UNITED STATES DEPARTMENT OF THE INTERIOR
Douglas McKay, Secretary

BUREAU OF RECLAMATION
W. A. Dexheimer, Commissioner

REGION 1 - BOISE, IDAHO
H. T. Nelson, Regional Director

MINIDOKA PROJECT
NORTH SIDE PUMPING DIVISION
IDAHO

SUPPLEMENTAL DRAINAGE APPENDIX
TO
DEFINITE PLAN REPORT

Rupert, Idaho
November 1954

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DRAFT--11-12-54
(KLAnderson)

INTRODUCTION

This supplemental appendix contains material to substantiate conclusions and recommendations in the revised Definite Plan Report as to the drainage requirements of the North Side Pumping Division, Minidoka Project. A list of additional materials filed as supporting data either in the Regional Office or the Construction Engineer's office at Rupert is included. Throughout this supplemental appendix the same general arrangement and order of topics has been followed as was used in the original drainage appendix which supported the August 1952 Definite Plan Report.

As approved September 30, 1950 Public Law 864, 81st Congress, 2d Session, authorized the irrigation of 77,650 acres of land on the North Side Pumping Division of the Minidoka Project. In the initial development 69,500 irrigable acres were selected from an area of about ~~124,400~~ 122,400 acres classified in detail. The irrigable area selected for development included 13,650 acres in Unit A to be served by water pumped from Snake River and 55,850 acres in Unit B to be served by pumping from ground water.

During the summer of 1954 an additional area of about ~~3,500~~ 8,400 acres in the northeastern part of the Division were classified in detail. This was done so that from the remaining more favorably located land withdrawn for Reclamation, 8,150 acres of the best land authorized for development could be selected. This detailed land classification embraced an area in the shallower ground-water belt near Minidoka in which about 5,000 acres paralleling the area under development had already been classified. Thus, in this area there is a total of about ~~13,500~~ 13,400 acres from which

the 8,150 irrigable acres can be largely selected to be served by pumping from wells designated as the Group 7 wells. This will increase the total area to be served from wells from 45,850 irrigable acres to 54,000 irrigable acres.

DRAINAGE PLAN

The plan for drainage on the North Side Pumping Division provides for collection and disposal of surface runoff from the division through drains constructed for the most part along natural drainage channels. These channels lead to settling basins from which point inverted drainage wells will discharge the water into the underlying permeable basalt.

The design of drainage structures and estimates for required capacities of structures and channels was made in the original appendix. Requirements for the entire division were estimated by making detailed studies of two typical areas within the division. One of these study areas, comprising 6,240 acres in Unit B, represents lands with a natural well-developed, dendritic drainage pattern. This study area was expanded to determine the requirements for the major portion of Unit B and all of Unit A. All of the land to be included under the Group 7 wells is considered to be represented by this dendritic drainage pattern study area. The second study area, comprising 2,550 acres in Unit B, represents the lands in which the natural drainage is internal to shallow, enclosed basins or "potholes".

A revised estimate for the structures and excavation required for the full 77,650 acres is shown in table 1. This table shows the

requirements for the two typical study areas and the expansion on a per-acre basis to cover all of the lands of the division.

A revised drainage cost estimate was then prepared covering the full 77,650 acres and is shown on the accompanying DC-1 forms. In preparing this new cost estimate all unit prices were increased approximately 12 percent over the original estimate used in the August 1952 report. An exception to this has been the unit costs for excavation which were increased percentage-wise somewhat greater. The currently used unit costs for excavation are 25 cents per cubic yard for ditcher or motor patrol excavation and 30 cents per cubic yard for dragline excavation. These figures are believed ample in both cases.

SUBSURFACE INVESTIGATIONS

At the time detailed land classification was made on the supplemental area four additional deep borings were installed to investigate the physical and chemical characteristics of the subsoil and substrata. The results of these borings including logs, mechanical analyses, permeability determinations, and chemical studies are all included as a part of the laboratory report in this appendix. The location of these four deep borings as well as the location of borings made during the earlier investigation are shown on the accompanying sketch map.

These laboratory studies showed that an appreciable amount of salt was present in some horizons but that the salt was apparently readily removed by leaching. Permeability studies showed some horizons with rather low permeabilities although they were not too low to prevent rather easy vertical percolation. Experience throughout most of the

general area on and adjacent to the project has shown that if soils and subsoils will permit vertical percolation of water the underlying basalt is sufficiently permeable and fractured to permit disposal of the water to the regional water table. High rates of permeability, to permit lateral percolation or movement of water, are therefore not imperative.

EXPERIENCE TO DATE

The experience in recent years both on the project lands and on privately-owned lands adjacent to the North Side Pumping Division is valuable in evaluating some of the estimates made for the original Definite Plan Report.

According to the best available information there are now nearly 35000 ~~25,000~~ acres of land either on or adjacent to the division that are irrigated from wells. In the 1954 irrigation season there were 15 wells in operation on Unit B which delivered nearly 25,000 acre-feet of water to almost 7,300 irrigable acres. A small map is included in this appendix showing the areas both inside the division and adjacent to it that are under irrigation at the present time. Irrigation on Unit B of the division began in the 1949 irrigation season when one well served approximately 370 acres. In the succeeding five seasons the acreage has increased to the present figure of 7,300 acres.

To date no drainage problems of any magnitude have developed and the principal concern is that of conveying irrigation waste water through shallow surface channels to a point where disposal can be made.

Design Capacity

As indicated in the original appendix the design capacity for structures and channels was based upon a peak return flow estimated at

one cubic-foot-per-second of each 400 acres of irrigated land. In addition to the capacity provided for return flow additional capacities of one c.f.s. from each square mile of drainage area was provided to carry storm runoff during the irrigation season. The final design capacity for the 6,280-acre study area was therefore 25 c.f.s. or 2.6 c.f.s. per square mile.

During the past years of operation on Unit B it has been possible to collect field data which supports this original estimate. In an accompanying table data are presented for the runoff in acre-feet by days for the irrigation seasons 1951 through 1954. These data were obtained at the V-3 weir located in the northeast quarter, Section 20, Township 8 South, Range 24 East. The total area tributary above this weir is 3,360 acres of which 1,940 acres are irrigated.

Channels and Structures

Experience on the project thus far has shown that the drainage channels and structures such as culverts as provided for the original Definite Plan Report have been satisfactory. Several of the existing channels, of which about 10 miles are now constructed and operated, are shown in the photographs included in this supplemental appendix.

Drainage Wells

To date only one inverted drainage well has been constructed on the division and it has operated satisfactorily for three seasons. No difficulty has been experienced to date from the washing of silt or debris into the well. The settling basin and intake structure as originally designed and built appears to be satisfactory. At the

present time five additional project drainage wells are under contract and will be in operation during the 1959 irrigation season. Additional wells will be drilled as necessary.

One change from the original Definite Plan Report has been to provide for the drilling of [illegible]-inch diameter drainage wells for the small anticipated flows rather than 6-inch diameter wells. This change was made because it has been found that the [illegible]-inch wells can be drilled at little or no additional cost over that of the 6-inch well, and the added diameter will give some added insurance that peak flows can be handled without difficulty. An increase of about 15 percent in the unit cost per well has been provided in the current estimate to take care of this increase in diameter.

RIGHT-OF-WAY

As recommended in the original Definite Plan Report right-of-way for drainage channels is being reserved at the time farm unit layout is made. This provision for right-of-way for future construction has proven to be very desirable and will be continued through the development of the project. One of the enclosed maps shows the location of rights-of-way reserved for drainage channels in a typical part of Unit B. It is readily apparent from this map that outlet for surface irrigation waste is provided to individual farms or small groups of farms to minimize difficulties arising when farmers must arrange among themselves for surface outlets.

QUALITY OF WATER

The quality of water from the Snake River for Unit A and from wells for Unit B is discussed in more detail in the supplemental water supply appendix. Enclosed as a part of this appendix, however, are three tables showing the results of analyses of samples collected from representative wells from the Snake River at Lake Walcott and from return flows in drain ditches on the Minidoka Irrigation District. These analyses indicate that the quality of water being used or proposed for irrigation is acceptable in all instances.

TOPOGRAPHY OF NEW AREA

The topography on the new area to be included under the Group 7 wells is very similar to that on adjacent parts of Unit B. Enclosed is a topographic map showing this additional area which is being included with the Division at this time and portions of the adjacent area. Based upon these topographic conditions and the results of land classification and drainage investigations, it was considered that the per-acre estimate for the study area having the dendritic drainage pattern on Unit B would be applicable to these new lands.

It is also believed that the per-acre estimate for channels and culverts could be considered as applicable to these new lands. The only unusual feature accompanying the new area is the main road and the main line of the Union Pacific Railroad that crosses the northern portion of the Group 7 well area. Existing culverts under both the railroad and road, however, should be ample to handle the small increased flows

resulting from irrigation north of the railroad. The position and capacity of existing culverts are shown on the accompanying topographic map.

REGIONAL WATER TABLE

As discussed in the original report the main body of ground water underlying the project occurs in highly permeable basalts. Irrigation elsewhere on the Snake River plain has shown that even large amounts of deep percolation losses do not generally raise the Regional water table appreciably over its previous position. This has been the case to date in connection with the area now under irrigation either on Unit B or on privately-owned lands adjacent to the project. Hydrographs of several observation wells on the Unit B are included in the appendix. These hydrographs show a slight annual rise in water level which is a Regional trend due to precipitation cycles rather than a result of irrigation.

OTHER DATA

Data on the designed section of drainage channels, structures, the study areas, drainage wells, and settling basins are contained in the original drainage appendix. Data obtained during the present study relative to land classification such as the logs of five-foot borings and infiltration studies are contained in the supplemental appendix on project lands.

This supplemental appendix was prepared by K. E. Andersen, Regional Drainage Engineer, Boise, Idaho assisted by members of the Construction

Engineer's staff at Rupert. Most of the data and illustrations used in this report were assembled by the staff at Rupert.

ALTERNATIVE PLANS

Although it is anticipated that most of the return flow and runoff water from Unit A and B will be disposed of in inverted drainage wells, it is also ~~possible~~ planned that a portion of the runoff will be reused for irrigation supply.

This reuse can be accomplished by installing relift pumps along drainage channels and pumping the drainage water onto adjacent higher lands of the North Side Pumping Division. Additional information on these plans is contained in the supplemental water supply appendix. It is also possible, however, that some of the runoff will be collected in a surface channel and disposed of into the existing distribution or drainage system of the Minidoka Irrigation District, which lies topographically below the North Side Pumping Division.

At the present time canal No. 20 of the Minidoka Irrigation District, west of Paul, Idaho, obtains all of its water by pumping from the main drain of the Minidoka Irrigation District. It is physically possible, and the irrigation district has expressed an interest, to substitute runoff from a portion of Unit A and B of the North Side Pumping Division for this pumped water. This arrangement would result in some saving in cost to the Minidoka North Side Pumping Division in that several drainage wells would not have to be drilled. It would also have some advantage to the Minidoka Irrigation District in that this return flow would enable them to curtail or eliminate operation of ~~a~~ the pump which serves their canal No. 20.

SUPPORTING DATA

Supporting data not included in this appendix or in the revised Definite Plan Report are on file at the Irrigation Operator's office or the Construction Engineer's office in Rupert, Idaho. These data include well logs and water level information from the irrigation supply wells on Unit B, water delivery records for the irrigated lands on Unit B for recent years, the farm development report for the irrigation season in 1951, and related information concerning the construction and operation and maintenance of drainage works to date on the Division.

