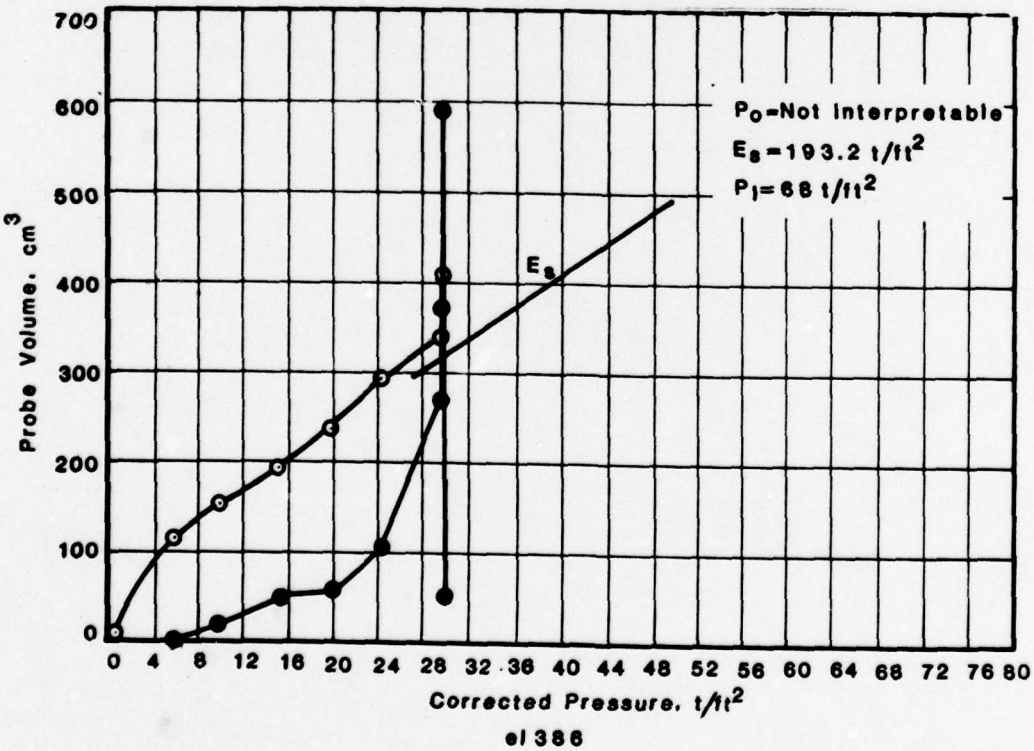
Woodward-Clyde Consultants

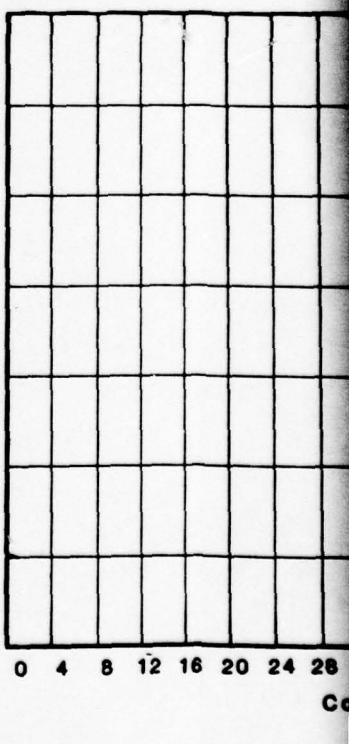
Fig. G.7

Y7C825 Phase IV

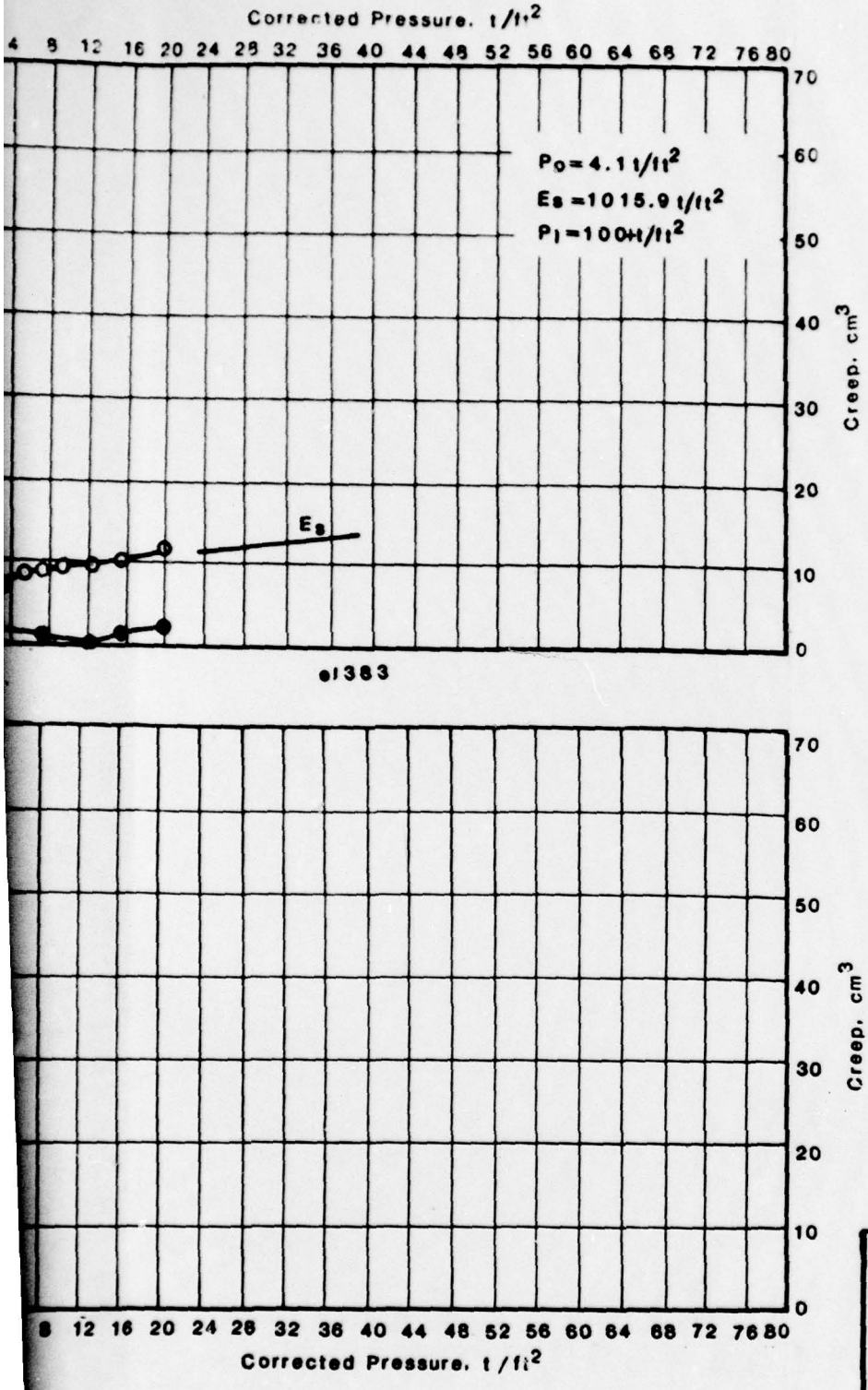








Test results obtained from boring AG-B11-2



ing AG-B11-2

Legend

- ○ Probe Volume Change versus Corrected Pressure
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

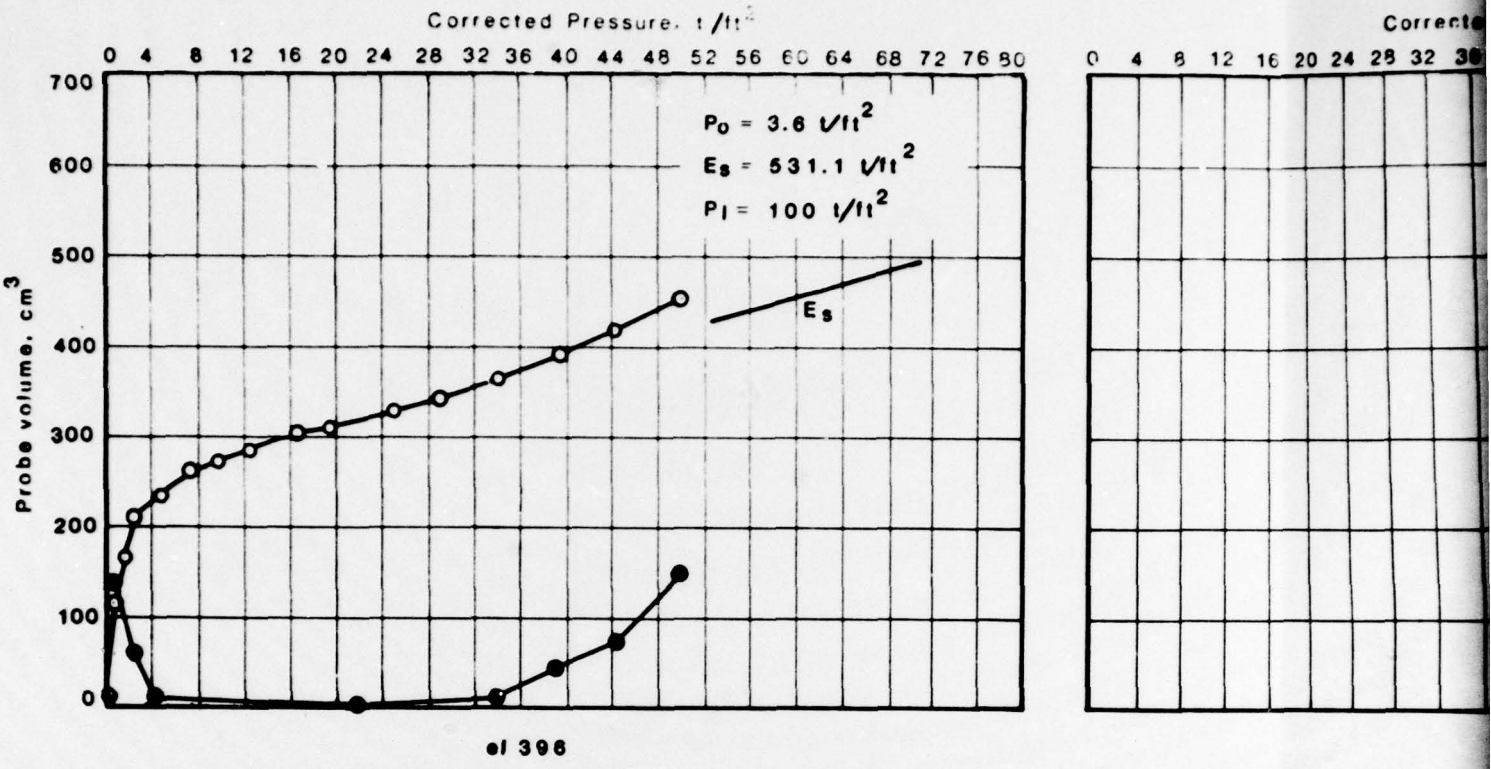
CHEMICAL GROUTING TEST PROGRAM

PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 11

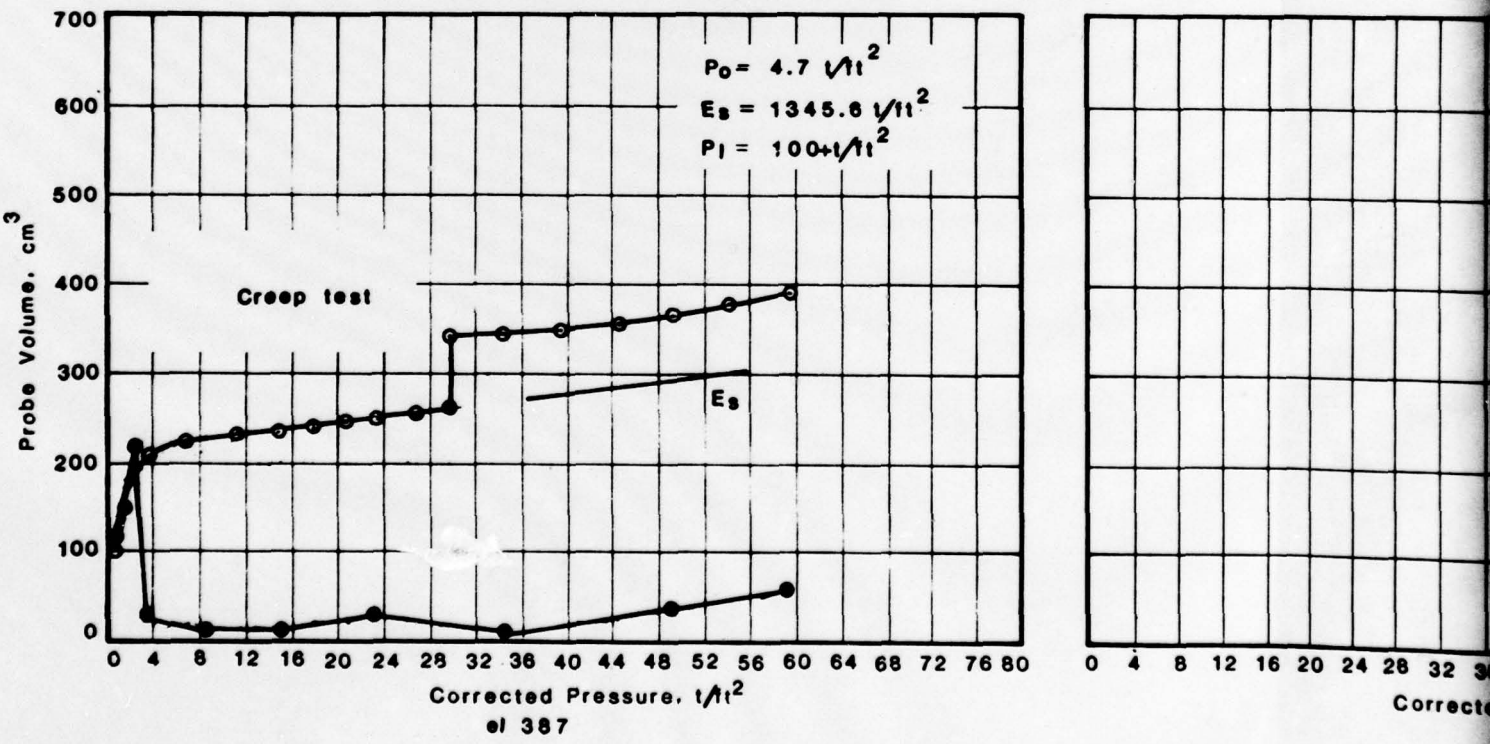
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants
Y7C825 Phase IX

Fig. G.8

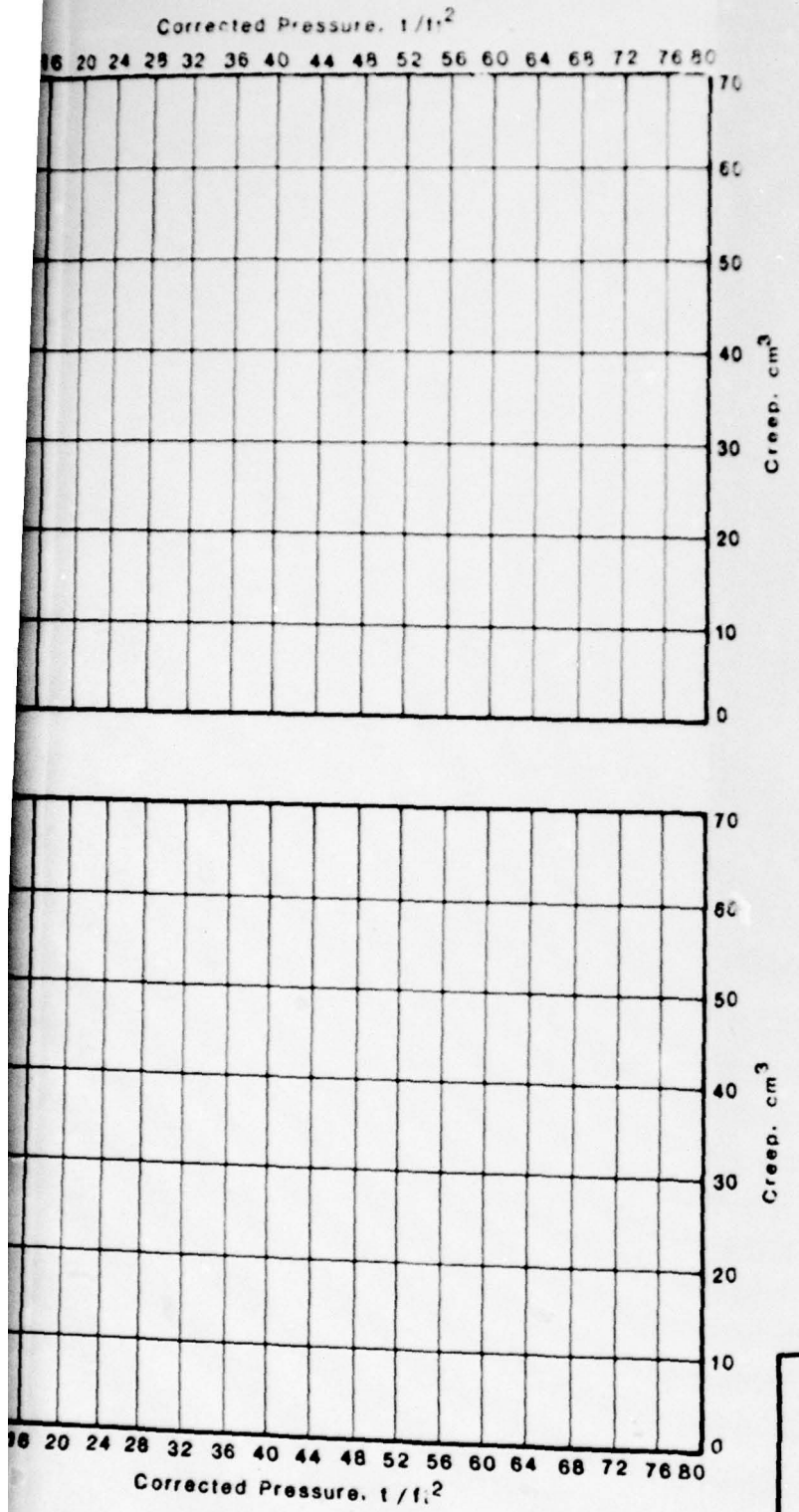


el 396



el 387

Test results obtained from boring AG-B13-2



G-813-2

Legend

- ○ Probe Volume Change versus *Corrected Pressure*
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

2

CHEMICAL GROUTING TEST PROGRAM

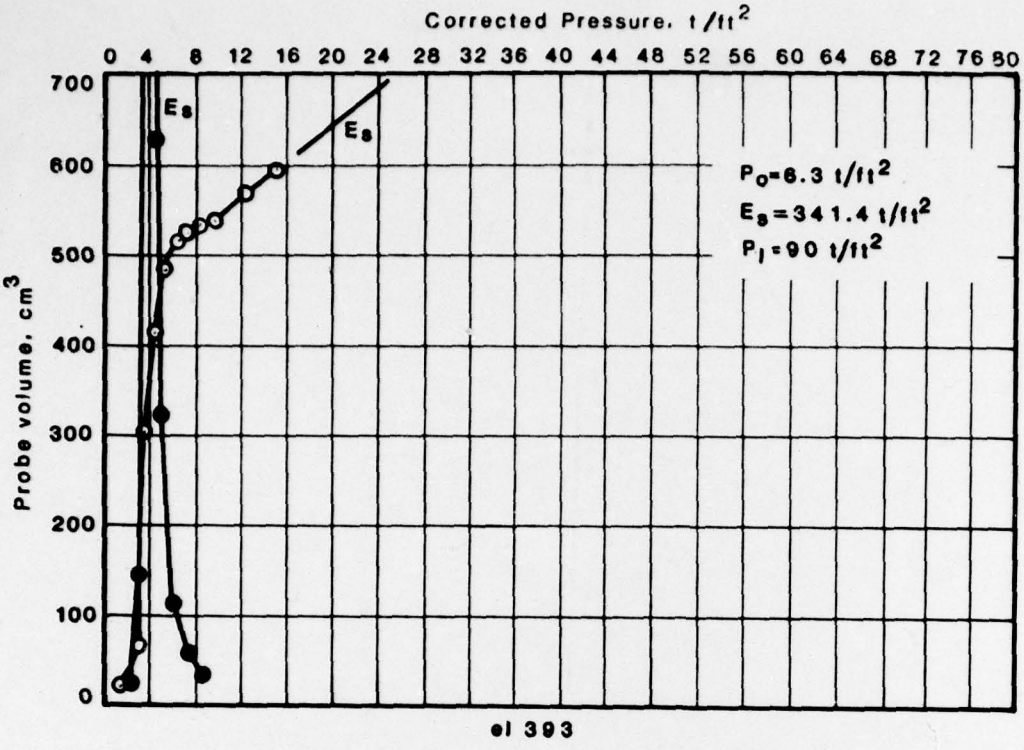
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 13

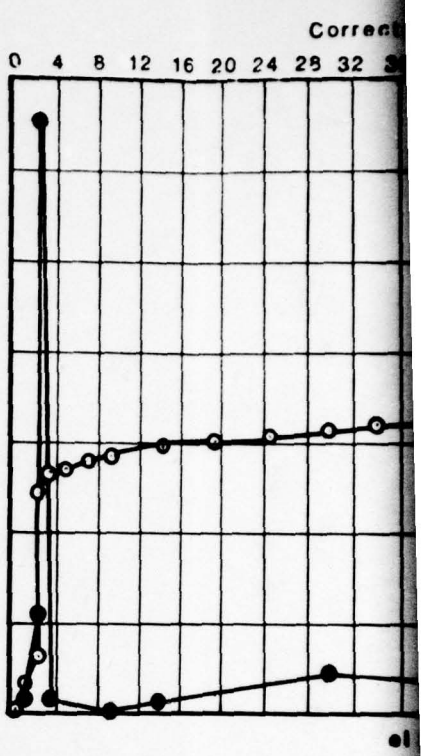
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

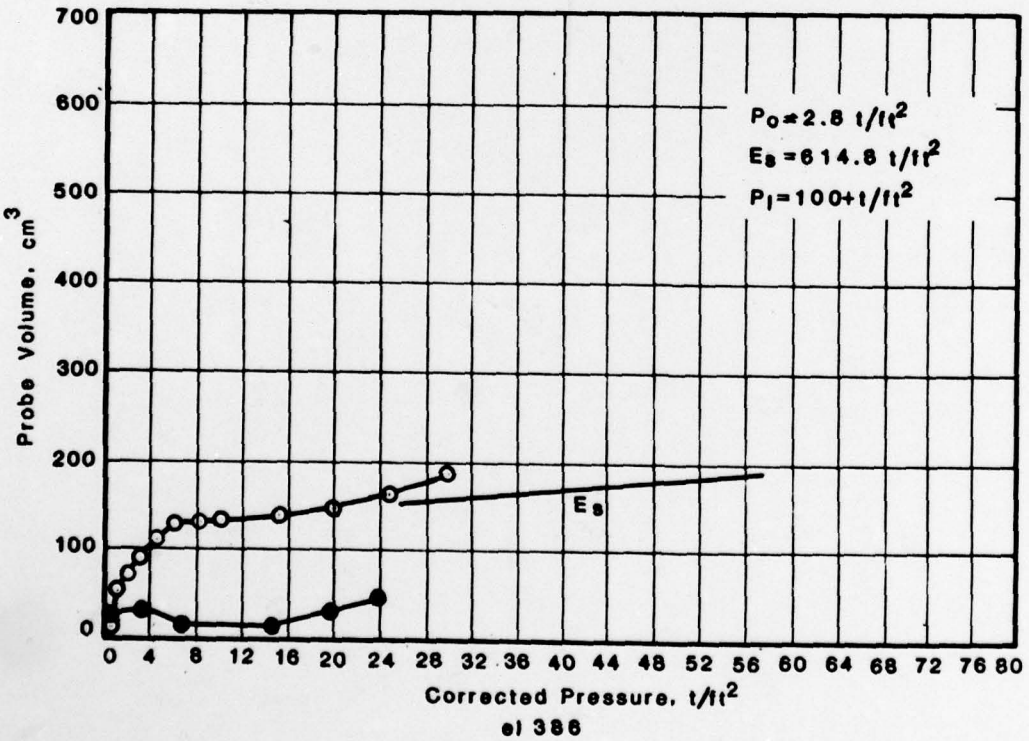
Woodward-Clyde Consultants

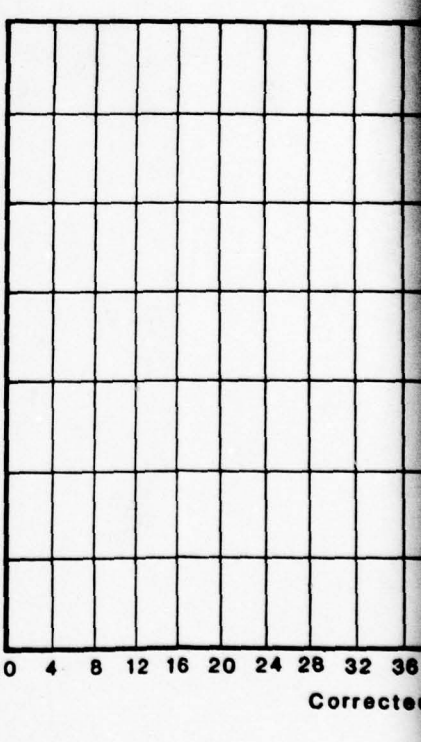
Fig. G.9

YTCB25 Phase IX

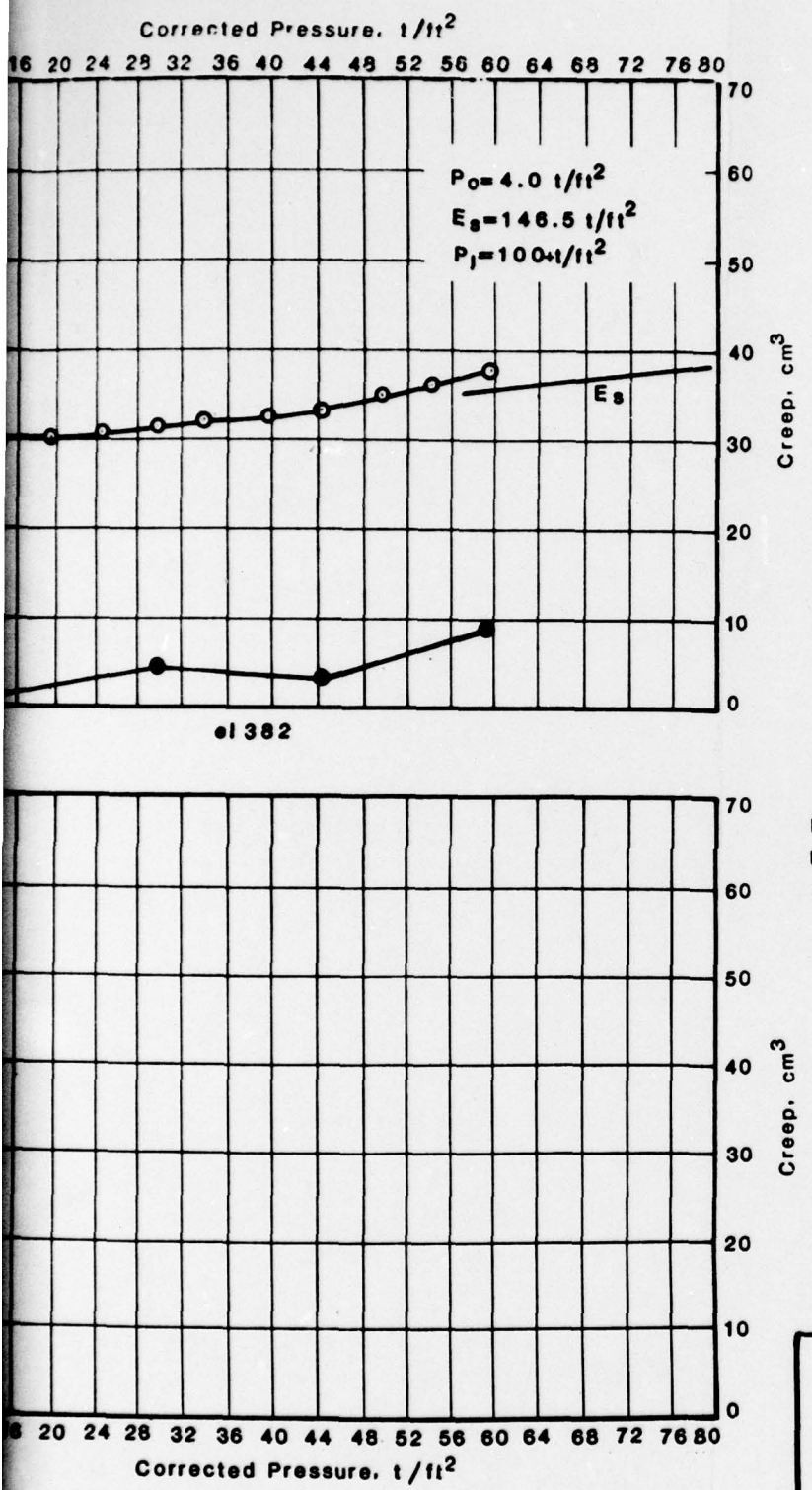








Test results obtained from boring AG-A13-4



Legend

- ○ *Probe Volume Change versus Corrected Pressure*
- ● Creep versus Corrected Pressure
- P_o In Situ Horizontal Stress
- E_s Elastic Deformation Modulus
- P_l Limit Pressure

