UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

SEEPAGE MEASUREMENTS--
LOWER-COST CANAL LINING PROGRAM--
RIVERTON PROJECT, WYOMING

Hydraulic Laboratory Report No. Hyd. 306

RESEARCH AND GEOLOGY DIVISION

BRANCH OF DESIGN AND CONSTRUCTION
DENVER, COLORADO

March 12, 1951

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Laboratory Report No. Hyd-306
Hydraulic Laboratory
Compiled by: B. R. Blackwell
Reviewed by: D. M. Lancaster
C. W. Thomas

Subject: Seepage measurements—Lower-cost Canal Lining Program—Riverton Project, Wyoming

PURPOSE

As part of the Lower-cost Canal Lining Program, seepage loss measurements were made during 1950 on a newly constructed reach of Wyoming Canal on the Riverton Project, Wyoming, for the purpose of determining seepage losses to aid in the selection of reaches of canal for lining. In addition to this immediate aim, data on seepage losses by three methods, (1) ponding, (2) seepage meter, and (3) well permeameter were obtained in order to determine the accuracy of the seepage meter and the well permeameter as instruments for the measurement of seepage losses from irrigation canals and laterals. The well permeameter studies were performed under the technical supervision of the Earth Materials Laboratory, Denver, and the results will be reported by that section at a later date.

PERSONNEL

These seepage measurements were made under the general direction of Mr. T. A. Clark, Project Engineer and under the general supervision of Mr. L. W. Mabbot, Field Engineer. The tests were performed under the immediate supervision of Mr. L. C. Schoonover, Materials Engineer. Technical assistance was supplied from the office of the Chief Engineer, Branch of Design and Construction, Denver, Colorado, by Engineers C. W. Thomas, D. M. Lancaster, and B. R. Blackwell.

SYNOPSIS

Ponding tests, conducted in the reach of Wyoming Canal between Stations 1659+71 and 2000+50, to assist in the selection of reaches of canal to be lined, indicated the following rates of loss:

Pond number	Seepage rate
1	0.50
2	0.46
3	0.72
4	0.35
5	0.55
6	0.46

Throughout this report the seepage rate is expressed in cubic feet per square foot of wetted area per 24 hours.

Seepage meter tests, run concurrently with the ponding tests, indicated that the meter results varied from the ponding results between the limits of -87 percent and +120 percent.

Well permeameter tests, run in conjunction with the other seepage measurements, will be discussed in a separate report.

CONCLUSIONS

As a result of these seepage studies, it was concluded that the seepage rates in the reaches of Wyoming Canal tested precluded the justification of lining any part of this reach based solely on the amount of water lost. However, following these studies it was recommended that the reach from Station 1870+00 to Station 1950+00 be lined with buried asphaltic membrane. Due to the poor drainage along this reach of canal losses of any magnitude might damage the adjacent farm land. Further, it was recommended that the reach of canal from Station 1742+00 to Station 1870+00 be lined with buried asphaltic membrane. This recommendation, however, was made contingent on additional investigations to determine whether the drainage of adjacent land is poor and if the land would therefore be damaged by seepage. Lining was not recommended for the remaining portions of the canal tested.

The seepage meter results, as in other instances where the meter was used, were erratic.

Evaluation of the well permeameter as an instrument for the measurement of seepage losses will be made in a separate report.

RECOMMENDATIONS

As a result of this study it is recommended that:

(1) The ponding test results be used to assist in the selection of sections of canal for lining.

(2) The present comprehensive ground-water study be continued by the project in order to throw further light on ground-water conditions resulting from seepage losses from canals and laterals.

(3) Seepage meter results, using the present design and techniques of operation, not be accepted as an accurate indication of seepage rates.

INTRODUCTION

The Riverton Project is located adjacent to Riverton, Wyoming. Water for the project is diverted from the Wind River at the Wind River Diversion Dam about 35 miles upstream from Riverton, Figure 1. The seepage measurement tests were conducted on a newly constructed reach of Wyoming Canal between the Muddy Ridge Tunnel, Station 1659+71 and Muddy Creek Siphon, Station 2000+50, Figure 2. These tests were performed as part of the Lower-cost Canal Lining Program.

Testing by ponding is the most accurate known technique for the determination of seepage losses from irrigation canals and laterals. Seepage rates from sections of the Wyoming Canal were determined by seepage meter as well as by the ponding method. The results with the seepage meter were compared with those obtained from the ponding tests to determine the accuracy of the meter for the measurement of seepage losses.

PONDING TESTS

Six ponds were formed in the Wyoming Canal for the determination of seepage losses. The general location of these ponds is shown in Figure 2 while the stationing and a description of each pond is given in Table 1. To form the ponds, two earth dikes were constructed and six canal structures were utilized. Provision was made at all structures and dikes for the passing of water for the refilling of the downstream ponds. Two hook gages were located in each pond for obtaining the water-surface elevations during the ponding tests. The type of hook gage used permitted observation of the water-surface elevation to the nearest 0.001 foot. Portable stilling wells were utilized in reading the hooks when the water surface was rough. Water-surface observations were made three or four times a day during the tests.

All ponds were filled three times in order to have the canal fully primed to simulate normal operating conditions.

Careful inspection during construction resulted in a cross section practically identical with the design cross section. The reaches tested had only recently been constructed and had not been used for conveyance of water prior to the tests. Therefore, in computing the results of the ponding tests the usual cross sectional survey was foregone and the design cross section used for obtaining the seepage rates.

Effect of Evaporation

Effects of evaporation on the seepage rate as determined by ponding were very minor. Although daily evaporation data were not available a careful evaluation of available information indicated that an evaporation rate of 8 inches per month was an appropriate value for the period of time that the ponding tests were in progress. This evaporation rate, converted to seepage rate for the ponds under consideration, amounted to 0.02 cubic foot per square foot of wetted area per 24 hours. Ponding rates were corrected by this amount.

Effect of Leaks on Seepage Rate

Two leaks from the ponds were observed and measured. Lateral turnout 31.69 leaked at a rate of 14.4 cubic feet per hour while the leak through the turnout gate for lateral 33.00 was 3.6 cubic feet per hour. Both these leaks were from Pond 1. Since these leaks amounted to only 0.001 cubic foot per square foot of wetted area per 24 hours they were disregarded.

Result of the Ponding Tests

The results of the ponding tests, after corrections for evaporation have been applied, are shown in Figures 3 through 8. Seepage rate is plotted against depth of water for each of the three fillings for the six ponds tested. In every case the seepage rate decreased with each refilling of the ponds. The final filling was taken as most nearly representing normal operating conditions when the canal is completely primed and bank and ground-water storage requirements have been satisfied. The following table summarizes the final seepage rates obtained by ponding in each of the six ponds.

Pond number	Seepage rate
1	0.50
2	0.46
3	0.72
4	0.35
5	0.55
6	0.46

Additional Ponding Tests

Additional ponding tests were performed by Project Personnel on the Wyoming Canal from Stations 2008+00 to 2560+00 and on lateral 44.69. These tests are discussed and the results shown in a Riverton Project memorandum, attached to this report as Appendix A.

SEEPAGE METER STUDIES

Approximately 275 seepage meter settings were made in conjunction with the ponding tests. Details of the meter used are shown in Figures 9 and 10 while a photograph of the meter is shown in Figure 11. This meter is a modified version of the constant head permeameter developed by the Department of Agriculture and consists of a watertight seepage cup connected by a tube to a flexible bag for holding water. The cup isolates a known area of canal bottom. The water seeping through this area comes from the flexible bag and may be measured. The bag, being submerged, maintains the same head on the test area under the meter as that which exists on the surrounding area of canal. Knowing the area under the meter (2 square feet) and the loss of water from the bag for a given period of time, the seepage rate in cubic feet per square foot of wetted area per 24 hours may be easily determined. Form "DCT-27, 11-49, Bureau of Reclamation," Figure 12, was used for recording the data.

Seepage Meter Results

Four seepage meter settings, two in the bottom and one on each side slope of the canal, were taken at either 500- or 1,000-foot intervals along the canal in the ponded areas. A graphical presentation of the data obtained in the bottom of the canal is shown in Figure 13 while Figure 14 displays, in similar form, seepage meter data obtained on the side slopes of the canal. The entire results of the seepage meter study are tabulated in Table 2 and the averages of the seepage meter readings are compared with the ponding test results for the same period of time. The comparisons reveal that the seepage meter is inconsistent. The differences between the results by ponding and the averages of the seepage meter readings vary from -87 to +120 percent. The corresponding variation in seepage rate is from -0.48 to +0.48 cubic foot per square foot of wetted area per 24 hours. Individual seepage meter readings taken adjacent to each other gave widely different results, Figures 13 and 14. Further correlation data and perhaps revisions in the meter or changes in technique are required before the seepage meter can be considered a reliable instrument for the measurement of seepage losses.

GROUND-WATER WELL OBSERVATIONS

Fifteen ground-water wells, located adjacent to the ponded reaches of the canal, Figure 2 and Table 3, were read daily during the period that the ponds were operative. A plot of these data, together with variations of the water-surface elevations in the ponds, is included in this report as Figures 15 through 19. These wells form a part of a comprehensive ground-water investigation program being conducted by project personnel. It is recommended that this comprehensive ground-water study be continued in order to throw further light on ground-water conditions resulting from seepage losses from canals and laterals.

Table 1

LOCATION OF PONDS
Riverton Project--Wyoming

Pond No	Structure	Station	Length	Description of material in canal
1	Tunnel	1659+71	9463	Shattered siltstone and sandstone
	Dike	1754+34		
2	Dike	1754+66	4634	Silty-sand with outcroppings of sandstone
	Check	1801+00		
3	Check	1801+34	9525	Medium to fine sugary sand with a 1,000-foot section of tight clay
	Dike	1896+59		
4	Dike	1896+91	6759	A transition zone changing from medium to fine sand to sandstone and a section of sand with high clay content with strata of gravel
	Check-drop	1964+50		
5	Chute	1974+82	1068	Sand with a moderate amount of fines--heavy gravel is located about 8 inches below the canal bottom
	Check-drop	1985+50		
6	Check-drop	1986+43	1407	Sand with a high percentage of fines
	Siphon	2000+50		

RIVERTON PROJECT—WYOMING CANAL
1950 Seepage Measurement Studies
Comparison of Results by Seepage Meter and by Ponding

