USEFUL

IRRIGATION INFORMATION

AND

PUMP DATA

by

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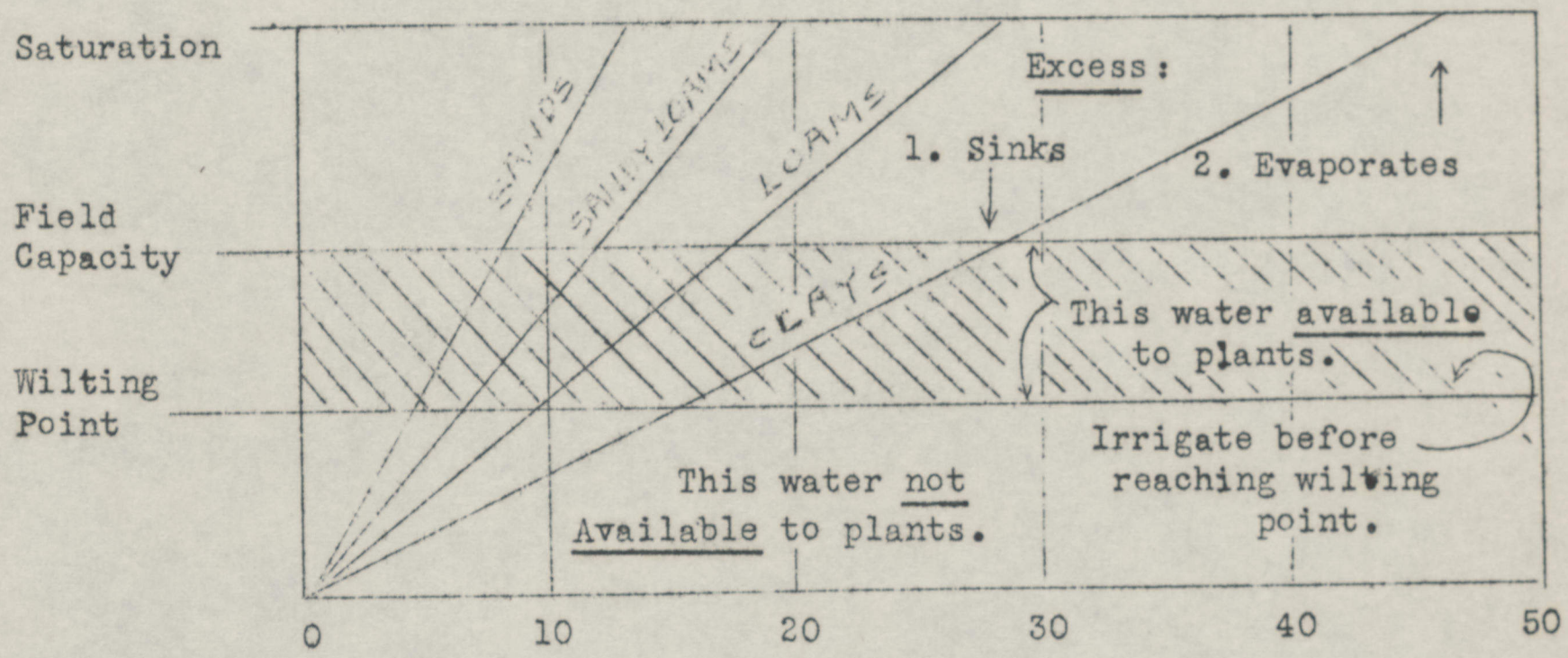
Depth of Water to be Applied to Bring Soil Moisture from Wilting Point to Field Capacity