CHEMICAL GROUTING TEST PROGRAM

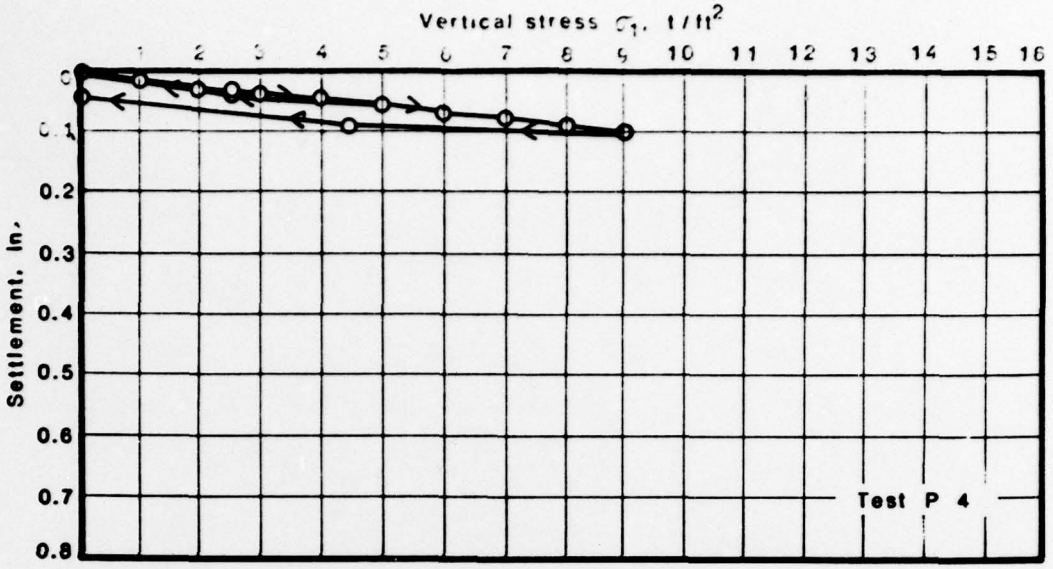
PRESSUREMETER TEST RESULTS AFTER GROUTING SUBAREA 13

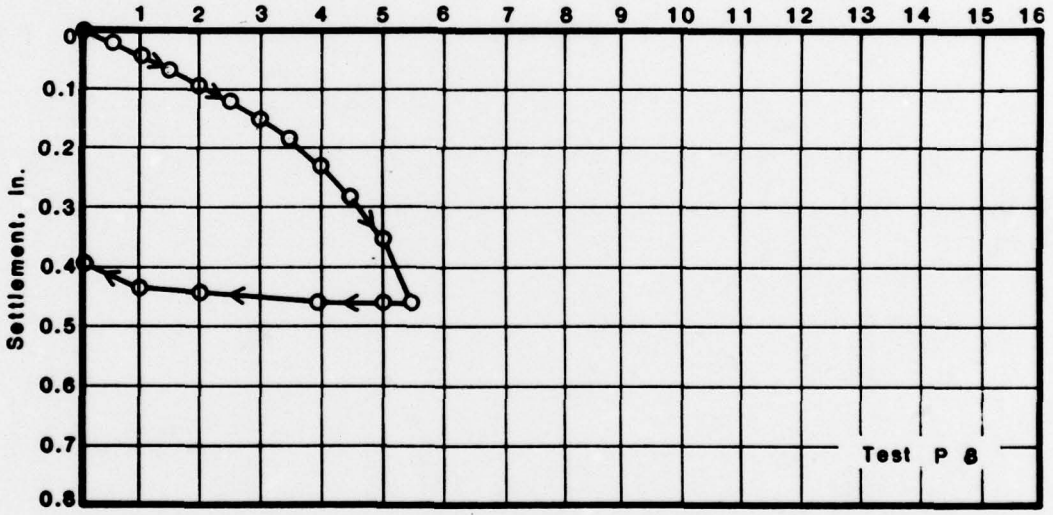
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

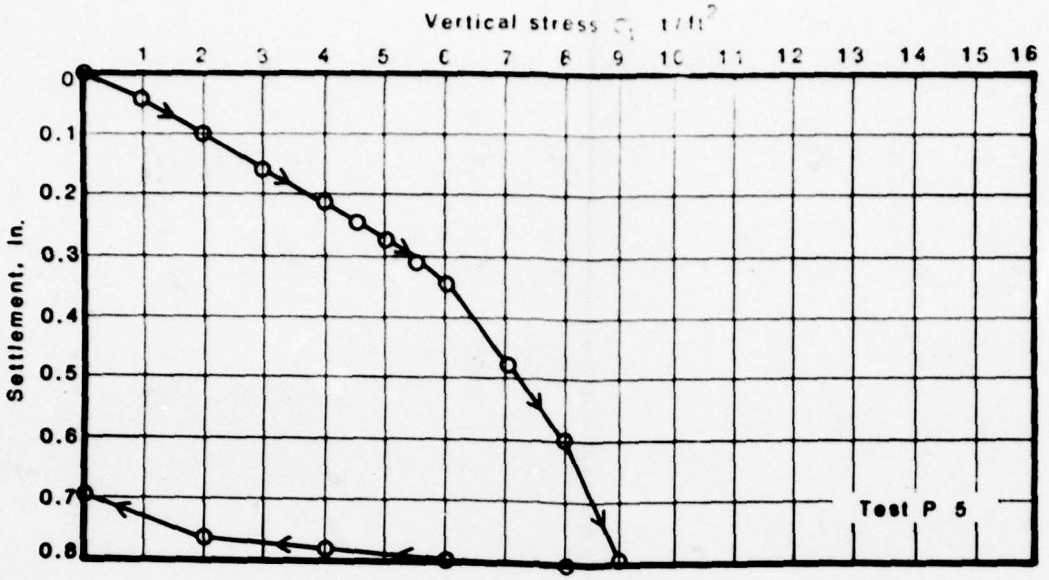
Woodward-Clyde Consultants

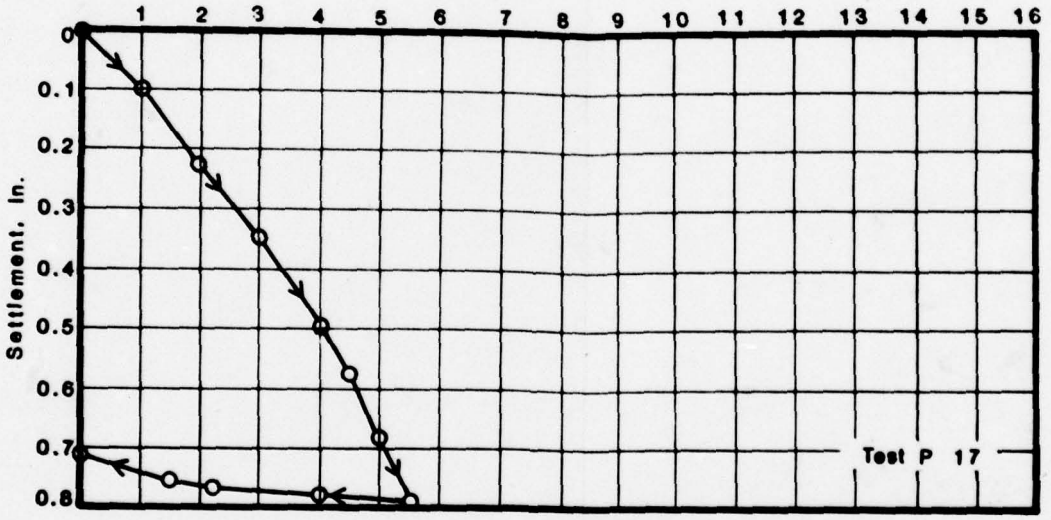
Y7C825 Phase IX

Fig. G.10


Vertical stress σ_1, t/ft^2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Settlement, in.
Test P 4


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
Settlement, in.
Test P 8





CHEMICAL GROUTING TEST PROGRAM

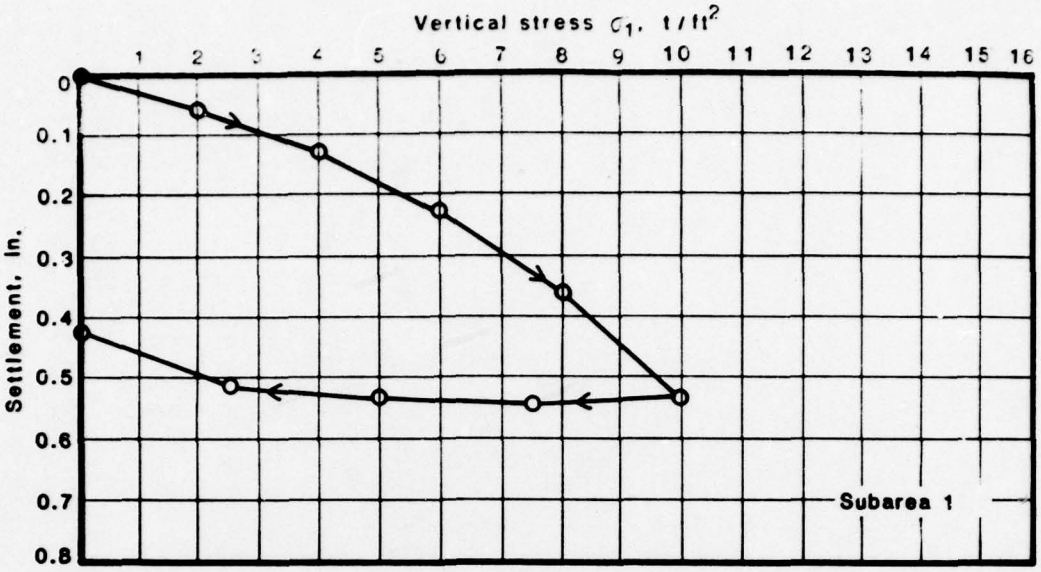
PLATE LOAD TEST RESULTS FOR UNGROUTED SOIL

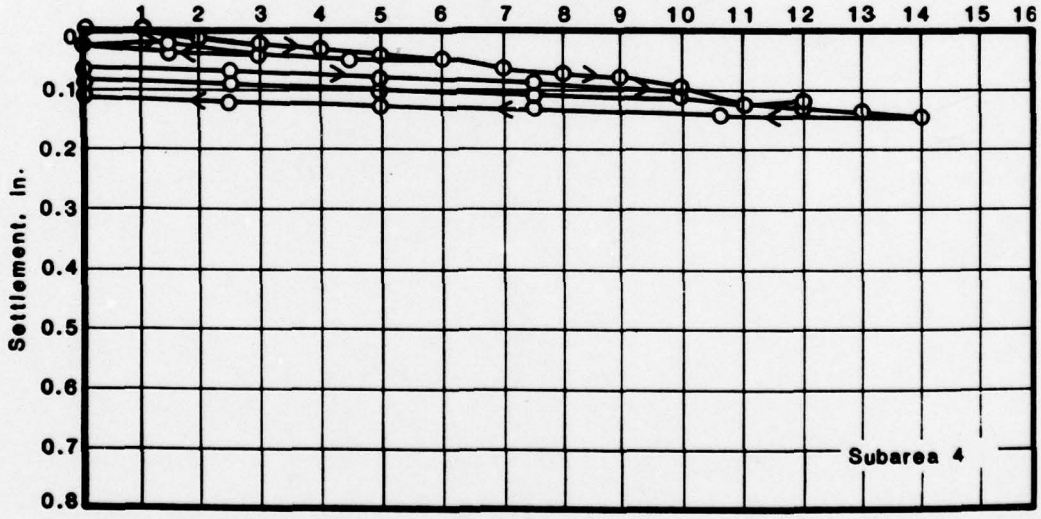
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

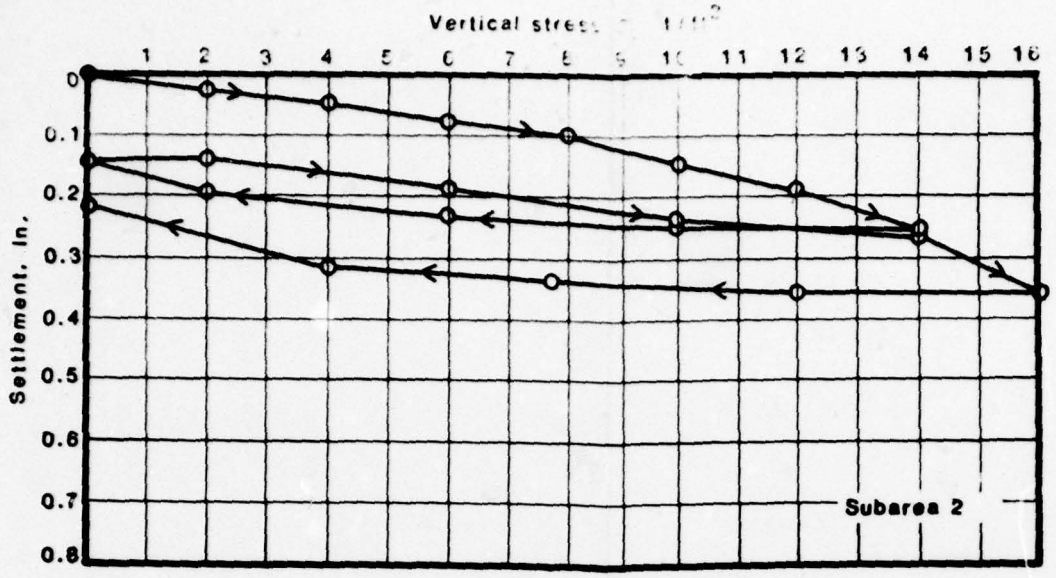
Woodward-Clyde Consultants

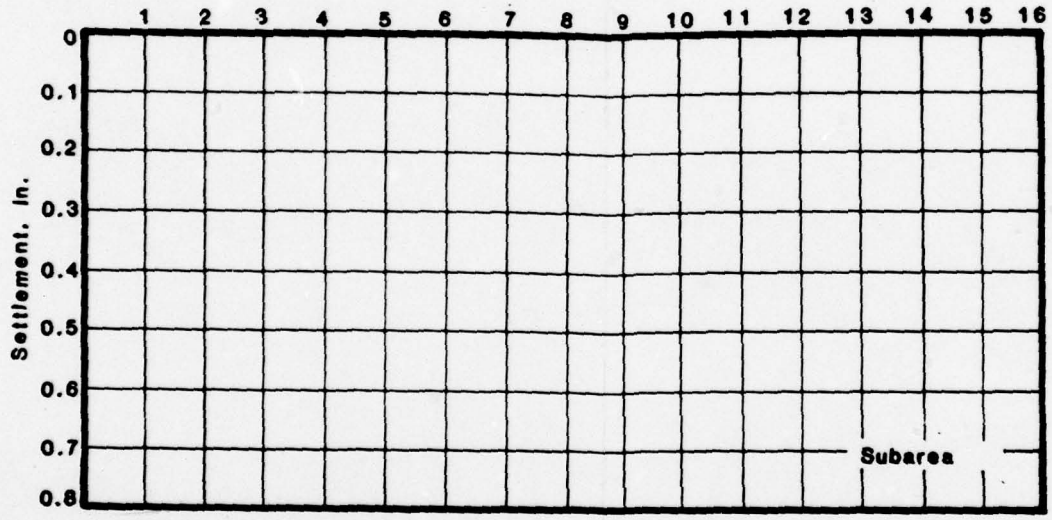
Fig.G.11

YTC625 Phase III


Vertical stress σ_1, t/ft^2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.
Subarea 1


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.
Subarea 4





2

CHEMICAL GROUTING TEST PROGRAM

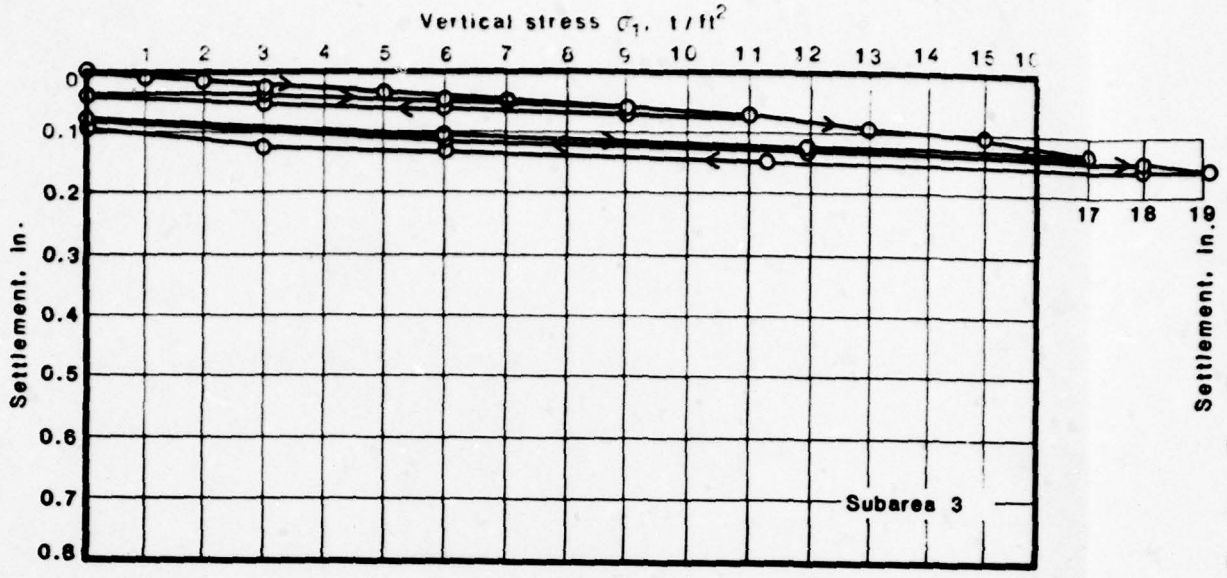
PLATE LOAD TEST RESULTS FOR SUBAREAS 1,2,4

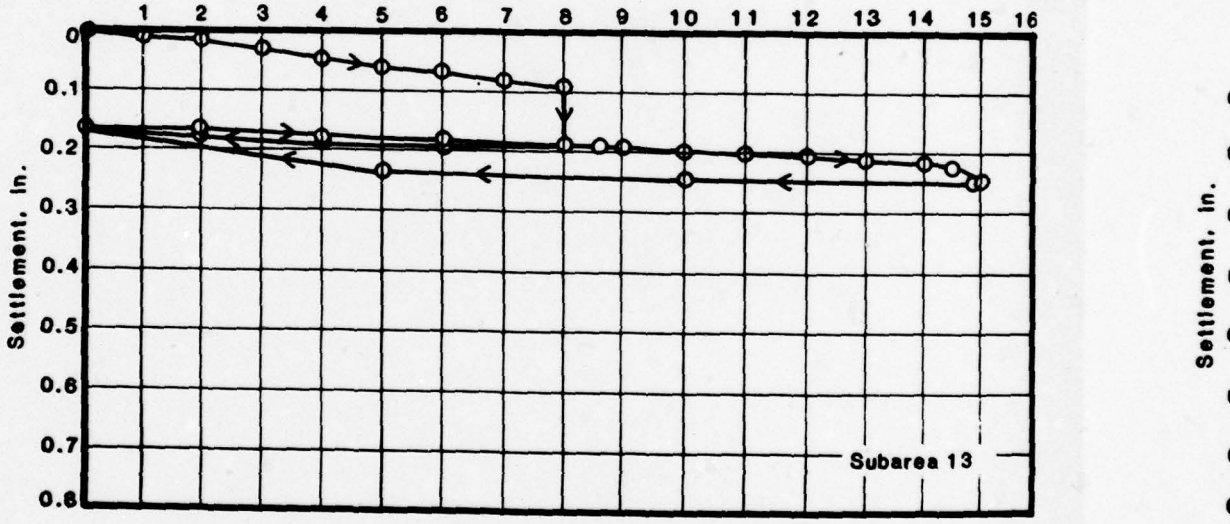
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

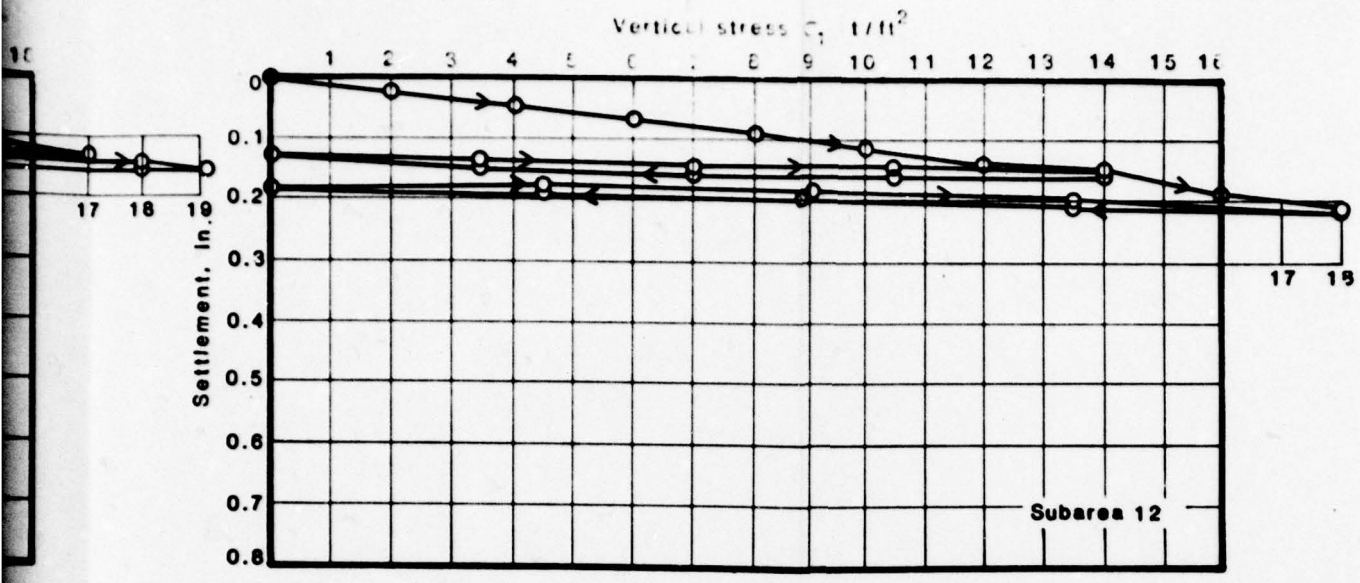
Woodward-Clyde Consultants

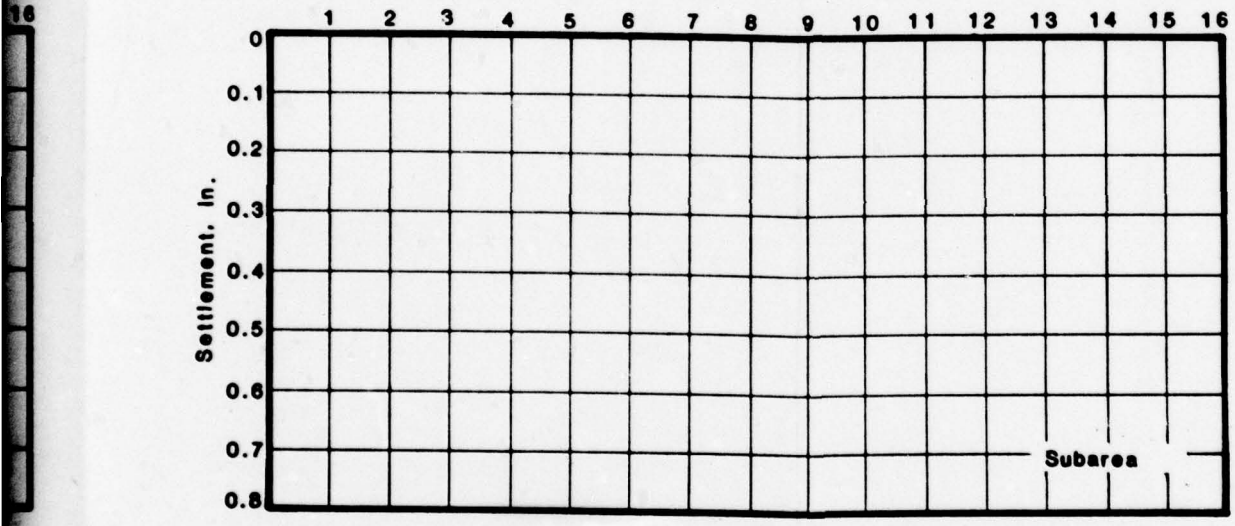
Fig. G.12

YTC625 Phase IX


Vertical stress σ_1, t/ft^2
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.
Subarea 3


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.
Subarea 13





2

CHEMICAL GROUTING TEST PROGRAM

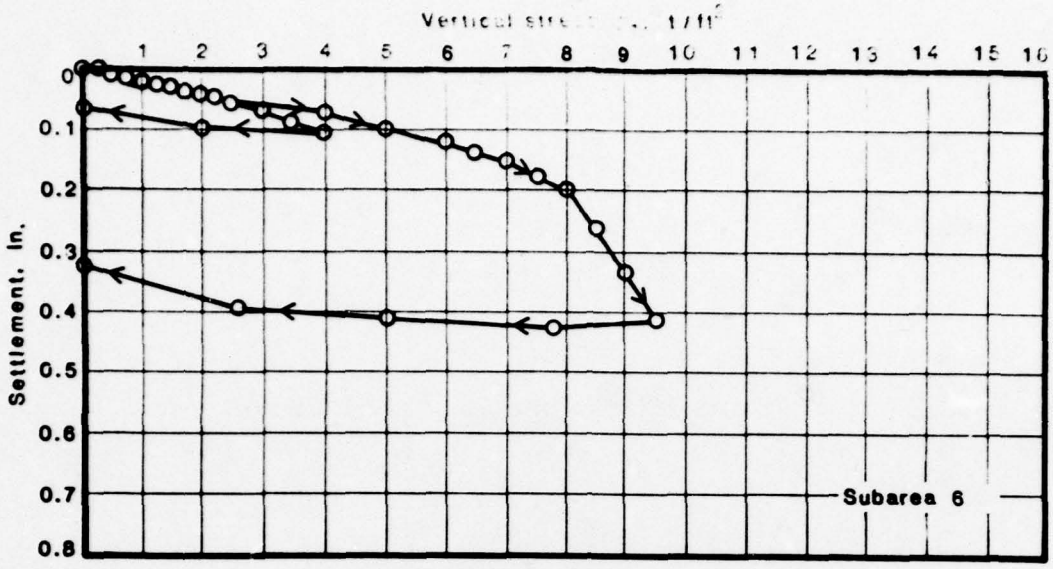
PLATE LOAD TEST RESULTS FOR SUBAREAS 3,12,13