Location	Number of settings	Average depth	Rate by seepage meter: Max.	Min.	Av.	Av.	Rate by ponding	Difference in rates	% difference ref. ponding
Pond No. 1—First Filling (May 29–June 1)									
Right bank	7	3.70	1.40	0.03	0.38				
Left bank	7	3.20	0.92	0.04	0.38	0.40	0.55	-0.15	- 27
Bottom	14	4.66	1.92	0.04	0.42				
Pond No. 1—Between First and Second Filling (June 2)									
Right bank	1	3.70	0.07	0.07	0.07				
Left bank	2	3.58	0.06	0.00	0.03	0.07	0.55*	-0.48	- 87
Bottom	3	5.98	0.27	0.01	0.10				
Pond No. 1—Following Third Filling (June 15–16)									
Right bank	7	2.05	1.89	0.01	0.56				
Left bank	7	2.35	0.40	0.01	0.16	0.42	0.50*	-0.08	- 16
Bottom	14	2.67	1.79/	0.00	0.48				
Pond No. 2—Prior to First Filling (May 24–26)									
Right bank	5	3.47	1.17	0.40	0.68				
Left bank	5	3.79	0.50	0.23	0.37	0.48	0.57*	-0.09	- 16
Bottom	10	6.91	0.44	0.31	0.38				
Pond No. 2—First Filling (May 29)									
Right bank	2	3.85	0.50	0.37	0.44				
Left bank	2	3.10	0.24	0.18	0.21	0.35	0.57	-0.22	- 39
Bottom	3	7.15	0.44	0.34	0.40				
Pond No. 2—Following Third Filling (June 15–19)									
Right bank	7	2.74	2.75	0.04	1.05				
Left bank	7	2.82	1.32	0.01	0.44	0.88	0.40*	/0.48	/120
Bottom	14	4.16	2.19	0.18	1.01				
Pond No. 3—Second Filling (June 5–8)									
Right bank	11	3.62	1.98	0.03	0.48				
Left bank	11	3.73	0.52	0.02	0.29	0.43	0.63	-0.20	- 33
Bottom	22	5.54	1.66	0.00	0.48				
Pond No. 3—Third Filling (June 10–14)									
Right bank	4	3.31	0.51	0.02	0.28				
Left bank	4	2.99	0.52	0.07	0.26	0.28	0.60	-0.32	- 53
Bottom	10	4.03	0.46	0.01	0.28				
Pond No. 4—Second Filling (June 5–8)									

Bottom	10	6.91	0.44	0.31	0.36				
Pond No. 2—First Filling (May 29)									
Right bank	2	3.85	0.50	0.37	0.44				
Left bank	2	3.10	0.24	0.18	0.21	0.35	0.57	-0.22	- 39
Bottom	3	7.15	0.44	0.34	0.40				
Pond No. 2—Following Third Filling (June 15-19)									
Right bank	7	2.74	2.75	0.04	1.05				
Left bank	7	2.82	1.32	0.01	0.44	0.88	0.40*	+0.48	+120
Bottom	14	4.16	2.19	0.18	1.01				
Pond No. 3—Second Filling (June 5-8)									
Right bank	11	3.62	1.98	0.03	0.48				
Left bank	11	3.73	0.52	0.02	0.29	0.43	0.63	-0.20	- 33
Bottom	22	5.54	1.66	0.00	0.48				
Pond No. 3—Third Filling (June 10-14)									
Right bank	4	3.31	0.51	0.02	0.28				
Left bank	4	2.99	0.52	0.07	0.26	0.28	0.60	-0.32	- 53
Bottom	10	4.03	0.46	0.01	0.28				
Pond No. 4—Second Filling (June 5-8)									
Right bank	5	3.69	0.65	0.06	0.30				
Left bank	5	3.29	0.58	0.00	0.24	0.34	0.39	-0.05	- 13
Bottom	10	4.93	0.59	0.01	0.40				
Pond No. 4—Between Second and Third Fillings (June 9)									
Right bank	2	3.40	0.32	0.08	0.20				
Left bank	1	2.85	0.18	0.18	0.18	0.27	0.37*	-0.10	- 27
Bottom	4	6.71	0.48	0.08	0.33				
Pond No. 4—Third Filling (June 10-14)									
Right bank	4	3.28	1.22	0.06	0.42				
Left bank	4	3.58	1.74	0.02	0.53	0.37	0.35	+0.02	+ 6
Bottom	8	5.26	0.51	0.06	0.26				
Pond No. 5—Between Second and Third Fillings (June 9)									
Right bank	1	3.05	0.41	0.41	0.41				
Left bank	1	3.50	0.72	0.72	0.72	0.42	0.49*	-0.07	- 14
Bottom	4	4.81	0.77	0.17	0.35				
Pond No. 5—Third Filling (June 10-14)									
Right bank	2	4.00	1.41	0.03	0.72				
Left bank	2	3.58	0.42	0.15	0.28	0.64	0.47	+0.14	+ 30
Bottom	4	5.79	1.64	0.43	0.78				
Pond No. 6—Prior to First Filling (May 22-24)									
Right bank	4	2.28	1.40	0.29	0.92				
Left bank	4	2.60	1.25	0.02	0.65	0.62	0.50*	+0.12	+ 24
Bottom	10	3.88	0.63	0.08	0.28				
Pond No. 6—Between Second and Third Fillings (June 9)									
Right bank	1	3.95	0.11	0.11	0.11				
Left bank	1	3.45	0.00	0.00	0.00	0.20	0.40*	-0.20	- 50
Bottom	2	4.53	0.46	0.22	0.34				
Pond No. 6—Third Filling (June 10-14)									
Right bank	4	3.35	0.62	0.00	0.36				
Left bank	3	4.06	1.05	0.52	0.72	0.38	0.45	-0.07	- 16
Bottom	8	5.01	0.62	0.04	0.30				

*Estimated values.

TABLE 2

Table 3

LOCATION OF GROUNDWATER WELLS
Riverton Project--Wyoming

Well No	Canal Station	Pond No	Distance from ℄ in feet to the right
12	1957+75	4	103
26	1742+65	1	93
27	1804+25	3	98
36	1685+25	1	180
37	1711+70	1	120
38	1728+28	1	111
39	1776+52	2	102
40	1798+29	2	88
41	1820+90	3	97
42	1836+65	3	79
43	1850+99	3	98
44	1869+03	3	87
45	1883+75	3	80
46	1917+61	4	93
47	1933+29	4	97
48	1946+58	4	77
49	1992+06	6	96

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FIGURE 1

MUDDY CREEK SIPHON
STA. 2000+50

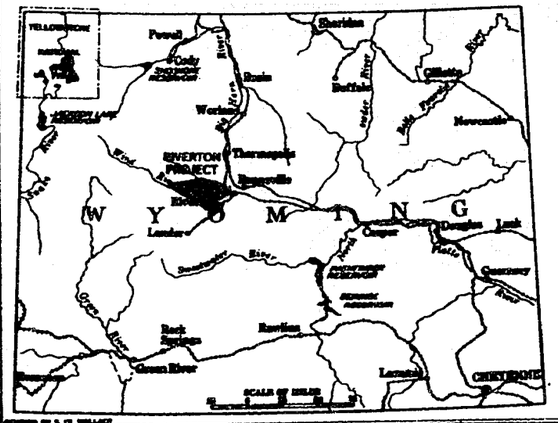
MUDDY RIDGE TUNNEL
STA. 1659+71

INFORMATION OF INTEREST

Source of water supply: Wind River and Tributaries.
Area of drainage basin: About 2,320 square miles.
Annual run-off in acre-feet: Wind River at Riverton, Wyo., 1906, 1908, and 1911 to 1945 inclusive, maximum 1,170,000, minimum 352,000.
Length of irrigation season: May 1 to September 30, 153 days.
Annual rainfall on irrigable area: About 9 inches at Pavillion.
Average maximum temperature, period 1921 to 1945 at Pavillion, Wyo. is 91 F.; average minimum temperature, -26 F.
Character of soil of irrigable area: Sandy loam to heavy clay.
Principal products: Alfalfa, cereals, sugar beets, potatoes, beans and alfalfa seed.
Principal markets: Omaha, Denver and local.

The irrigation plan of the Riverton Project provides for the storage of the flood waters of Bull Lake Creek, a tributary of Wind River, in Bull Lake Reservoir, and the diversion of water from Wind River by a dam 24 miles northwest of Riverton, Wyo., into the Wyoming Canal, for the irrigation of lands lying northeast of Wind River, west of the Big Horn River and south of Cottonwood Creek. Additional storage is provided in Pilot Butte Reservoir which is about nine miles below the head of the Wyoming Canal.

The United States claims all waste, seepage, spring and groundsloing water arising within the project and proposes to use such water in connection therewith.



EXPLANATION

- GOVERNMENT CANALS
- GOVERNMENT CANALS, PROPOSED
- OTHER CANALS
- GOVERNMENT TELEPHONE LINES
- POWER TRANSMISSION LINES
- HIGHWAYS
- PROJECT LANDS FOR WHICH WATER IS AVAILABLE

UNITED STATES
DEPARTMENT OF THE INTERIOR
J. A. Krug, Secretary
BUREAU OF RECLAMATION
Michael W. Straus, Commissioner Walker R. Young, Chief Engineer

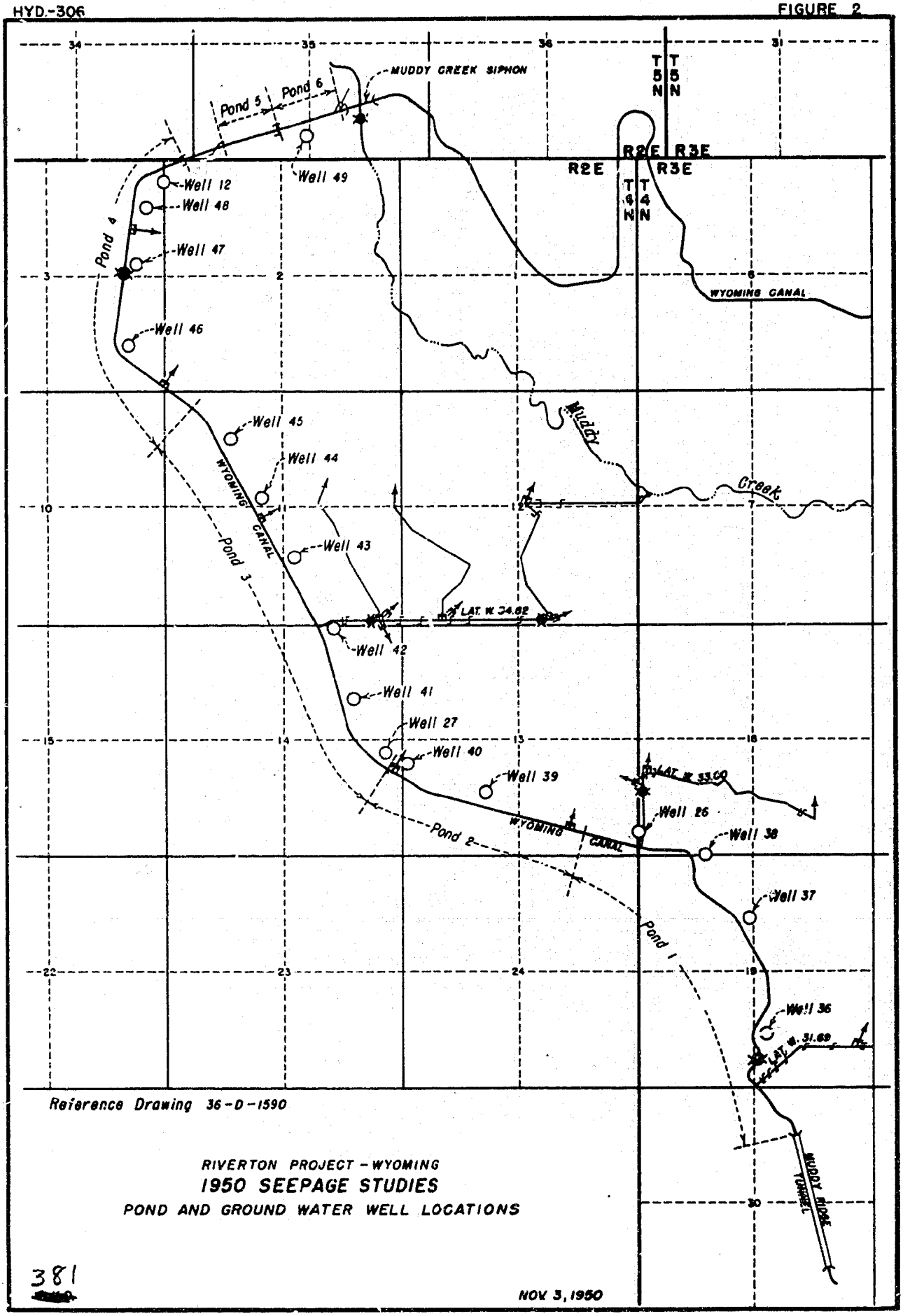
RIVERTON IRRIGATION PROJECT

FREMONT COUNTY - WYOMING

Kenneth F. Vernon, Regional Director
Prepared in the Washington Office
A. M. Smith, Chief Draftsman
MAP NO. 48-4
SCALE OF MILES
1 0 1 2 3 4 5 6
1946