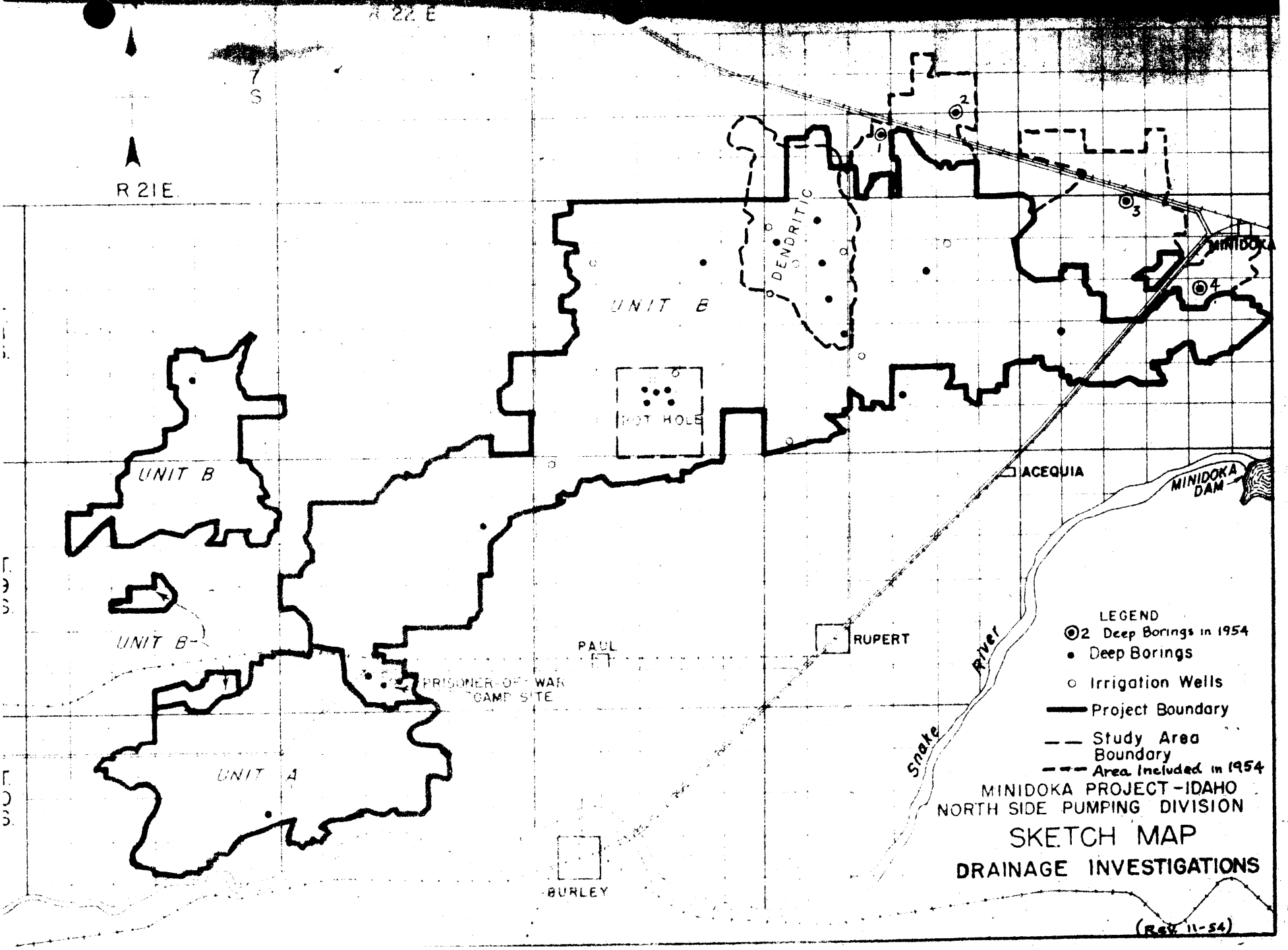
CALCULATION OF DRAINAGE CONSTRUCTION REQUIRED
(Based on study area requirements)

Item	Pothole Study Area	Dendritic Drainage Study Area	Unit "B" Pothole Area	Unit "B" Dendritic Area	Unit "B" Total	Unit "A" Total	Project Total
Acres	2,550	6,240	11,200	52,800	64,000	13,650	77,650
12" Wells	1	5	4	42	46	11	57
8" Wells	5	-	22	-	22	-	22
Settling basins	6	5	26	42	68	11	79
Excavation, common, cubic yards	26,000	13,745	114,240	116,500	230,740	30,030	260,770
Culverts:							
48-inch		2		17	17	4	21
36-inch		2		17	17	4	21
30-inch		2		17	17	4	21
24-inch		6		51	51	13	64
18-inch		12		102	102	26	128

--November 1954

PROJECT Minidoka North Side Pumping Division
Date of Estimate November 1954
Prices as of October 1954
Sheet 1 of 1 sheets

LD ST	FIELD COST	CONSTRUCTION FACILITIES	INVEST'GNS ENGR'G AND GEN'L EXP.	TOTAL COST	TOTAL COST	TOTAL COST
ERTY UNT	IDENTIFIED PROPERTY	IDENTIFIED PROPERTY	IDENTIFIED PROPERTY	IDENTIFIED PROPERTY	PROPERT CLASS	ALL CLASSES
	9	10	11	12	13	14
	269,500	10,000	76,000		355,500	
	226,500					
9,600						
3,900						
	43,000					
5,400						
9,600						


R 22 E
R 21 E
UNIT B
UNIT B
UNIT B
UNIT A
DENDRITIC
POT HOLE
PAUL
PRISONER OF WAR CAMP SITE
BURLEY
RUPERT
ACEQUIA
MINIDOKA
MINIDOKA DAM
Snake River
LEGEND
2 Deep Borings in 1954
Deep Borings
Irrigation Wells
Project Boundary
Study Area Boundary
Area Included in 1954
MINIDOKA PROJECT - IDAHO
NORTH SIDE PUMPING DIVISION
SKETCH MAP
DRAINAGE INVESTIGATIONS
(Rev. 11-54)

Laboratory Report

Subject: Analyses of four deep soil profile samples from the Minidoka Project, North Side Pumping Division

Four deep borings were sampled in the Unit B supplemental land classification area approximately equivalent to the Group Seven Wells area. These samples have been tested in the laboratory to provide basic data for the drainage investigations. The field descriptions of these holes are shown in table 1, and the mechanical analyses of the soil separates are shown in table 2.

The limited amount of sample available from three of the holes precluded a detailed analyses of these samples. However, basic data such as pH, salt, lime, hydraulic conductivity, water soluble and exchangeable sodium, and percent exchangeable sodium were determined. These data are shown for holes 1, 2, and 4 in table 3. The same data are also shown for hole 3, along with other data, which received a more detailed study.

The samples of each horizon of hole 3 were dried and crushed to pass a 2 mm. sieve. The samples were then carefully poured into a 2" diameter lucite tube to the same thickness and in the same sequence as occurred in the field. In effect, a 2-inch disturbed core was reconstructed. The core was divided lengthwise into three sections: the first section from 0-49.5", the second section from 49.5" - 8', and the third section 8-10.5' with the bottom of the core resting on washed fine gravel. Piezometers or tensiometers were attached to the core between horizons. The leachate from the first section was applied to the second section; and the leachate from the second section was in turn applied to the third section. Leachate from the third section was collected in eight separate increments, and each incremental part was analyzed separately. These analyses are shown in table 4. These data are summarized in table 5 to show the amount of each ion removed from the soil as leaching progressed.

Constant heads were maintained on each section of the core during the measurements of the hydraulic conductivity. The results from these determinations are shown on table 3.

From table 5 it is possible to estimate the amount of salt the drainage system of this area will have to dispose of by assuming that the core represents one-three millionth of an acre. Thus for the 6.3 acre-feet transmitted by the core the calculation can be made as follows:

Ion	[illegible]/[illegible]	[illegible]/[illegible]	[illegible]/acre (x10[illegible])	lbs./acre	tons/acre
B	-	[illegible].12	3[illegible].16	[illegible]4.13	[illegible].04
CO_3	1.[illegible]	[illegible]	[illegible]	76[illegible]	[illegible].38
HCO_3	[illegible].74	[illegible]	[illegible]	[illegible],7[illegible]	3.3[illegible]
Cl	[illegible]	[illegible].4[illegible]	14,[illegible].44	3[illegible],29[illegible]	[illegible]3
SO_4	[illegible].4	[illegible].2[illegible]	[illegible]	33,4[illegible]	[illegible].73
Ca	1[illegible]	[illegible]	[illegible]	[illegible],[illegible]3.3	1.[illegible]
Mg	[illegible].4	[illegible]	3,[illegible]	[illegible]	3.[illegible]7
Na	[illegible].7	3[illegible]4.[illegible]	11,[illegible].30	2[illegible],3[illegible].[illegible]6	12.[illegible]
K	[illegible]	30.[illegible]	[illegible].73	[illegible].[illegible]4	[illegible]
Total	-	[illegible],3[illegible].8[illegible]	[illegible]	[illegible]5	53.[illegible]3

Under normal irrigation practice the downward movement of salt would be accomplished quite slowly with normal irrigation amounting to [illegible] feet per acre per year. The amount of water [illegible] of intermittent application, thus [illegible] of the salts [illegible], tending to lengthen the time required for [illegible]. Assuming that [illegible] a very rough estimate of the leaching rate would be about [illegible] tons of salt per acre per year for five years, 5 tons per acre per year for another five years, then 2 tons per year for five years and 1 ton per year for the next 30-40 years. This latter rate corresponds to the depletion of the replacement of exchangeable sodium. Summarized, this means that the neutral salts will be largely removed in 15 years (5[illegible] tons per acre), followed by about 35 years where the salt will be largely sodium bicarbonate. Altogether, this amounts to nearly 100 tons of salts per acre to be removed in 50 years.

After leaching the core sections each section was drained as though the sections were combined into a single core [illegible].5 feet long. This was accomplished as follows: The bottom section ([illegible]-[illegible]') drained free into gravel. The second section (4[illegible]'-[illegible]') had a constant tension equal to 2.5 feet of water applied at the bottom. The first section had a constant tension equal to 7[illegible] inches of water applied at the bottom. Each section was plugged at the top with cotton. In each section the drainage volume increased until sometime between 4[illegible] and [illegible] hours. Had the core been in one unit instead of three separate sections from six to nine days probably would have been required for equal drainage.

After drainage each horizon of the core was sampled for moisture content. These results along with the 15 atmosphere moisture

retention and available moisture values are as follows:

Horizon	Disturbed Core Field Capacity In./Ft.	15 Atmosphere Moisture Retention In./Ft.	Available Moisture In./Ft.	In./Horizon
0-12"	3.42	1.20	2.22	2.22
12-36"	4.12	1.21	2.91	5.82
36-60"	4.15	1.08	3.07	6.14
5- 8'	4.63	1.50	3.13	9.39
8-10.5'	4.75	1.22	3.53	8.82

A moisture tension curve was also made for each horizon of this profile. The calculated field capacities for this profile appear to be high. This, along with other work, seems to confirm our belief that the curves themselves are high because of two probable defects in the U. S. Salinity Laboratory method as now used, such as (1) thickness of the sample on the plates, and (2) failure to re-establish capillary contact with the plate after each sample weighing. However, this curve and moisture data is useful for comparison with curves made earlier for this project.

Basically, soils as represented by these four holes present two closely related problems. First, the permeability appears to be adequate for vertically moving water, but, should the basalt be less permeable than anticipated, the lateral movement to a drain would be very slow. Second, the soils are generally saline in the lower subsoil poising a definite threat should the deep drainage turn out to be unsatisfactory. Thus, the potential value of such soils when irrigated depends largely on the permeability of the underlying basalts.