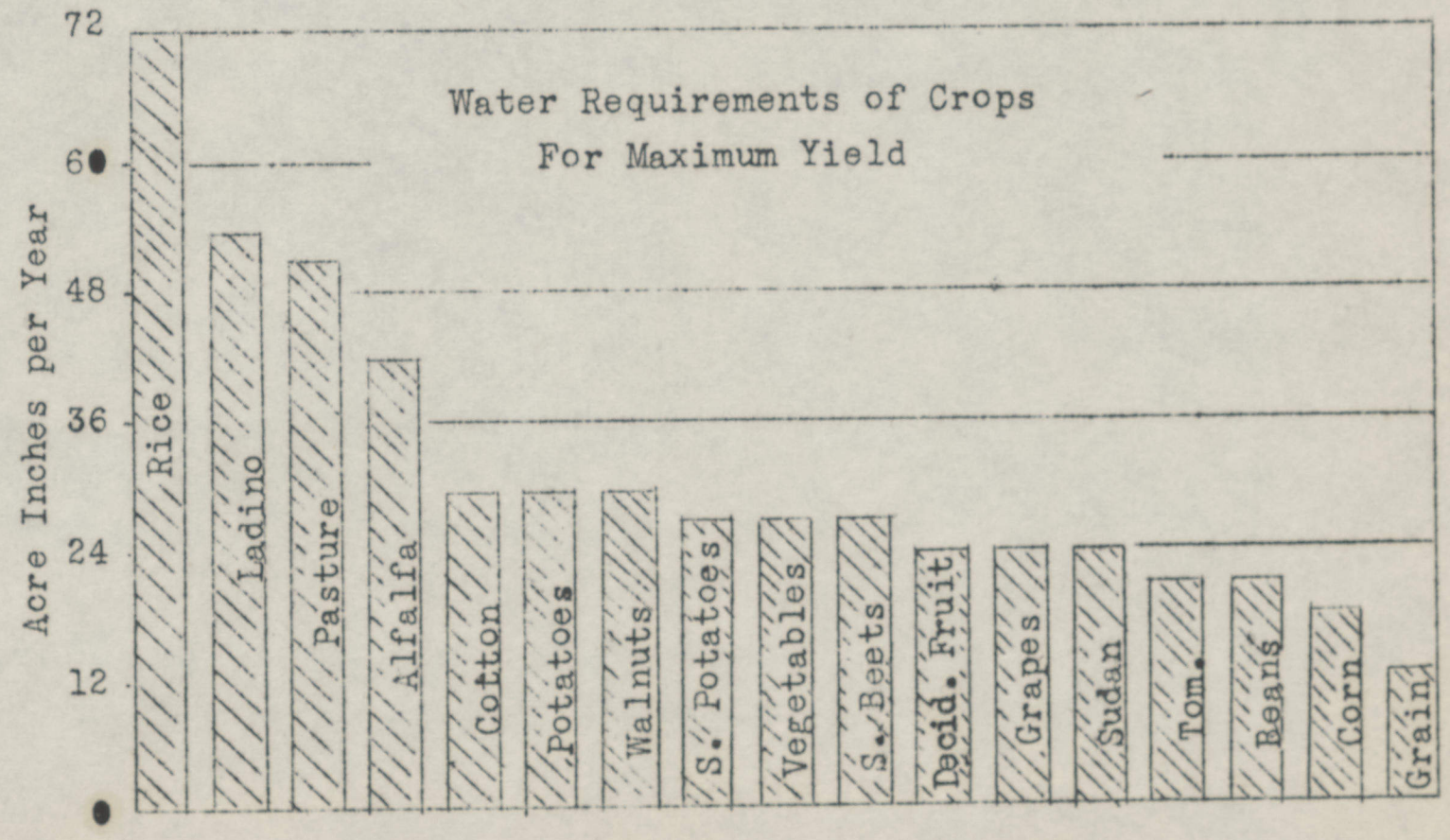
Root zone	Sandy Soil	Loam Soils	Clay Soils
Less than 2 feet	1 - 2 inches	2 - 3 inches	3 - 4 inches
2 - 4 feet	2 - 3 "	4 - 6 "	6 - 9 "
4 - 8 feet	4 - 6 "	8 - 10 "	10 - 14 "

Period Between Irrigations

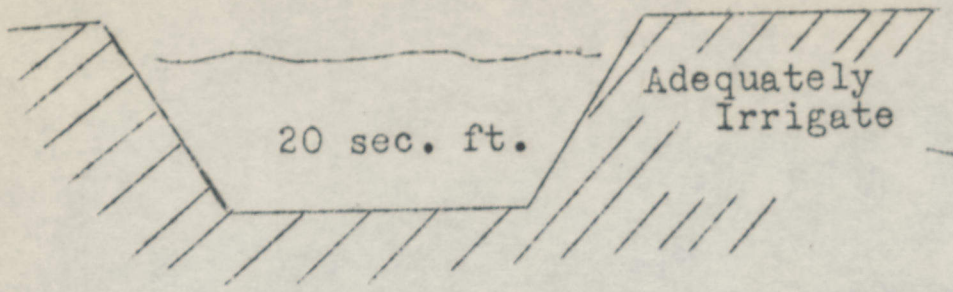
Crop Type	Depth of Available Water Retained in Root Zone			
	1 inch	3 inches	6 inches	12 inches
Heavy user	3 - 6 days	9 - 18 days	18 - 36 days	36 - 72 days
Medium user	4 - 8 "	12 - 24 "	24 - 48 "	48 - 96 "
Light user	6 - 12 "	18 - 36 "	36 - 72 "	72 - 144 "