Supersedes Map No. 28-124

FIGURE 2



Reference Drawing 36-D-1590

RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

POND AND GROUND WATER WELL LOCATIONS

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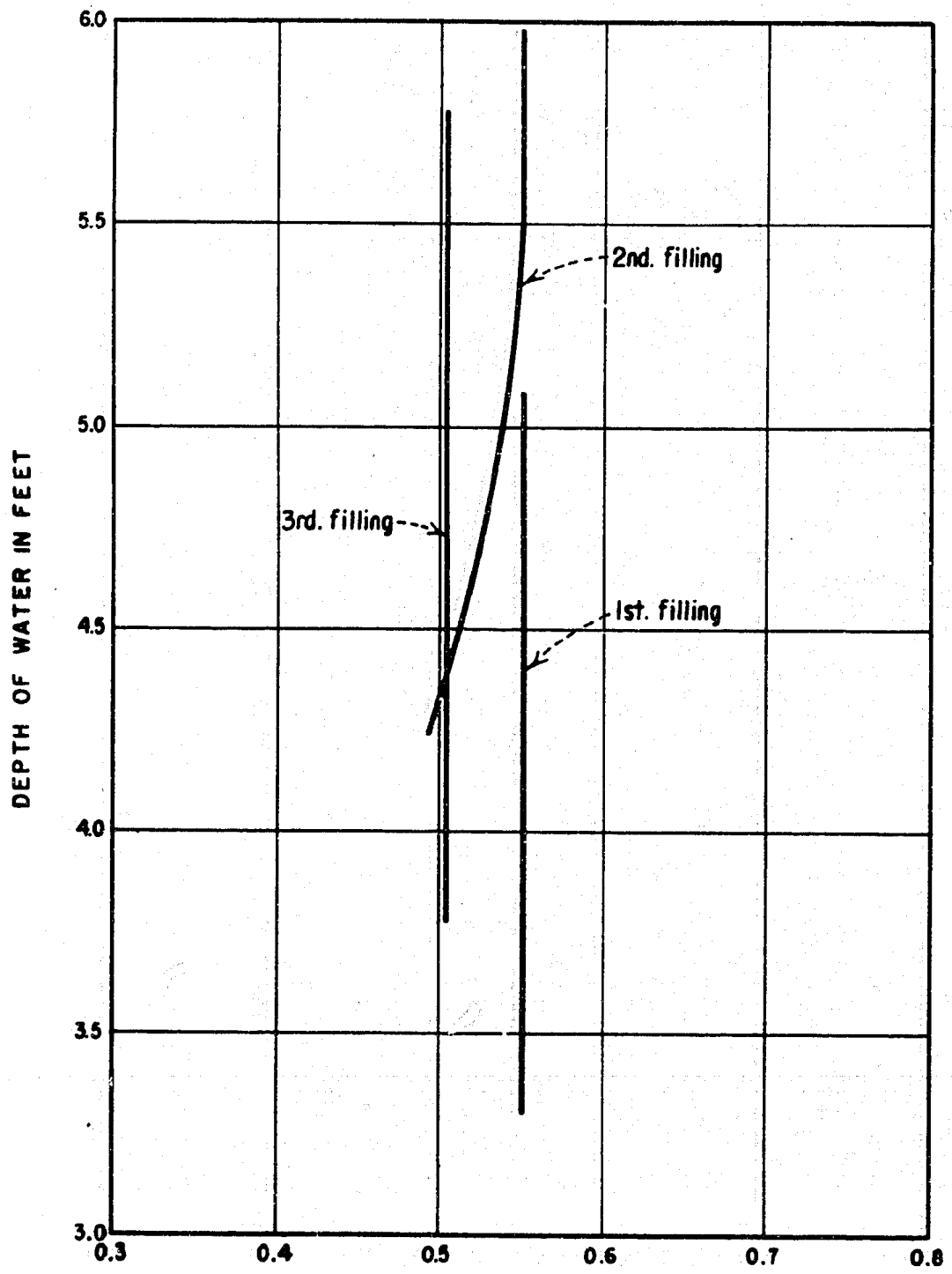
FIGURE 3



RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL - POND 1

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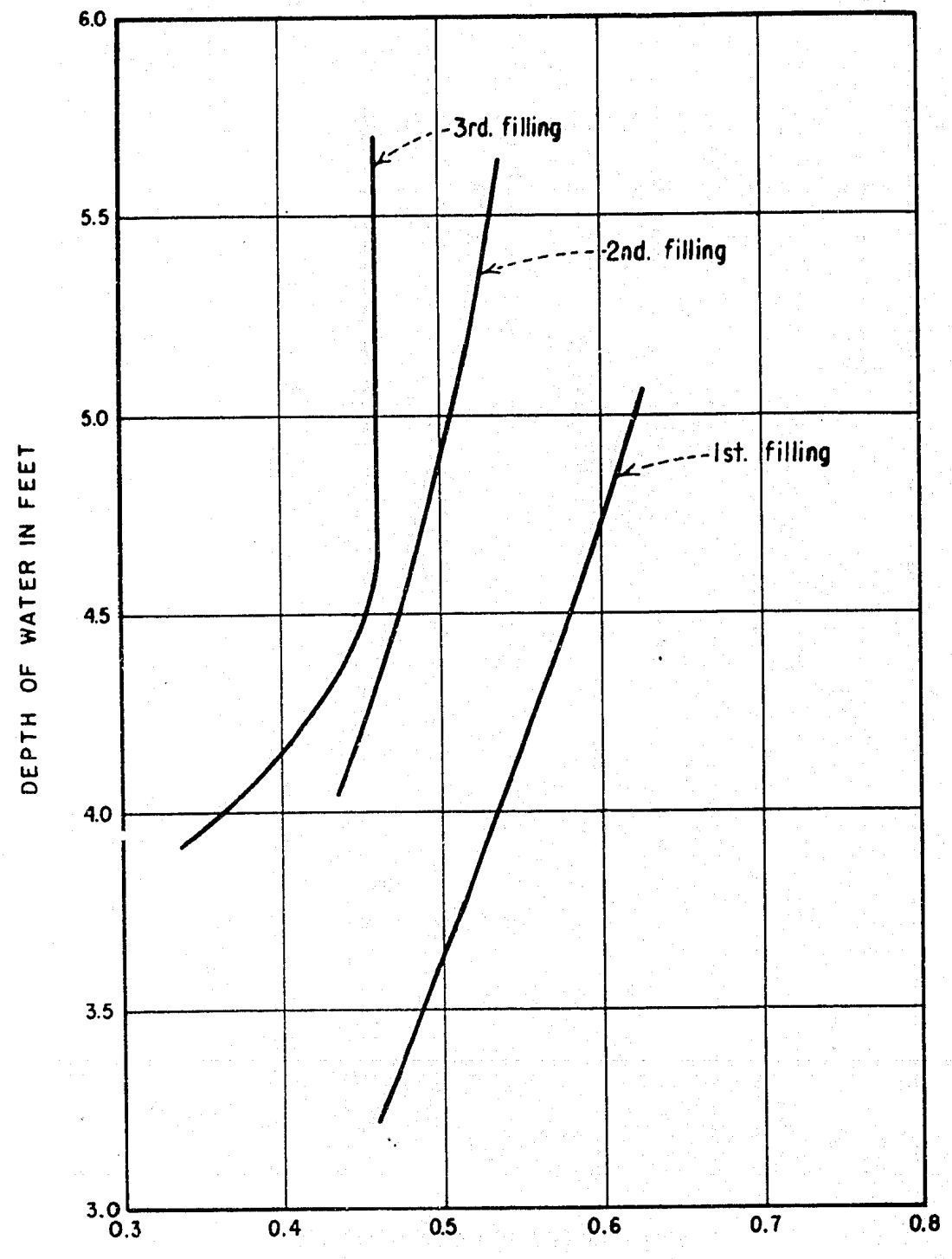
FIGURE 4



RIVERTON PROJECT - WYOMING
1950 SEEPAGE STUDIES
WYOMING CANAL - POND 2

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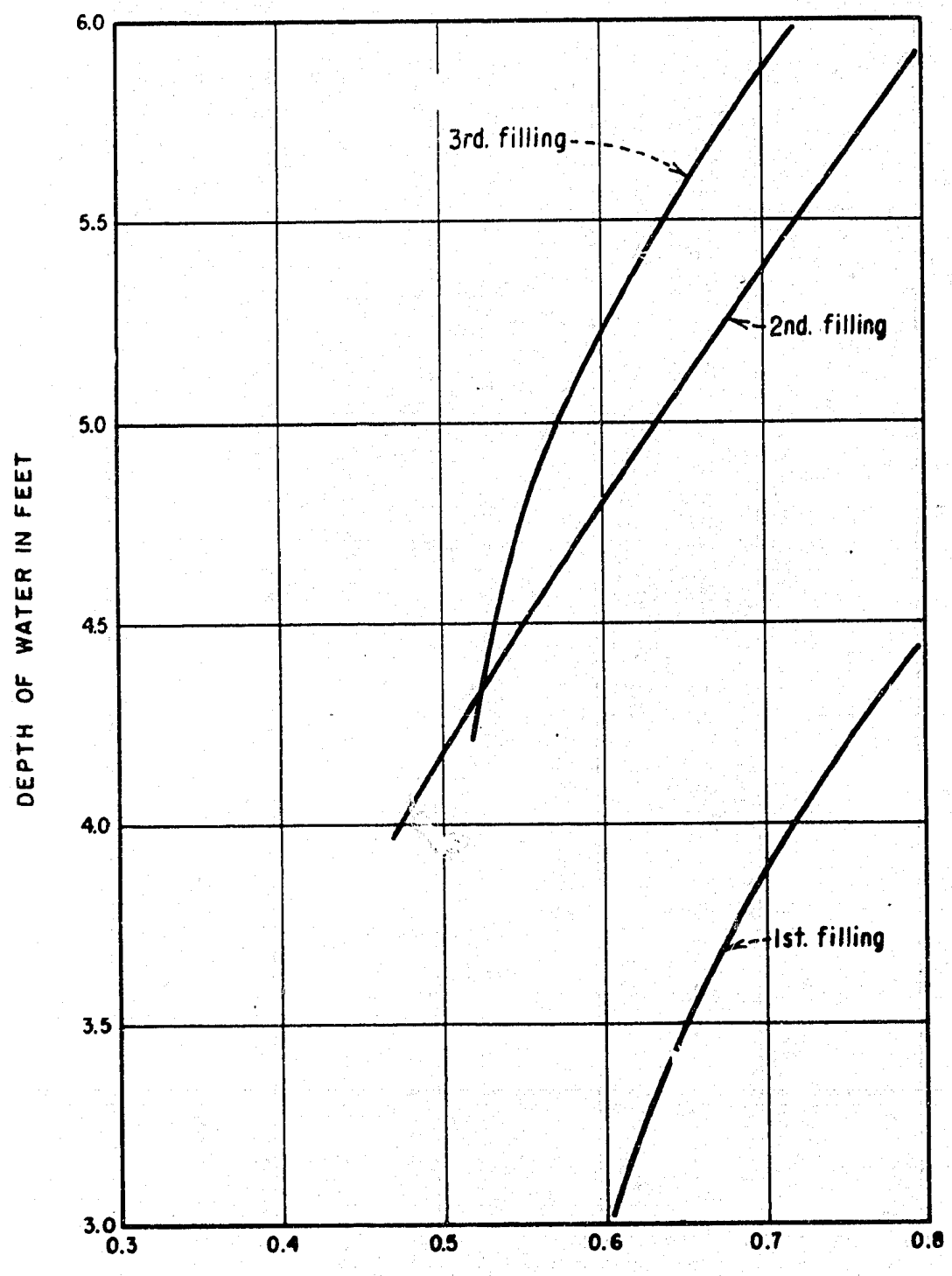
FIGURE 5



RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL - POND 3

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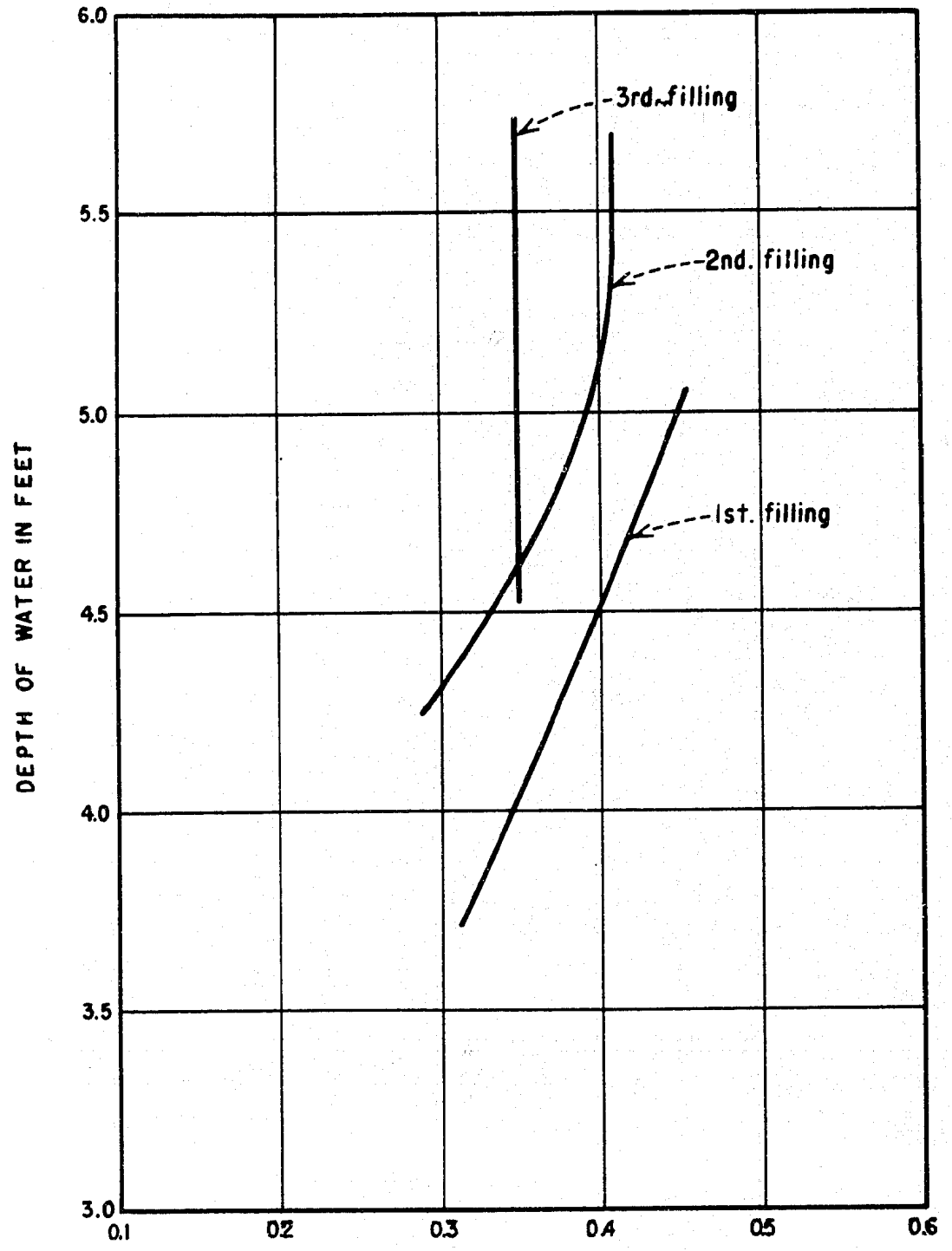
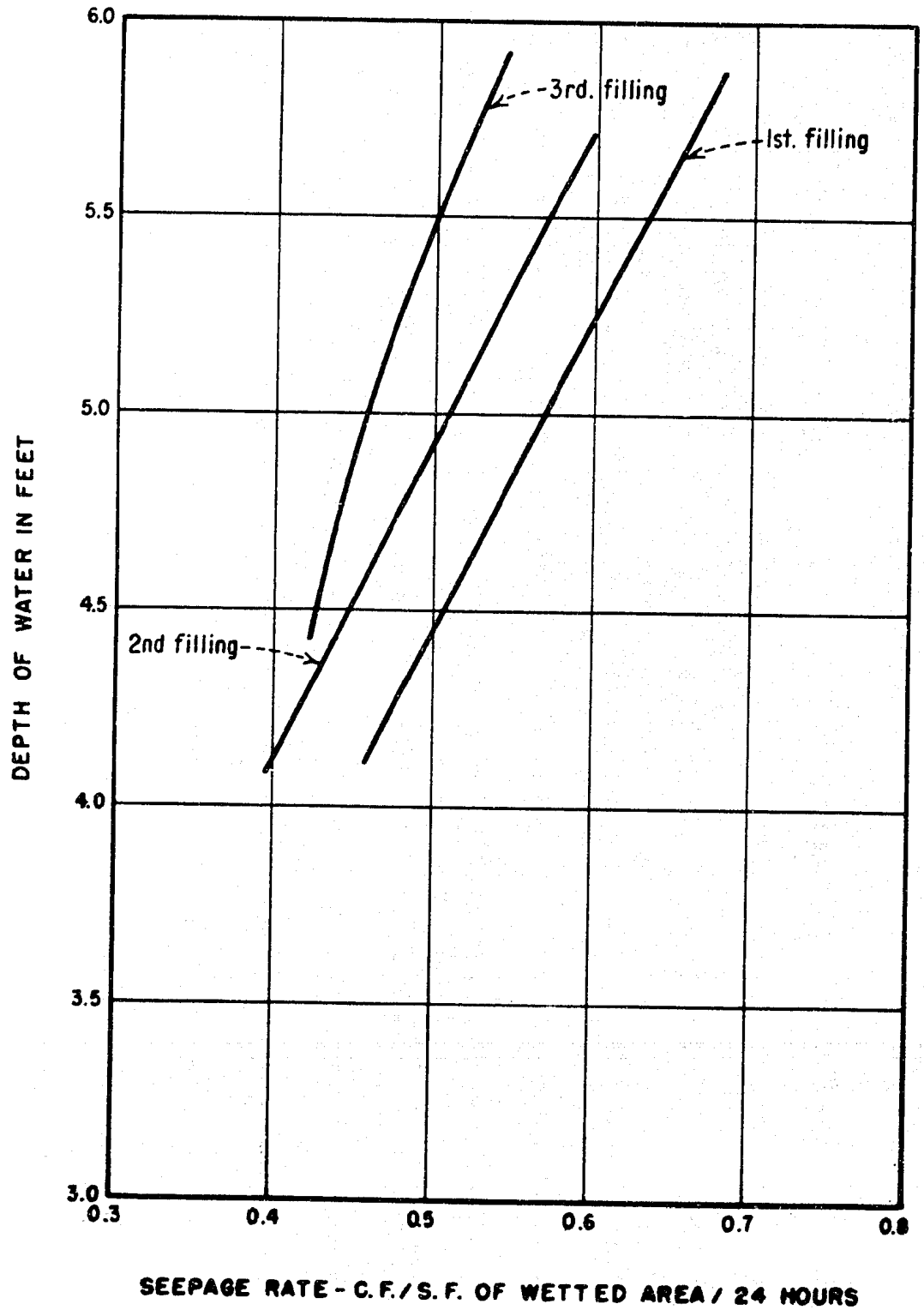
FIGURE 6