Vernon C. Bushnell

PROFILE DESCRIPTIONS OF DEEP BORINGS
(Field Descriptions)

Hole No. 1 - Class 1 Soil 124

Sec. 28, T. 7 S., R. 24 E. At 16/14 Cor.

0" - 32" - Silt loam
32" - 55" - Nodular compacted very fine sandy loam
55" - 84" - Compact very fine sandy loam
84" - 100" - Loam to light clay loam, with dark nodules
100" - 120" - Loam
120" - 140" - Loam (moist)
140" - 165" - Light clay loam to clay loam
165" - 216" - Loam
18' -24'6" - Loam - lime capping at 24'6"
24'6" - 25'6" - Loam to light clay loam. Broken basalt at 25'6"

Hole No. 2 - Class 1 Soil 124

Sec. 23, T. 7 S., R. 24 E. At S-1/4 Cor.

0" - 12" - Silt loam
12" - 40" - Nodular silt loam
40" - 60" - Floury silt loam
60" - 108" - Silt loam
108" - 126" - Blocky heavy silt loam
126" - 168" - Loam
168" - 216" - Nodular highly compacted silt loam to light clay loam
18' - 27' - Light clay loam to clay loam (small pea size basalt chunks last 3 feet)

Hole No. 3 - Class 3 Soil 124

660' S. of N-1/4 Cor., Sec. 4, T. 8 S., R. 25 E.

0" - 12" - Silt loam
12" - 36" - Nodular silt loam
36" - 60" - Very fine sandy loam
5' - 8' - Light clay loam
8'-10-1/2' - Loam - compacted zone with caps. Basalt rock at 10.5'. Some lime coating on basalt crevices.

Hole No. 4 - Class 2s Soil 334

Sec. 14, T. 8 S., R. 25 E. At 16/11 Cor.

0" - 12"	- Silt loam
12" - 36"	- Silt loam - nodular compaction
36" - 66"	- Caliche
36" - 42"	- Indurated caliche
42" - 66"	- Series of caliche layers
5'6" - 11'	- Nodular compacted loam. White mottling throughout this zone
11' -17'8"	- Loam. Some nodules and compaction

RO - 42
PP 5-52

MECHANICAL ANALYSES OF SOIL SEPARATES

PERCENT OF EACH PARTICLE SIZE

Minidoka - North Side Pumping Division — November 1954

Sample No.	Depth Inches	Clay	Silt	V.F.S.	F.S.	M.S.	C.S.	F.G.	Texture
1	0-32	12.0	60.5	24.5	3.0	0.0	0.0	0.0	Silt loam
	32-55	10.5	58.5	30.0	1.0	0.0	0.0	0.0	Silt loam
	55-84	12.5	51.0	22.5	8.0	4.0	2.0	0.0	Silt loam
	84-100	12.0	53.5	26.0	7.0	1.5	0.0	0.0	Silt loam
	100-120	11.0	58.5	25.5	4.0	1.0	0.0	0.0	Silt loam
	120-140	22.5	55.0	21.5	1.0	0.0	0.0	0.0	Silt loam
	140-165	27.0	51.0	21.0	0.5	0.5	0.0	0.0	Heavy silt loam
	165-216	18.5	59.5	19.0	2.0	1.0	0.0	0.0	Silt loam
	18-24-1/2'	24.0	51.0	17.0	7.0	1.0	0.0	0.0	Silt loam
	24-1/2-25 1/2'	21.0	52.0	20.0	5.0	1.0	1.0	0.0	Silt loam
2	0-12	17.0	55.5	24.0	3.5	0.0	0.0	0.0	Silt loam
	12-40	19.5	54.5	25.0	0.5	0.5	0.0	0.0	Silt loam
	40-60	13.5	57.5	25.0	3.5	0.5	0.0	0.0	Silt loam
	60-108	11.0	59.5	23.5	5.5	0.5	0.0	0.0	Silt loam
	108-126	24.0	58.0	16.5	1.0	0.5	0.0	0.0	Silt loam
	126-168	27.0	55.0	16.5	0.5	1.0	0.0	0.0	Heavy silt loam
	168-218	24.5	55.0	17.5	2.0	1.0	0.0	0.0	Silt loam
	18-27'	24.0	53.0	20.0	2.0	1.0	0.0	0.0	Silt loam
3	0-12	17.5	47.0	25.5	8.5	1.5	0.0	0.0	Loam
	12-36	11.5	36.5	27.0	21.0	3.5	0.5	0.0	Loam
	36-60	9.5	47.0	31.5	9.5	2.5	0.0	0.0	Loam
	5-8'	9.0	55.5	29.5	6.0	0.0	0.0	0.0	Silt loam
	8-10-1/2'	19.0	44.0	31.0	1.5	3.5	1.0	0.0	Loam
4	0-12	18.5	48.5	29.0	3.0	1.0	0.0	0.0	Loam
	12-36	15.0	56.5	22.5	4.0	1.5	0.5	0.0	Silt loam
	3-5-1/2'	7.0	52.0	33.0	7.0	1.0	0.0	0.0	Silt loam
	5-1/2-8'	8.0	62.5	23.5	6.0	0.0	0.0	0.0	Silt loam
	8-17.8'	7.0	62.0	30.5	0.5	0.0	0.0	0.0	Silt loam

insert map 1

LABORATORY REPORT

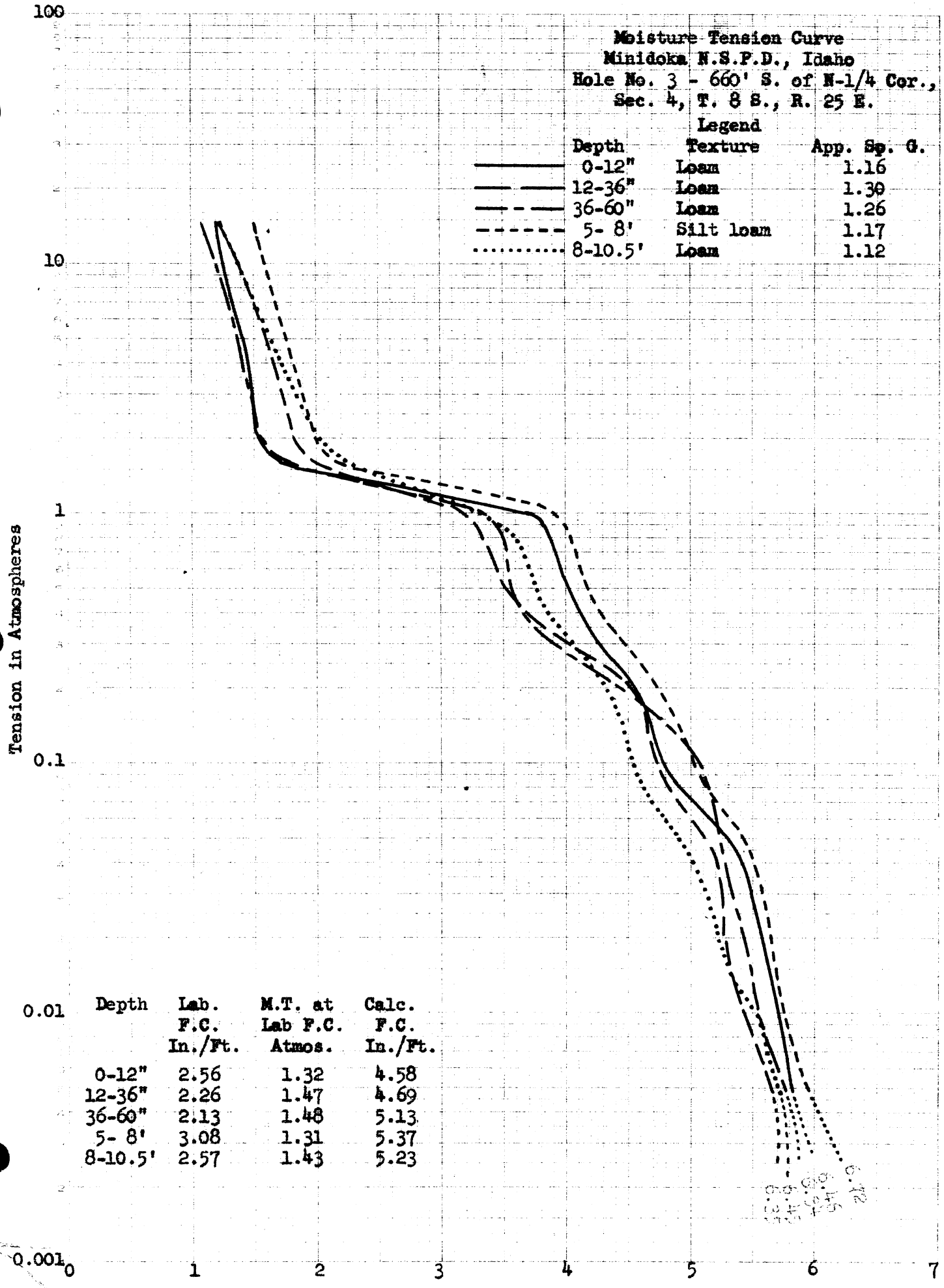
Water Analyses **Minidoka North Side Pumping Division - Leachate from disturbed core for Sample No. 3**

Date	Sample No. Volume	pH	ECx10³ @25°C	Boron p.p.m. or mg.	Anions, m.e./l. CO_3	HCO_3	Cl	SO_4	Cations, m.e./l. Ca	Mg	Na	K	Residual Na_2CO_3 m.e./l.	SAR	Salinity Laboratory Rating
/31-/10	265	7.1	57.47	3.04	0.00	5.51	476.5	347.1	51.70	358.8	494.0	2.16	None	34.48	C4-S4
/10-/13	225	8.1	4.60	2.84	0.98	5.90	6.77	30.38	4.94	5.32	33.75	0.02	None	14.86	C4-S4
/13-/17	283	8.6	2.94	5.43	1.76	9.81	7.70	10.35	4.20	3.60	21.45	0.10	3.77	10.84	C4-S3
/17-/20	240	8.6	2.00	4.99	2.05	10.05	3.20	5.04	2.10	1.70	16.95	0.03	8.30	13.31	C3-S3
/20-/27	494	8.6	1.73	6.12	1.95	9.22	3.05	3.14	1.90	1.35	15.20	0.10	7.92	11.97	C3-S3
/27-10/5	373	8.8	1.48	5.65	1.72	9.45	1.22	1.92	0.92	1.02	12.60	0.10	9.23	12.79	C3-S3
10/5-10/11	363	8.8	1.45	5.80	1.60	9.60	1.77	1.73	1.16	1.18	12.56	0.10	8.86	11.63	C3-S3
10/11-10/18	277	8.8	1.45	4.90	1.76	9.82	1.63	1.53	1.02	0.98	12.56	0.10	9.58	12.56	C3-S3
Tap Water		7.52	0.314	0.02	0.00	2.18	0.14	0.36	1.20	0.33	0.88	0.00	0.65	1.01	C2-S1