ONE ACRE INCH OF WATER EQUALS 27,154 GALLONS





EFFECT OF REDUCING HEAD



Ratios to Remember

Soil	Sec. ft.	Irrigates :	Acres/Setting
Sand	20	:	1
Loam	10	:	1
Clay	2	:	1

1 Acre
Sandy Soil
at One Setting

Pump
2 sec. ft.
Adequately
Irrigates
Only

0.1A
Sand

1 second foot
equals
450 gallons per
minute.

BUT

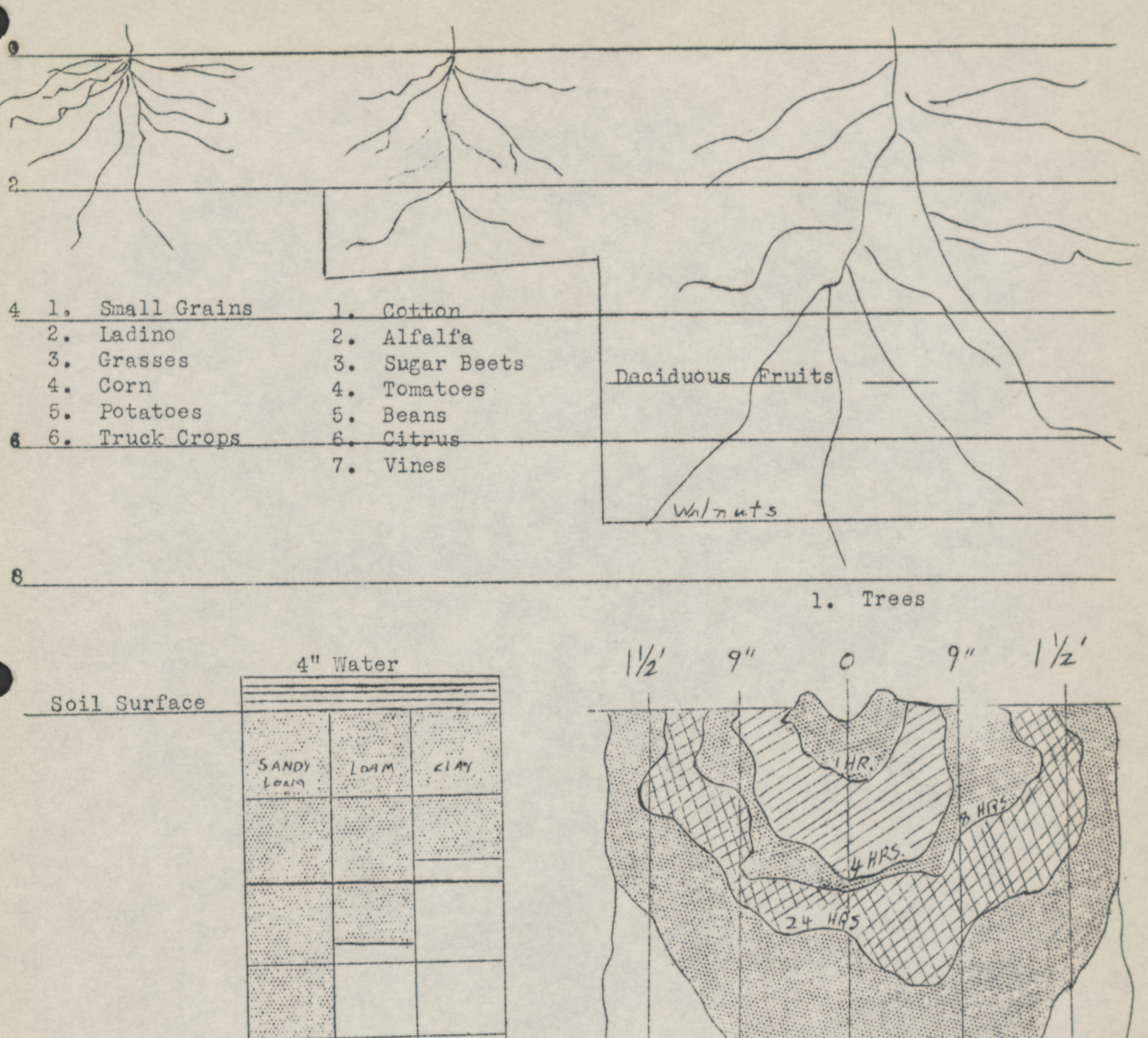
1 Acre
Clay Soil
at One Setting

If checks are too large for smaller head of water, they should be made smaller by shortening or narrowing, or both,

If furrows are too long, shorten them if possible. If not increase unit flow per furrow, or cut down number of furrows irrigated at one time.