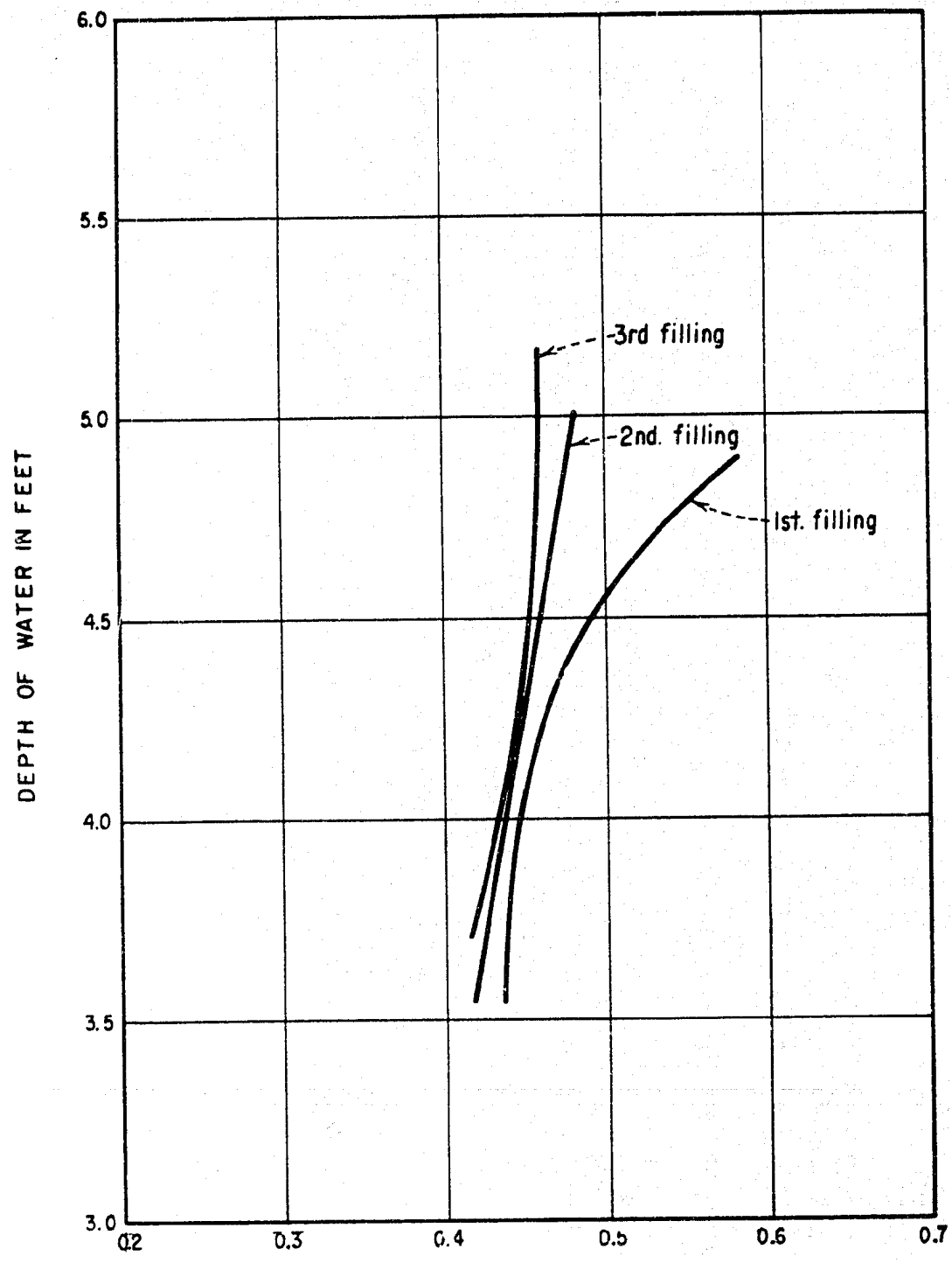
RIVERTON PROJECT - WYOMING
1950 SEEPAGE STUDIES
WYOMING CANAL - POND 4

FIGURE 7



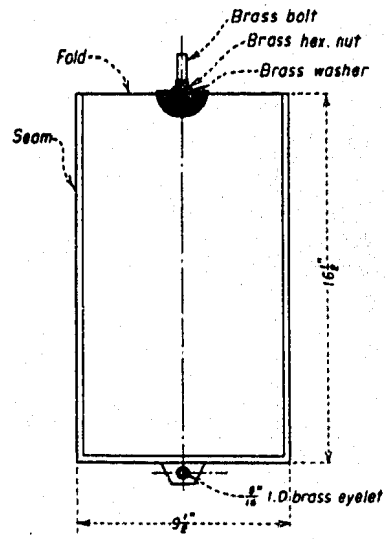
RIVERTON PROJECT - WYOMING
1950 SEEPAGE STUDIES
WYOMING CANAL - POND 5

FIGURE 8

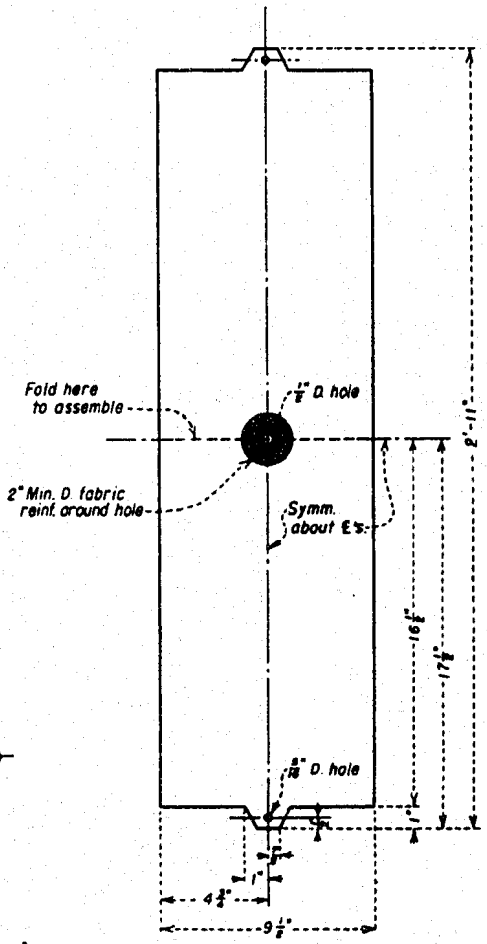


RIVERTON PROJECT - WYOMING
1950 SEEPAGE STUDIES
WYOMING CANAL - POND 6

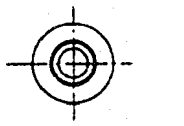
FIGURE B



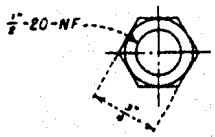
ASSEMBLED PLASTIC BAG
With appurtenant parts



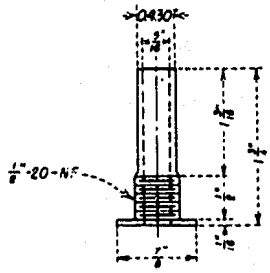
CUT-OUT PATTERN
For Plastic Bag



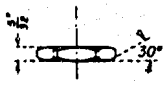
TOP VIEW



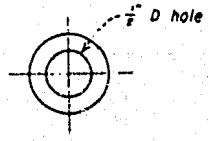
PLAN



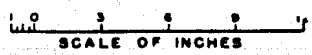
ELEVATION

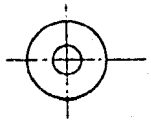


ELEVATION
BRASS, HEXAGON NUT

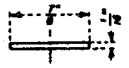


PLAN





BOTTOM VIEW
BRASS BOLT
Make from ½" O.D. brass



ELEVATION
BRASS WASHER

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
LOWER COST CANAL LINING PROGRAM

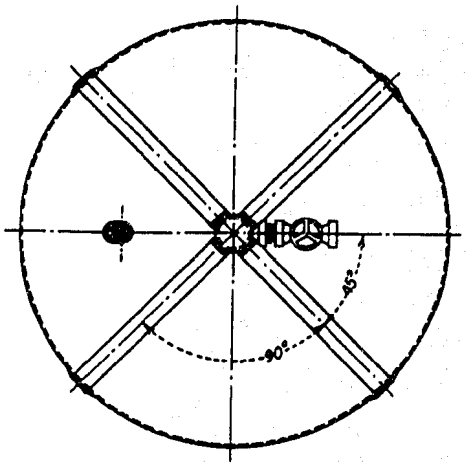
PLASTIC BAG WITH BRASS FITTING FOR SEEPAGE METER

DRAWN	A.J.A.	SUBMITTED	
TRACED	E.V.M.	RECOMMENDED	
CHECKED	R.S.-E.D.D.	APPROVED	

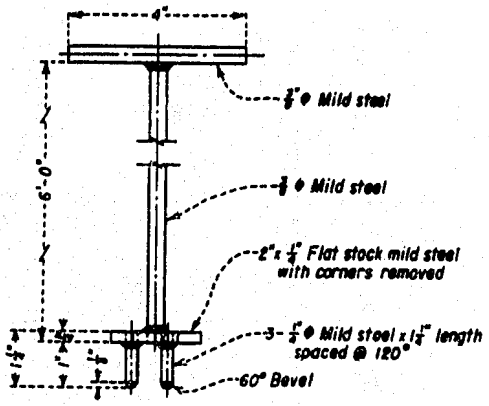
DENVER, COLORADO—APRIL 21, 1950 | 6030-RH-2

250

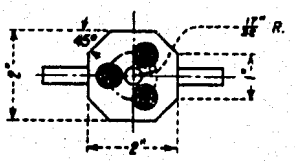
FIGURE 10



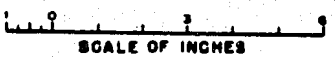
PLAN



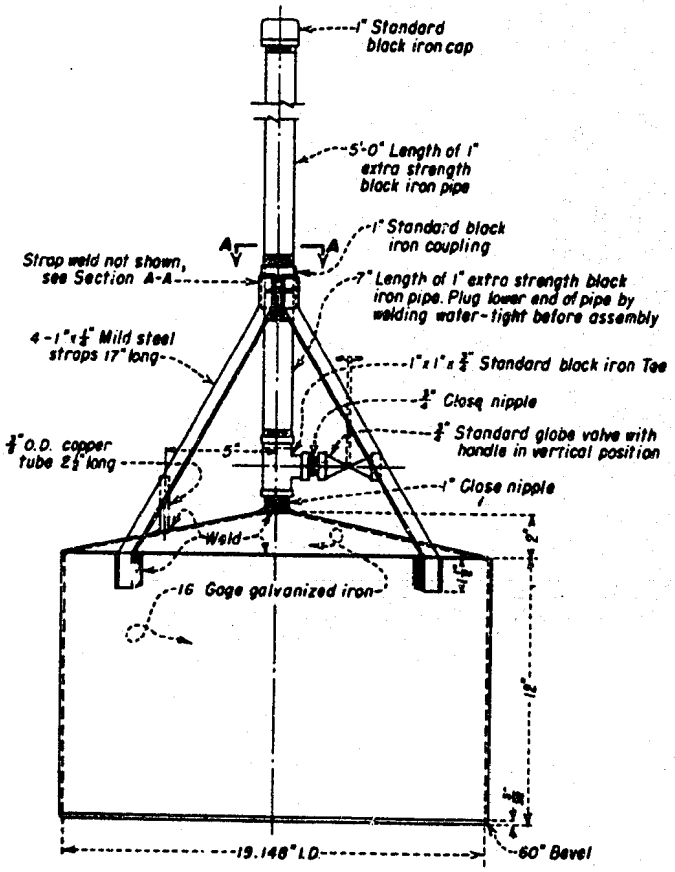
ELEVATION



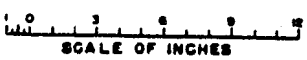
BOTTOM VIEW
VALVE HANDLE EXTENSION



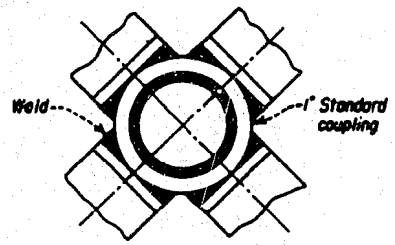
SCALE OF INCHES



ELEVATION
SEEPAGE METER



SCALE OF INCHES



SECTION A-A

NOTES

Paint all exposed parts, except brass, with aluminum paint.
All welds on seepage meter, except welds on straps, to be water-tight.
All parts of valve handle extension to be welded together using appropriate size welds.