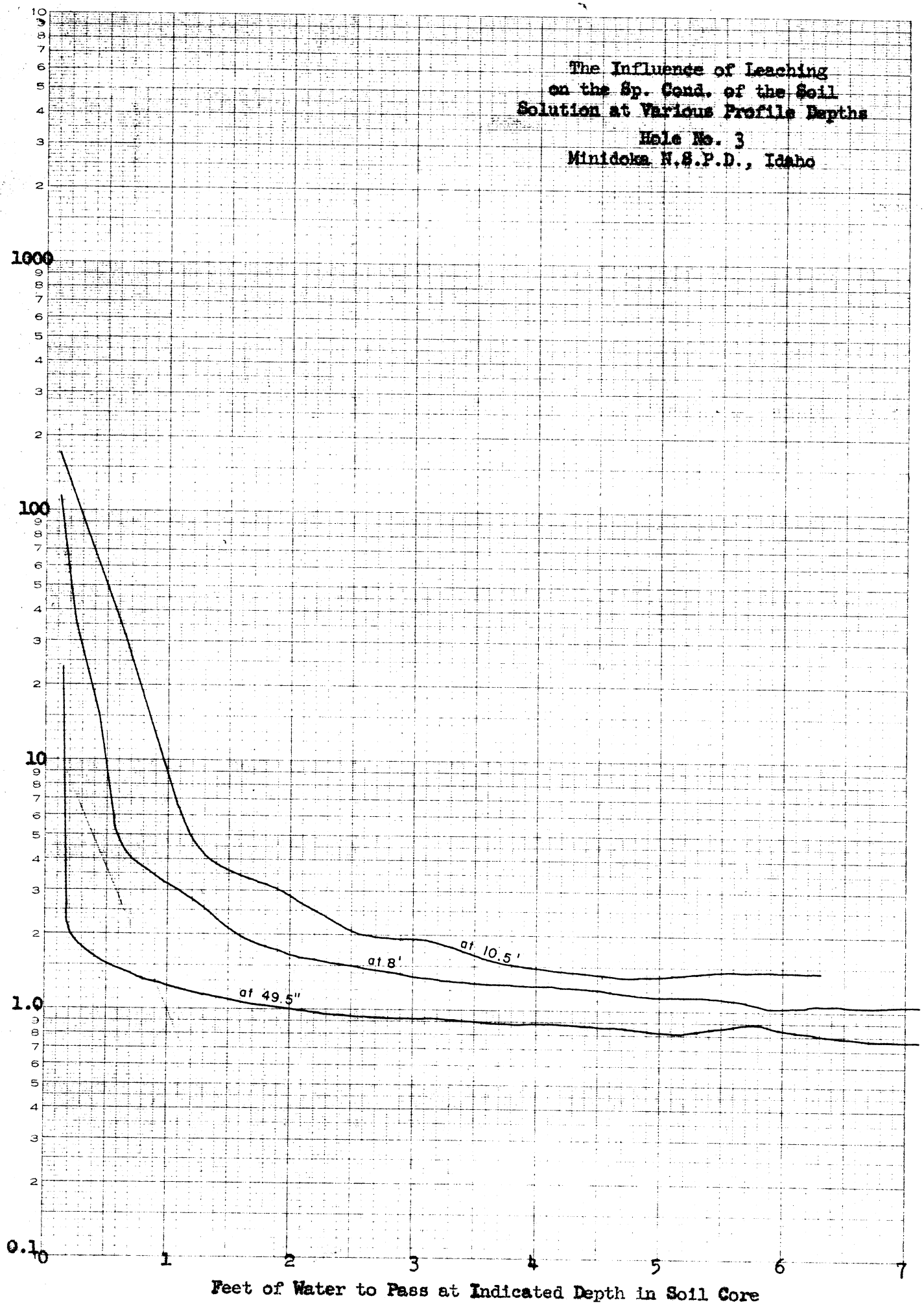
LABORATORY REPORT

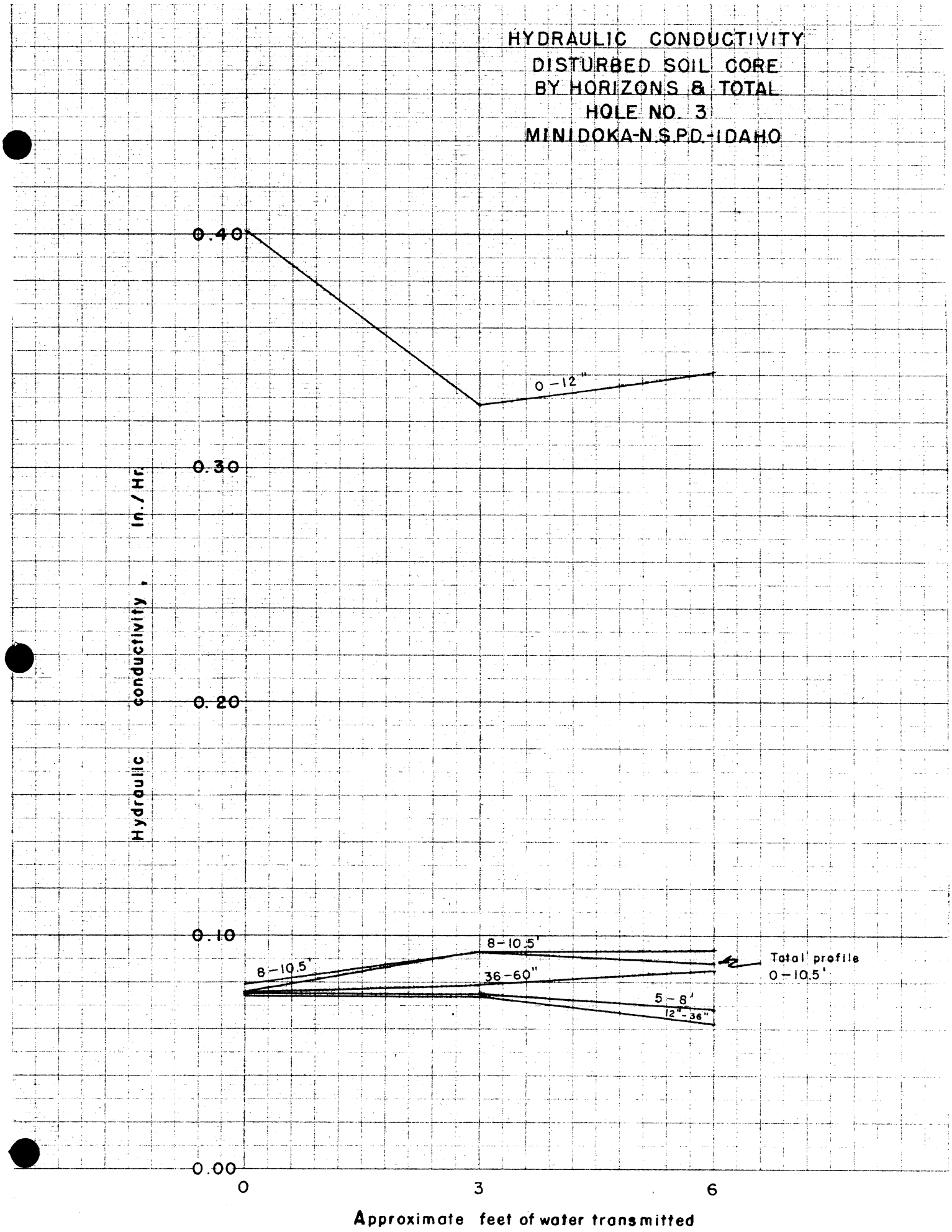
Water Analyses: Minidoka North Side Pumping Division - Accumulative amounts of salts removed

Water Used Ac. Ft./Ac.	Boron mg.	Anions, me.				Cations, me.			
		CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	K
0.66	0.80	0.00	0.88	126.2	91.88	13.38	94.99	130.7	0.57
1.22	1.44	0.22	1.72	127.7	98.64	14.22	96.12	138.1	0.57
1.93	2.97	0.72	3.88	129.8	101.5	15.07	97.05	143.9	0.60
2.53	4.16	1.21	5.77	130.5	102.6	15.28	97.38	147.8	0.61
3.77	7.17	2.17	9.24	131.9	104.0	15.63	97.89	154.9	0.66
4.70	9.27	2.81	11.95	132.3	104.6	15.52	98.15	159.3	0.70
5.61	11.37	3.39	14.64	132.9	105.1	15.50	98.46	163.5	0.74
6.30	12.72	3.88	16.76	133.3	105.4	15.45	98.64	166.7	0.77



Depth	Lab. F.C. In./Ft.	M.T. at Lab F.C. Atmos.	Calc. F.C. In./Ft.
0-12"	2.56	1.32	4.58
12-36"	2.26	1.47	4.69
36-60"	2.13	1.48	5.13
5- 8'	3.08	1.31	5.37
8-10.5'	2.57	1.43	5.23


The Influence of Leaching
on the Sp. Cond. of the Soil
Solution at Various Profile Depths
Hole No. 3
Minidoka N.S.P.D., Idaho
Sp. Cond. soil solution at indicated depth, millimhos
1000
100
10
1.0
0.1
at 10.5'
at 8'
at 49.5"
0
1
2
3
4
5
6
7
Feet of Water to Pass at Indicated Depth in Soil Core


HYDRAULIC CONDUCTIVITY
DISTURBED SOIL CORE
BY HORIZONS & TOTAL
HOLE NO. 3
MINIDOKA-N.S.P.D.-IDAHO
0.40
0.30
0.20
0.10
0.00
Hydraulic conductivity, In./Hr.
0 - 12"
8 - 10.5'
8 - 10.5'
36 - 60"
5 - 8'
12" - 36"
Total profile
0 - 10.5'
0
3
6
Approximate feet of water transmitted

North Side Pumping Division
Minidoka Project, Idaho

- - -

SEASONAL PUMPING FROM PROJECT WELLS - (Acre Feet)

Well No.	Acres*	1949	1950	1951	1952	1953	1954
11A824	498.4	--	1848	1825	2208	2061	1744
7B824	505.3	1334	2110	1494	1710	1219	**
27A823	284.3	--	1196	871	1127	1054	2295
27A823	294.9	--	--	749	1011	921	
18A824	482.1	--	--	1087	2074	1807	**
6A824	645.0	--	--	1967	2542	2218	5584**
6A923	431.3	--	--	1438	1719	1420	1681
21A824	726.2	--	--	1784	2618	2475	2379
8A823	609.3	--	--	1160	1986	1679	1353
14A824	486.0	--	--	--	--	--	1657
15A824	359.1	--	--	--	--	--	1173
10A824	902.1	--	--	--	--	--	3291
10B824		--	--	--	--	--	
8A824	548.1	--	--	1460	2045	2209	3477
4B824	417.1	--	--	--	--	--	
33A922	70.	--	--	219	279	203	236
Irrigable Acres	7259.2						
Irrigated Acres		370	1090	4782	4812	5170	6612
Pumping Ac.-Ft.		1334	5154	14054	19319	17266	24871

Footnotes: * - Irrigable acreage served by each well
** - Pumpage combined in 1954 for wells 7B824, 18A824, and 6A824

--Nov. 1954

WASTE WATER DATA IN ACRE FEET - V-3 WEIR
NORTH SIDE PUMPING DIVISION
MINIDOKA PROJECT, IDAHO

Location of Weir:
NE 1/4 NE 1/4 sec 20, T 8 S, R 24 E
Tributary area:
1940 A. irrigated, 1920 A. nonirrig.
(total of 3860 acres)