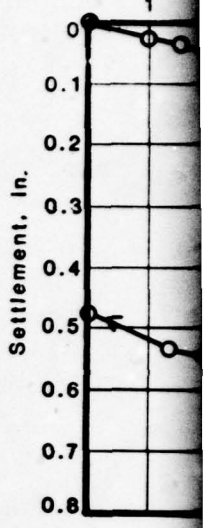
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

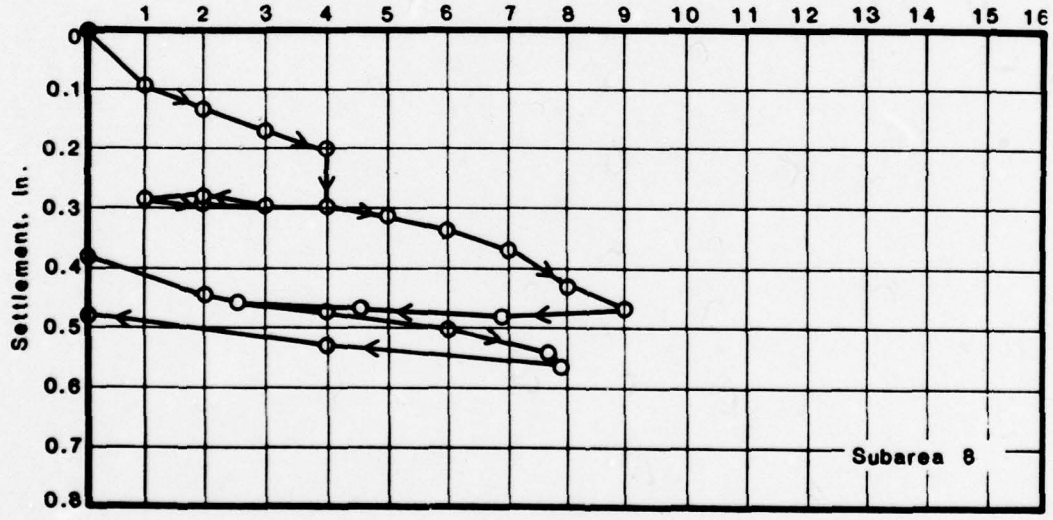
Woodward-Clyde Consultants

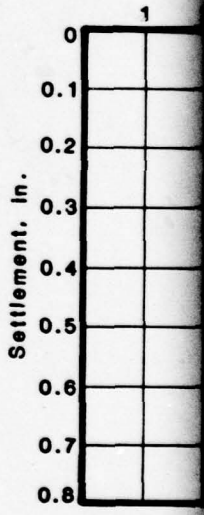
Y7C825 Phase IX

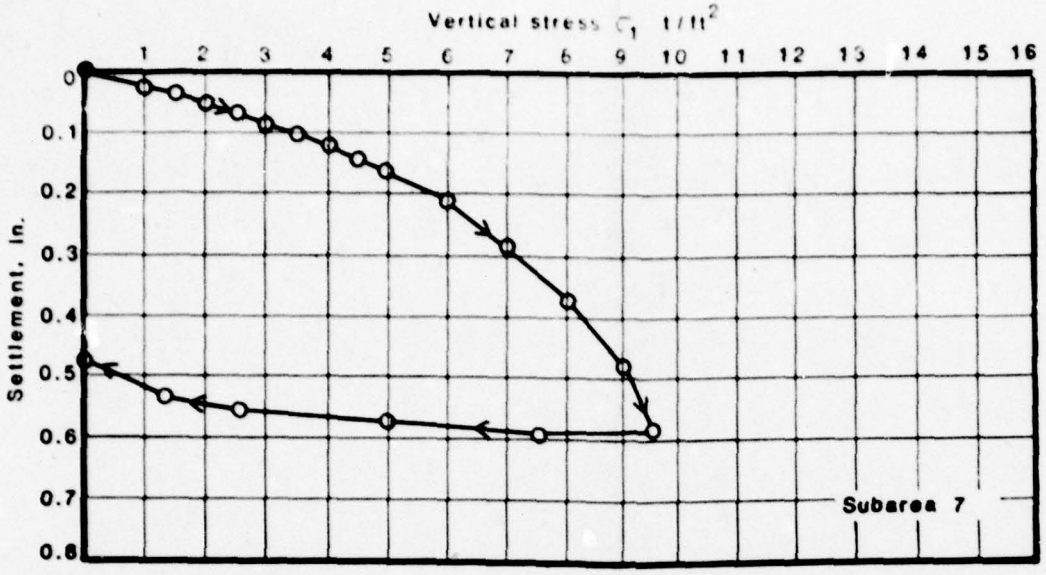
Fig. G.13

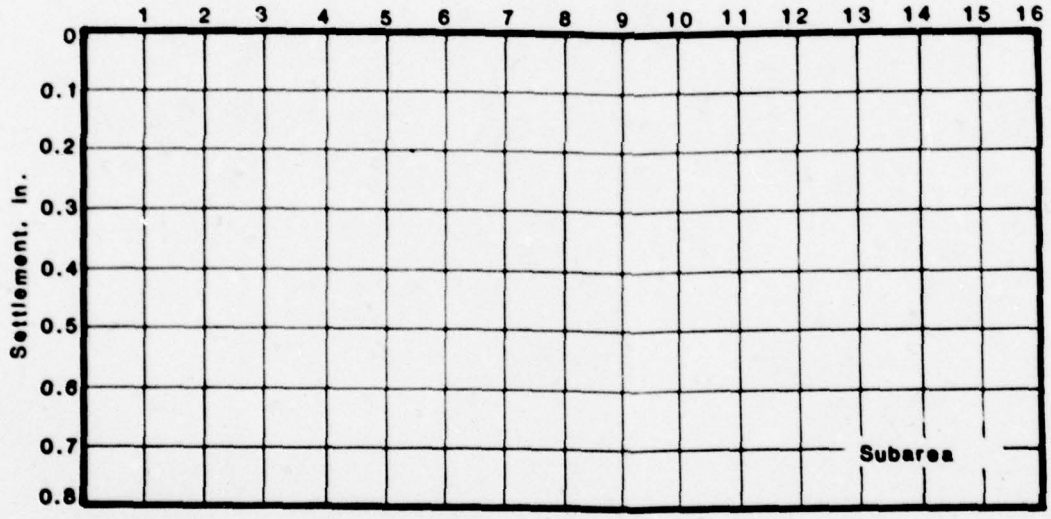

Vertical stress, tsf
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.
Subarea 6


1
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.
Subarea 8


1
0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8
Settlement, in.





2

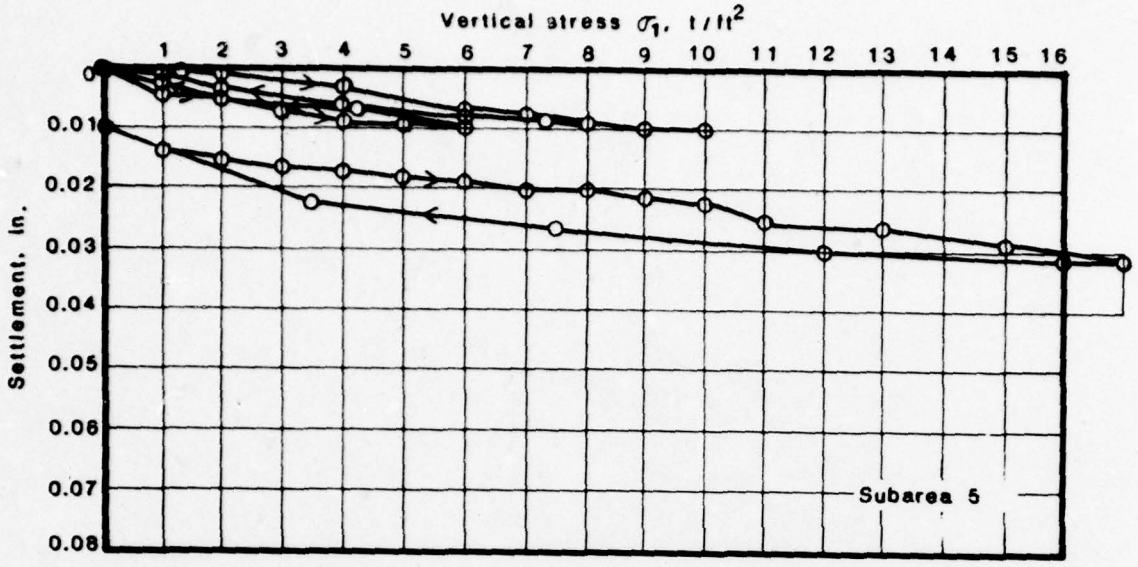
CHEMICAL GROUTING TEST PROGRAM

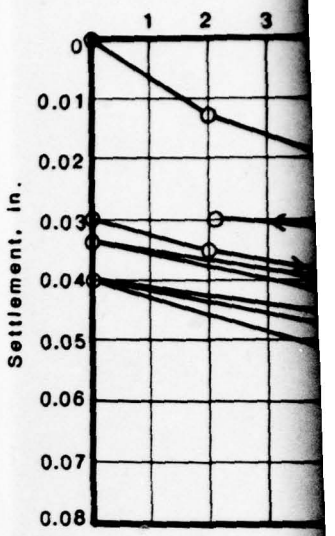
PLATE LOAD TEST RESULTS FOR SUBAREAS 6.7.8

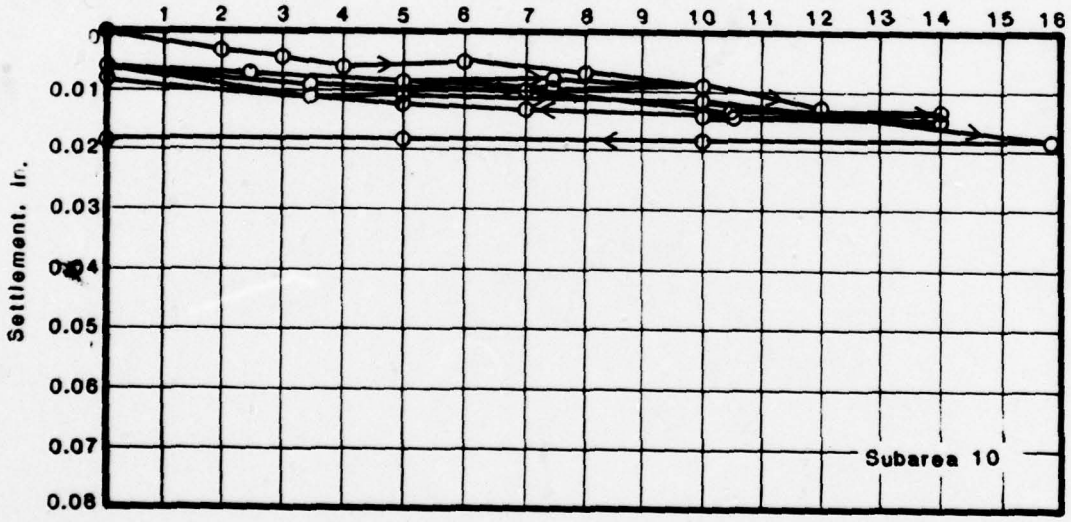
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0006

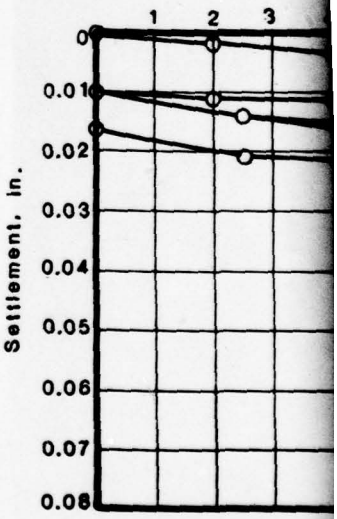
Woodward-Clyde Consultants
Y7C825 Phase IX

Fig. G.14

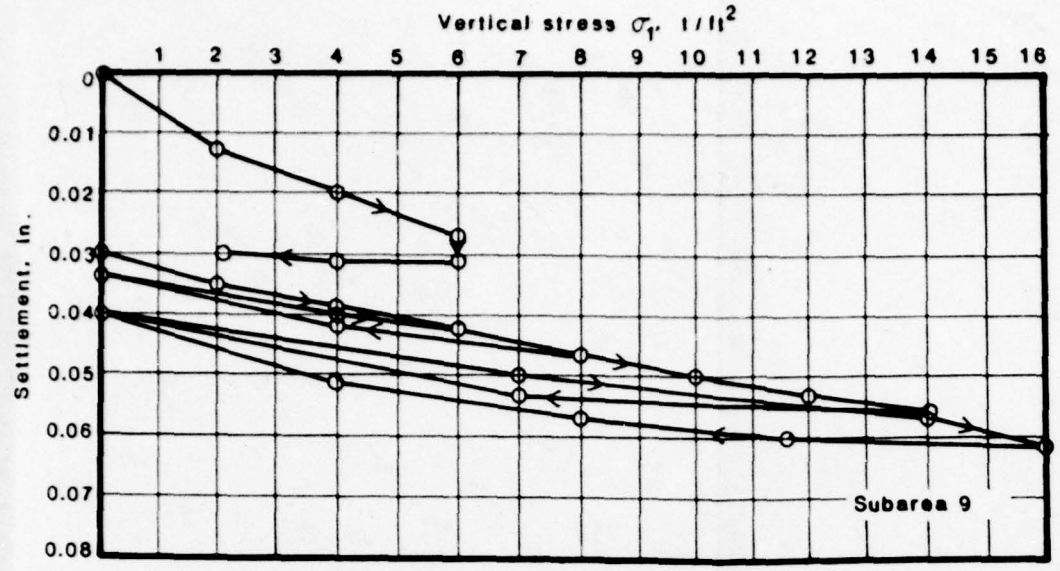


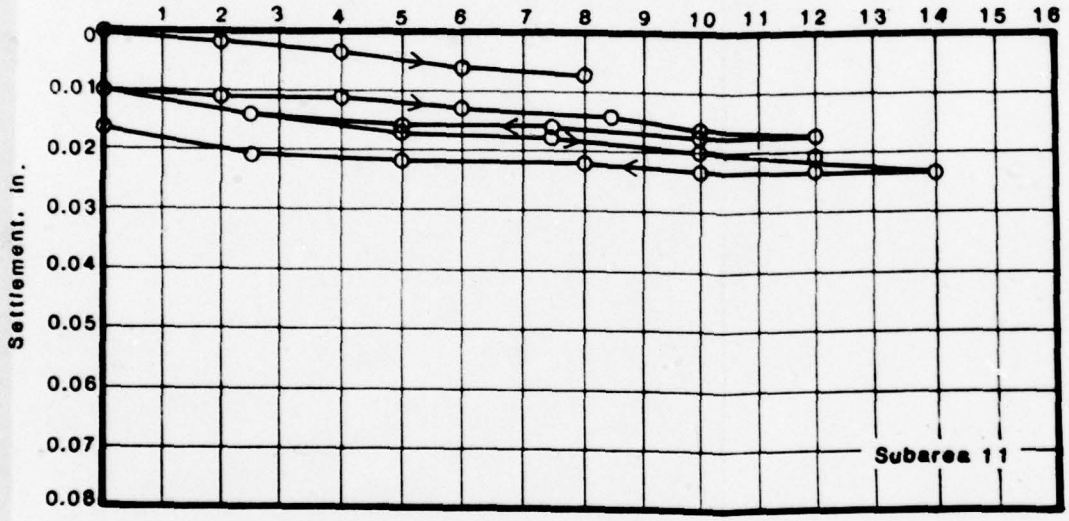






Note: Settlement scale increased 10 times to 10^{-1} in/divisio





creased 10 times to 10^{-1} in/division

2

CHEMICAL GROUTING TEST PROGRAM

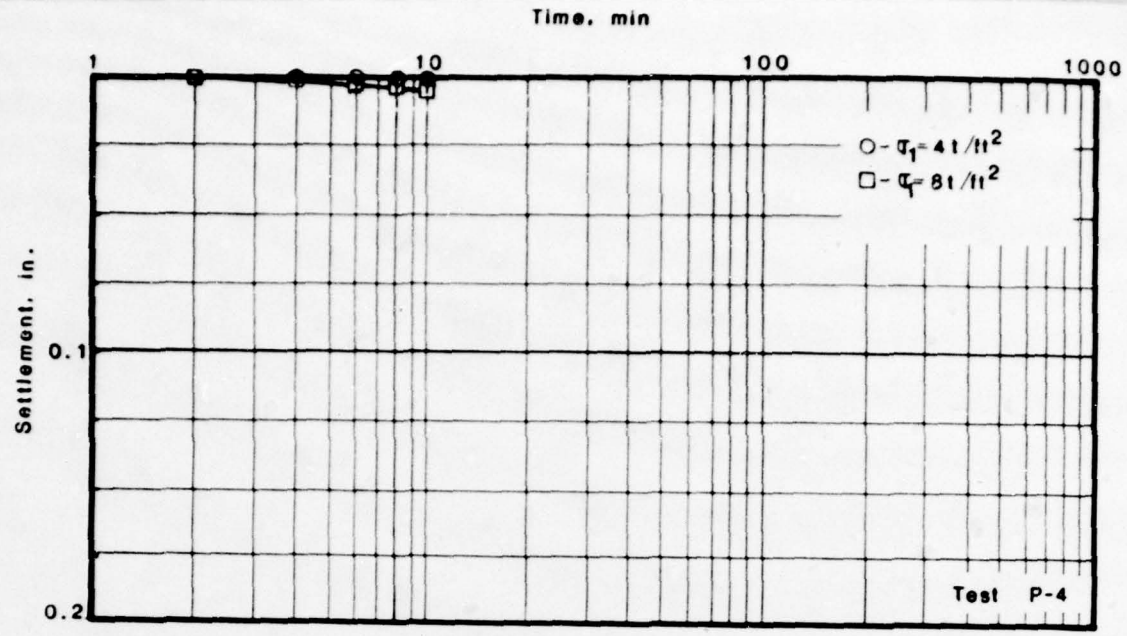
PLATE LOAD TEST RESULTS FOR SUBAREAS 5,9,10,11

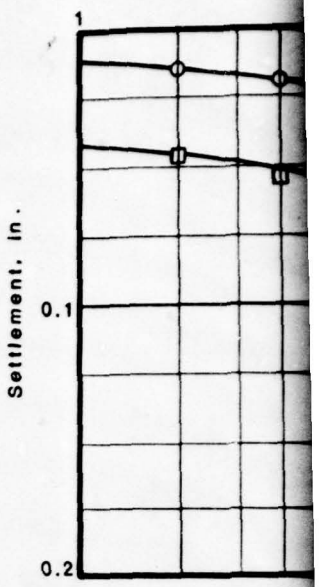
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

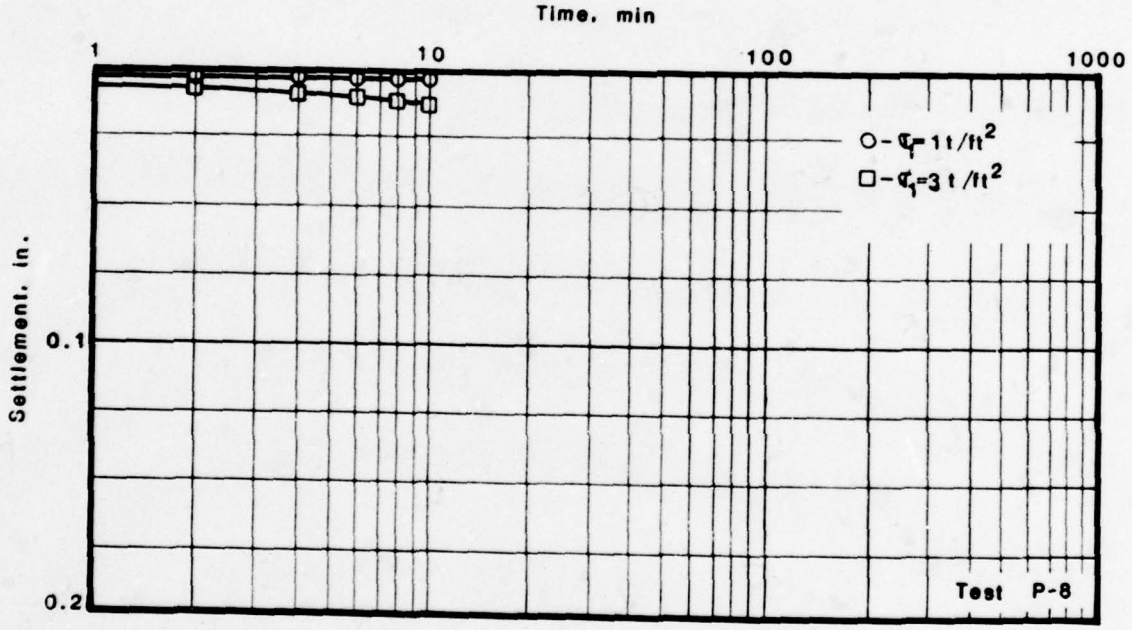
Woodward-Clyde Consultants

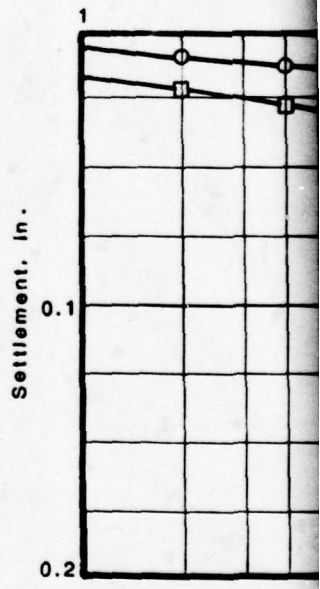
Fig. G.15

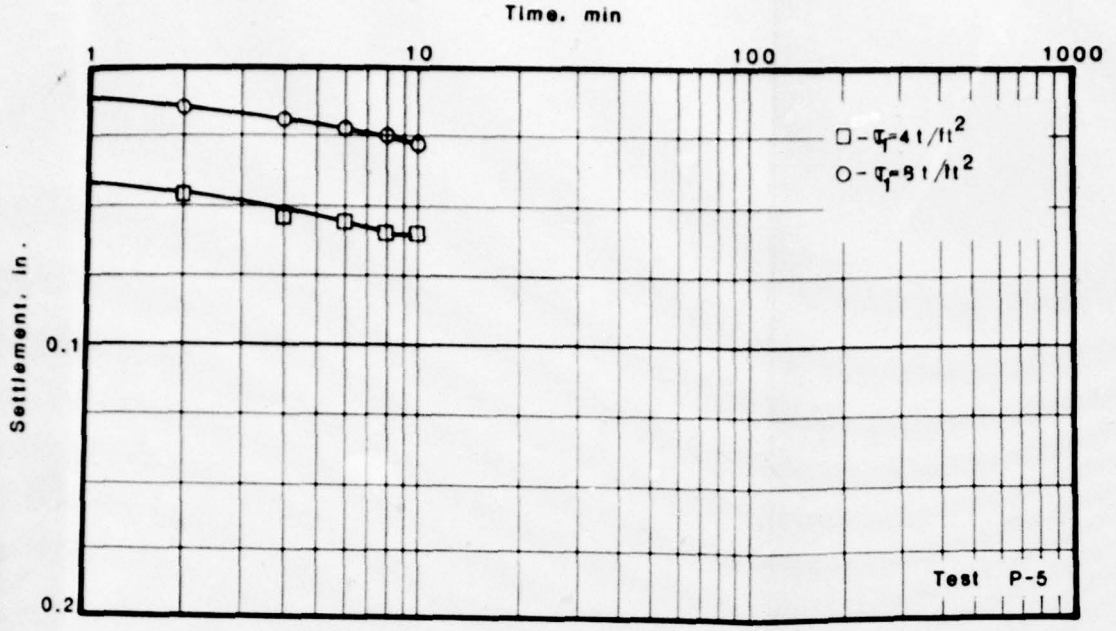
Y7C925 Phase IX

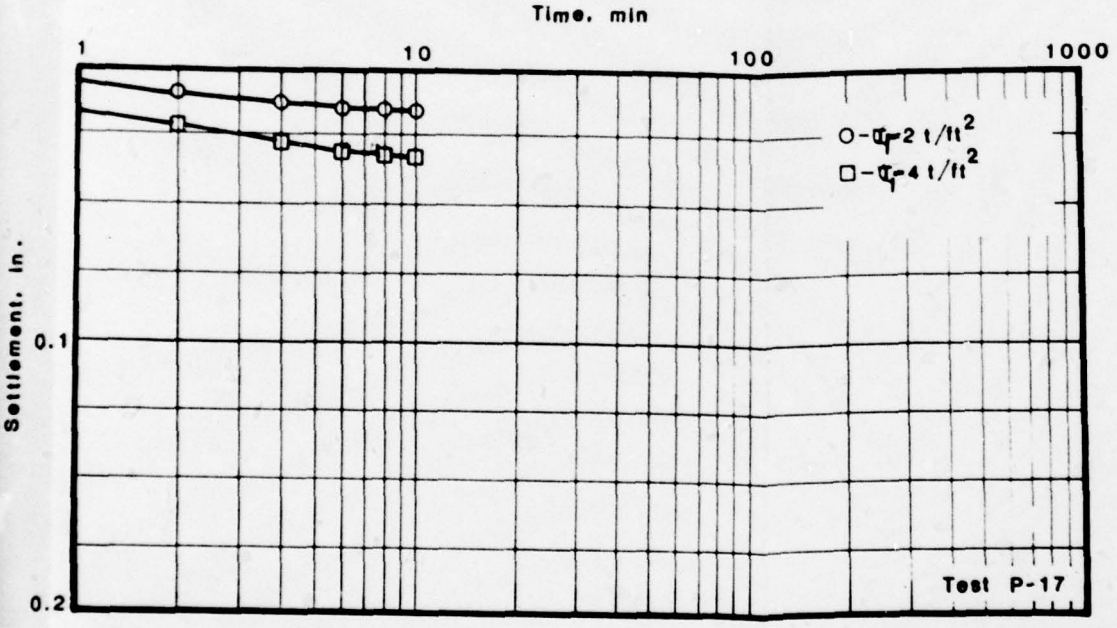

Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
○ - σ_1 = 4 t/ft^2
□ - σ_1 = 8 t/ft^2
Test P-4


1
Settlement, in.
0.1
0.2


Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
○ - σ_1 = 1 t/ft^2
□ - σ_1 = 3 t/ft^2
Test P-8


1
Settlement, in.
0.1
0.2





2

CHEMICAL GROUTING TEST PROGRAM

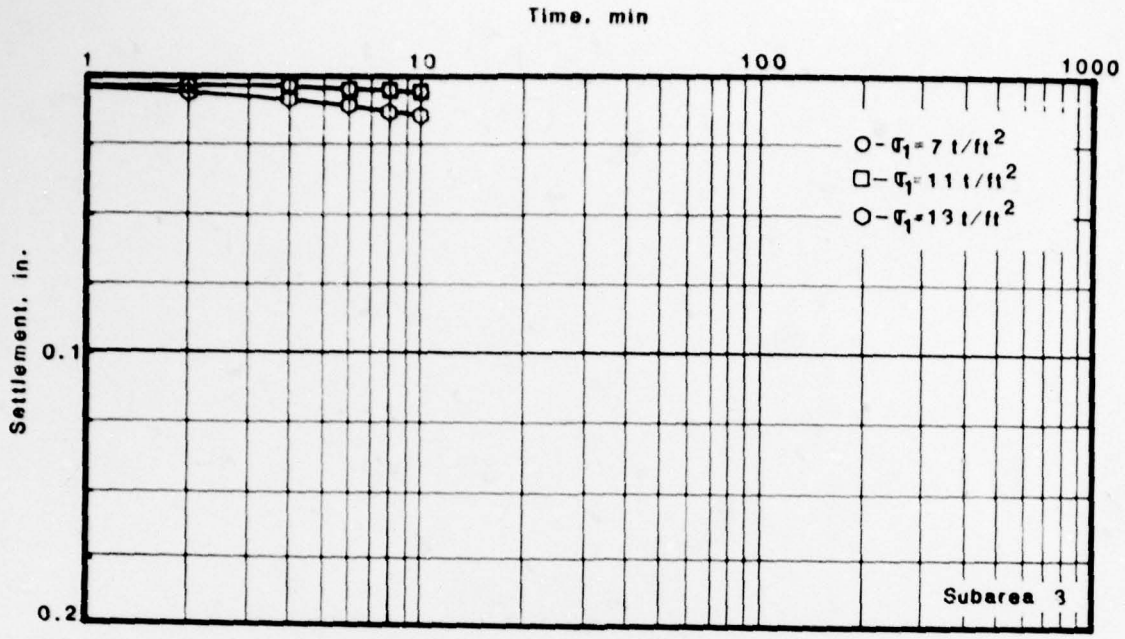
CREEP RESULTS FROM PLATE LOAD TEST UNGROUTED SOIL