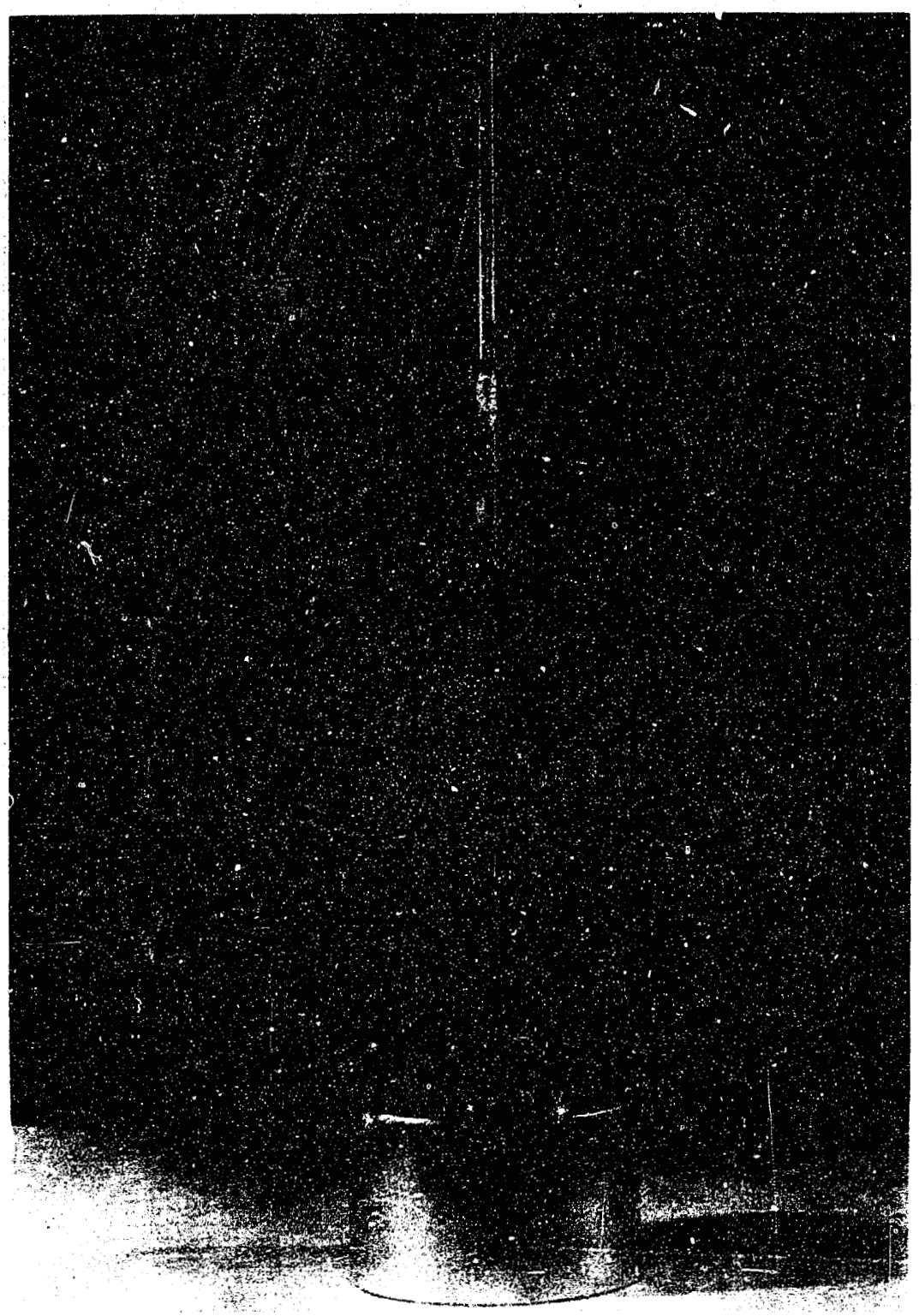
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
LOWER COST CANAL LINING PROGRAM

SEEPAGE METER
AND VALVE HANDLE EXTENSION

DESIGN	A.J.A.	SUBMITTED	Chas. A. Lauer
TRACED	C.V.M.	RECOMMENDED	
CHECKED	A.E.-C.C.O.	APPROVED	
DENVER, COLORADO — APRIL 22, 1953			8030-FM-1

250

Figure 11



SEEPAGE METER

SEEPAGE METER DATA SHEET

Project_____ Canal_____ Sheet ____ of ____

Meter Depth_____ Meter Area_____ Weather_____

Variation of WS from Normal_____ Design Capacity_____

Percent Cut_____ Fill_____ Soil Type_____

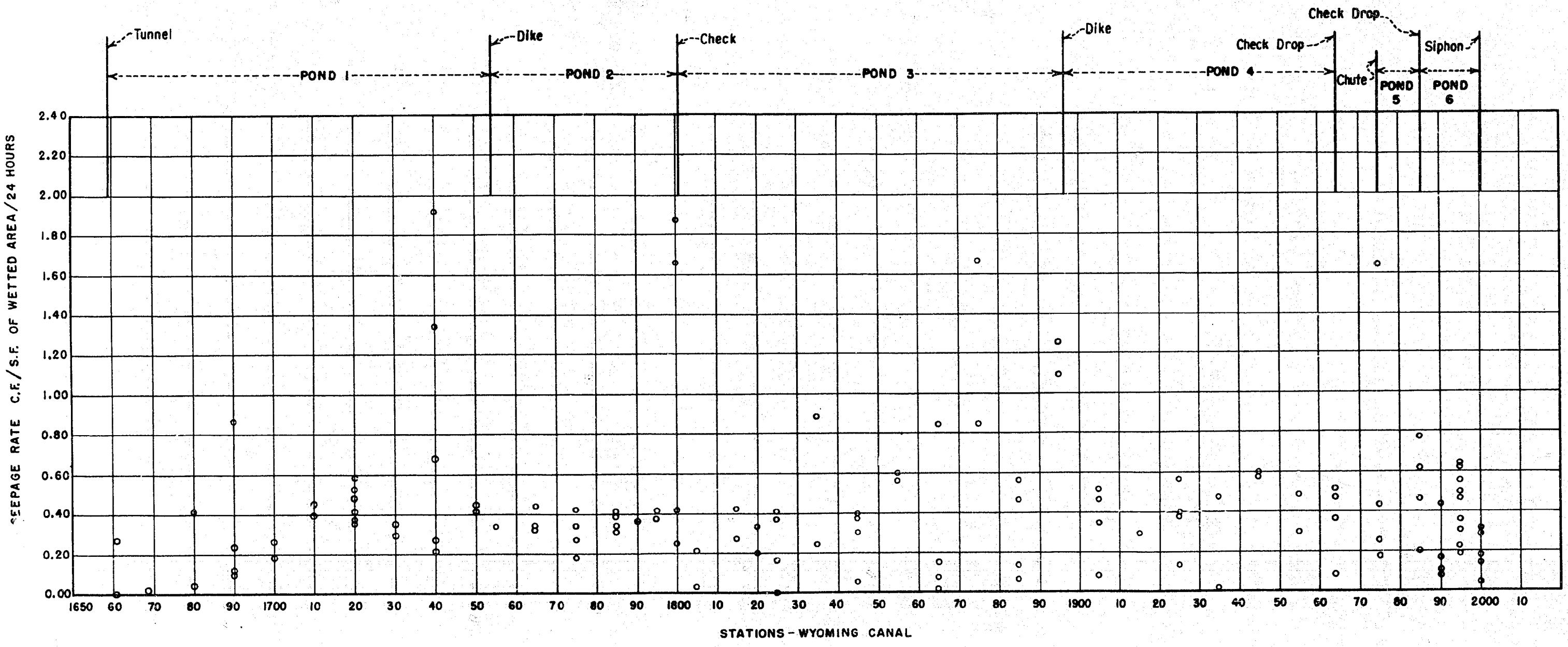
Observer_____ Date_____

Station	Temperature		Water Depth	Water Bag Weights			Time (Min.)			Seepage Loss c.f./s.f./24 hrs.	Remarks
	Air	Water		Initial	Final	Loss	Initial	Final	Net		

FIGURE 12

HYD-306

FIGURE 13



EXPLANATION

o METER SETTINGS ON BOTTOM OF CANAL

RIVERTON PROJECT-WYOMING

1950 SEEPAGE STUDIES

SEEPAGE METER TESTS

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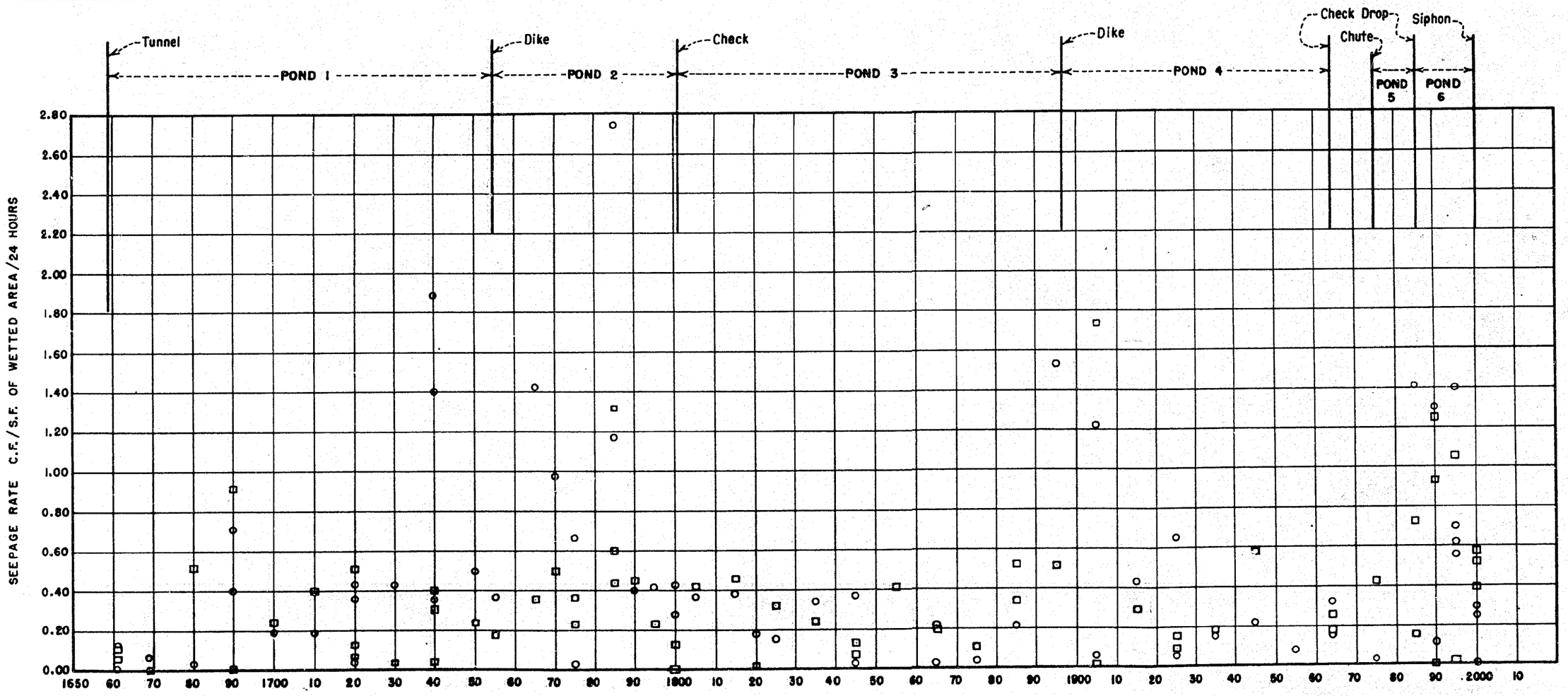
HYD- 306