ROOT TYPES

Effective Depths from Which Roots Absorb Water



AVERAGE WATER PENETRATION

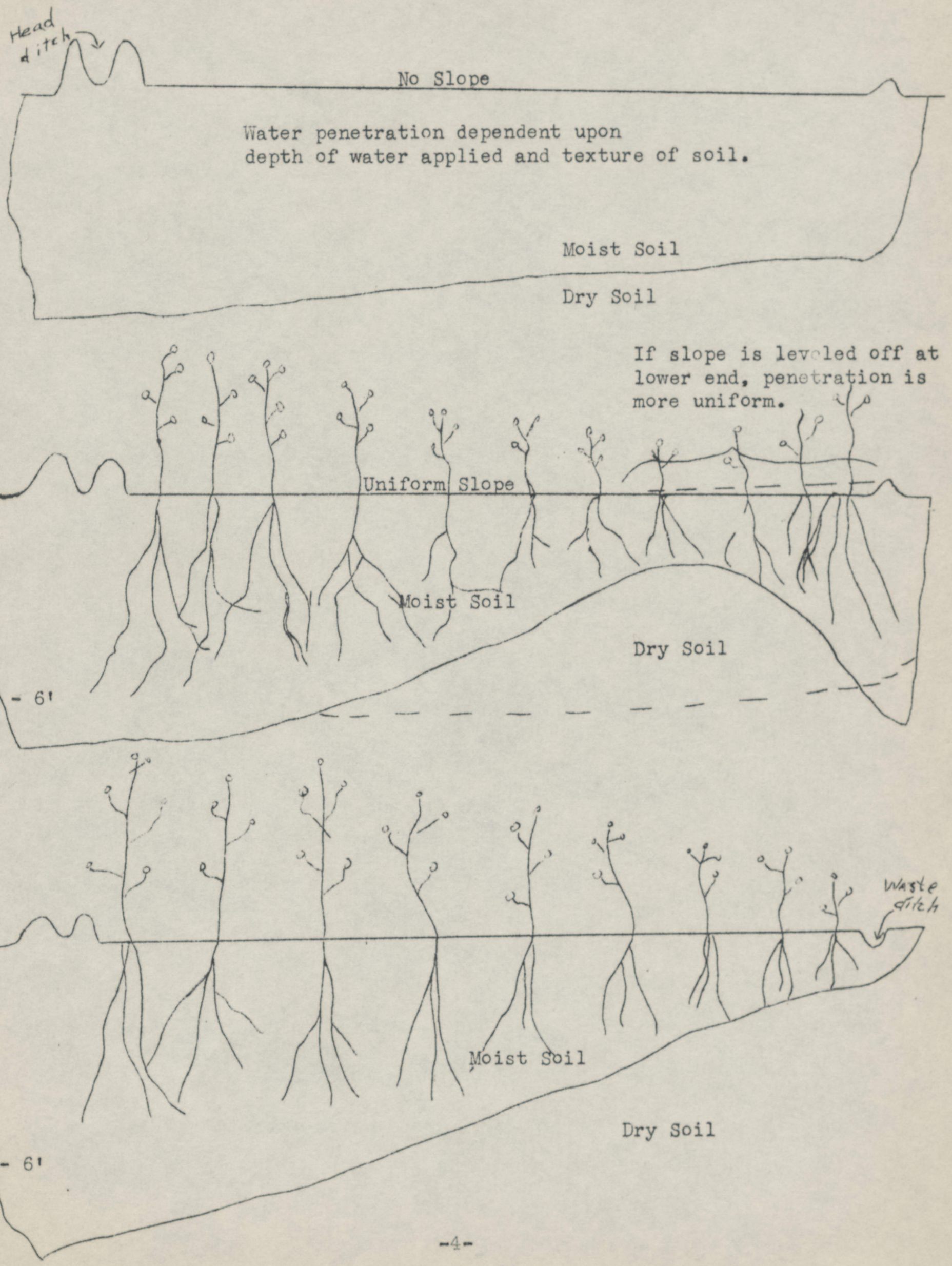
After 4"
Irrigation

DISTRIBUTION OF WATER

In a well drained clay loam soil,
under continuous water application.

PENETRATION OF WATER

Penetration of water is roughly proportioned to time water is on surface. Here is shown relative root and top growth of cotton on long borders. (Would be similar for furrows.)



CENTRIFUGAL PUMP FACTS

1. The quantity a centrifugal pump will deliver varies approximately as the speed.