	1951				1952					
Day	June	July	August	September	May	June	July	August	September	October
1		1.53	3.96	6.85		3.29	6.85	8.38	7.51	3.29
2		.97	4.60	4.37		3.60	6.44	9.07	7.94	3.29
3		1.05	5.07	4.52		4.14	6.65	8.38	7.94	4.50
4		2.20	3.45	7.07		5.25	7.51	6.62	8.16	4.50
5		2.06	2.20	7.29		2.36	3.96	6.24	8.33	3.96
6		4.41	4.34	7.94		2.36	7.29	8.61	9.53	2.97
7		.83	7.07	7.73		5.07	6.66	9.53	8.61	3.13
8		1.17	9.07	6.44		4.32	6.24	7.73	7.65	2.20
9		1.19	9.29	1.89		4.12	5.44	8.16	7.94	.02
10		1.79	7.51	2.52		5.25	4.50	8.33	8.61	.48
11		1.79	8.61	9.53		6.04	6.85	9.35	10.00	1.41
12		1.29	10.00	8.61		5.25	7.94	8.83	8.33	1.05
13		1.79	7.44	8.38	0.0	5.04	7.51	8.61	9.07	.81
14		1.92	6.44	5.34	0.0	5.45	8.47	8.38	9.07	1.29
15		2.36	6.85	7.07	.54	6.04	8.16	7.94	8.40	1.92
16	.64	1.81	7.29	5.07	1.41	5.94	7.94	8.83	7.94	1.67
17	1.29	2.06	7.07	2.22	.83	6.04	7.73	9.07	7.73	1.41
18	.73	2.50	6.24	9.76	1.41	6.65	8.83	9.91	7.29	1.17
19	.46	2.50	6.04	9.07	2.89	5.84	7.94	8.61	7.07	.73
20	1.29	2.36	6.25	5.84	2.50	7.29	8.61	8.38	6.85	.73
21	.97	2.36	7.29	3.80	1.17	7.94	8.62	8.16	6.44	1.41
22	.93	2.20	5.84	1.25	2.81	7.51	8.16	8.83	5.96	.06
23	.73	2.31	2.06	0.0	1.79	6.61	7.73	8.38	6.04	0.0
24	1.17	1.53	8.61	0.0	1.41	6.44	7.73	7.94	6.24	0.0
25	1.48	1.92	8.83	0.0	1.53	6.44	7.94	8.08	5.65	0.0
26	1.17	2.06	5.65	0.0	1.75	6.44	6.85	7.73	4.87	0.0
27	.83	1.67	9.19	0.0	2.50	6.44	8.16	7.73	5.07	0.0
28	.93	.93	11.72	0.0	3.29	6.85	6.29	8.83	5.45	
29	1.53	5.25	10.48	0.0	2.97	6.44	6.44	8.83	4.66	
30	1.53	5.21	8.38	0.0	3.13	6.59	6.04	7.73	3.96	
31		4.50	7.29		3.13		7.29	6.44		
Total	15.60	64.52	213.73	132.96	35.06	167.84	223.17	258.14	219.31	42.05

LABORATORY REPORT

Water Analyses — Ten wells on Unit B, Minidoka North Side Pumping Division, Idaho (Analyses by U.S.G.S.)

Sample No.	pH	ECx10⁶ @25°C	Boron p.p.m.	Anions, m.e./l.				Cations, m.e./l.				Residual Na_2CO_3 m.e./l.	SAR	Salinity Laboratory Rating
				CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	K			
6S-24E-35ca1														
9/28/53	7.6	338	-	-	2.46	0.34	0.58	1.50	1.07	0.74	0.09	none	0.65	C2 - S1
6S-24E-5cc1														
10/2/53	8.3	351	0.10	-	2.44	0.48	0.62	1.50	1.07	0.87	0.10	none	0.77	C2 - S1
7S-25E-35bc1														
6/29/51	7.6	353	0.15	0.00	2.64	0.37	0.67	1.80	1.15	0.74	0.06	none	0.61	C2 - S1
3S-23E-27bd1														
9/17/50	-	609	0.02	0.00	4.08	1.24	1.04	2.90	1.81	1.74	- 1/	none	1.14	C2 - S1
6/29/51	7.8	614	0.15	0.00	4.08	1.18	0.96	2.85	1.81	1.61	0.19	none	1.06	C2 - S1
3S-24E-7da1														
6/11/49	-	502	0.00	-	3.31	0.96	0.90	2.30	1.32	1.57	- 1/	none	1.16	C2 - S1
9/17/50	7.8	519	0.02	0.00	3.38	1.07	0.96	2.30	1.48	1.48	0.16	none	1.08	C2 - S1
3S-24E-11ba1														
9/17/50	-	477	-	0.00	3.08	0.87	0.92	2.15	1.40	1.35	- 1/	none	1.01	C2 - S1
6/21/51	7.8	457	0.11	0.00	3.05	0.73	0.92	2.15	1.40	1.09	0.10	none	0.85	C2 - S1
3S-24E-16bb1														
9/19/50	-	654	-	0.26	3.66	1.52	1.19	2.65	1.81	2.22	- 1/	none	1.49	C2 - S1
3S-25E-1cb1														
6/3/53	7.7	381	0.09	0.00	2.66	0.39	0.77	2.00	1.23	0.74	0.07	none	0.58	C2 - S1
4/8/49	-	388	0.01	-	2.62	0.51	0.82	2.00	1.23	0.74	- 1/	none	0.58	C2 - S1
3S-25E-16da1														
9/17/50	-	489	0.02	0.00	3.44	0.82	0.90	2.30	1.48	1.39	- 1/	none	1.01	C2 - S1
3S-22E-33ad1														
6/29/51	7.9	984	0.25	0.00	6.11	2.08	2.19	4.05	2.47	4.00	0.13	none	2.30	C3 - S1

1/ Included as Na

LABORATORY REPORT

Water Analyses **Minidoka North Side Pumping Division** **Sheet 1 of 2**

Sample No.	pH	ECx10⁶ @25°C	Boron p.p.m.	Anions, m.e./l.				Cations, m.e./l.				Residual Na_2CO_3 m.e./l.	SAR	Salinity Laboratory Rating
				CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	K			
Snake R. at Minidoka Dam														
1/ Low Sp.C. 7/9-7/26/49	8.11	350	-	0.36	2.47	0.60	0.75	2.08	1.20	0.66	0.27	none	0.52	C2 - S1
High Sp.C. 4/18-5/16/49	8.24	500	-	0.74	2.55	0.99	1.05	2.35	1.70	1.07	0.18	none	0.75	C2 - S1
Average 1948-49	-	410	-	0.34	2.59	0.74	0.91	2.15	1.29	0.84	0.26	none	0.64	C2 - S1

1/ **Analyses by University of Idaho (Research Bulletin No. 19, February 1951)**

LABORATORY REPORT

Water Analyses **Minidoka North Side Pumping Division**

Sample No.	pH	ECx10^6 @25°C	Boron p.p.m.	Anions, m.e./l.				Cations, m.e./l.				Residual Na_2CO_3 m.e./l.	SAR	Salinity Laboratory Rating
				CO_3	HCO_3	Cl	SO_4	Ca	Mg	Na	K			
Drainage Water 1/														
M-1	5.85	770	0.08	0.00	5.58	1.09	0.34	4.17	2.83	2.07	0.52	none	1.11	C3 - S1
M-2	7.60	600	0.04	0.00	4.88	0.85	1.17	3.79	1.91	3.18	0.22	none	1.88	C2 - S1
M-3	7.70	540	0.08	0.00	4.71	0.65	0.98	3.71	1.78	1.08	0.19	none	0.65	C2 - S1
M-4	7.85	700	0.08	0.00	5.88	1.04	1.46	3.82	2.24	2.08	0.26	none	1.20	C2 - S1
M-5	7.75	640	0.04	0.00	5.62	0.99	1.34	3.62	2.63	1.27	0.26	none	0.72	C2 - S1
M-6	7.80	770	0.08	0.00	6.20	1.20	1.94	3.44	3.45	2.43	0.32	none	1.31	C3 - S1

M-1 On bridge, main highway W. of N-1/4 Cor., Sec. 32, T. 9 S., R. 23 E.

M-2 On main highway bridge near mid. Sec. 31, T. 9 S., R. 24 E.

M-3 From bridge near N.W. Cor. Sec. 27, T. 9 S., R. 24 E.

M-4 Near N.W. Cor. Sec. 3, T. 10 S., R. 24 E.

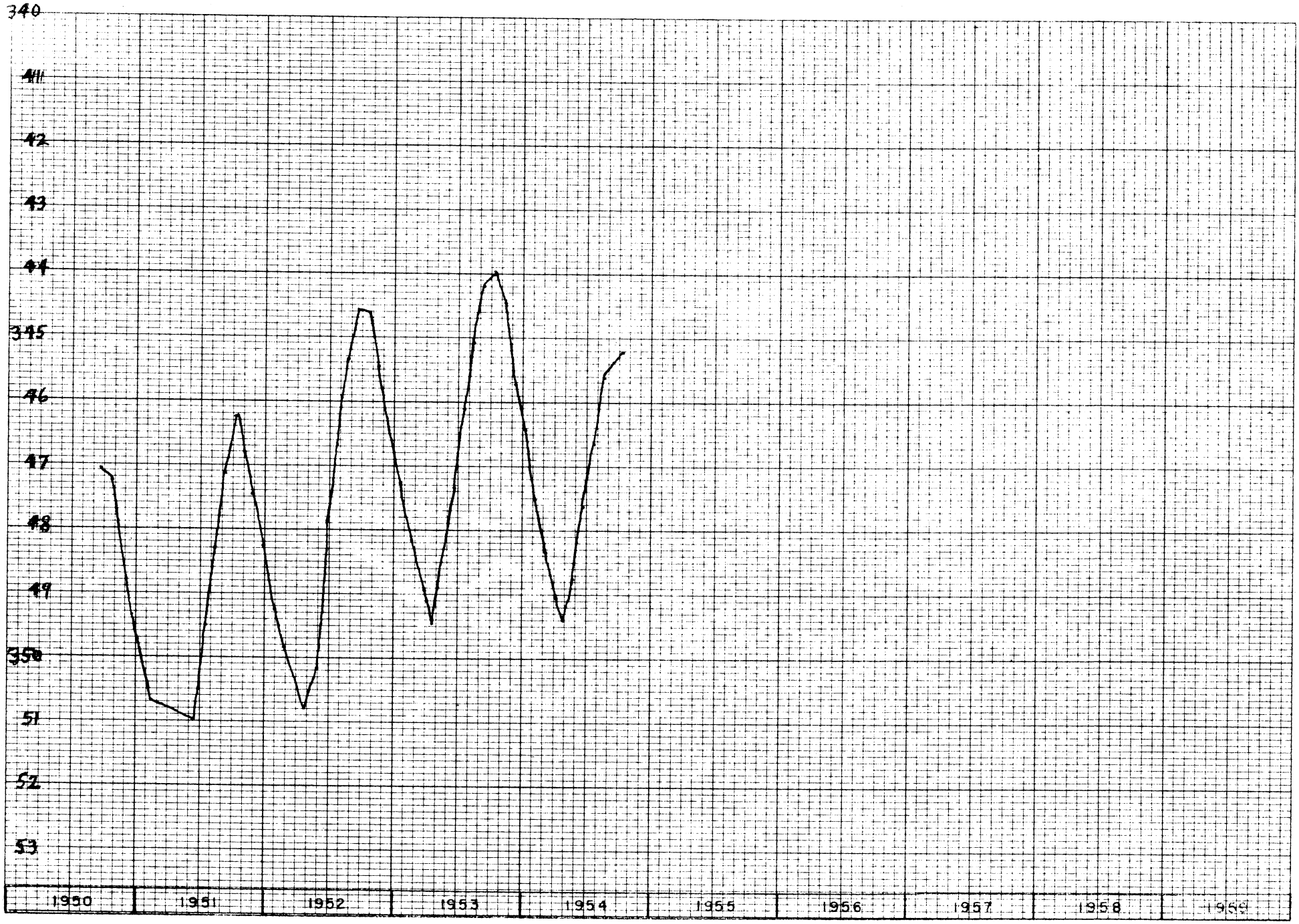
M-5 From bridge near E-1/4 Cor. Sec. 10, T. 10 S., R. 23 E.

M-6 From bridge near N-1/4 Cor. Sec. 14, T. 10 S., R. 23 E.