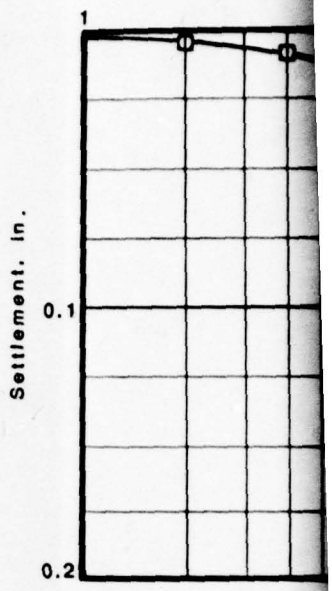
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

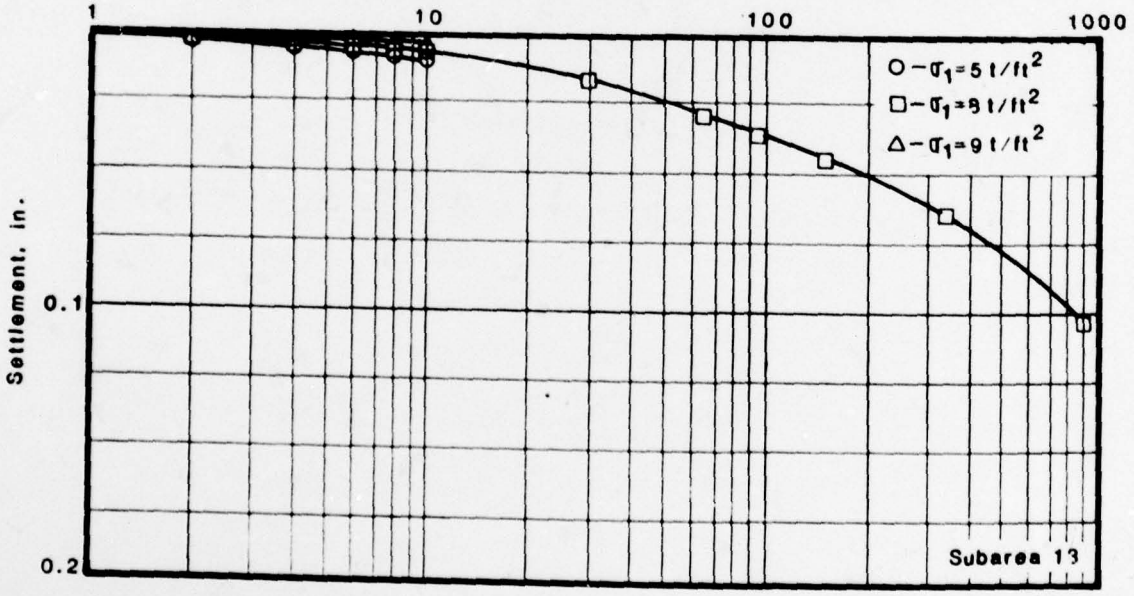
Woodward-Clyde Consultants

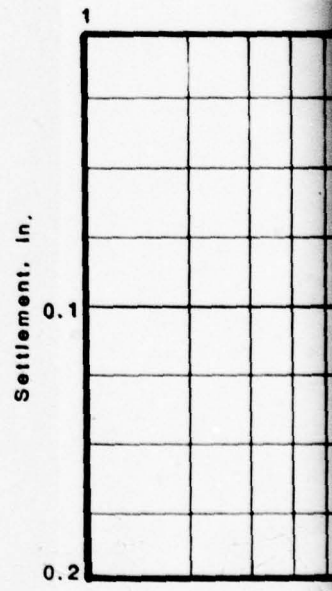
Fig. G. 16

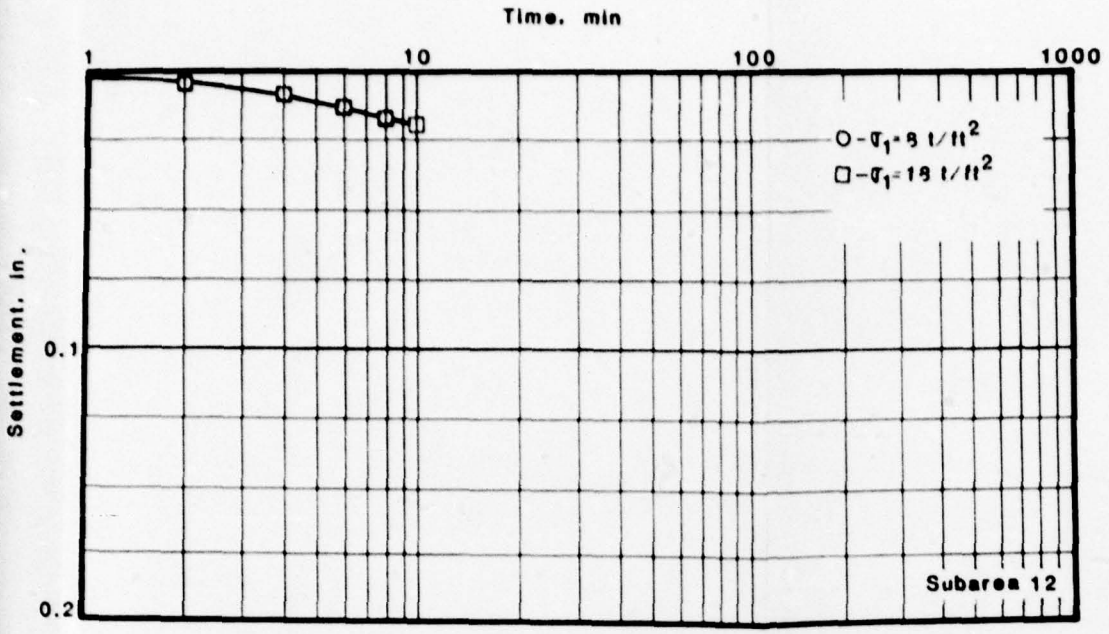
Y7C325 Phase IV

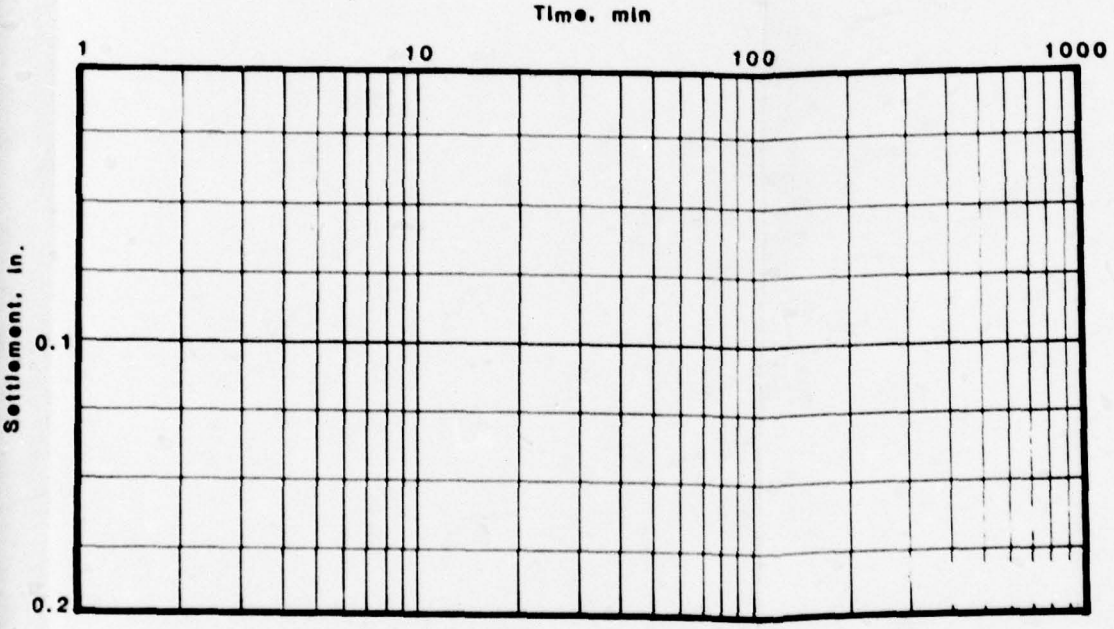

Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
O - σ1 = 7 t/ft2
□ - σ1 = 11 t/ft2
O - σ1 = 13 t/ft2
Subarea 3


1
Settlement, in.
0.1
0.2


Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
O - σ1 = 5 t/ft2
□ - σ1 = 8 t/ft2
△ - σ1 = 9 t/ft2
Subarea 13


1
Settlement, in.
0.1
0.2





2

CHEMICAL GROUTING TEST PROGRAM

CREEP RESULTS FROM PLATE LOAD TEST SUBAREAS 3,12,13

FOUNDATION INVESTIGATION AND TEST PROGRAM

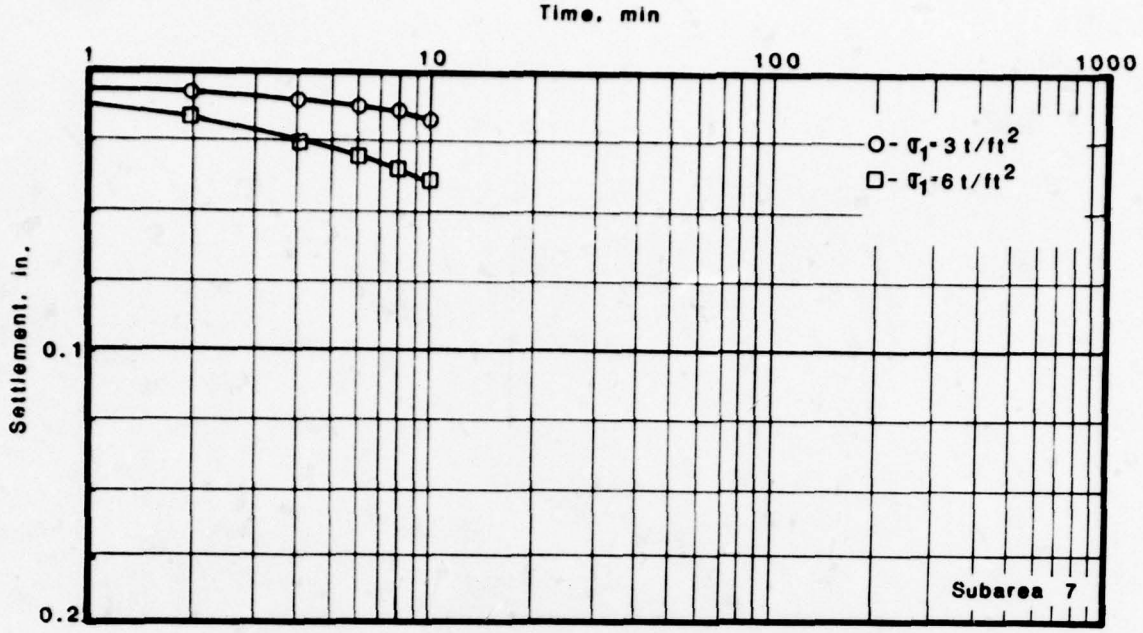
EXISTING LOCKS AND DAM No. 26

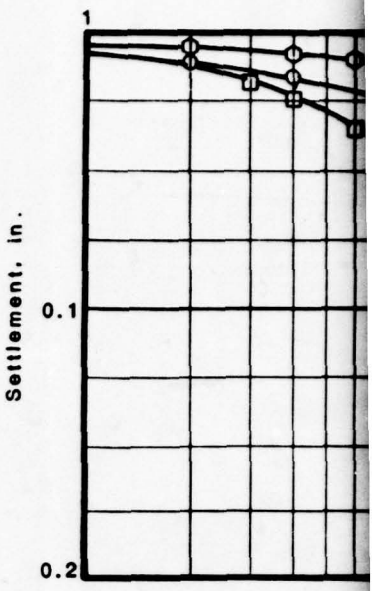
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.

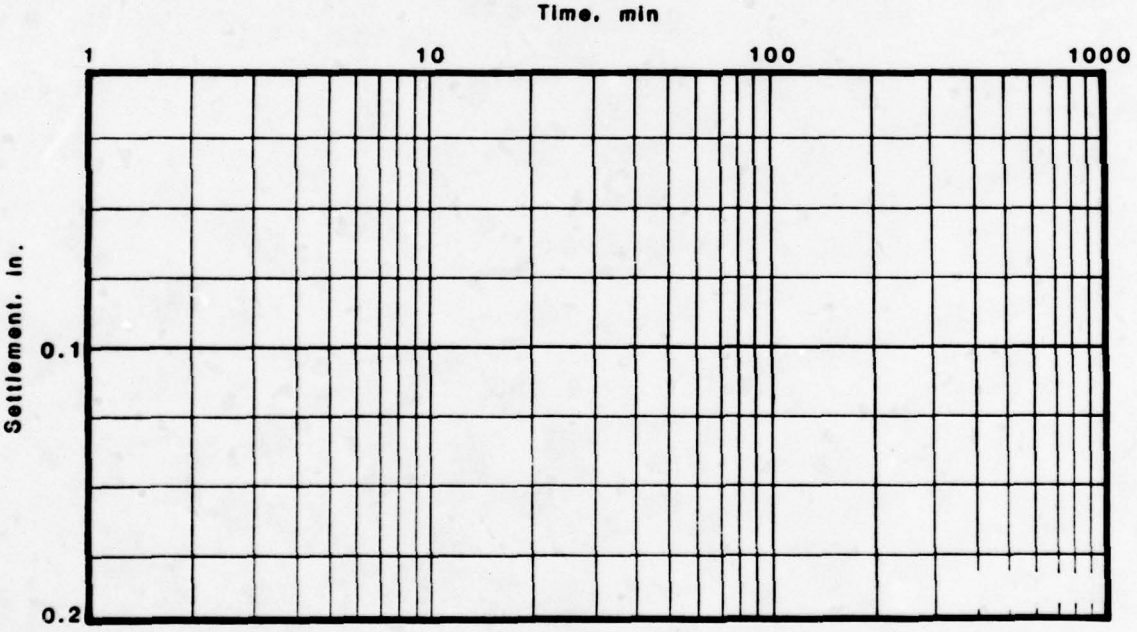
DACW43-78-C-0005

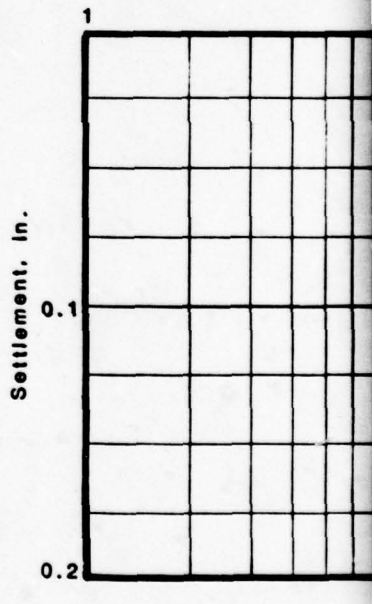
Woodward-Clyde Consultants

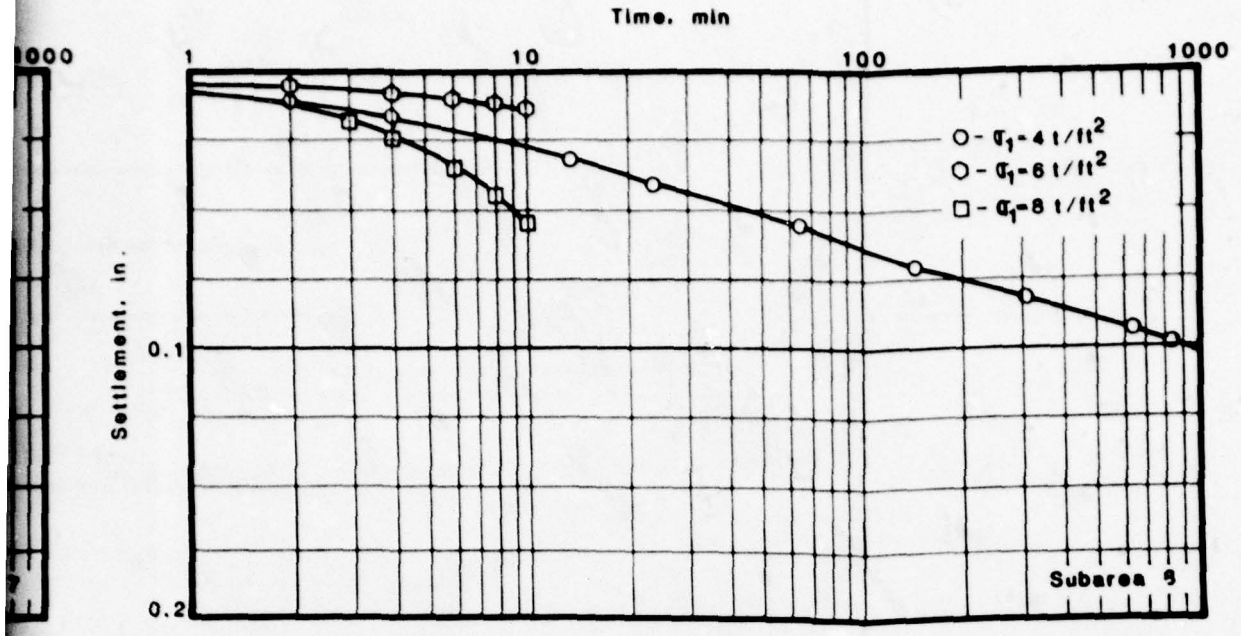
Fig. G.17

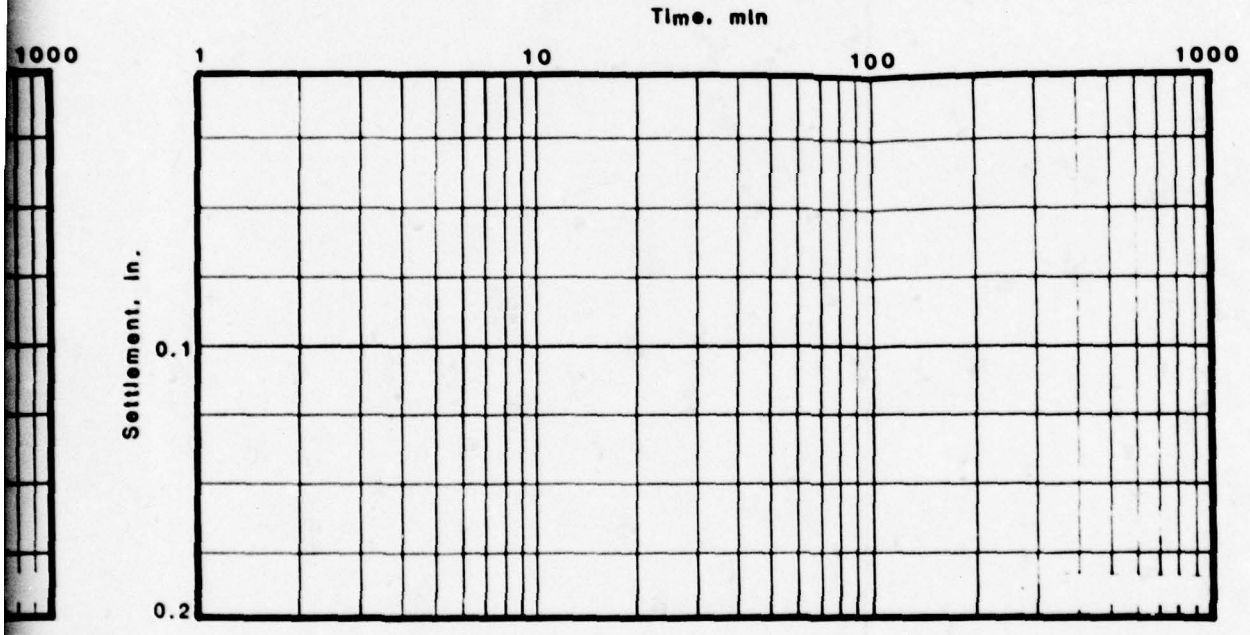

Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
O- σ_1= 3 t/ft^2
□- σ_1=6 t/ft^2
Subarea 7


1
Settlement, in.
0.1
0.2


Time, min
1
10
100
1000
Settlement, in.
0.1
0.2


1
Settlement, in.
0.1
0.2





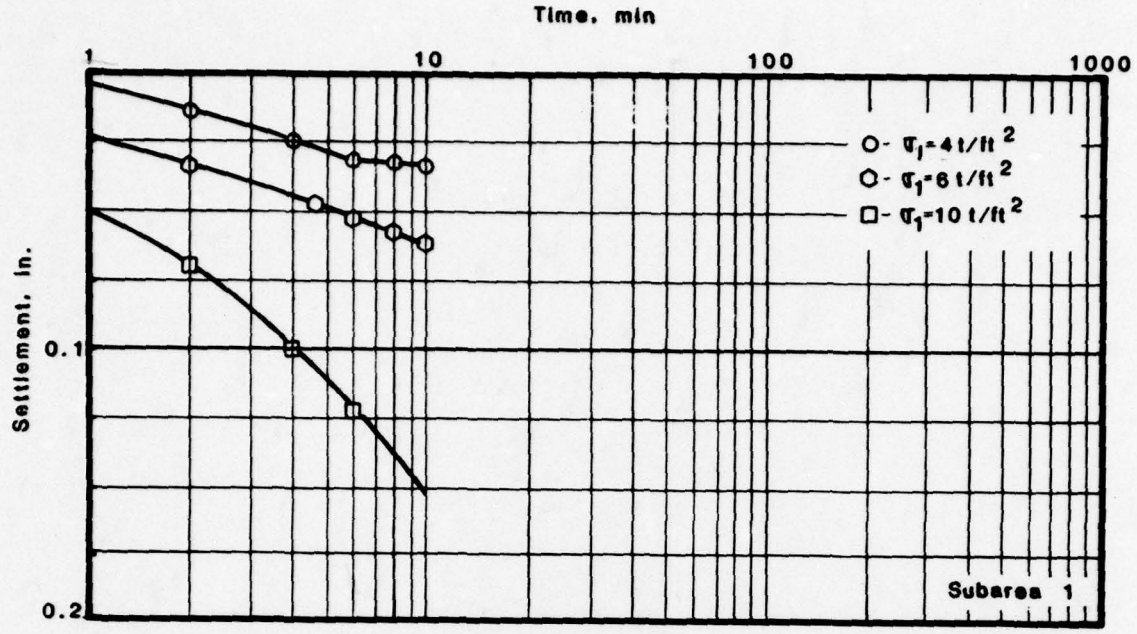
CHEMICAL GROUTING TEST PROGRAM

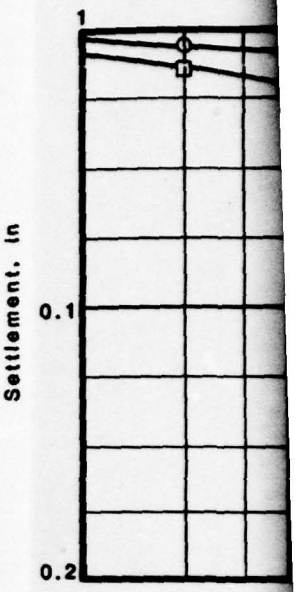
CREEP RESULTS FROM PLATE LOAD TEST. SUBAREAS 7.8

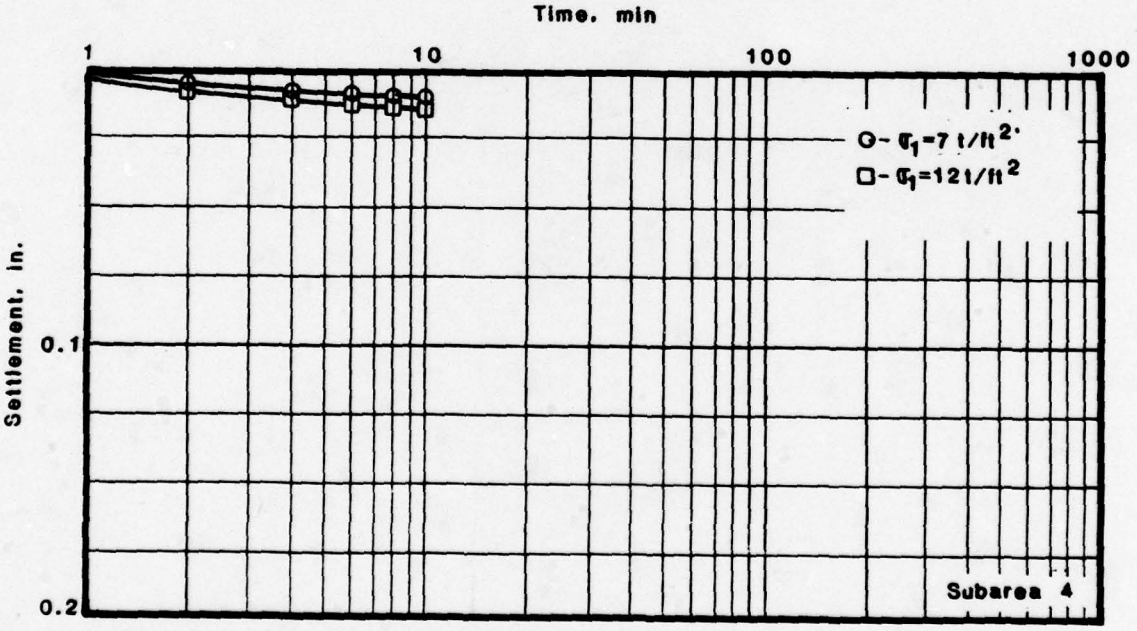
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