The head it will deliver varies as the square of the speed.
The horse power needed varies as the cube of the speed.

EXAMPLE: At a normal speed of 1750 rpm a pump is designed to deliver 1000 gpm at a total head (suction - lift) of 100' using 40 hp. What will be the result if the pump speed is increased to 1785 rpm?

ANSWER:
Speed ratio = 1785 ÷ 1750 = 1.02
gpm = 1.02 x 1000 = 1020
Head = $(1.02)^2$ x 100 = 104'
H.P. = $(1.02)^3$ x 40 = 42.4

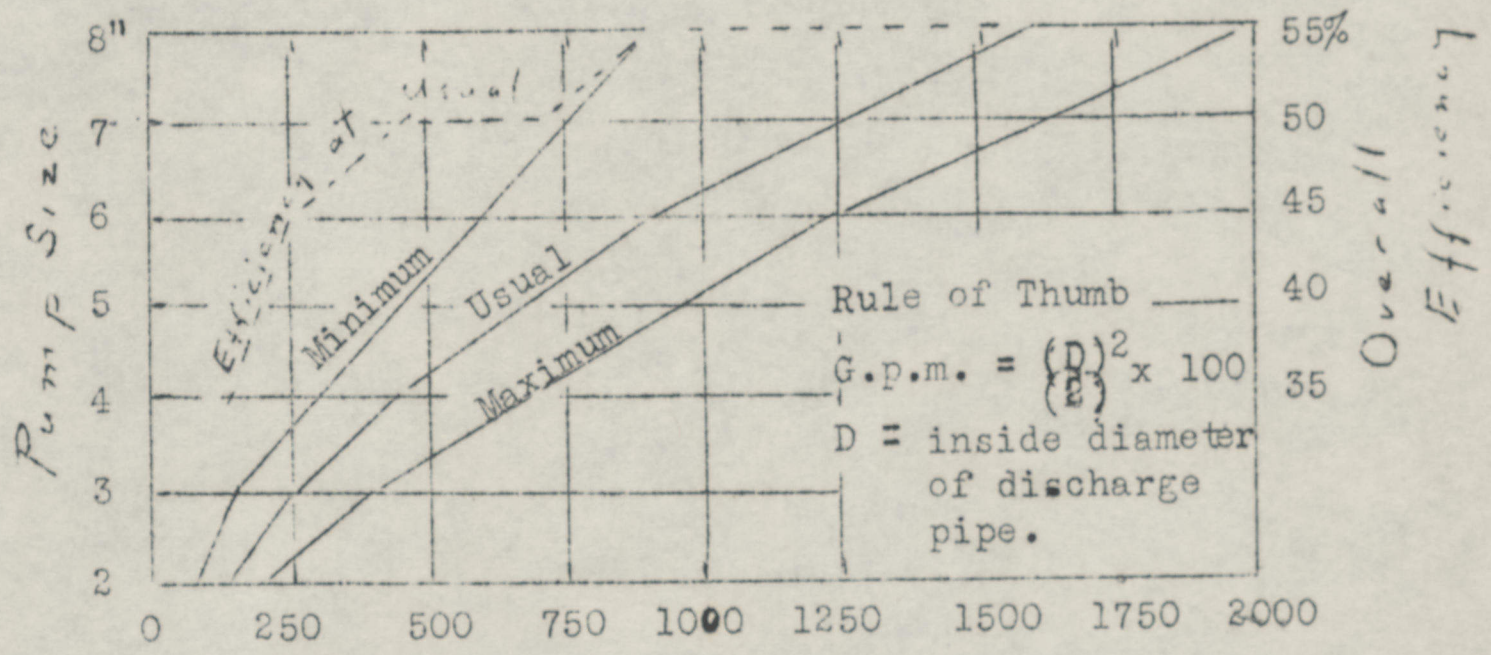
2. Centrifugal pumps must be primed to start.