1/ Analyses by U.S.B.R. Regional Laboratory, Boise, Idaho, December 4, 1947.

NO. 340-34 DIETZGEN GRAPH PAPER
12 X 20 PER INCH

EUGENE DIETZGEN CO.



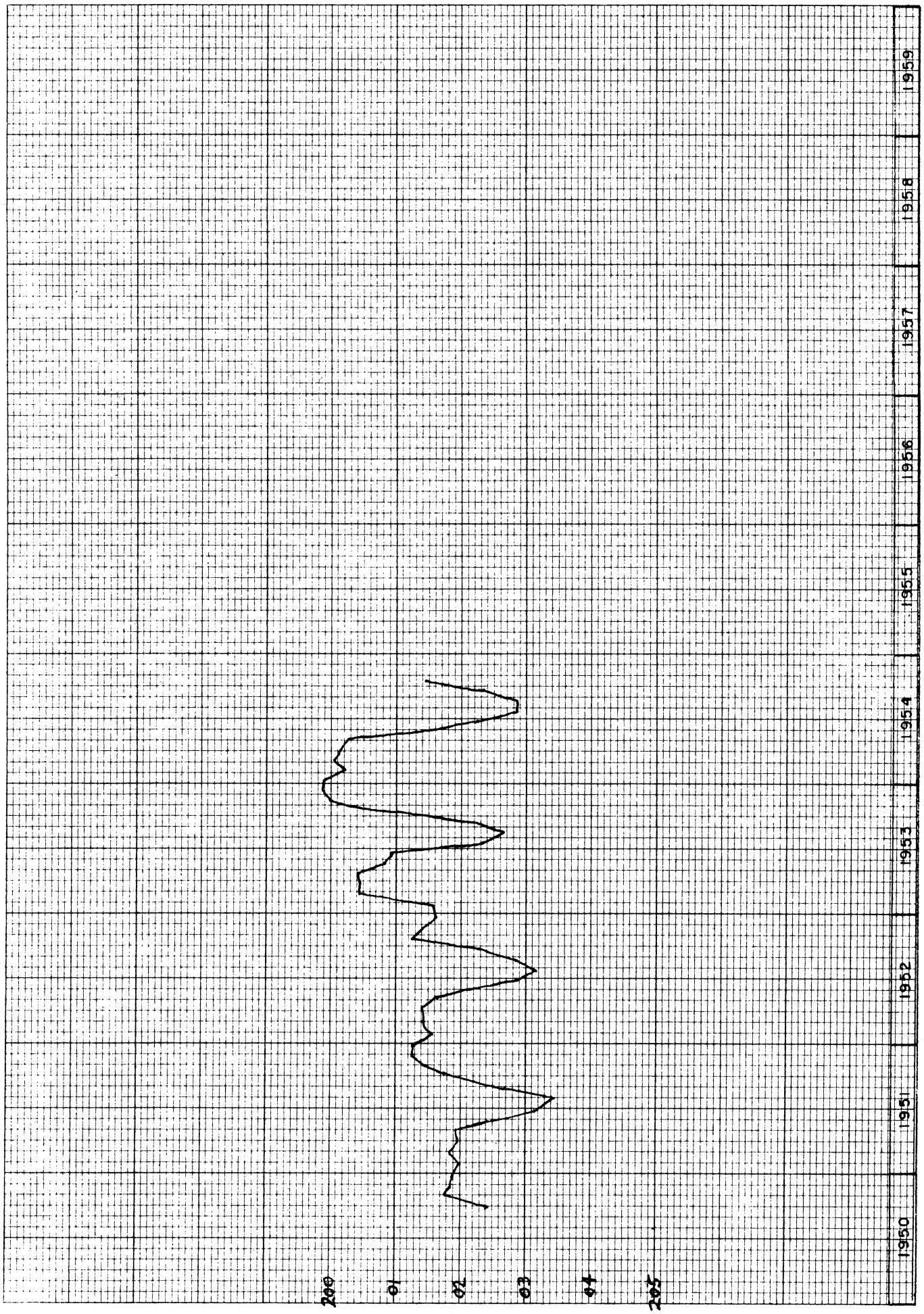
DEPTH TO WATER - feet below measuring point

MINIDOKA PROJECT, IDAHO Owner USBR No. Obs. 1 U.S.G.S. Well No. 9S20E-1da1

(Subtract 50 ft. from USBR elevations

ELEVATIONS ~~USGS~~ DATUM: Measuring Point 4262.99 Land Surface 4261.29

MINIDOKA PROJECT, IDAHO Owner USBR No. Obs. 2 Well No. 8S 23E-2ba1



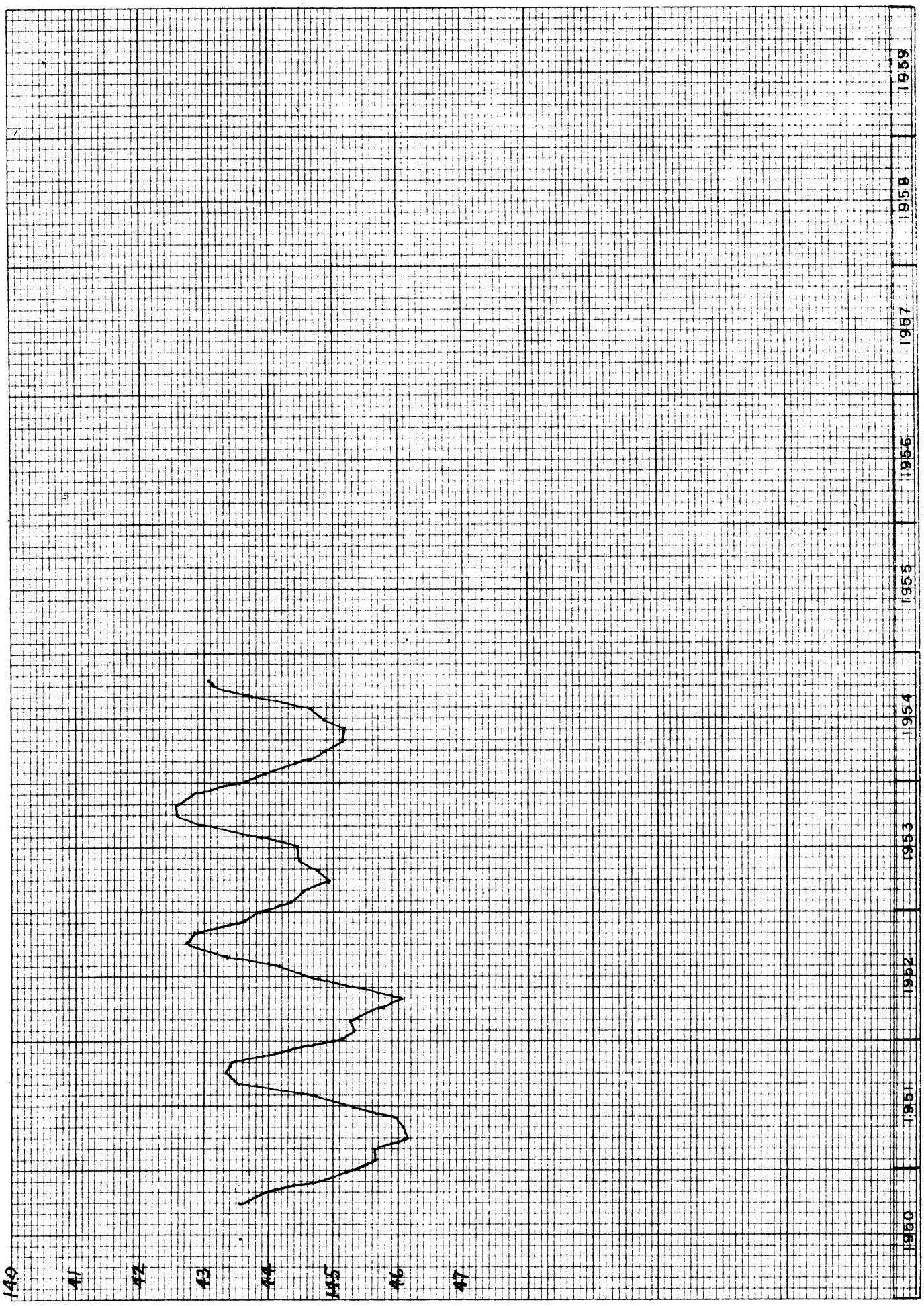
(Subtract 50 ft. from USBR elevations

4313.62

4315.52

EUGENE DIETZGEN CO.
NO. 340-34 DIETZGEN GRAPH PAPER
12 X 20 PER INCH

MINIDOKA PROJECT, IDAHO Owner USBR No. obs. 3 U.S.G.S. Well No. 8S 24E-31dc1



ELEVATIONS ~~MSL~~. DATUM: Measuring Point 4278.29 Land Surface 4276.49

(Subtract 50 ft. from USBR elevations

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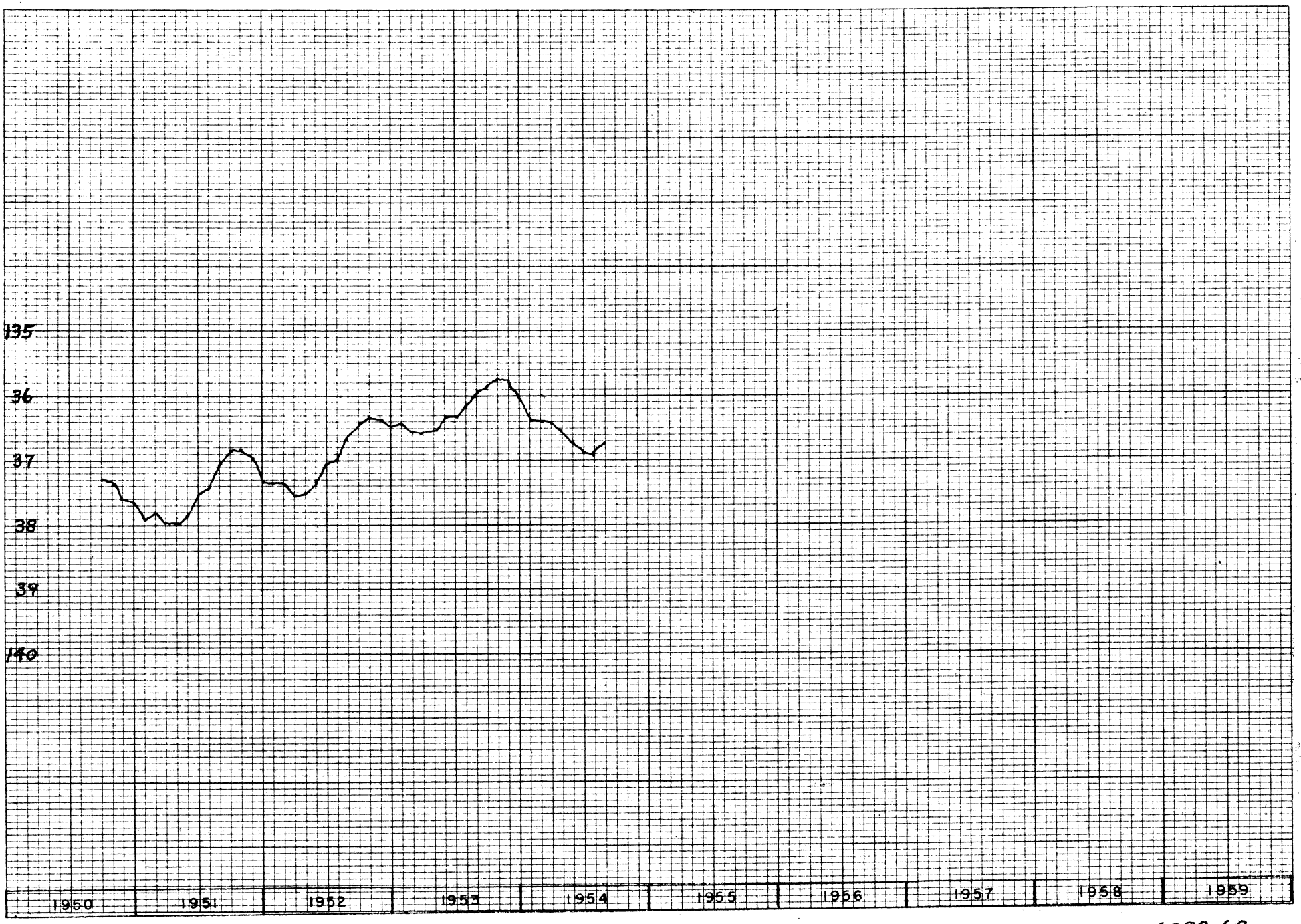
EUGENE DIETZGEN CO.