FIGURE 14



EXPLANATION

○ METER SETTINGS ON RIGHT SIDE SLOPE

□ METER SETTINGS ON LEFT SIDE SLOPE

RIVERTON PROJECT-WYOMING
1950 SEEPAGE STUDIES
SEEPAGE METER TESTS

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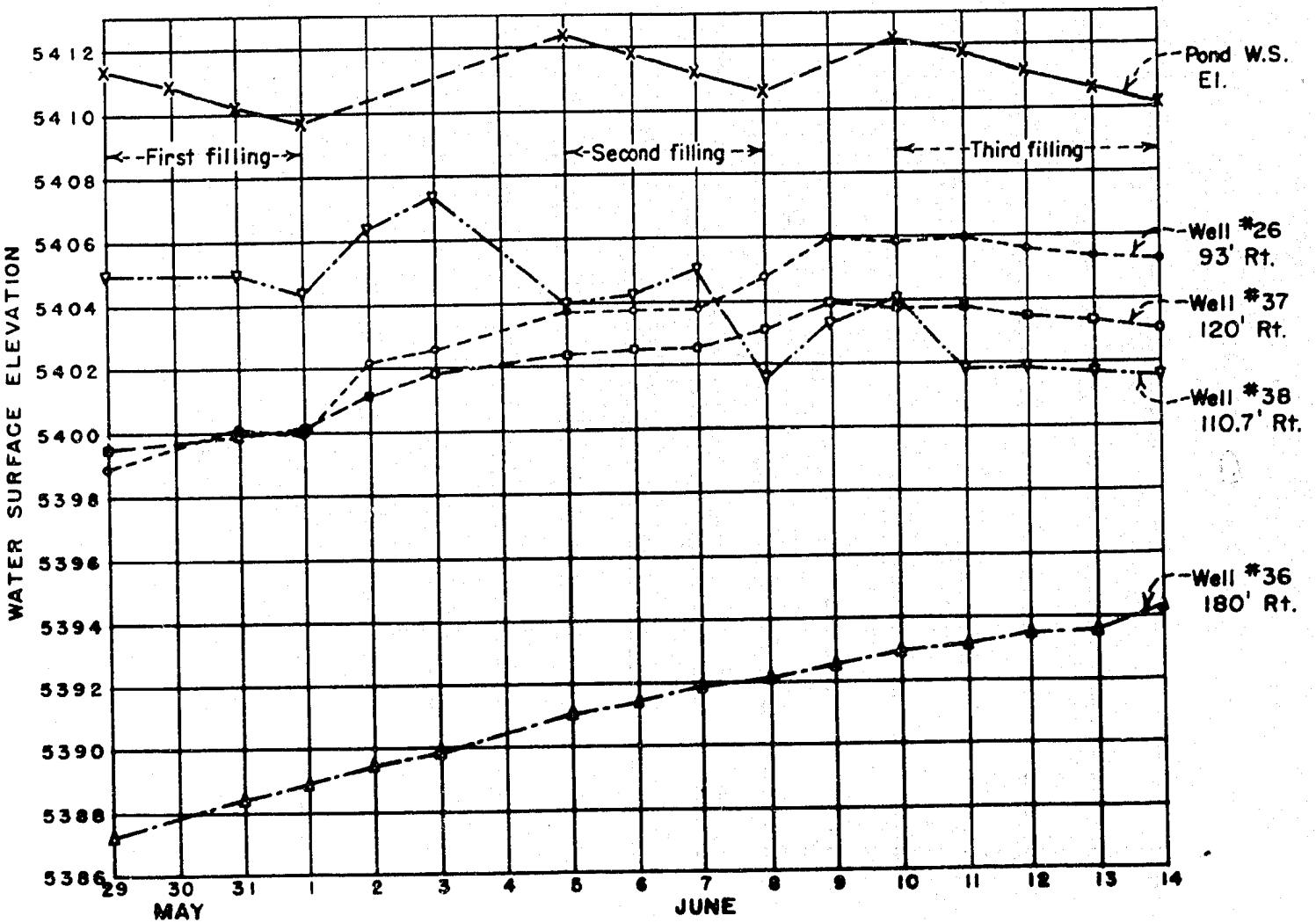

RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL - POND 1 — GROUND WATER STUDIES

HYD-306

FIGURE 15

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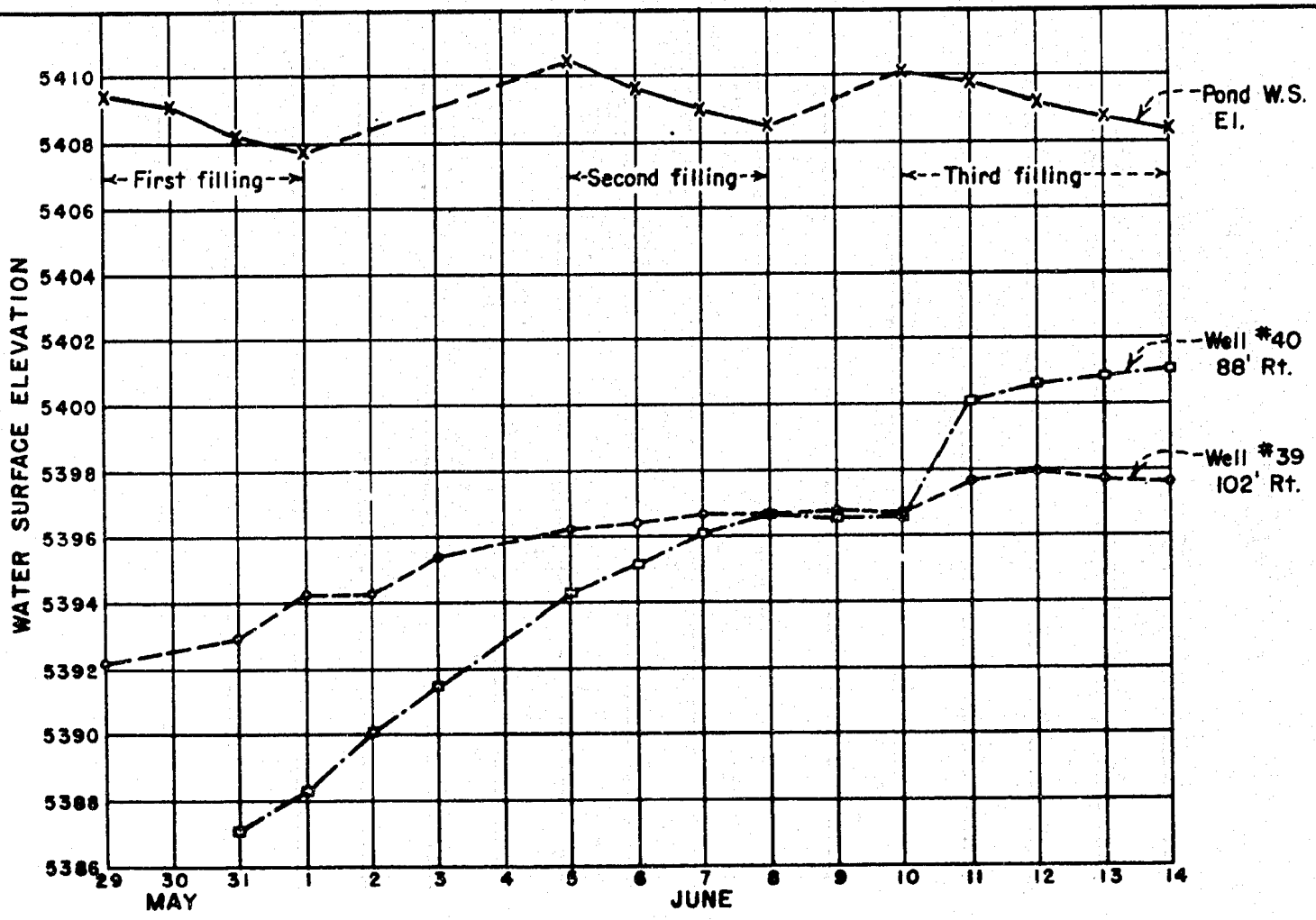

RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL - POND 2 — GROUND WATER STUDIES

HYD-306

FIGURE 16

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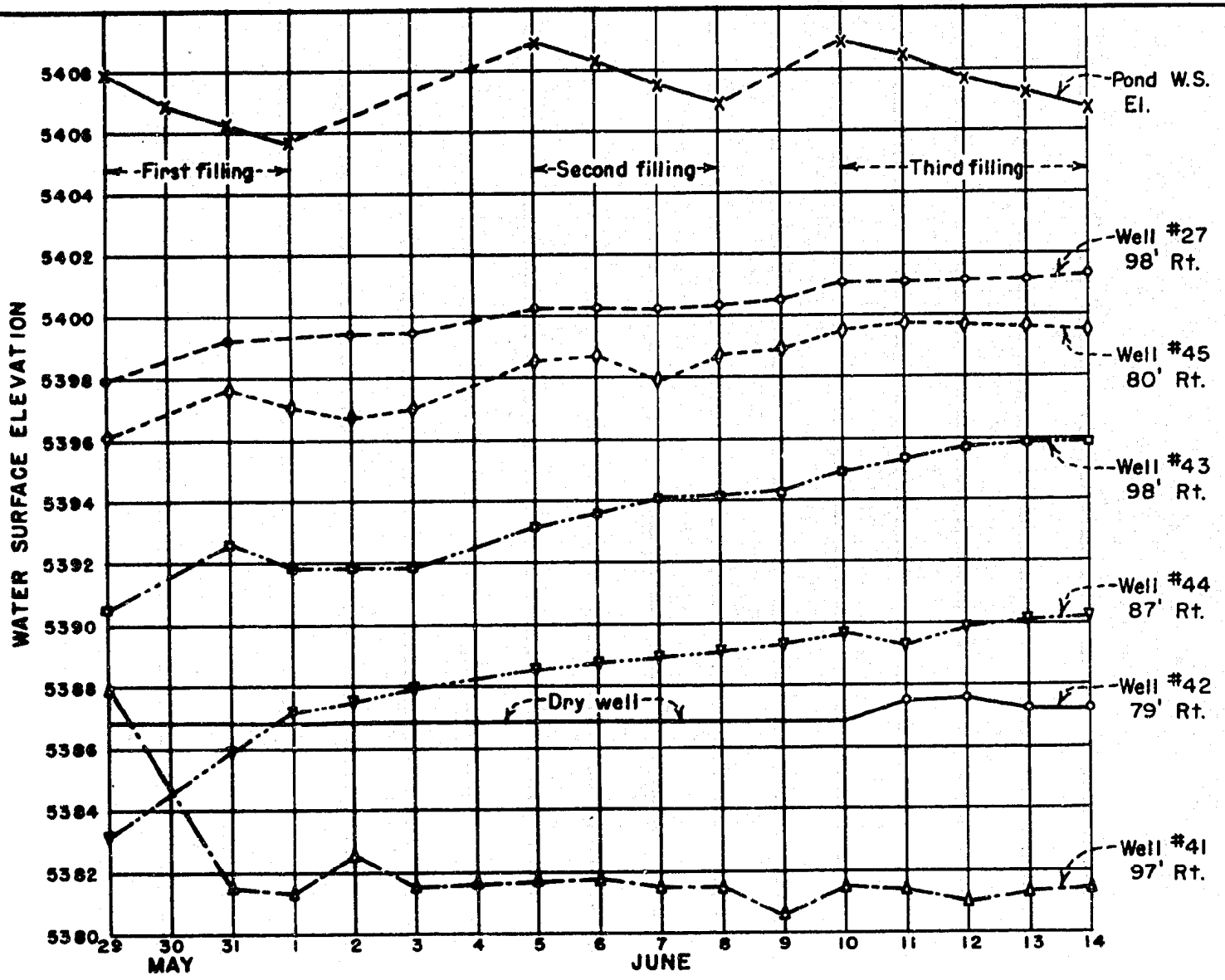

RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL-POND 3—GROUND WATER STUDIES