3. At the time a pump is installed it would probably be most economical to dig a pit as deeply as possible and lower the pump. This would save having to lower it later on during the pumping season when the water table is sure to go down.

4. Under most conditions the pump is best placed at the water table level, the draw-down then becoming the suction lift.

5. Suction lifts as great as 33' at sea level are theoretically possible. However, suction lifts greater than 15' result in decreased efficiency.

6. The greatest efficiency is obtained at the head for which the pump is designed. When operated at same speed, the pump will deliver water at both greater and lesser heads but at a reduced efficiency.



Capacities of Centrifugal Pumps
(Approximate)

SOME CENTRIFUGAL PUMP "IFS"

If after starting the pump it throws a little water at the first few revolutions, and then churns and fails to discharge more, it is just evidence that the air was not all out of the pump and pipes, or the suction lift too great, or a leaky pipe, or a long suction and insufficient discharge head.

If when first started the pump throws a full stream for a few minutes, and then fails, it is caused by failure of supply, or water receeding in the well below the suction limit, which in a well is best determined by a vacuum gauge placed on the suction elbow of the pump. The remedy for this is to lower the pump, thus reducing the suction lift.

If the pump delivers a full stream of water at the surface, or level of the pump, but fails to pump at a higher discharge point, the speed of the pump is too low.

If the pump starts a full stream, and then the discharge decreases very slowly until the pump fails to deliver any water, it is caused by an air leak at the packing gland.

If the pump delivers a full quantity for a few hours and fails, the speed and water supply being unchanged, the suction pipe or impeller is obstructed.

If when running there is a heavy vibration, the shaft has been sprung, the pump is out of alignment or an obstruction has lodged in one side of the impeller.

If the bearings heat unduly, the belt is unnecessarily tight, the bearings lack oil, or there is an end thrust.

The last "If" is, that if the pump is properly installed, and operating, it will positively operate successfully, as the centrifugal is the most simple, most efficient and long-lived water lifting device manufactured.