NO. 340-34 DIETZGEN GRAPH PAPER
12 X 20 PER INCH

EUGENE DIETZGEN CO.
MADE IN U.S.A.

MINIDOKA PROJECT, IDAHO Owner USBR No. Obs. 4 U.S.G.S. Well No. 8S 25E-24bd1

DEPTH TO WATER — Feet Below Measuring Point

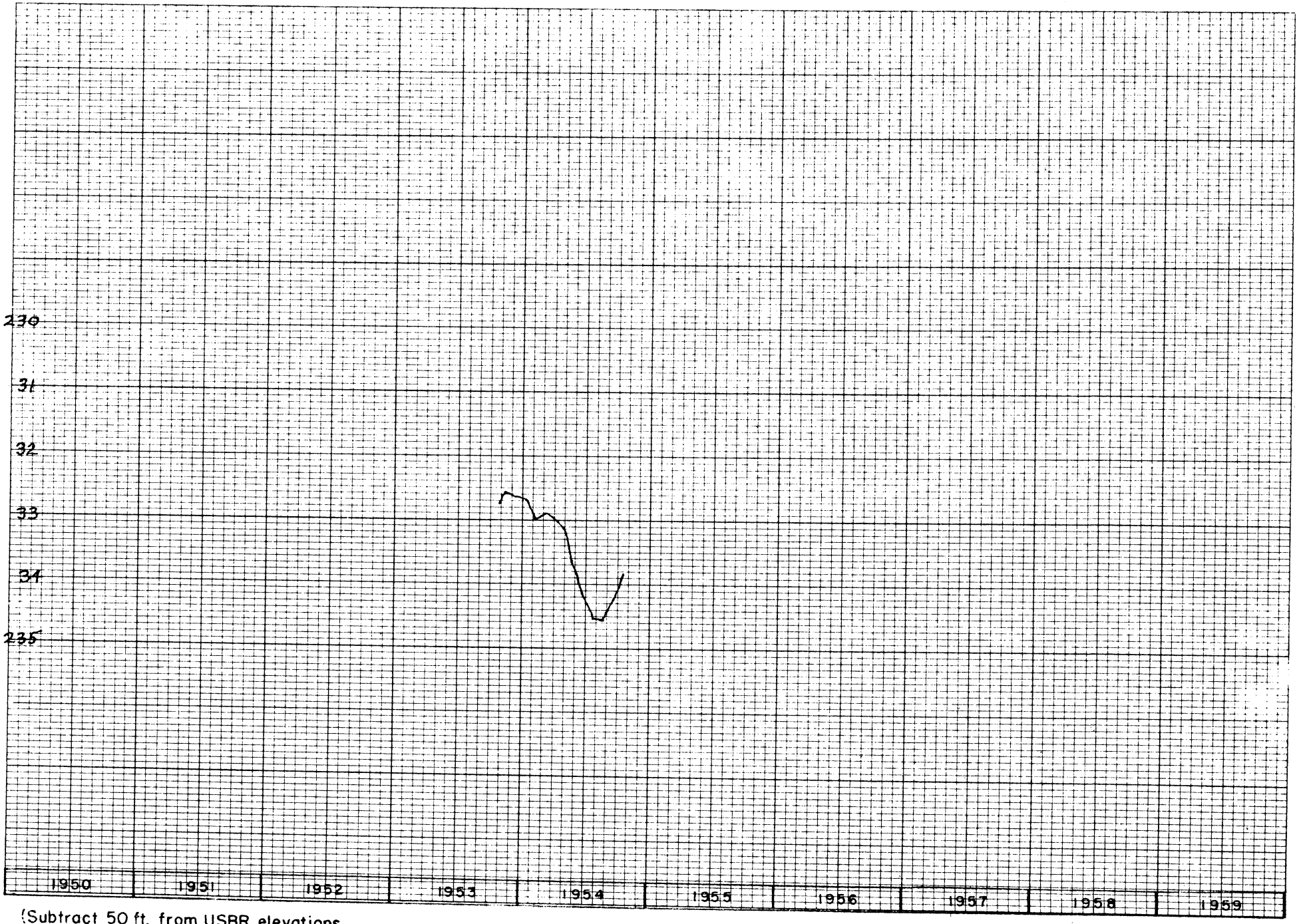


(Subtract 50 ft. from USBR elevations to get Mean Sea Level elevations)

ELEVATIONS ~~MSL~~ U.S.B.R. DATUM: Measuring Point 4284.78, Land Surface 4282.68

NO. 340-34 DIETZGEN GRAPH PAPER
12 X 20 PER INCH
EUGENE DIETZGEN CO.

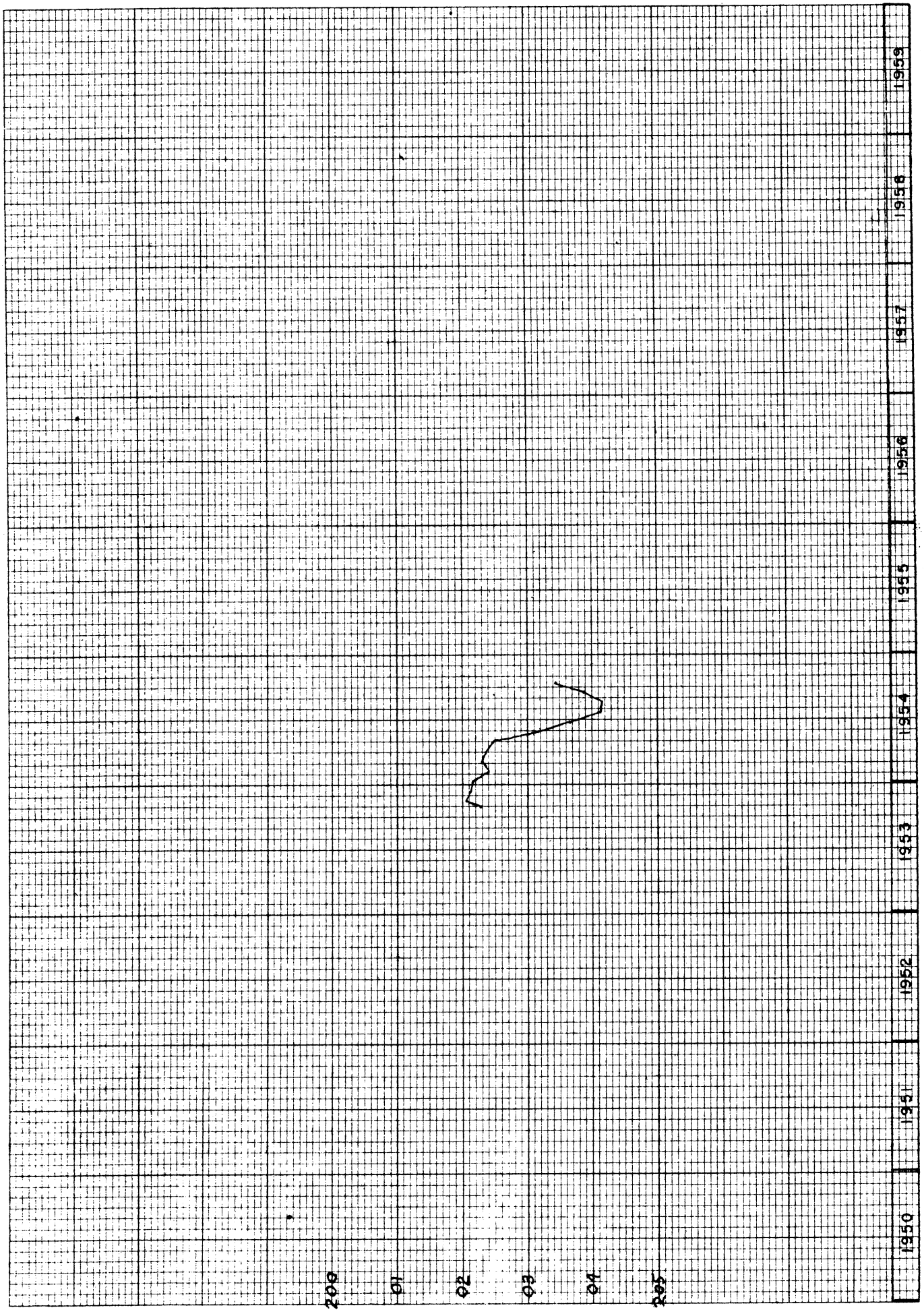
MINIDOKA PROJECT, IDAHO Owner USBR No. Obs. 13 U.S.G.S. Well No. 7S 25E - 19ba1



(Subtract 50 ft. from USBR elevations to get Mean Sea Level elevations)

ELEVATIONS ~~M.S.L.~~ U.S.B.R. DATUM: Measuring Point 4371.01, Land Surface 4370.01