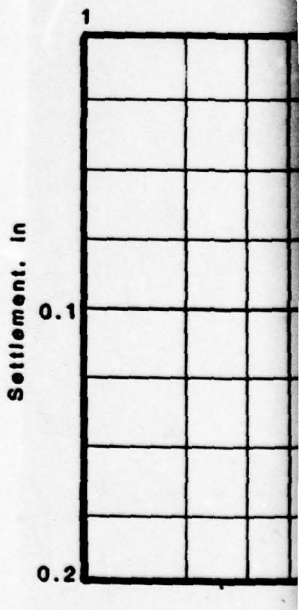
Woodward-Clyde Consultants

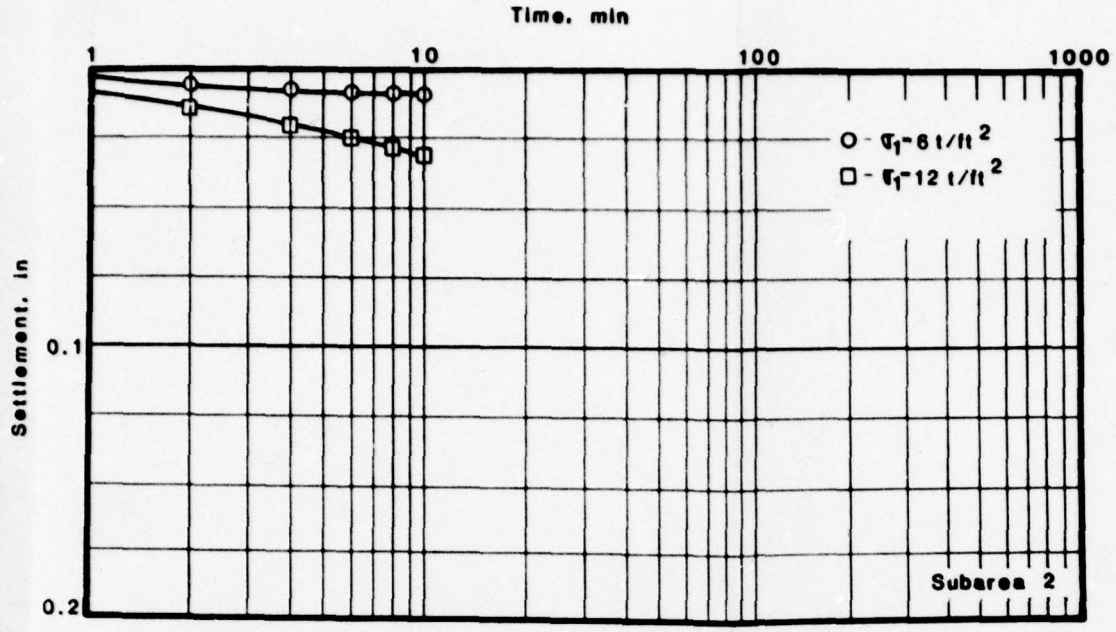
Fig. G.18

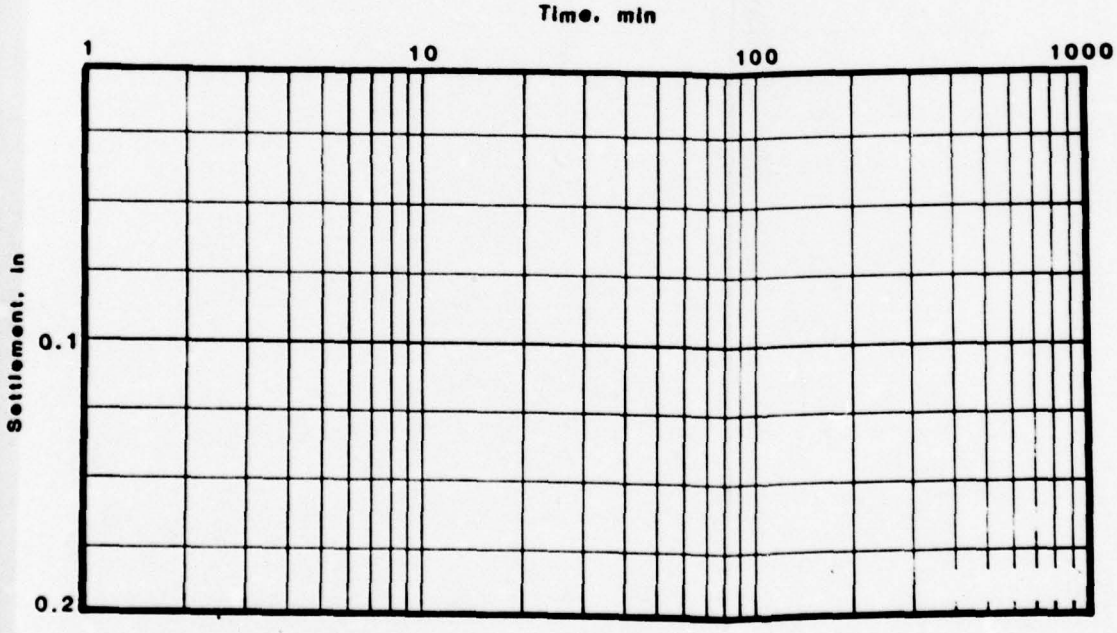

Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
O- σ_1=4 t/ft^2
O- σ_1=6 t/ft^2
□- σ_1=10 t/ft^2
Subarea 1


1
Settlement, in
0.1
0.2


Time, min
1
10
100
1000
Settlement, in.
0.1
0.2
O- σ_1=7 t/ft^2
□- σ_1=12 t/ft^2
Subarea 4


1
Settlement, in
0.1
0.2





2

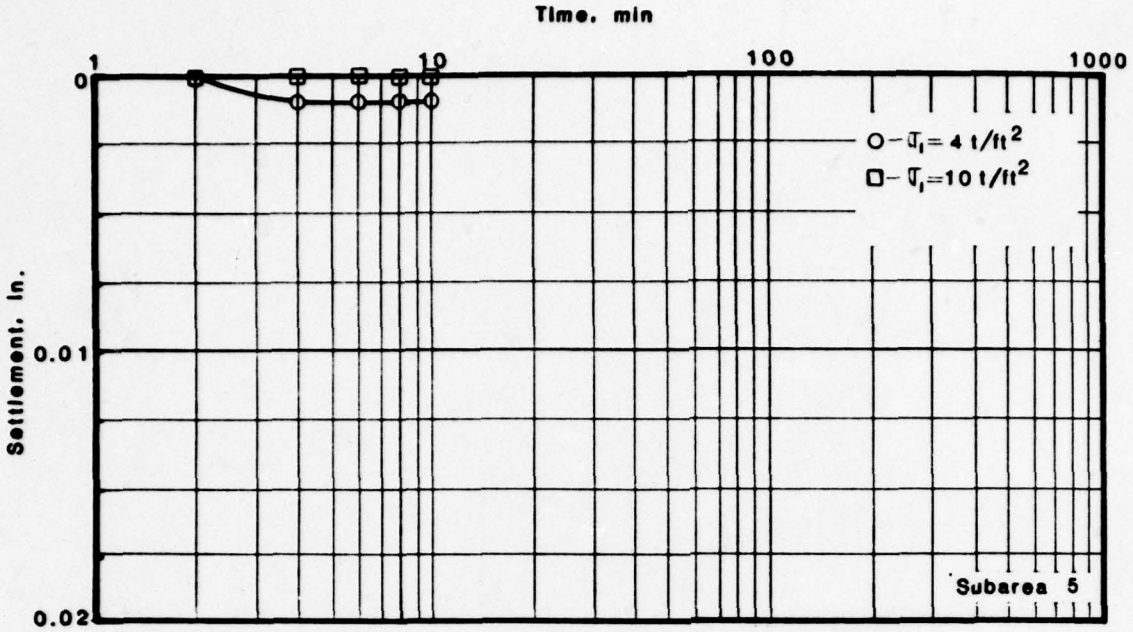
CHEMICAL GROUTING TEST PROGRAM

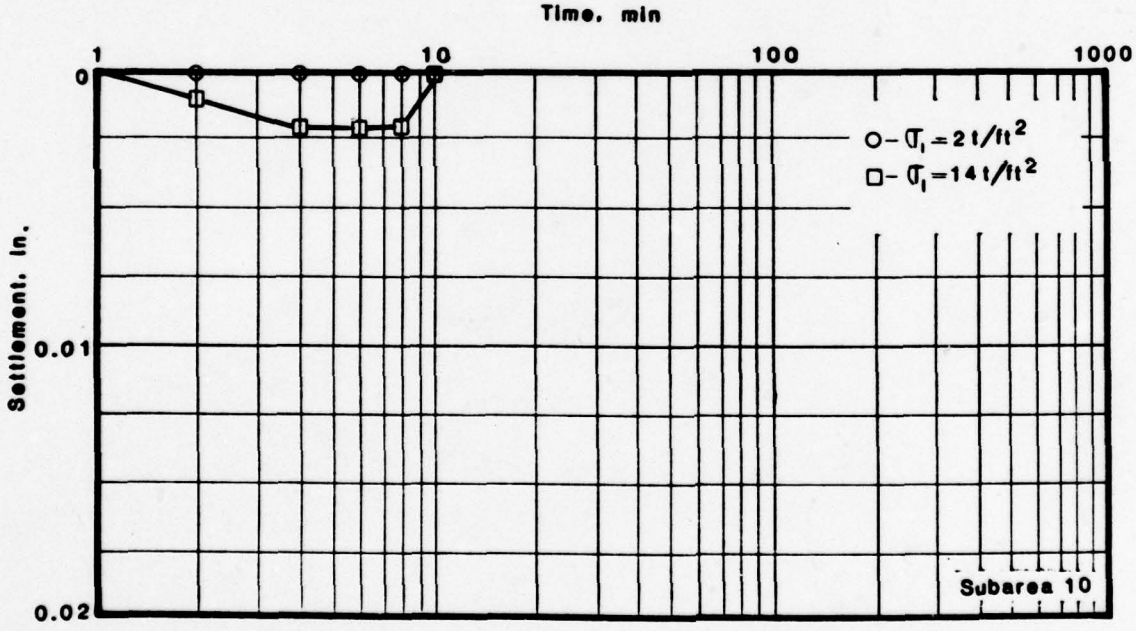
CREEP RESULTS FROM PLATE LOAD TEST SUBAREAS 1,2,4

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

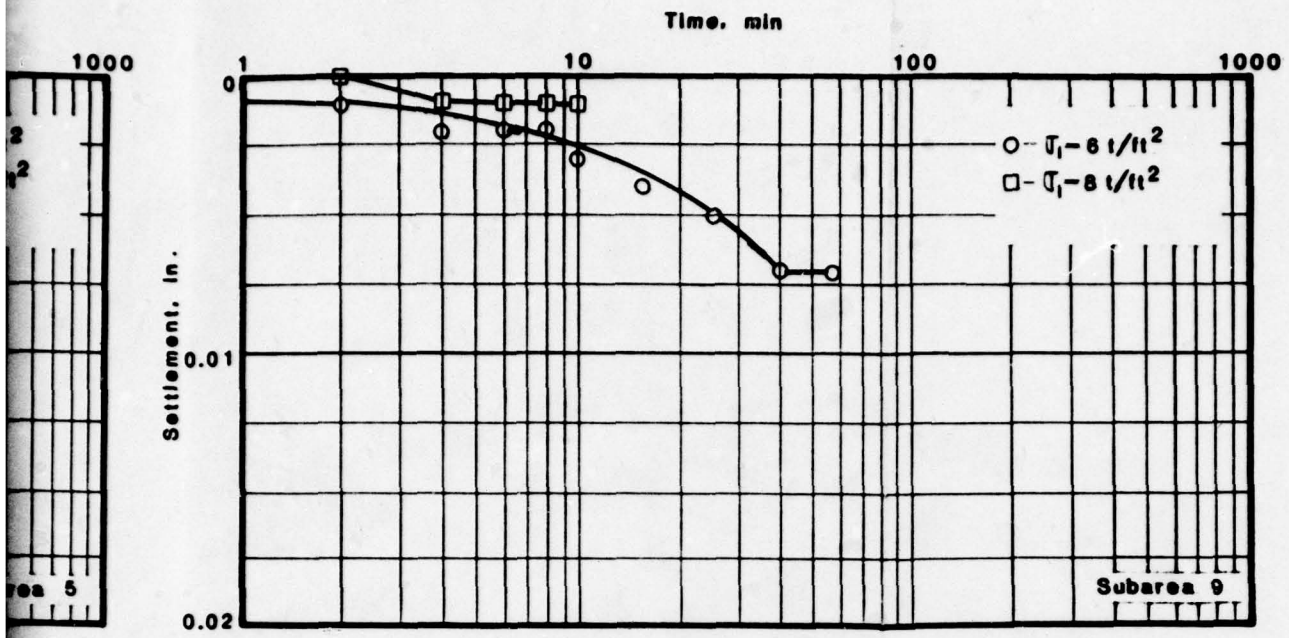
Woodward-Clyde Consultants
Y7C825 Phase IV