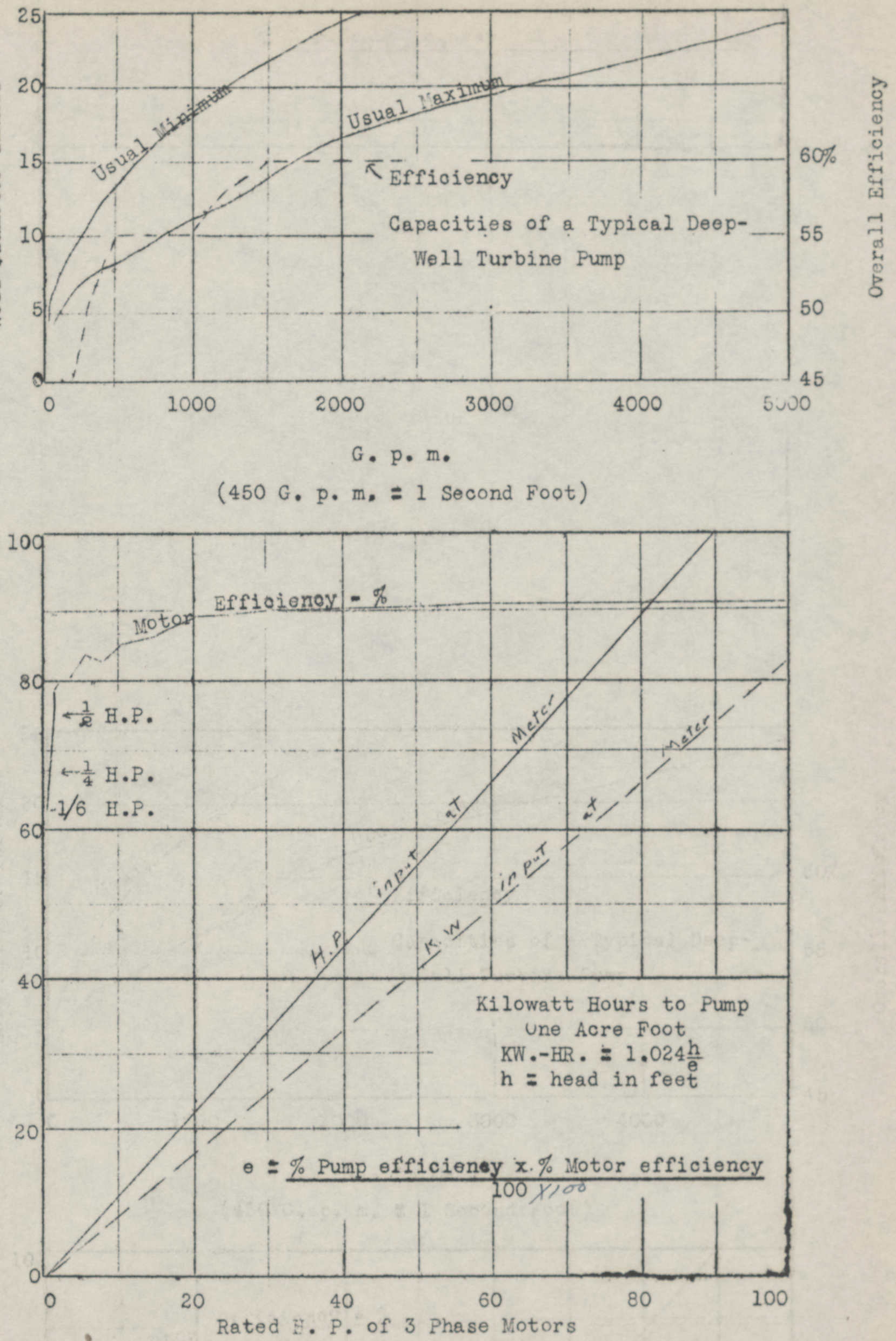
Water should not discharge into a sump or tank near the end of the suction pipe, as there is danger of carrying air down, and into the suction pipe.

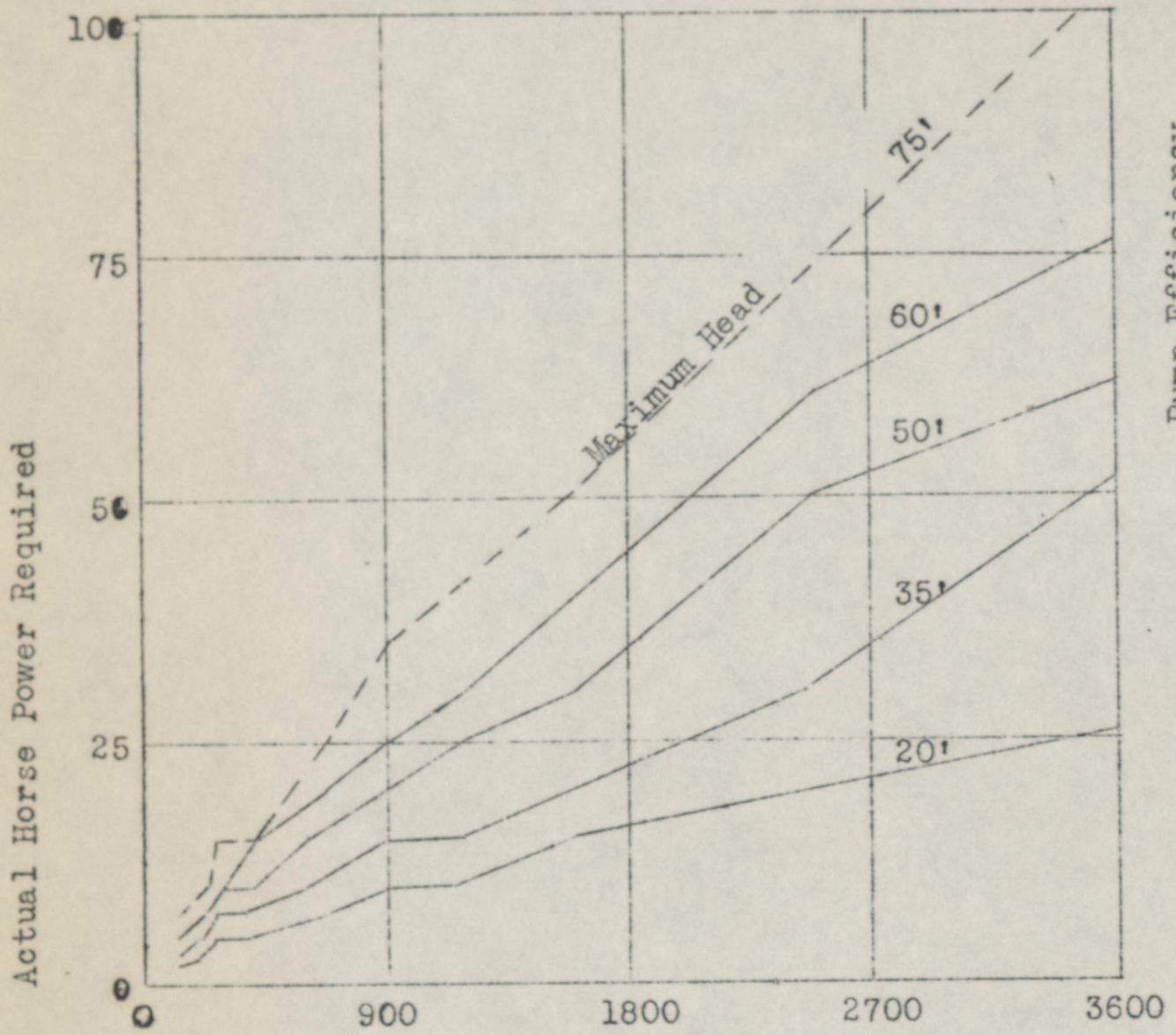
Do not attempt to pump more than the maximum catalog rating of the pump, as that will cause waste of power.