MINIDOKA PROJECT, IDAHO Owner USBR No. Obs. 14 U.S.G.S. Well No. 7S 24E-2ad1



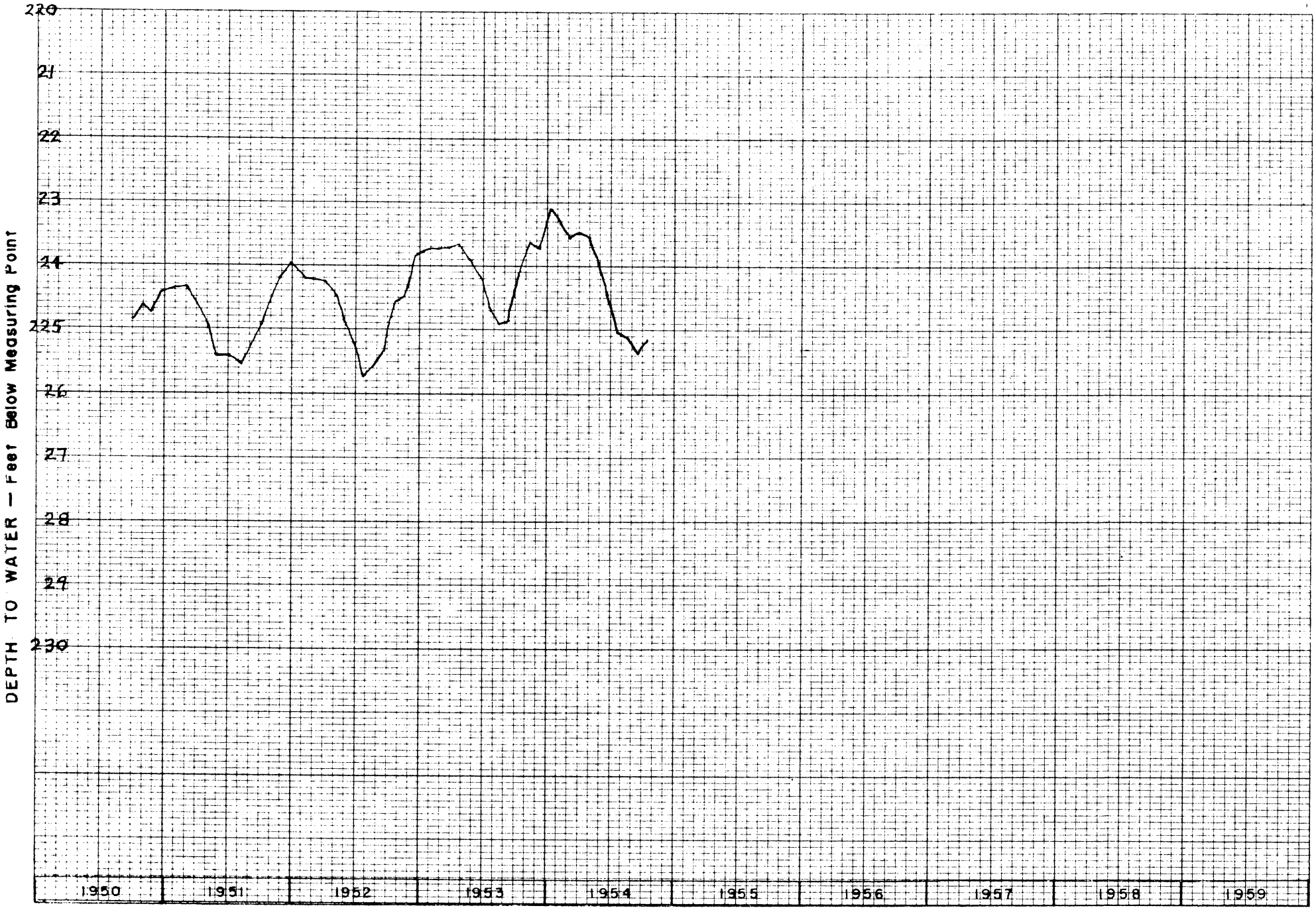
ELEVATIONS ~~USGS~~ USBR DATUM: Measuring Point 4336.80, Land Surface 4335.30

(Subtract 50 ft. from USBR elevations

NO. 340-34 DIETZGEN GRAPH PAPER 12 X 20 PER INCH
EUGENE DIETZGEN CO. MADE IN U.S.A.

NO. 340-34 DIETZGEN GRAPH PAPER
12 X 20 PER INCH
EUGENE DIETZGEN CO.

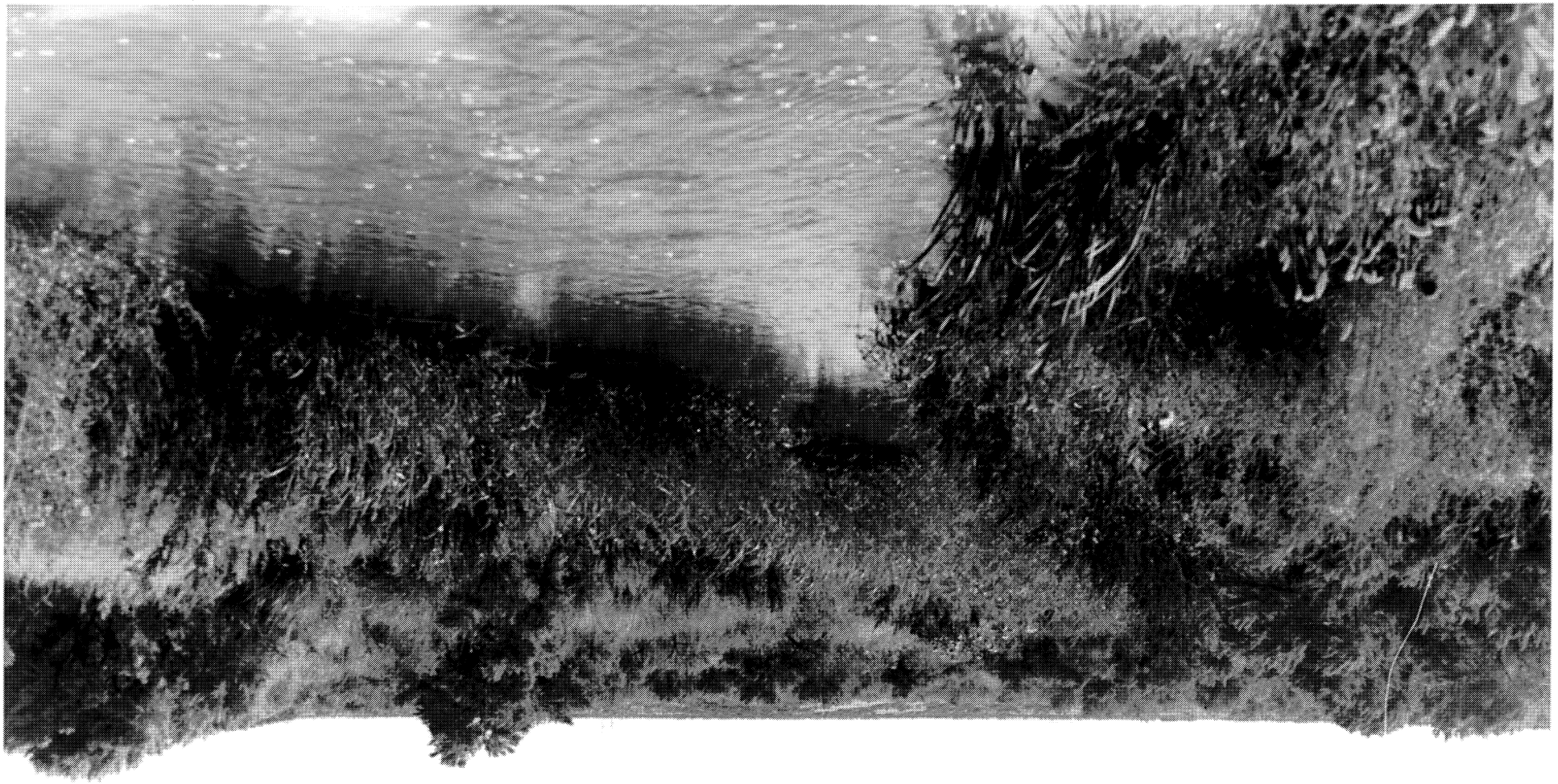
MINIDOKA PROJECT, IDAHO Owner USBR No. P.O.W. Well U.S.G.S. Well No. 9S 22E-33ab1



(Subtract 50 ft. from USBR elevations to get Mean Sea Level elevations)

ELEVATIONS ~~M.S.L.~~ U.S.B.R. DATUM: Measuring Point 4235.20, Land Surface 4234.70

Drain through Section 20, Township 8 South, Range 24 E. About one-half mile upstream from well 20R24. Photograph by O. L. Kime, September 1954.

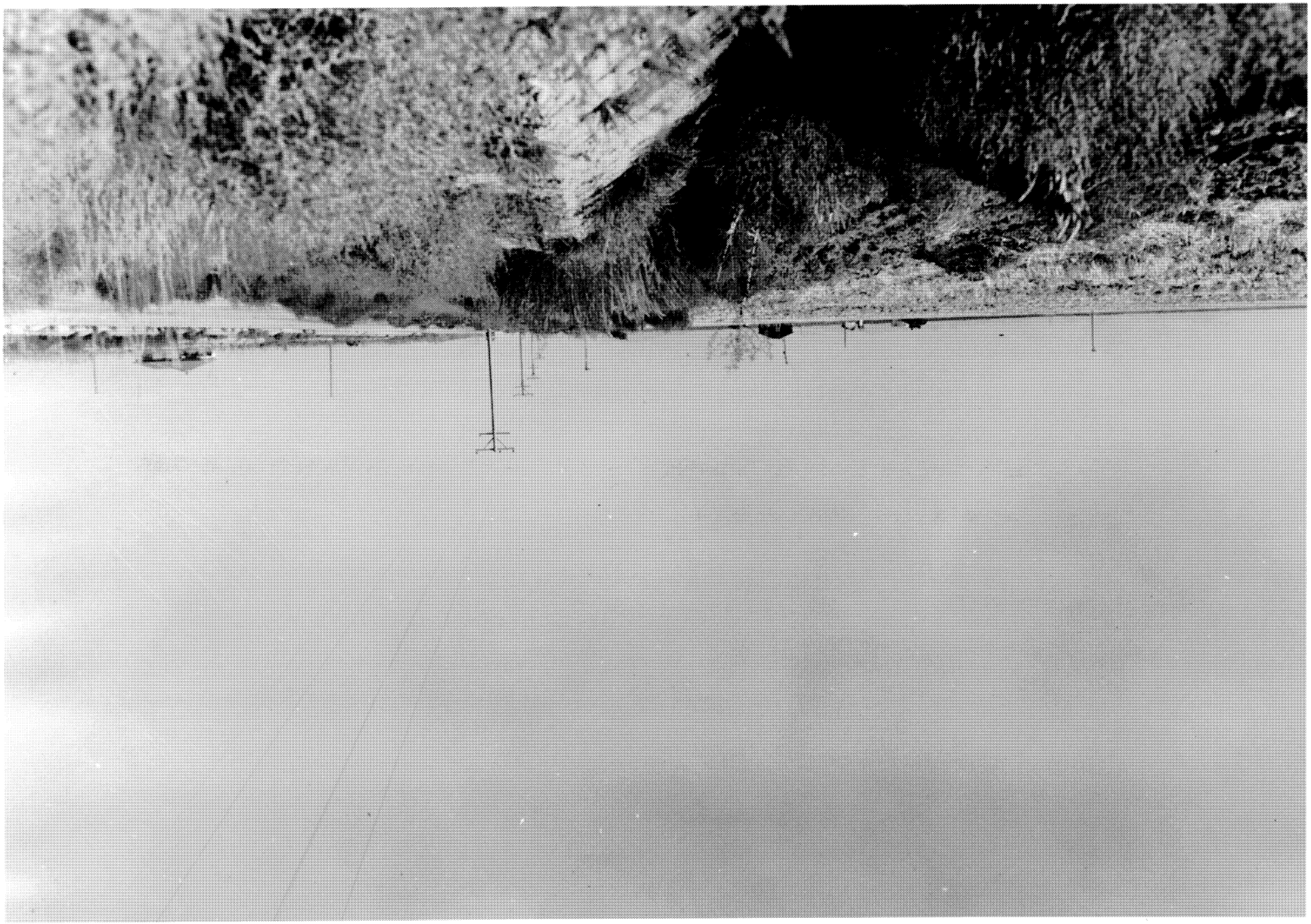


Wasteway on lateral 14A824 to Drain A. Photograph by O. L. Kime, September 1954.

Road culvert on Drain A looking south from a point where the drain crosses the south section line of Section 13, Township 8 South, Range 24 E.
Photograph by O. L. Kime, September 1954.

Natural drain through Section 11, T. 8 S., R. 23 E. Picture taken near the northeast corner of Section 10 looking north. This drainageway will be channelized during project construction. Photograph by O. L. Kime, September 1954.

Natural drain in Section 11, Township 8 South, Range 23 East. Picture taken near the northeast corner of Section 10. This drain will be channelized during project development. Photograph by O. L. Kime, September 1954.

Operating drain through Section 16, Township 8 South, Range 24 East, looking south from the north boundary line of Section 16.
Photograph by O. L. Kime, September 1954.

Drain A between Sections 10 and 11, Township 8 South, Range 24 East, constructed in the fall of 1953.
Photograph by O. L. Kime, September 1954.