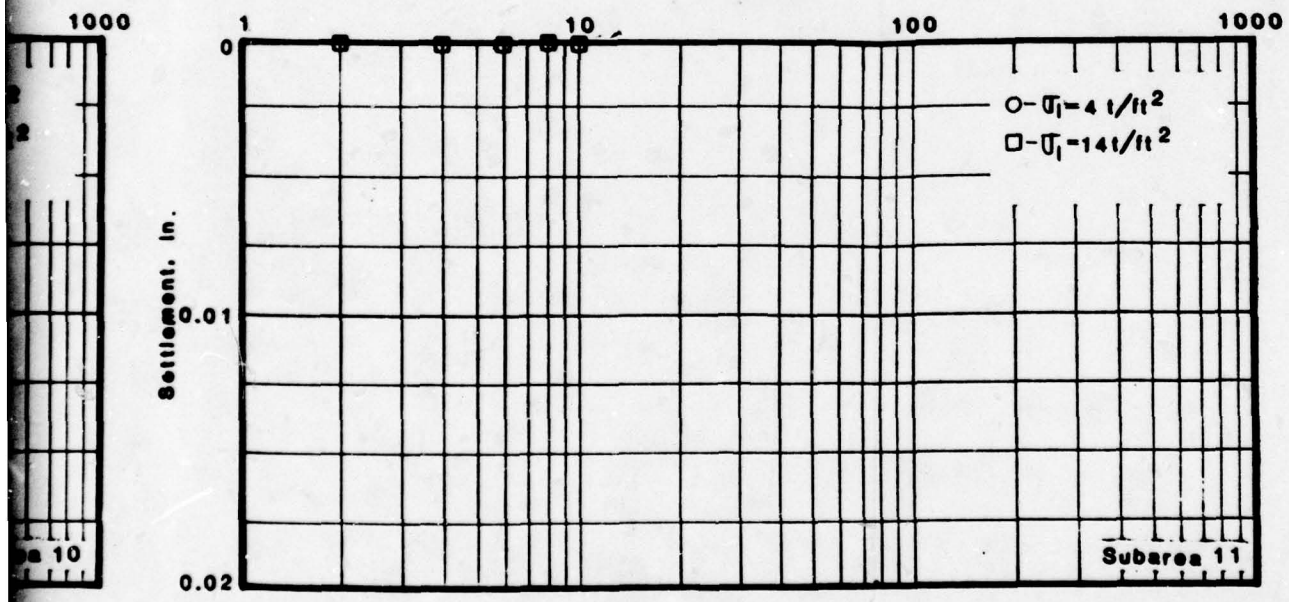
Fig. G.19





Note: Settlement scale is increased 10 times to .0025 in/divisi





2

creased 10 times to .0025 in/division

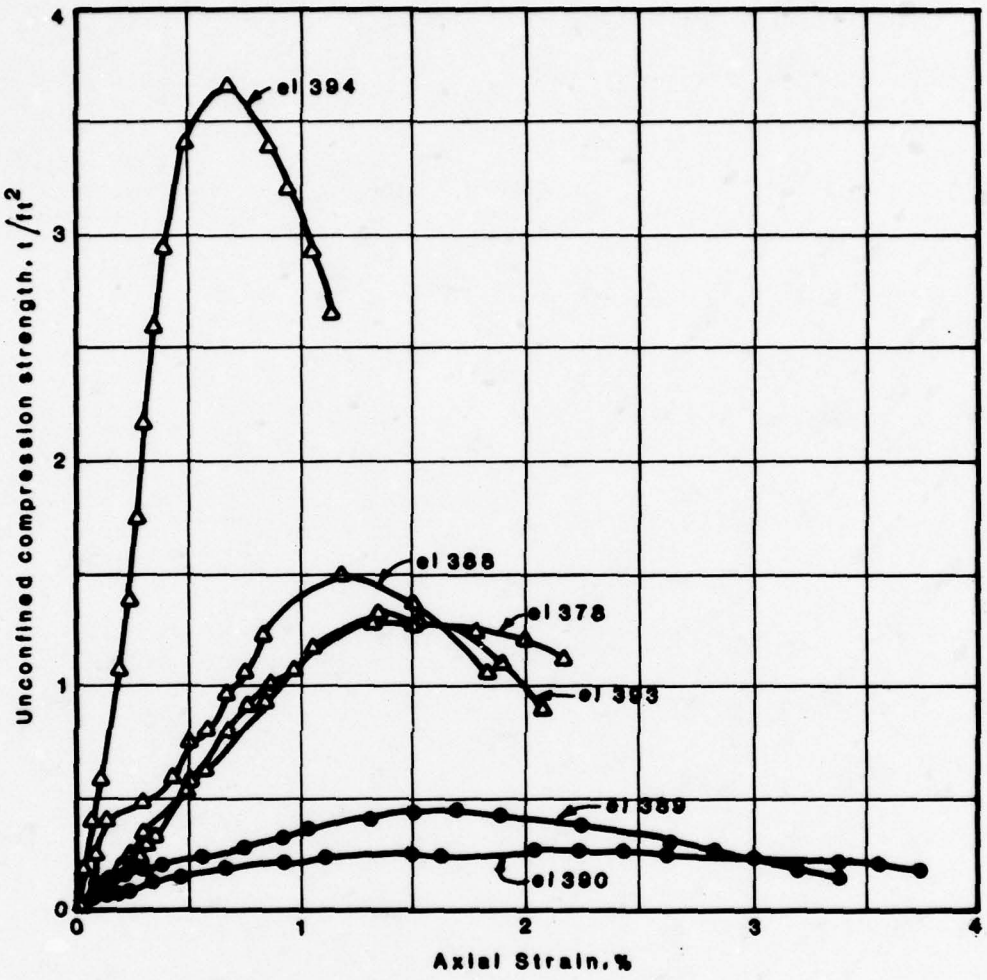
CHEMICAL GROUTING TEST PROGRAM

CREEP RESULTS FROM PLATE LOAD TEST- SUBAREAS 5,9,10,11

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. G. 20



Legend

● Boring AG-A1-4 35% Siroc 142 Test Subarea 1

△ Boring AG-A4-3 35% Siroc 142 Test Subarea 4

CHEMICAL GROUTING TEST PROGRAM

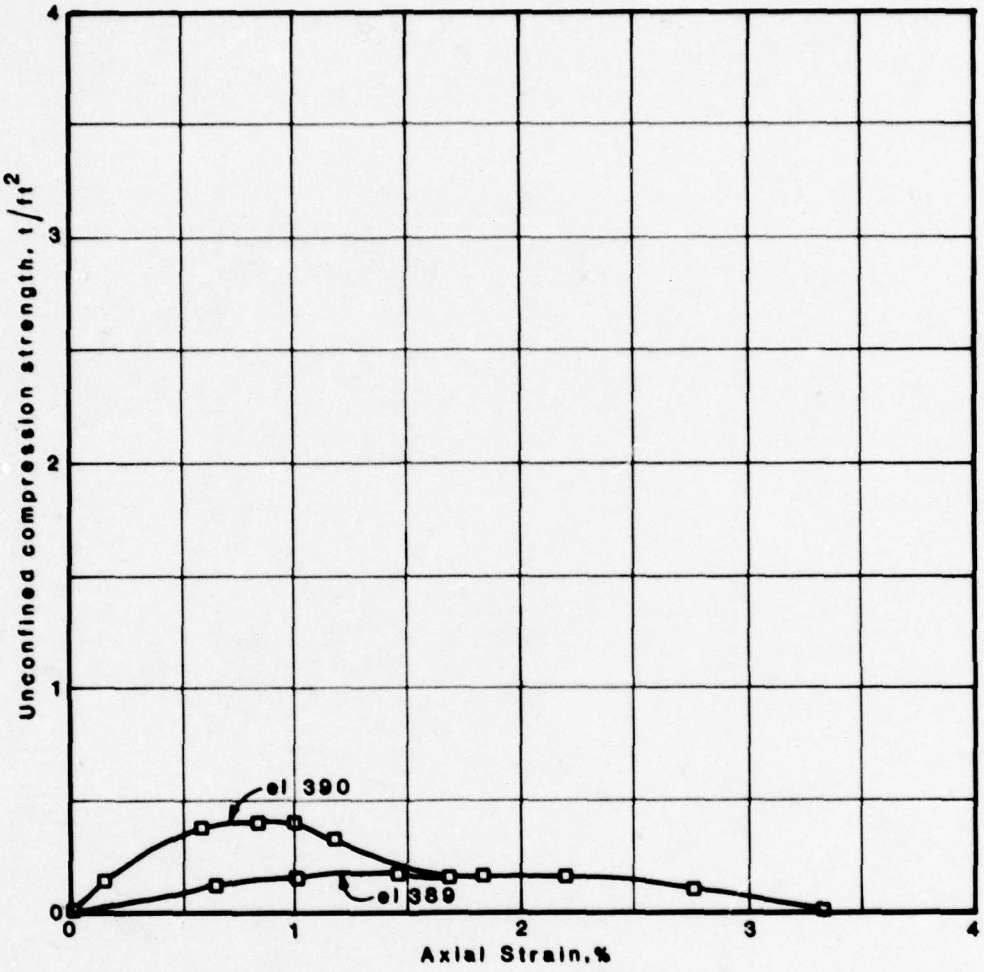
RESULTS OF UNCONFINED COMPRESSION TESTS BOREHOLE SAMPLES 35 % SIROC 142

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. G.21



Legend

□ Boring AG-A3-3 28% Silicate/R600
Test Subarea 3

CHEMICAL GROUTING TEST PROGRAM

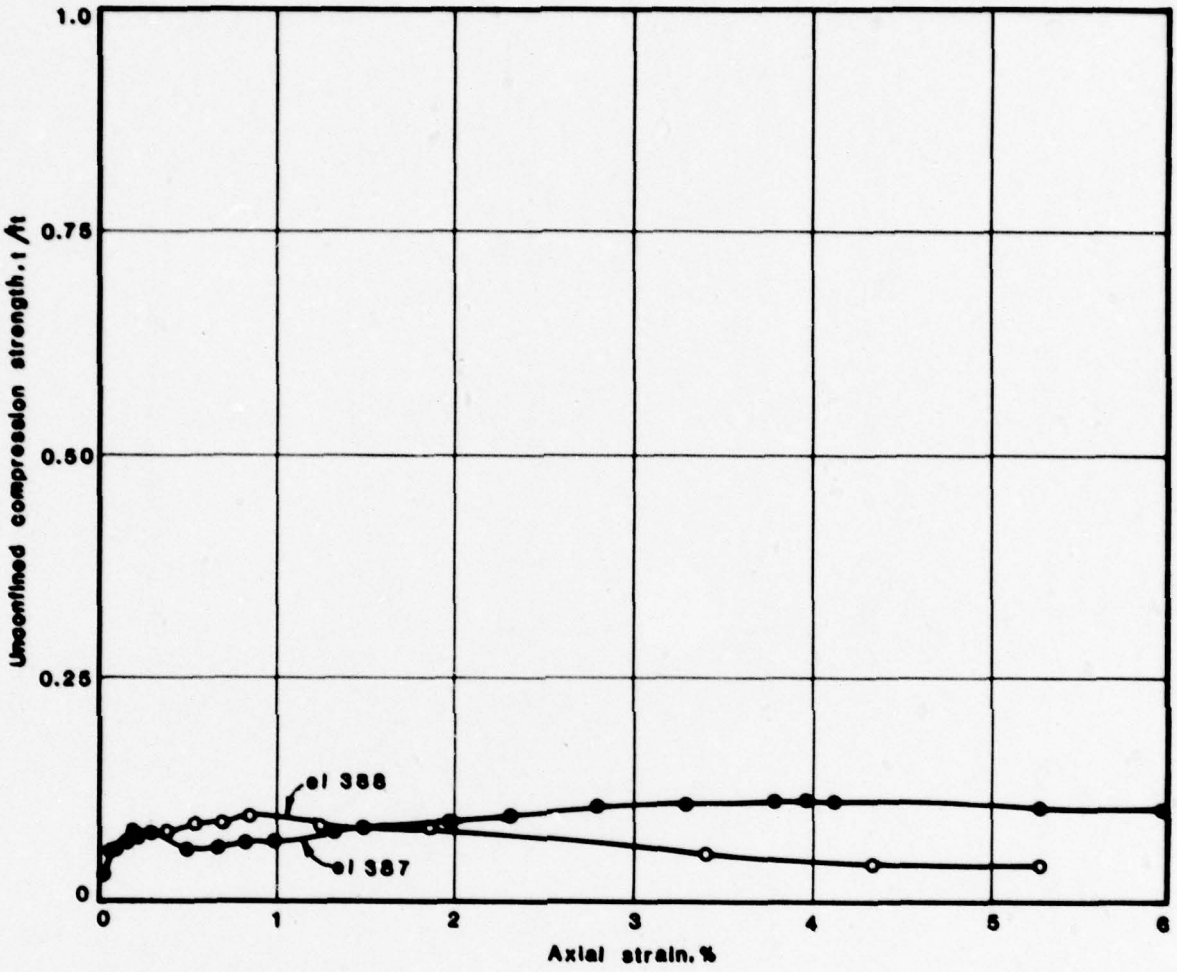
RESULTS OF UNCONFINED COMPRESSION TEST BOREHOLE SAMPLES 28 % SILICATE/R600

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig. G.22

Y7C825 Phase IX



Legend

●○ Boring AG-A8-4 25% Silicate Aluminate
Test subarea 8

CHEMICAL GROUTING TEST PROGRAM

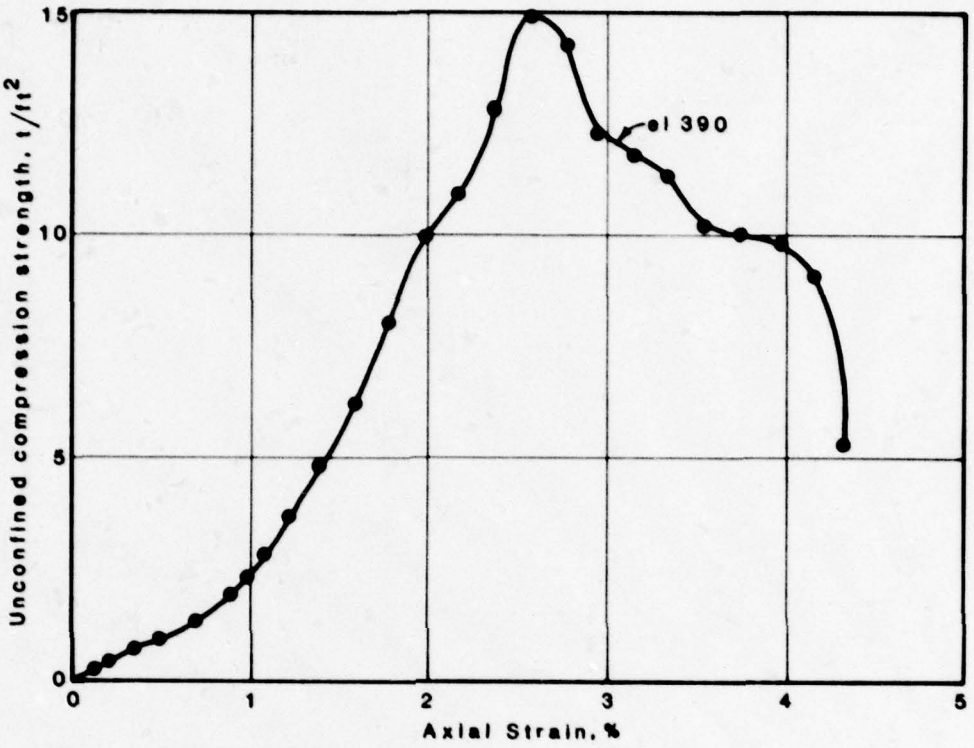
RESULTS OF UNCONFINED COMPRESSION TEST BOREHOLE SAMPLES 25% SILICATE/ALUMINATE

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0008

Woodward-Clyde Consultants

Fig.G.23

Y7C625 Phase IX



Legend

● Boring AG-A11-4 55% Siroc 132/142
Test Subarea 11

CHEMICAL GROUTING TEST PROGRAM

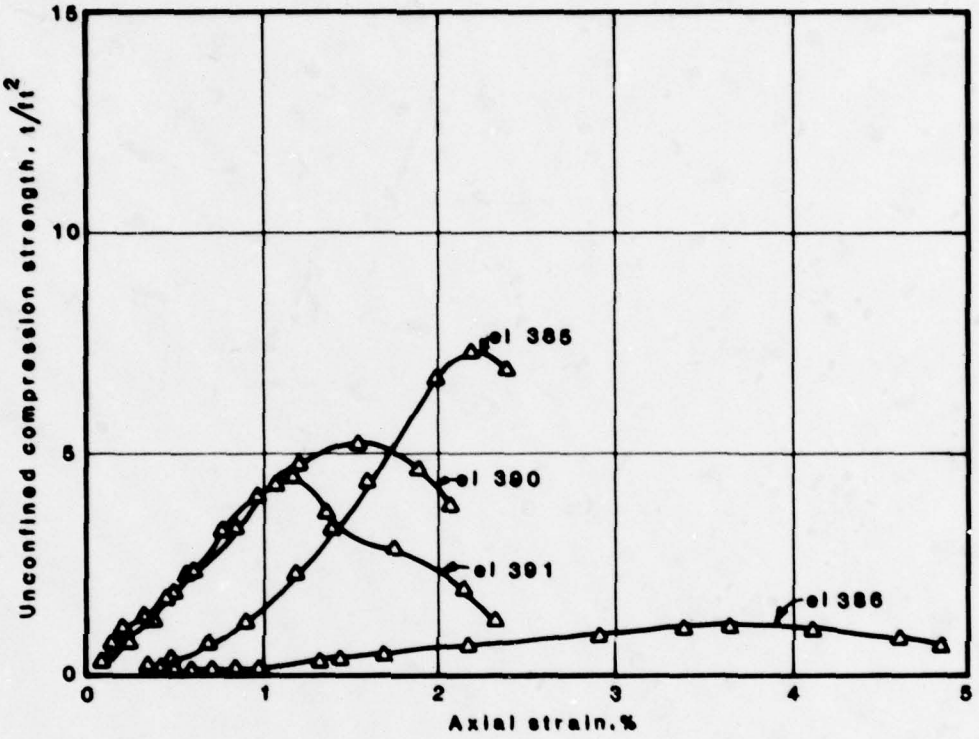
RESULTS OF UNCONFINED COMPRESSION TEST BOREHOLE SAMPLES 55% SIROC 132/142

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. G.24



Legend

△ Boring AG-A13-3 46% Silicate / R600
Test Subarea 13

CHEMICAL GROUTING TEST PROGRAM

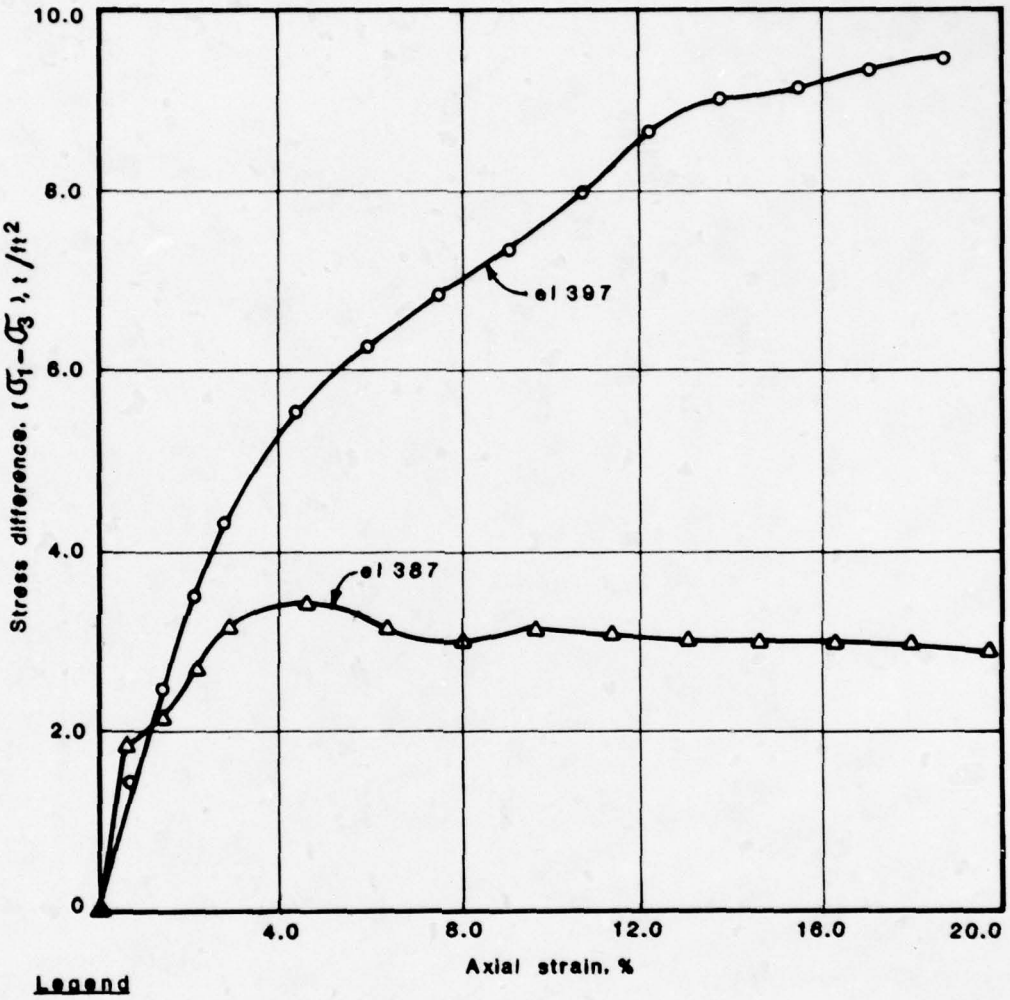
RESULTS OF UNCONFINED COMPRESSION TESTS BOREHOLE SAMPLES 46% SILICATE/R600

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

Woodward-Clyde Consultants

Fig. G.25

Y7C825 Phase III



Legend

○ △ Boring AG-A13-3 46% Silicate/R600
Test Subarea 13

CHEMICAL GROUTING TEST PROGRAM

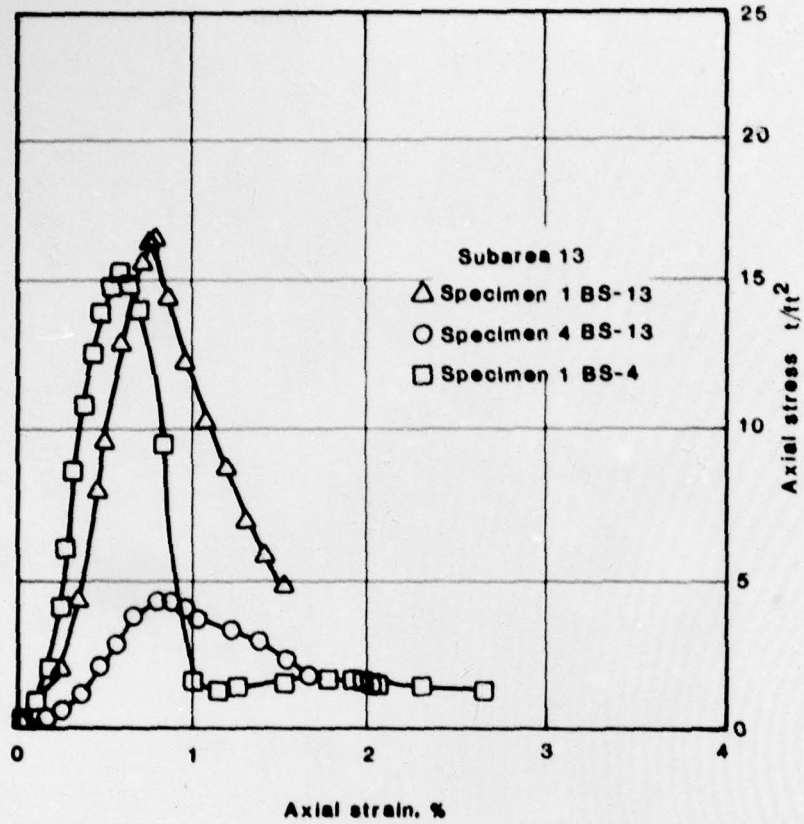
RESULTS OF UNCONSOLIDATED UNDRAINED TRIAXIAL COMPRESSION TESTS ON BOREHOLE SAMPLES 46% SILICATE/R600

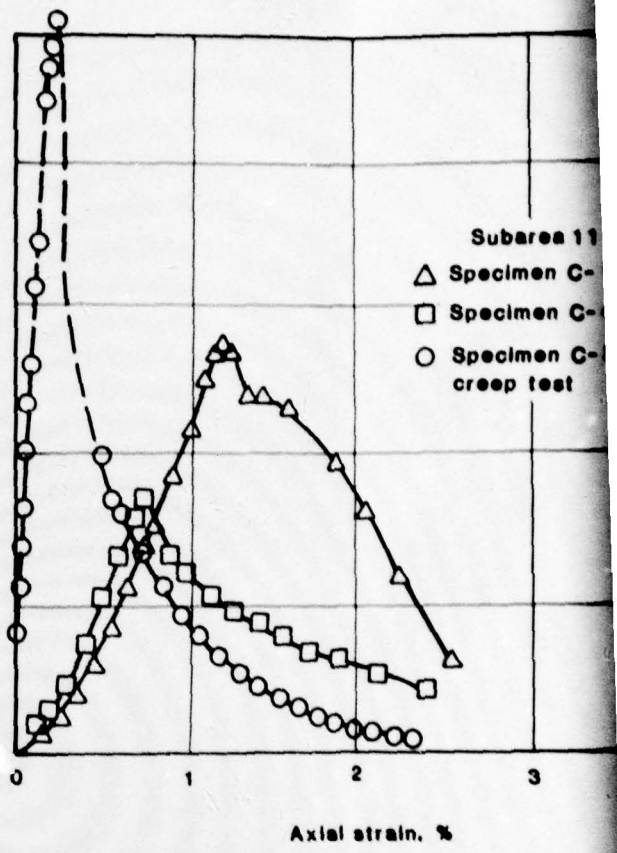
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST. LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

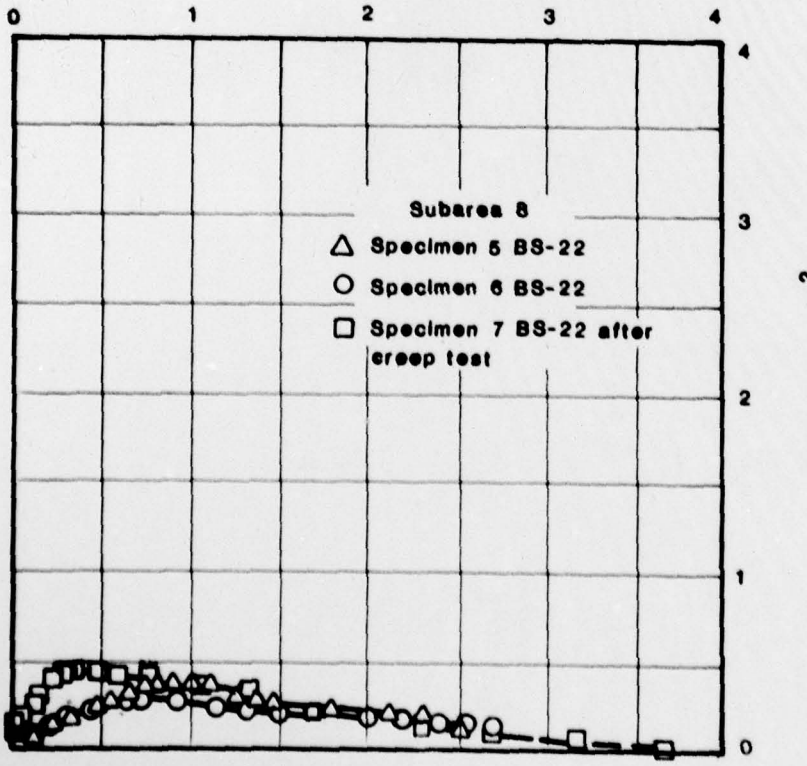
Woodward-Clyde Consultants

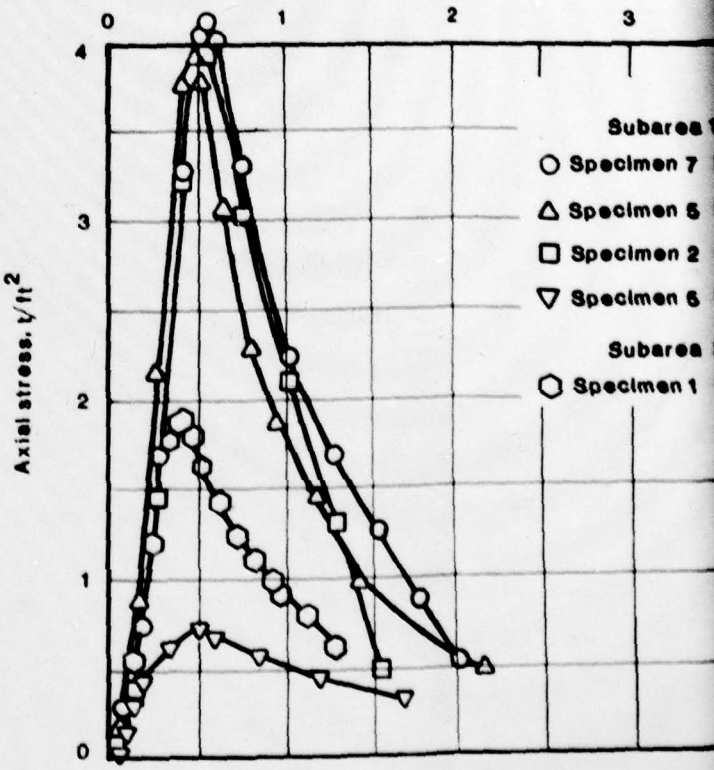
Y7C625 Phase IX

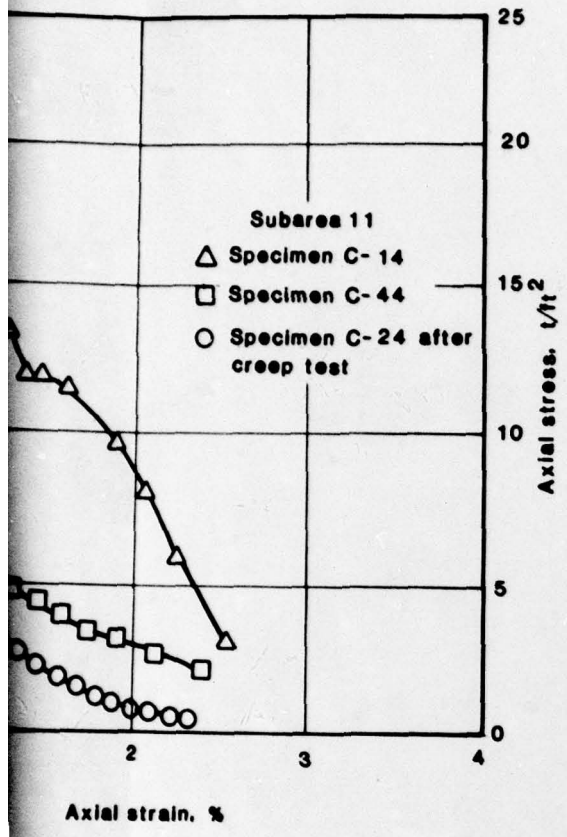
Fig. G.26

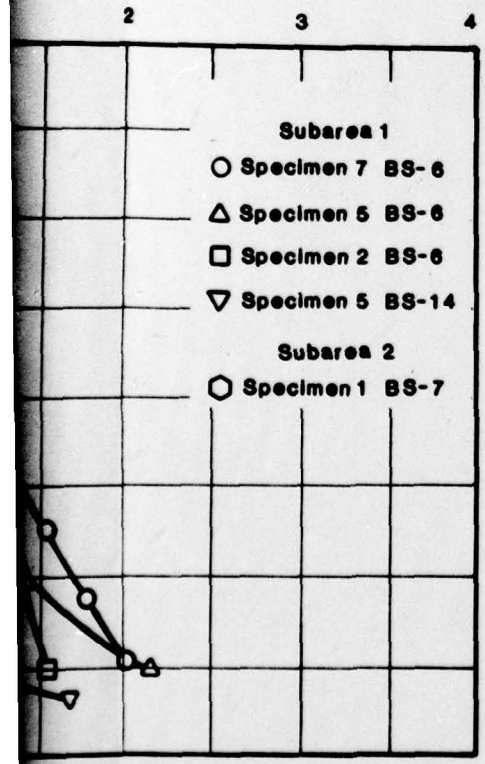

Subarea 13
Specimen 1 BS-13
Specimen 4 BS-13
Specimen 1 BS-4
Axial stress, t/ft²
Axial strain, %

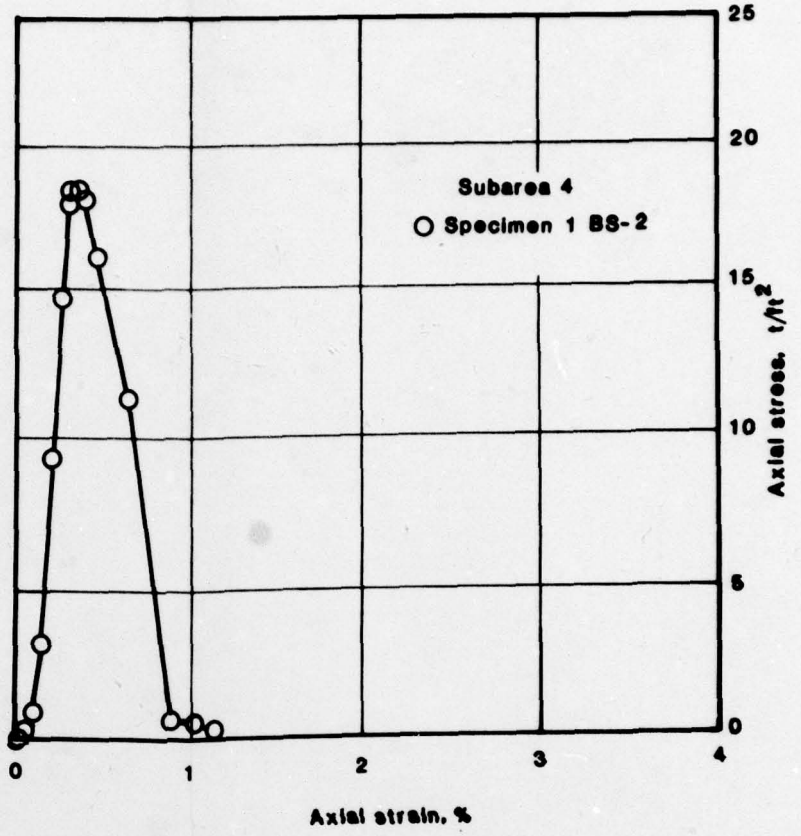

Subarea 11
Specimen C-
Specimen C-
Specimen C-
creep test
Axial strain, %


Subarea 8
Specimen 5 BS-22
Specimen 6 BS-22
Specimen 7 BS-22 after
creep test


Subarea
Specimen 7
Specimen 5
Specimen 2
Specimen 6
Subarea
Specimen 1
Axial stress, t/ft²







2

CHEMICAL GROUTING TEST PROGRAM

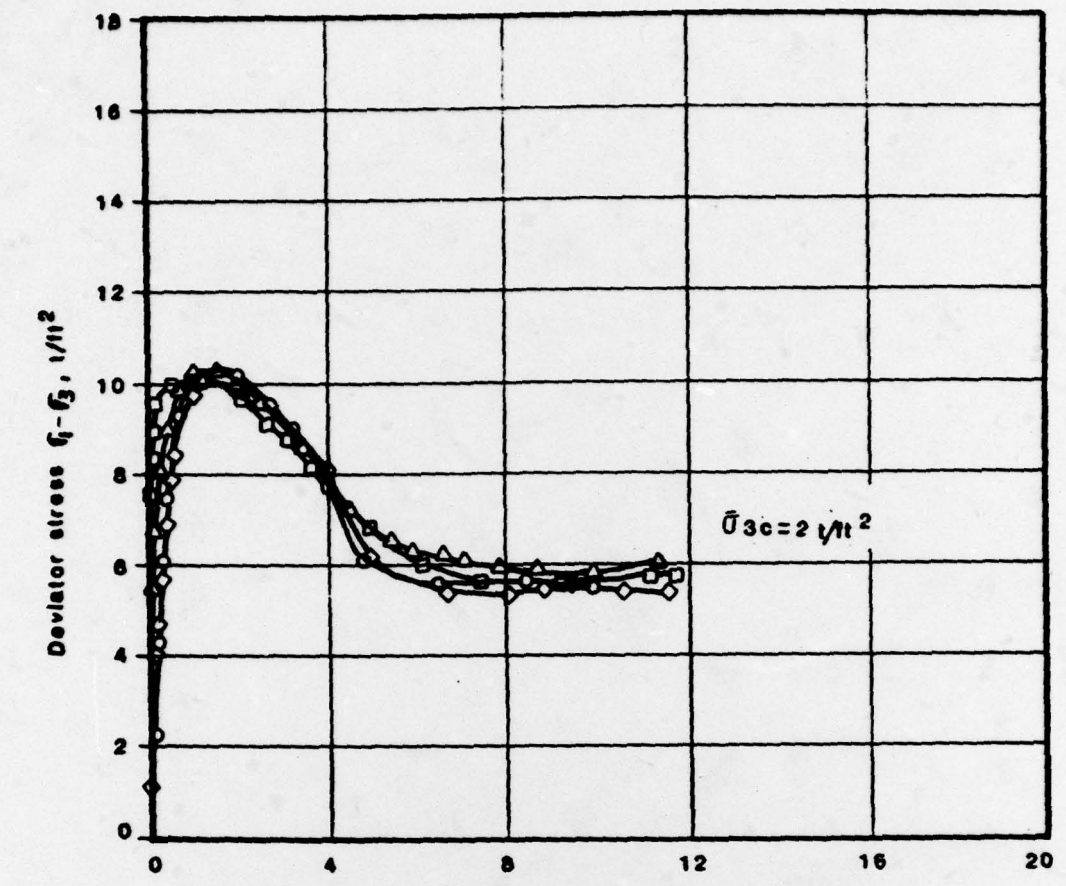
RESULTS OF UNCONFINED COMPRESSION TESTS ON EXCAVATION BLOCK AND CORE SAMPLES

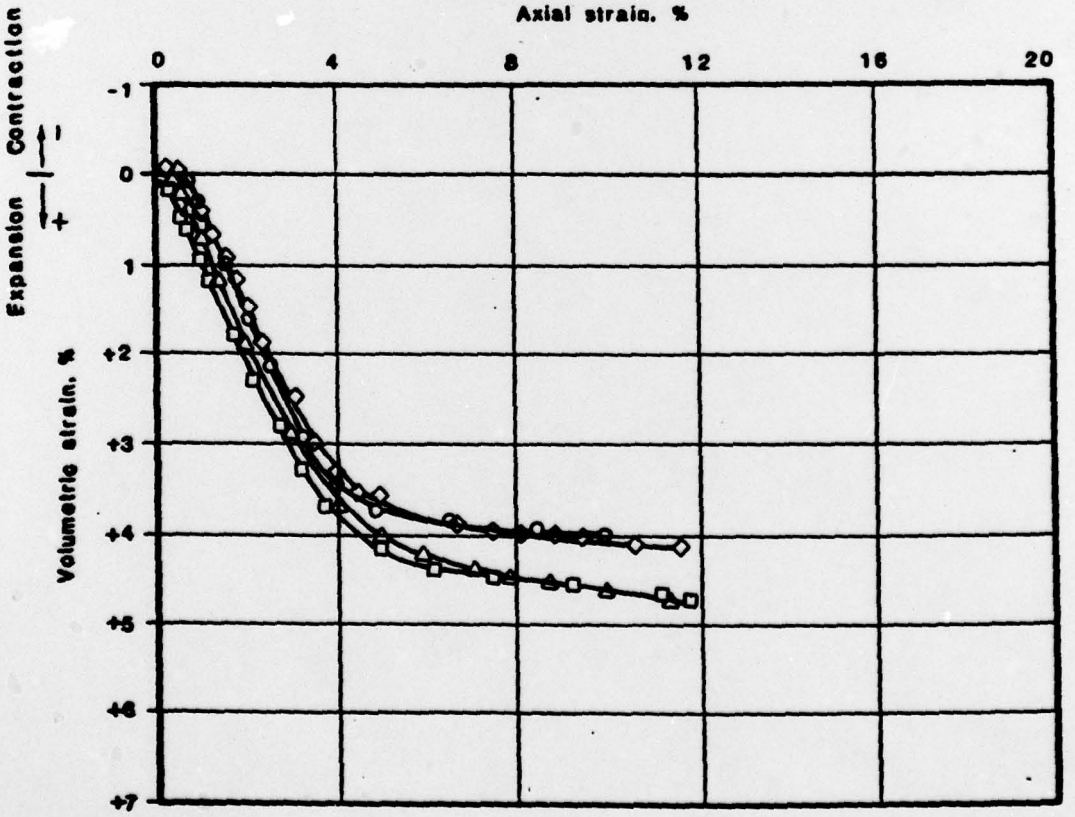
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

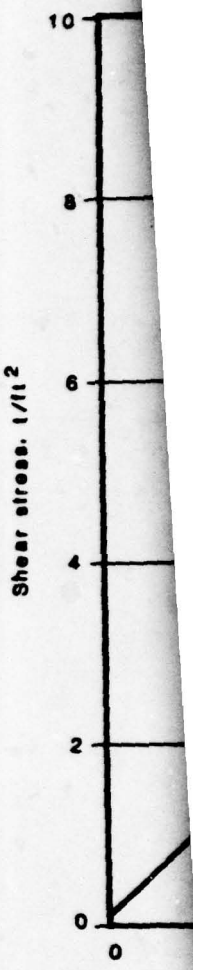
Woodward-Clyde Consultants

Y7C825 Phase IX

Fig. G.27







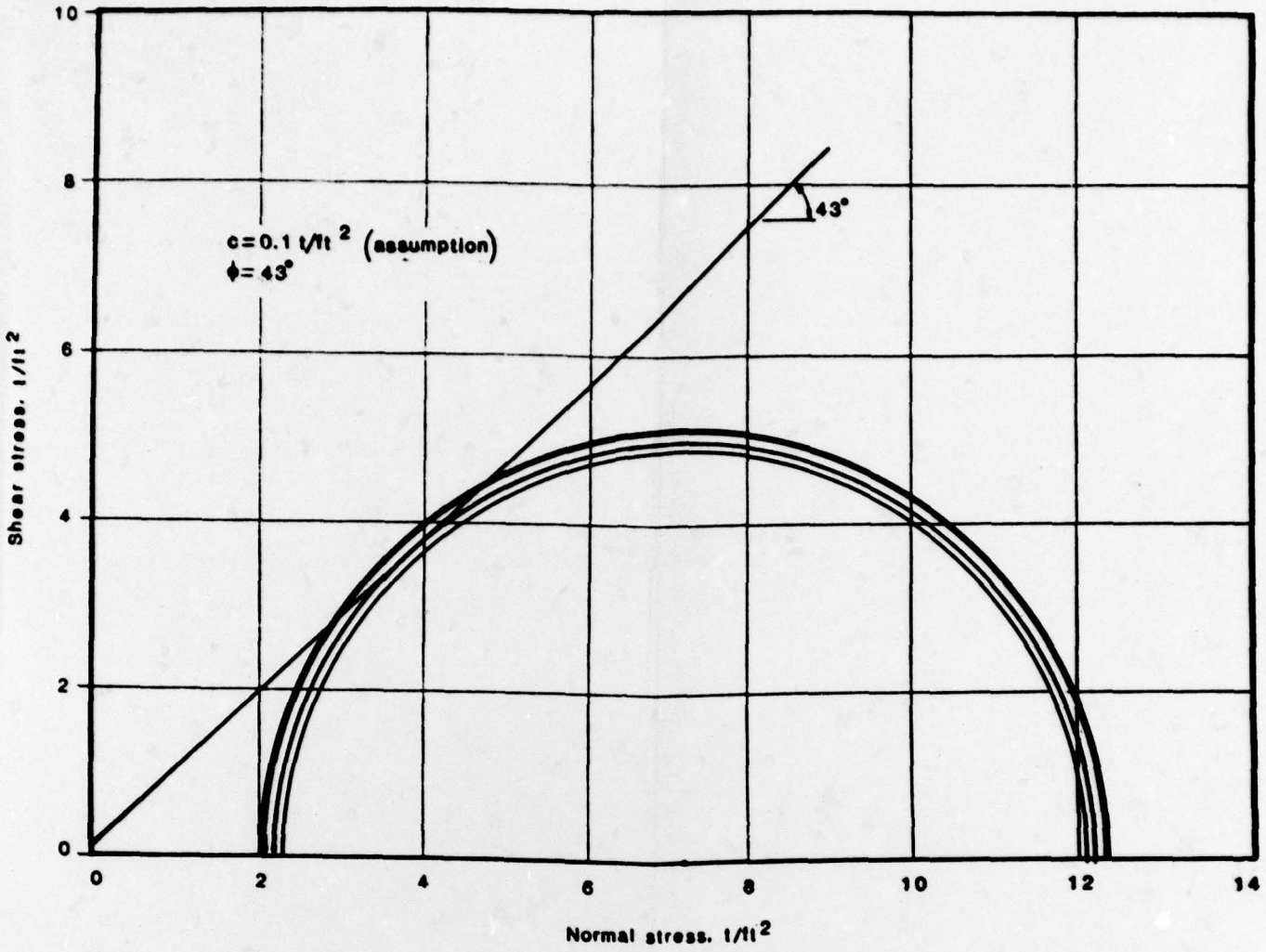
Notes:

1 Ax

2 Tes
and

Le

Sy



Notes:

1. Axial strain rate = 0.5 %/min
2. Test specimens were 2.8-in.-dia and 6.6-in.-high

Legend:

Symbol	Specimen No.	
○	3	
△	4	after creep test
□	5	
◇	6	

2

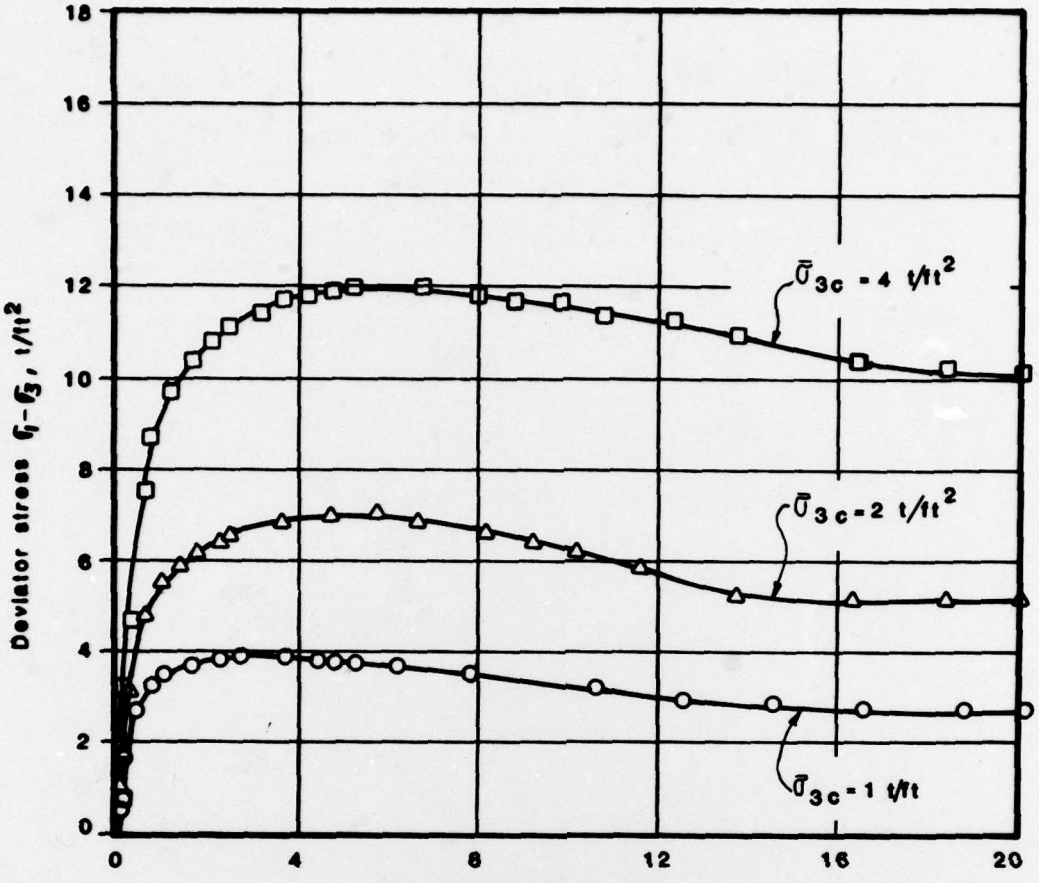
CHEMICAL GROUTING TEST PROGRAM RESULTS OF CID TRIAXIAL COMPRESSION TESTS UNGROUTED RECONSTITUTED SAND SAMPLES

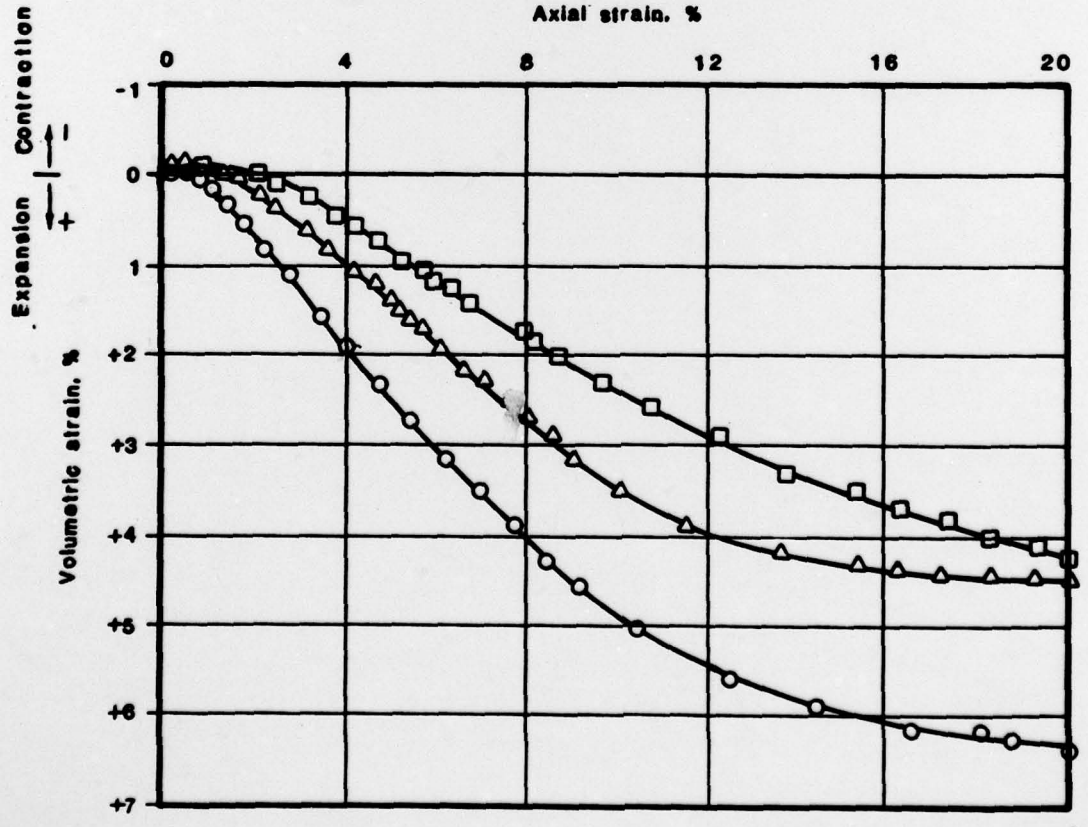
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

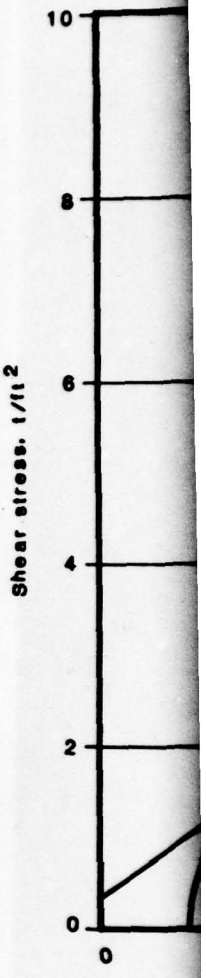
Woodward-Clyde Consultants

Fig. G.28

77C025 Phase II



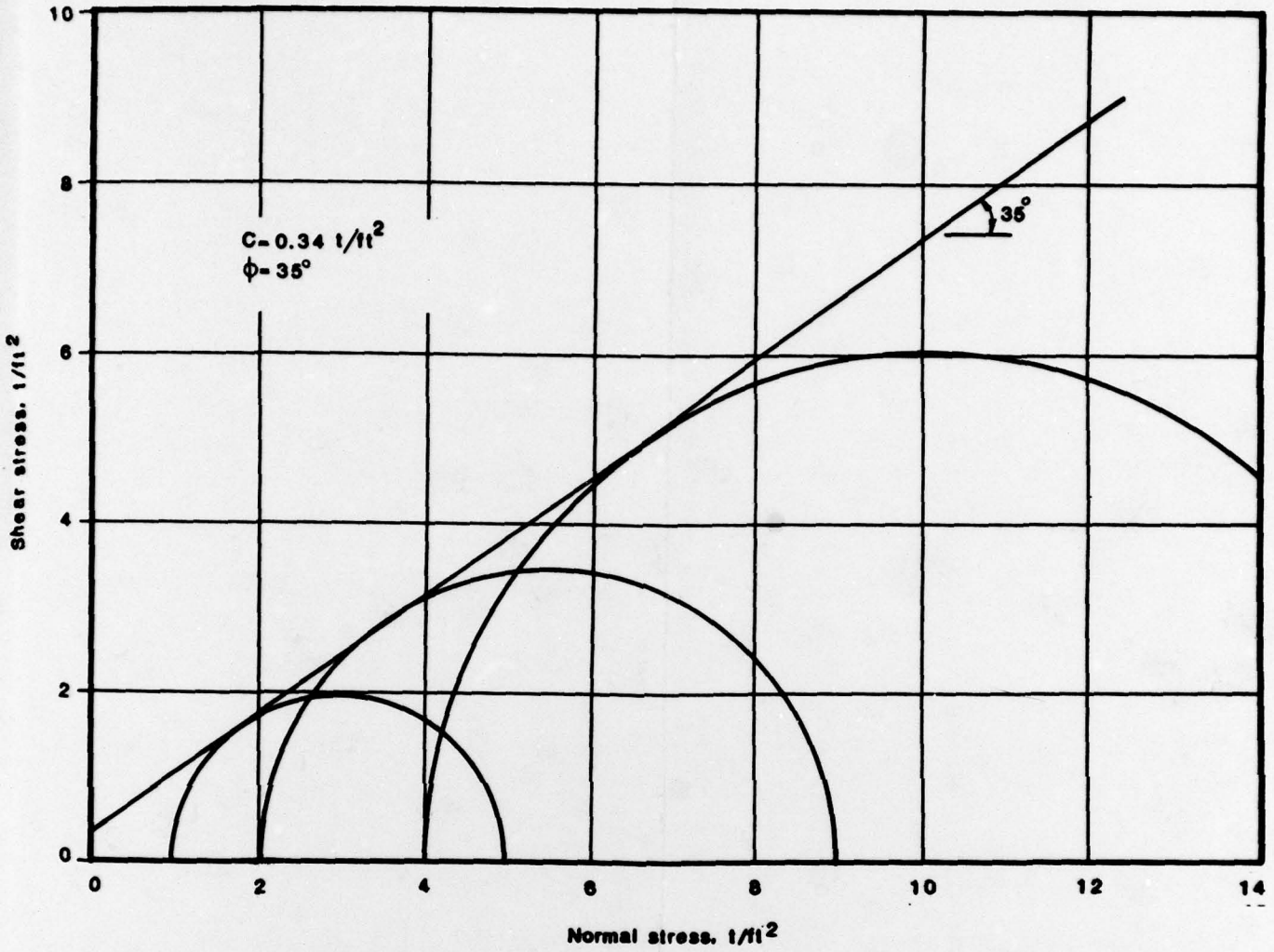




Notes:

1. Axis

2. Test
6.6-



Notes:

1. Axial strain rate = 0.5 %/min
2. Test specimens were 2.8-in.-dia and 6.6-in.-high

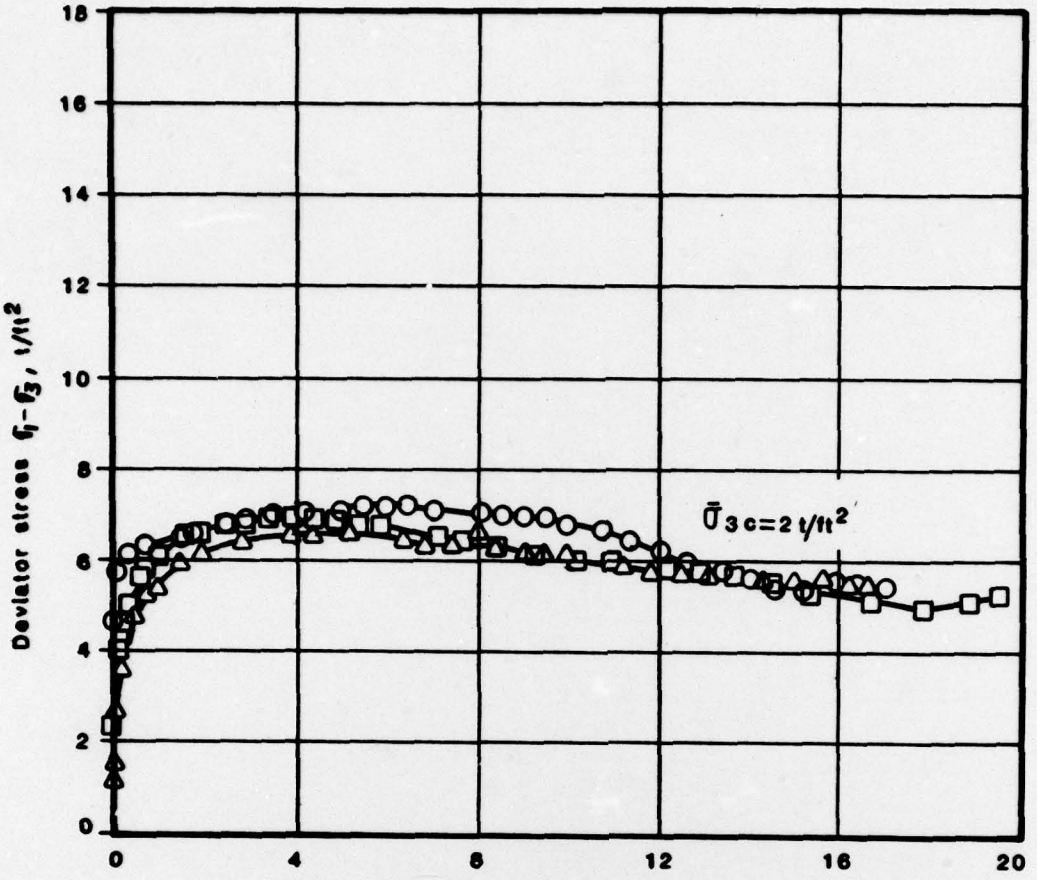
2

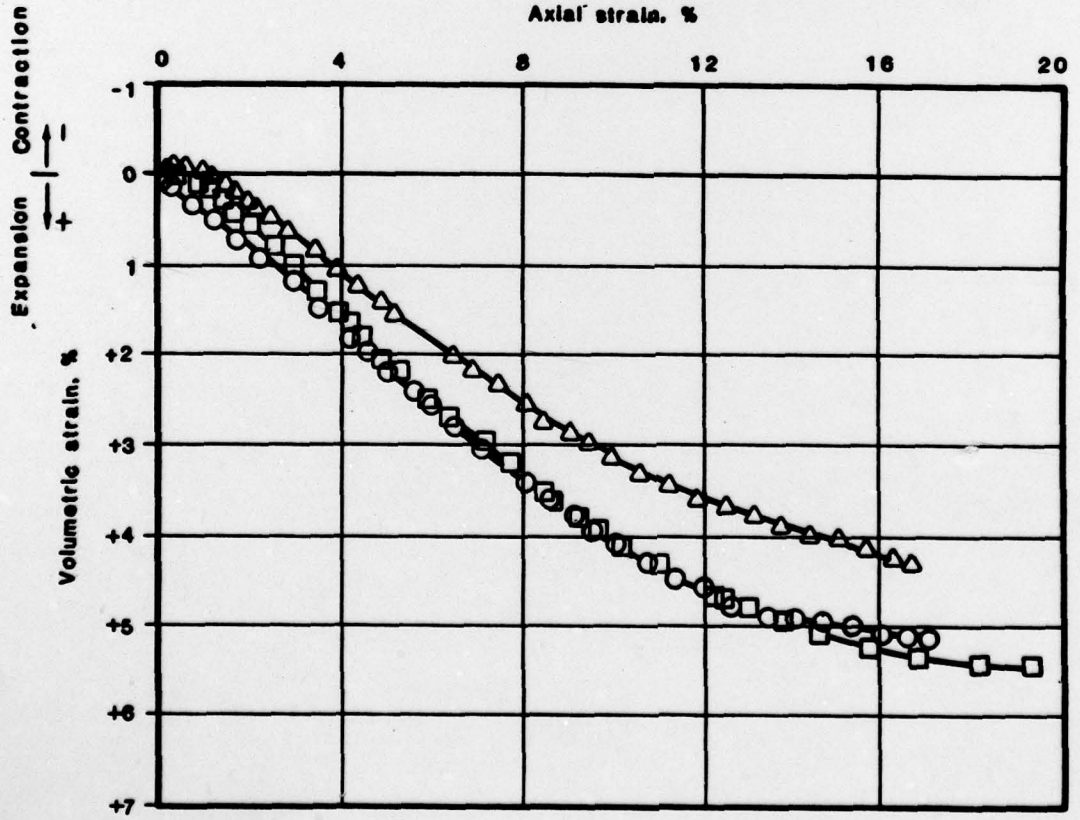
CHEMICAL GROUTING TEST PROGRAM
RESULTS OF CID TRIAXIAL COMPRESSION TESTS
EXCAVATION BLOCK SAMPLES
25% SILICATE/ALUMINATE

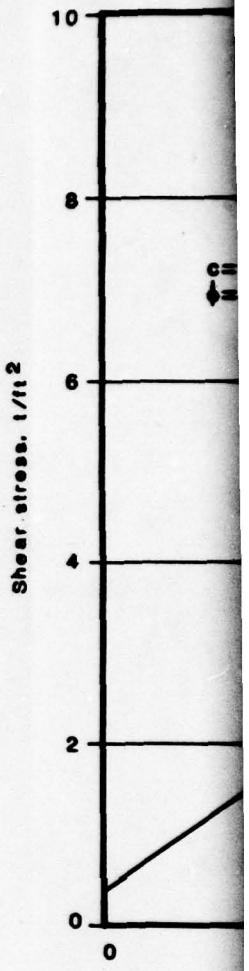
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0065

Woodward-Clyde Consultants
Y7C825 Phase II

Fig. G.29





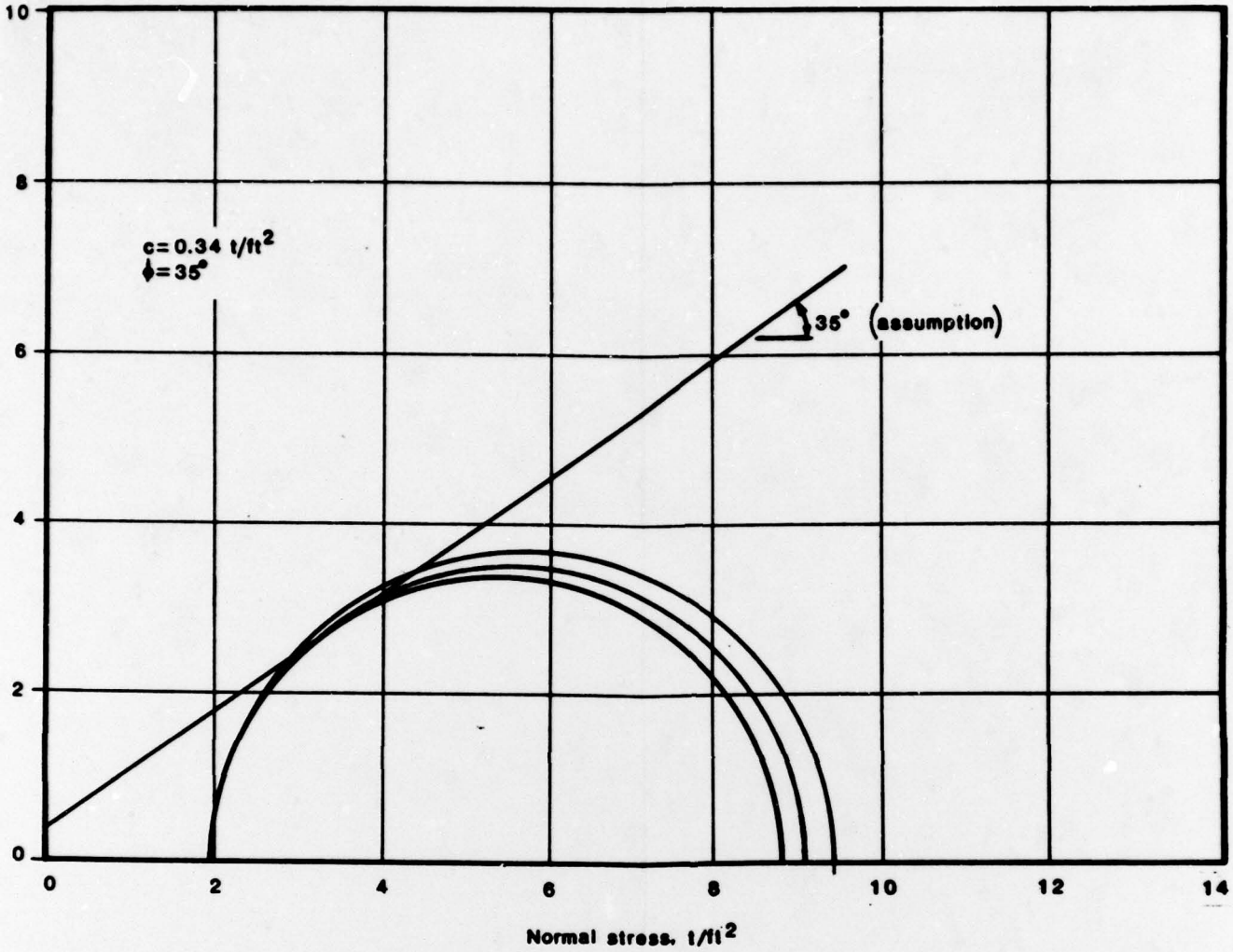


Notes:

1. Axial

2. Test sp
and 6.6

Symbol



Notes:

1. Axial strain rate = 0.5 %/min
2. Test specimens were 2.8-in.-dia and 6.6-in.-high

Legend:

Symbol	Sample No.	CSR
○	8	68%
△	9	10%
□	10	35%

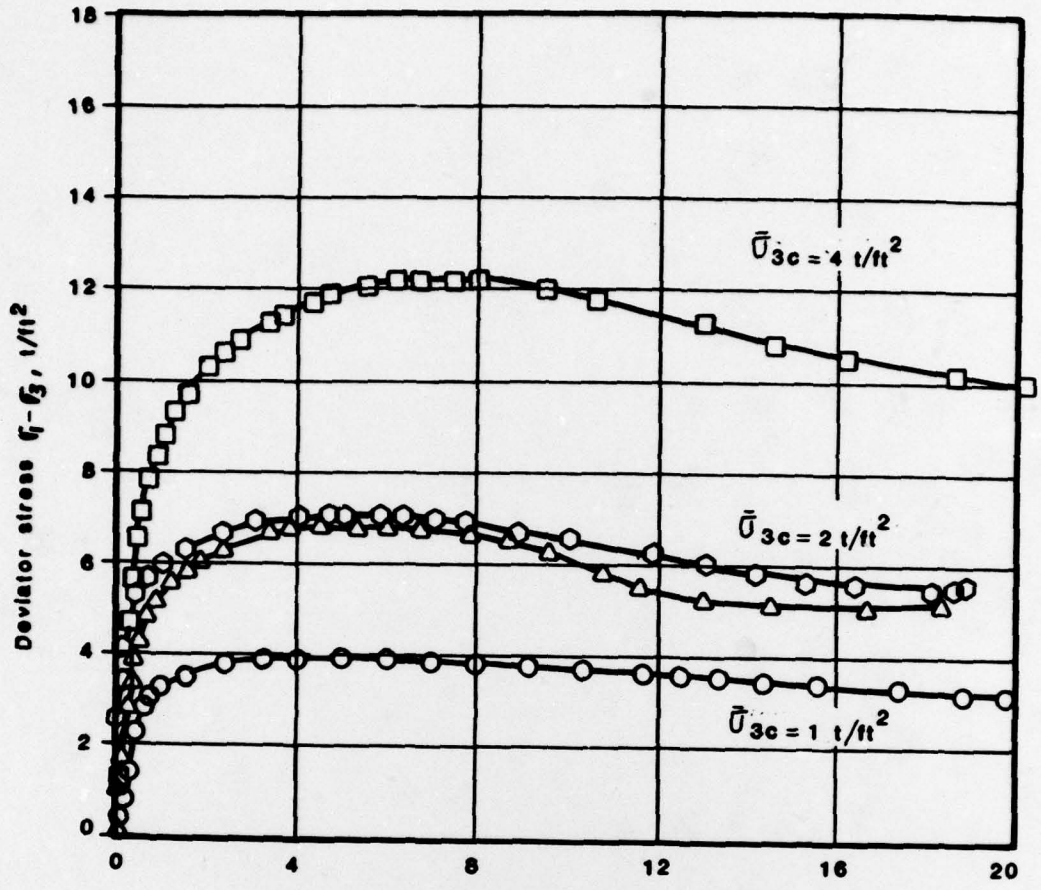
2

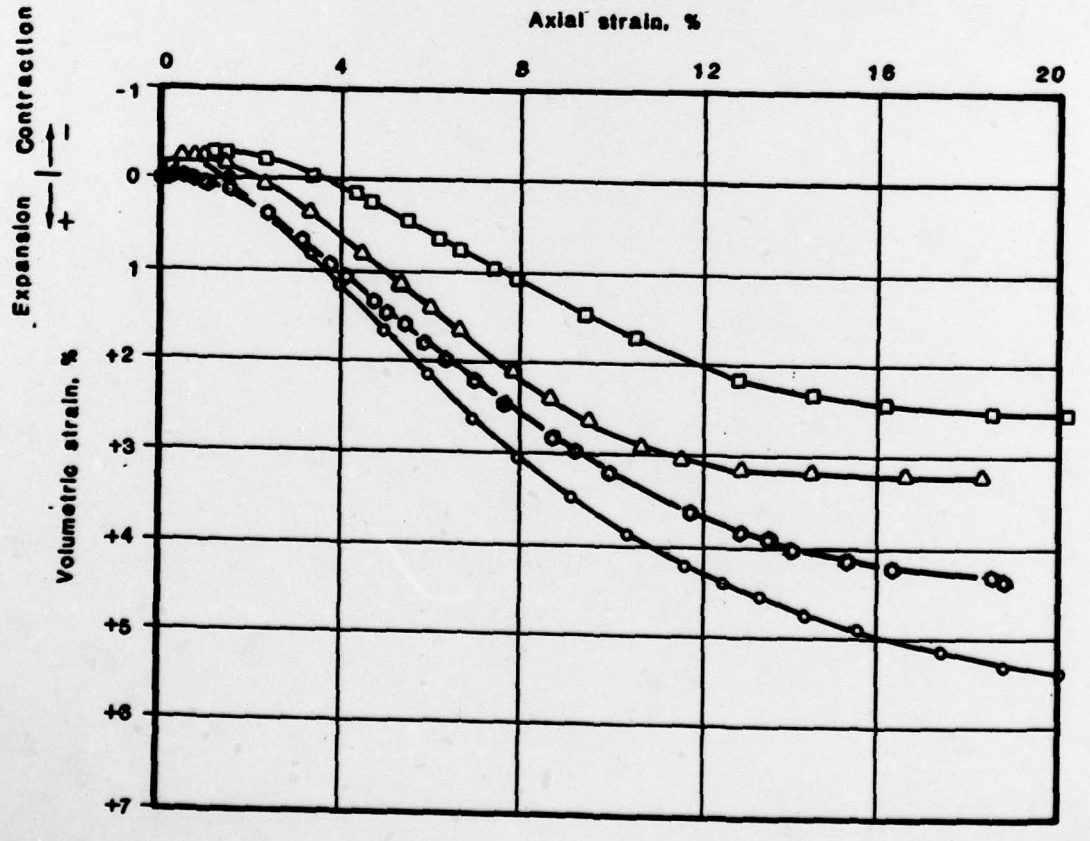
CHEMICAL GROUTING TEST PROGRAM
RESULTS OF CID TRIAXIAL COMPRESSION TESTS AFTER CREEP TESTS
EXCAVATION BLOCK SAMPLES
25% SILICATE/ALUMINATE