HYD-306

FIGURE 17

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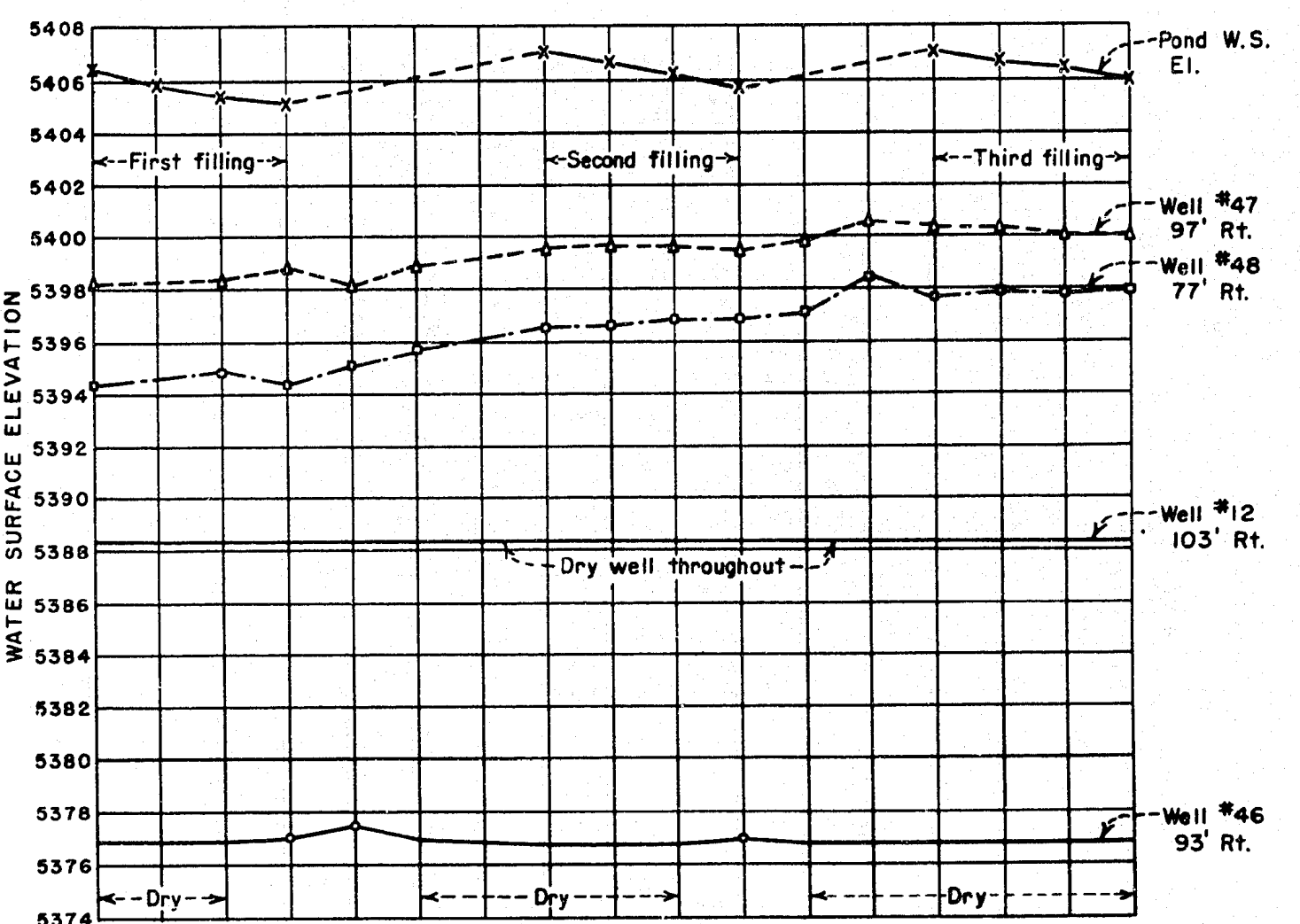

RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL - POND 4 — GROUND WATER STUDIES

HYD-306

FIGURE 18

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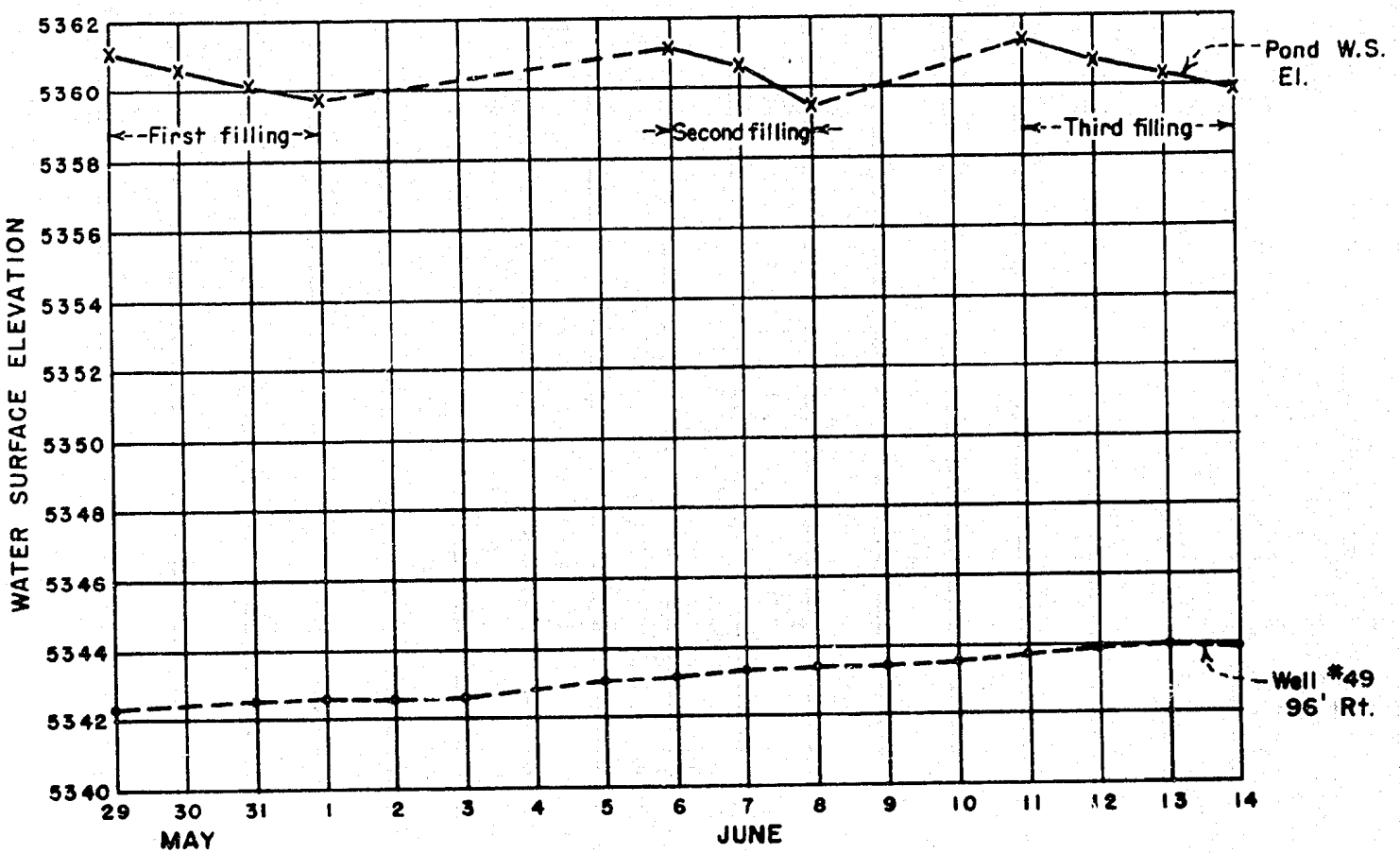

RIVERTON PROJECT - WYOMING

1950 SEEPAGE STUDIES

WYOMING CANAL - POND 6 - GROUND WATER STUDIES

HYD-306

FIGURE 19

APPENDIX A

C O P Y PAC

Riverton, Wyoming

Memorandum

To: L. W. Mabbott, Field Engineer

From: L. C. Schoonover, Materials Engineer

Subject: Ponding tests, Wyoming Canal, Station 2008+00 to Station 2560+00, and Lateral 44.69

Following the recommendations of the Canal Lining Conference as set forth in a letter to the Chief Engineer, dated July 15, 1950, subject, "Lining of Wyoming Canal, Station 1659 to 2560, etc.," four test ponds were constructed in what is considered typical materials for this reach of Wyoming Canal.

Using the existing structures for upper and lower pond limits, the tests were located between the following stations:

Pond No. 7 — Station 2242+18 to Station 2247+50

Pond No. 8 — Station 2261+83 to Station 2275+00

Pond No. 9 — Station 2394+81 to Station 2406+00

Pond No.10 — (Lat. 44.69) Station 23+00 to Station 31+50

A description of each test pond follows

Pond No. 7

Overall length of pond	602'
Length through which loss occurs	532'
Length covered with concrete	70'
Side Slopes	1-½:1
Base	22'
Design Quantity	420 ft.^{3}/sec.

Description of soil:
Gravel with fairly high percentage of fines, large salt content, some cemented material.

Average results from four tests 0.29 ft.^{3}/ft.^{2}/day

Pond No. 8

Overall length of pond	1387'
Length through which loss occurs	1317'
Length covered with concrete	70'
Side slopes	1-½:1
Base	22'
Design Quantity	420 ft.^{3}/sec.

Description of soil:
Gravel with fairly high percentage of fines, large salt content, some cemented material.

Average results from four tests 0.35 ft.^{3}/ft.^{2}/day

Pond No. 9

Overall length of pond	1189'
Length through which loss occurs	1119'
Length covered with concrete	70'
Side slopes	1-3/4:1
Base	22'

Description of soil:
Clean gravel and sand, few fines, small salt content with no cemented materials.

Average results from six tests 4.79 ft.^{3}/ft.^{2}/day

Pond No. 10 (Lat. 44.69)

Overall length of pond	850'
Length through which loss occurs	850'
Length covered by concrete	Negligible
Side slopes	1-½:1
Base	4'

Description of soil:
Uniform sand, small percentage of fines, some gravel, small salt content with little cemented material.

Average test results 0.96 ft.^{3}/ft.^{2}/day

It should be noted for lining purposes that the side slopes change from 1-1/2:1 to 1-3/4:1 at Station 2303+00 and continue as such to Station 2560+00.

Pond No. 7 is considered to be of material typical of that between Station 2241+25 and Station 2261+00.

Pond No. 8 is considered to be of material typical of that between Station 2261+00 and Station 2275+00.

Pond No. 9 is considered to be of material typical of that between 2275+00 and the end of present excavation (2560+00).

Pond No. 10 (Lat. 44.69) is considered to be of material typical of that between Station 8+50 and Station 44+00. From Station 0+00 to Station 4+00, the material is similar to that in Pond No. 9. Dangerous seepage and movement of lateral embankment were observed after only two days of priming in this area.

The reach of canal from the end of Muddy Creek Siphon (2008+00) to the first check drop (2241+25) was used as a reservoir for downstream ponding operations. Sufficient readings were taken, however, to establish an average water loss of 0.62 $ft.^3/ft.^2/day$ for this section. It should be emphasized here that the above figure on water loss is an average, and it is probable that there are sections within this reach where seepage losses would be very excessive. Visible seepage has already developed in some areas within this section.

In a previous memorandum, it was pointed out that as water was checked up at Stations 2349+00, 2364+50, and 2406+00, excessive seepage was observed running freely into weep holes in pool sections of structures and from draws on the north side of canal. This seepage is very responsive to water depth changes in the canal and has been increasing in magnitude each day.

Summary

Canal Section	Seepage rate $ft.^3/ft.^2/day$
Sta. 2008+00 to Sta. 2241+25	0.62
Sta. 2241+25 to Sta. 2261+00	0.29
Sta. 2261+00 to Sta. 2275+00	0.35
Sta. 2275+00 to Sta. 2560+00 (end)	4.79
Lat. 44.69 Sta. 0+00 to Sta. 4+00	4.79
Lat. 44.69 Sta. 4+00 to Sta. 40+00	0.96