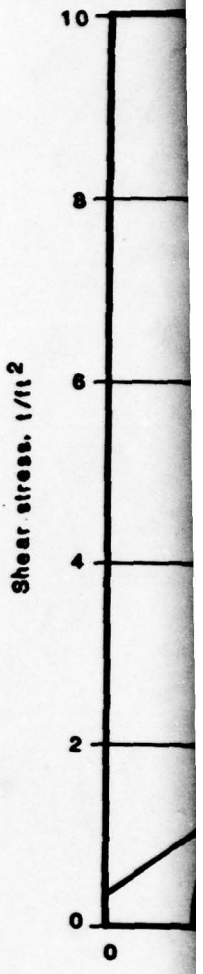
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

Woodward-Clyde Consultants
Y7C825 Phase III

Fig. G.30



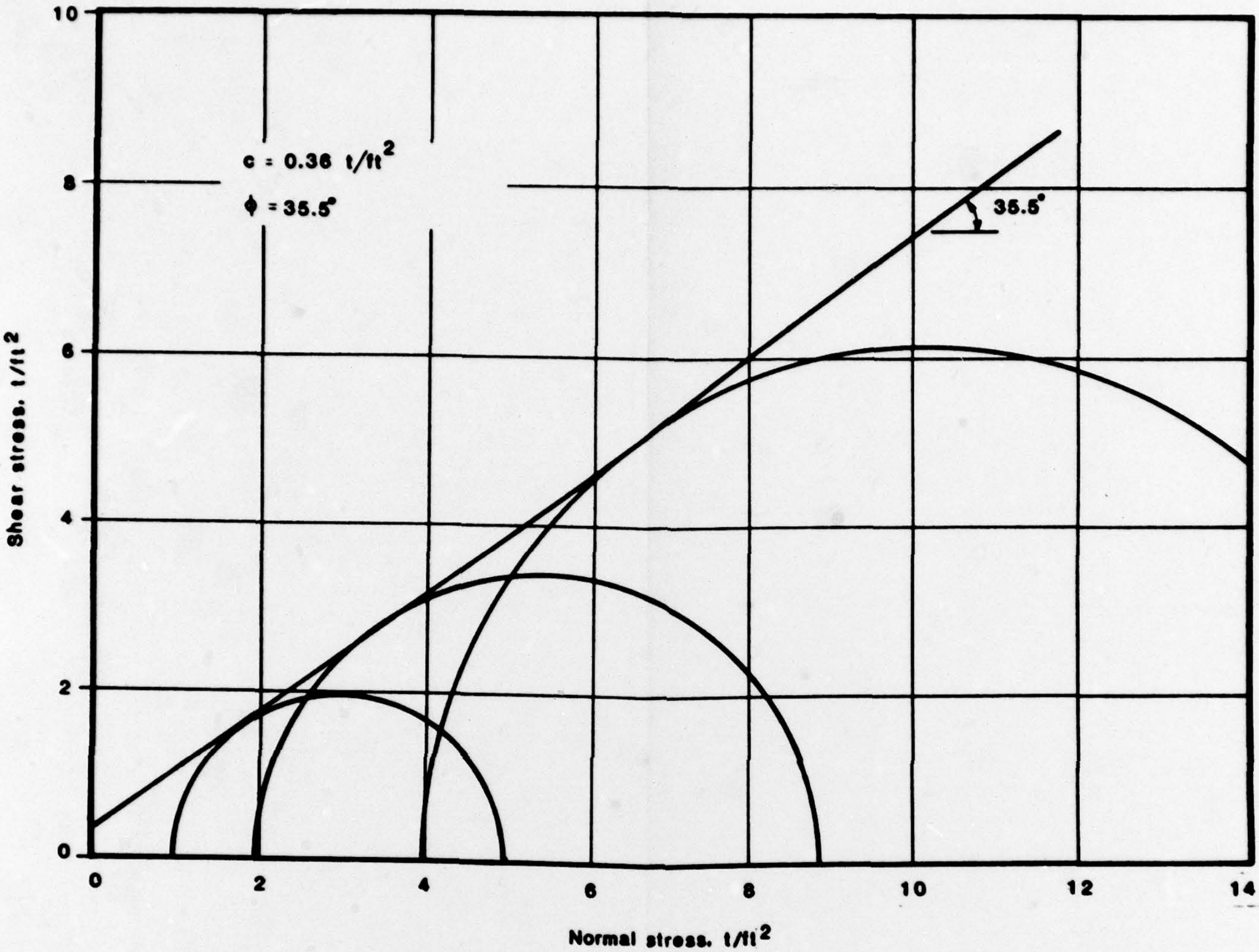




Notes:

1. Axi

2. Tes
and



Notes:

1. Axial strain rate – 0.5 %/min
2. Test specimens were 2.8 -in.-dia and 6.6 -in.-high

2

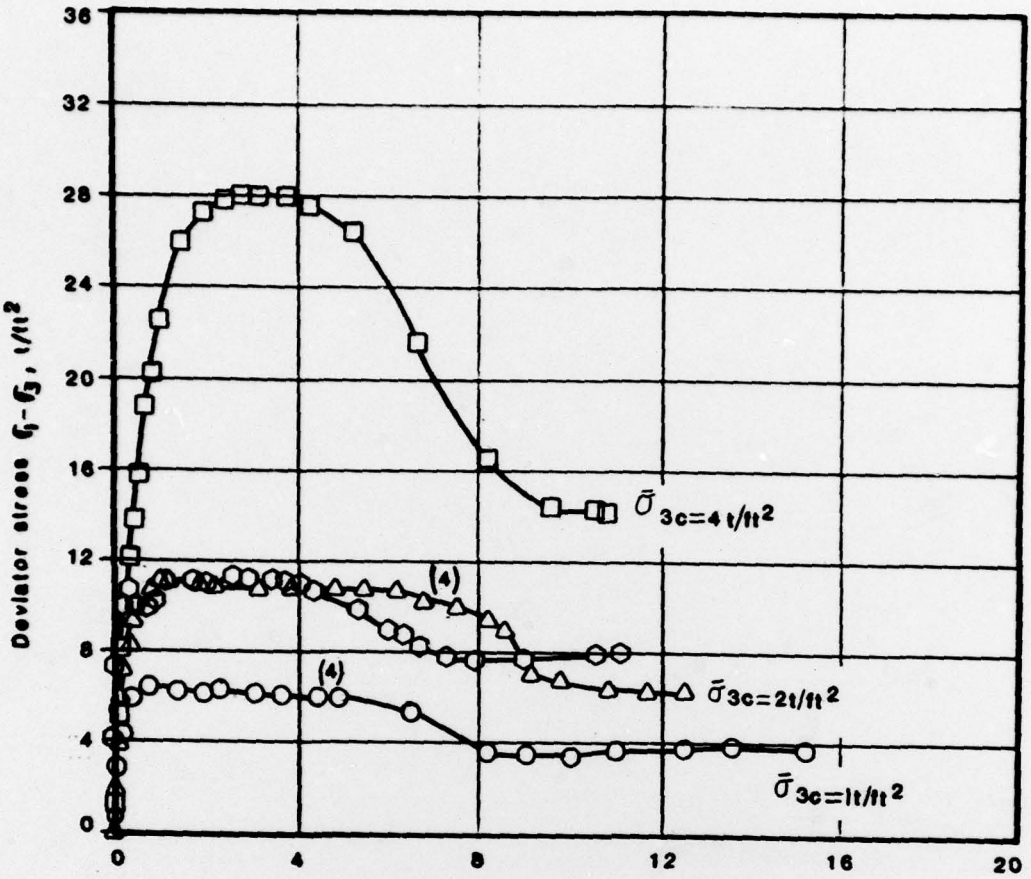
CHEMICAL GROUTING
TEST PROGRAM
RESULTS OF CID TRIAXIAL
COMPRESSION TESTS
EXCAVATION BLOCK SAMPLES
35% SIROC 142, SUBAREA 1

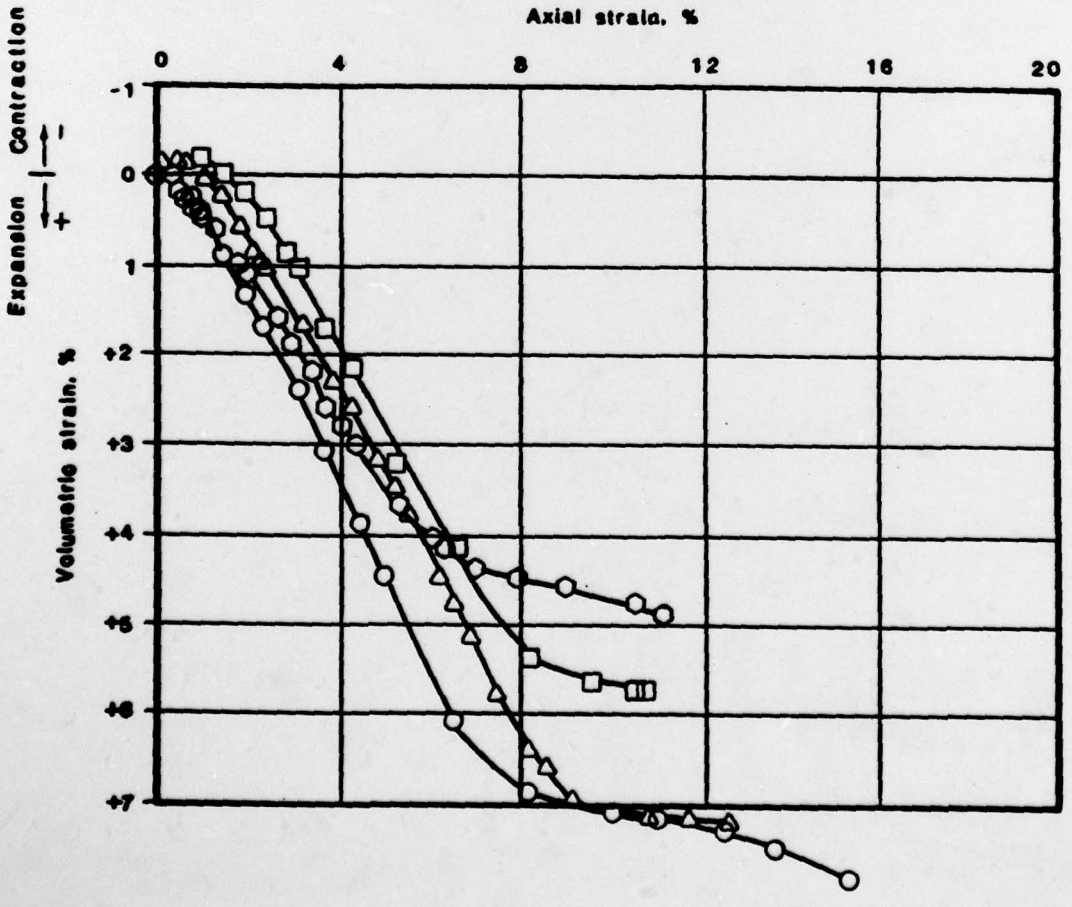
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-78-C-0005

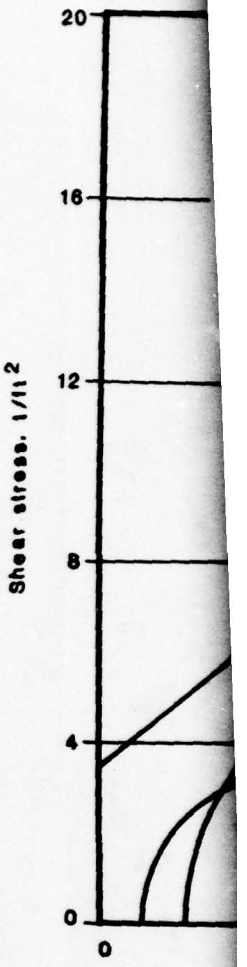
Woodward-Clyde Consultants

Fig. G.31

Y7C626 Phase IX

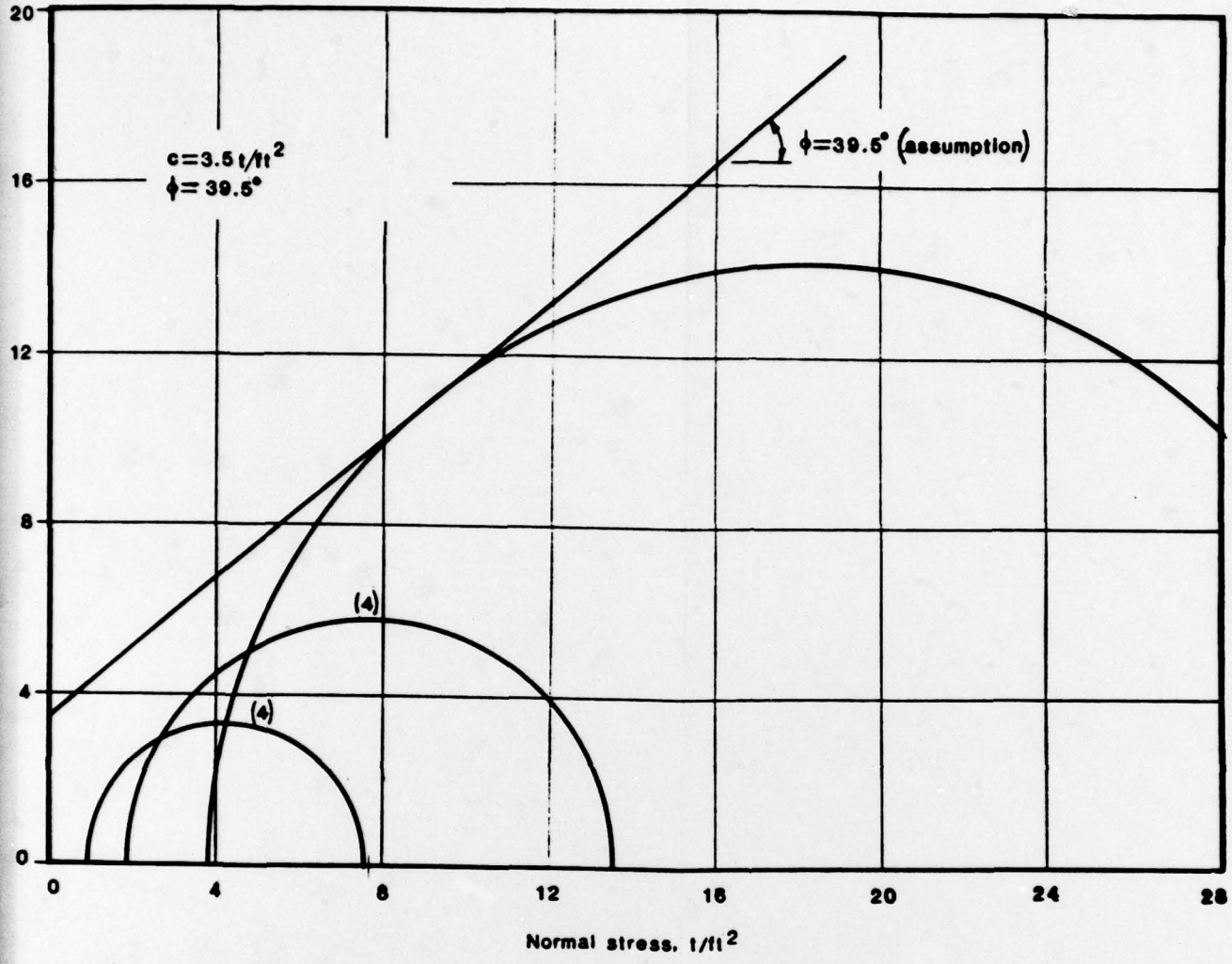






Notes:

1. Axial
2. Test sp
and 6.6
3. Sample
was aci
undrain
and rec
4. Samples
had ung



Notes:

1. Axial strain rate = 0.5 %/min
2. Test specimens were 2.8 -in.-dia and 6.6 -in.-high
3. Sample tested at $\bar{\sigma}_{3c}$=1 t/ft was acidentally subjected undrained loading, unloading and reconsolidation
4. Samples tested at $\bar{\sigma}_{3c}$=1.2 t/ft² had ungrouted zones

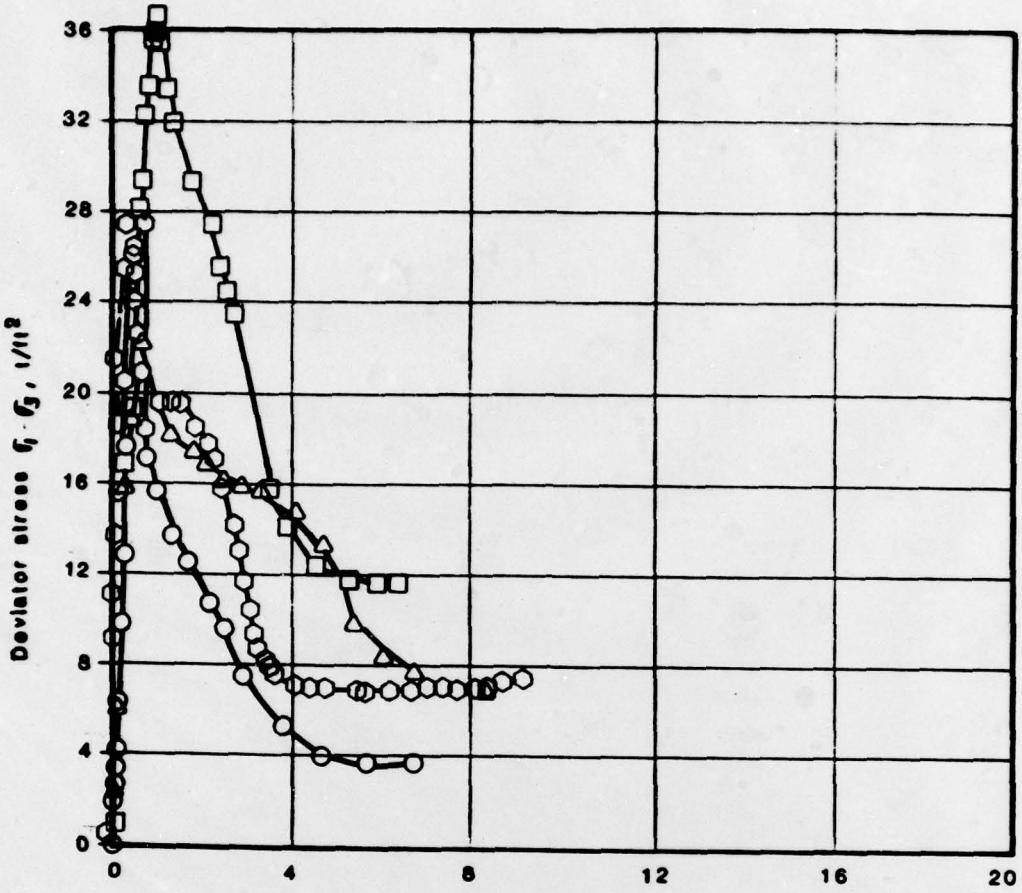
CHEMICAL GROUTING TEST PROGRAM RESULTS OF CID TRIAXIAL COMPRESSION TESTS EXCAVATION BLOCK SAMPLES 46% SILICATE/R600

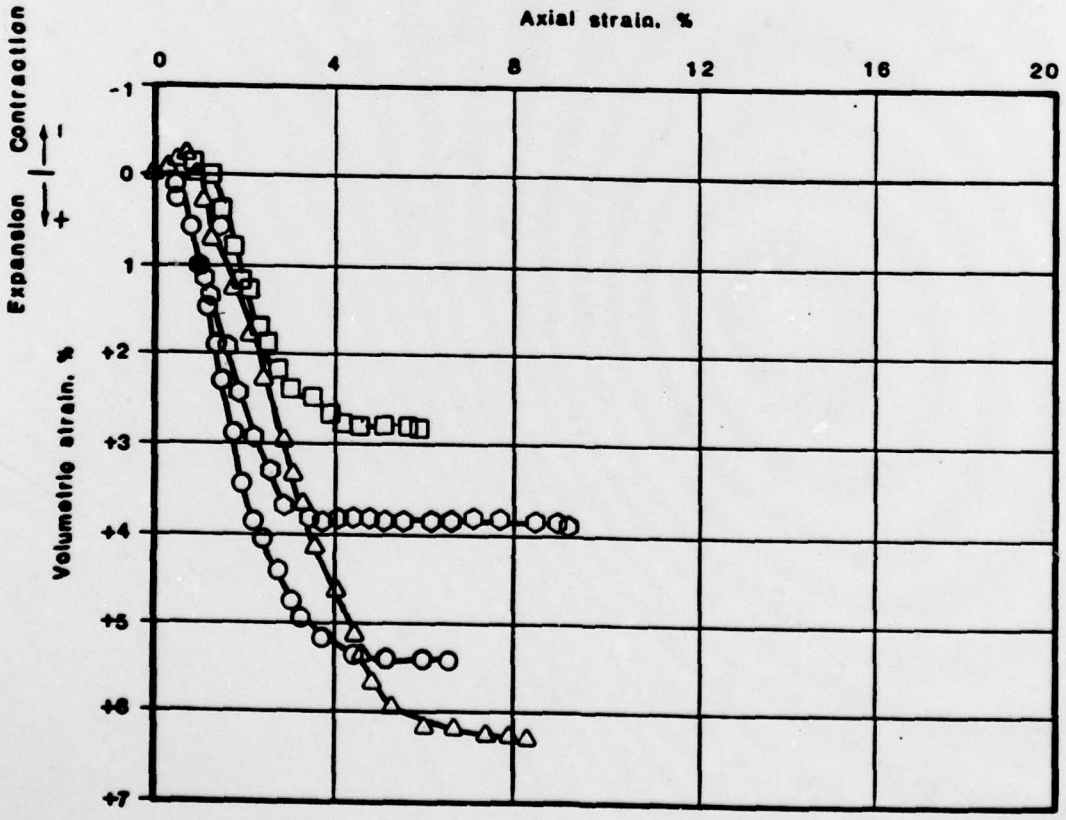
FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS.
DACW43-76-C-0005

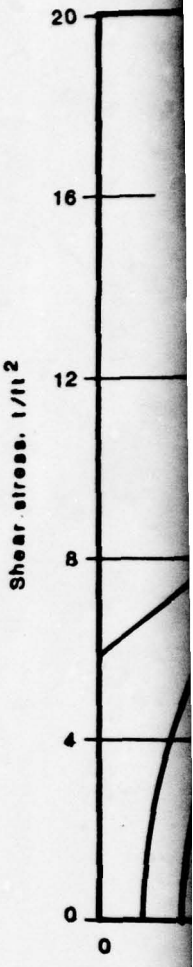
Woodward-Clyde Consultants

Fig.G.32

Y7C625 Phase IX



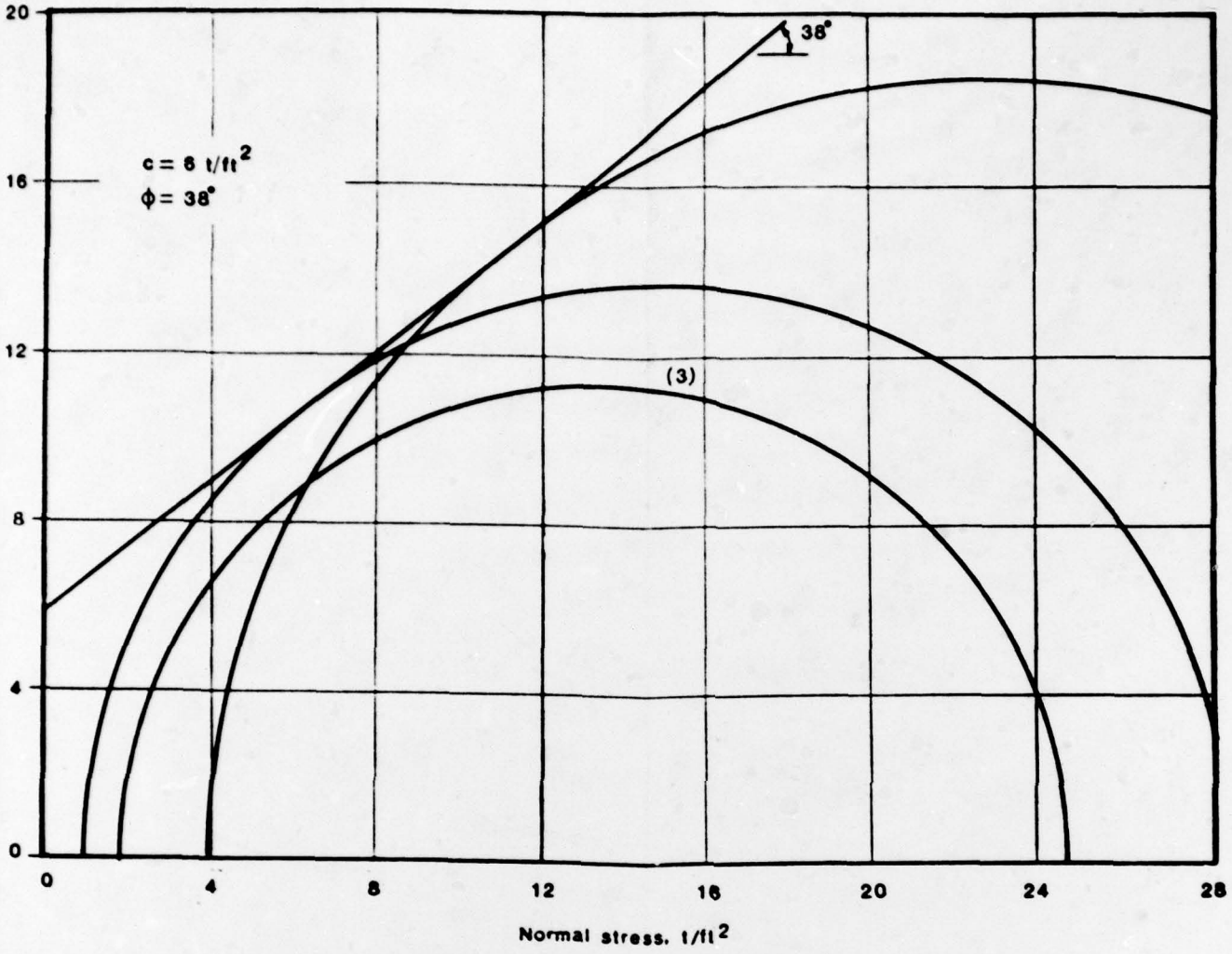




Notes:

1. Axi
2. Test and
3. Spe had

Symbol



Notes:

1. Axial strain rate - 0.5 %/min
2. Test specimens were 2.8-in.-dia and 6.6-in.-high
3. Specimen No. 2 (BS-10) had a horizontal discontinuity

2

Legend

Symbol	Specimen No.
○	1, BS-10
△	2, BS-10
○	3, BS-10 (after creep test)
□	4, BS-10

CHEMICAL GROUTING TEST PROGRAM
RESULTS OF CID TRIAXIAL COMPRESSION TESTS
EXCAVATION BLOCK SAMPLES
55% SIROC 142

FOUNDATION INVESTIGATION AND TEST PROGRAM
EXISTING LOCKS AND DAM No. 26
ST LOUIS DISTRICT, CORPS OF ENGINEERS
DACW43-78-C-0005

Woodward-Clyde Consultants

Fig. G.33

77C825 Photo IX