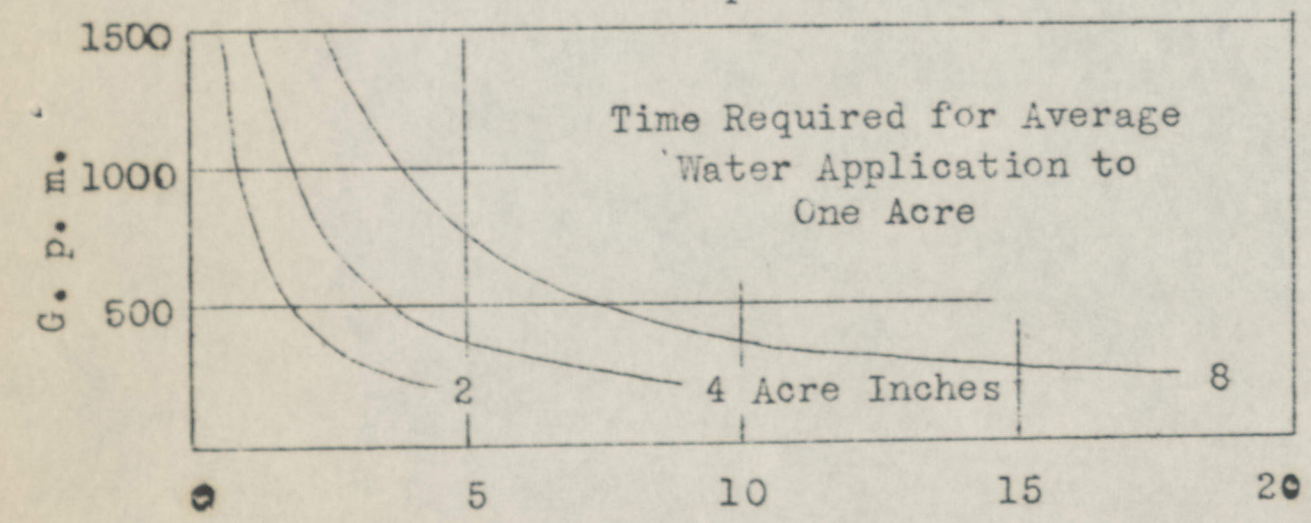
Do not call for help until you are sure none of the above "Ifs" are present.

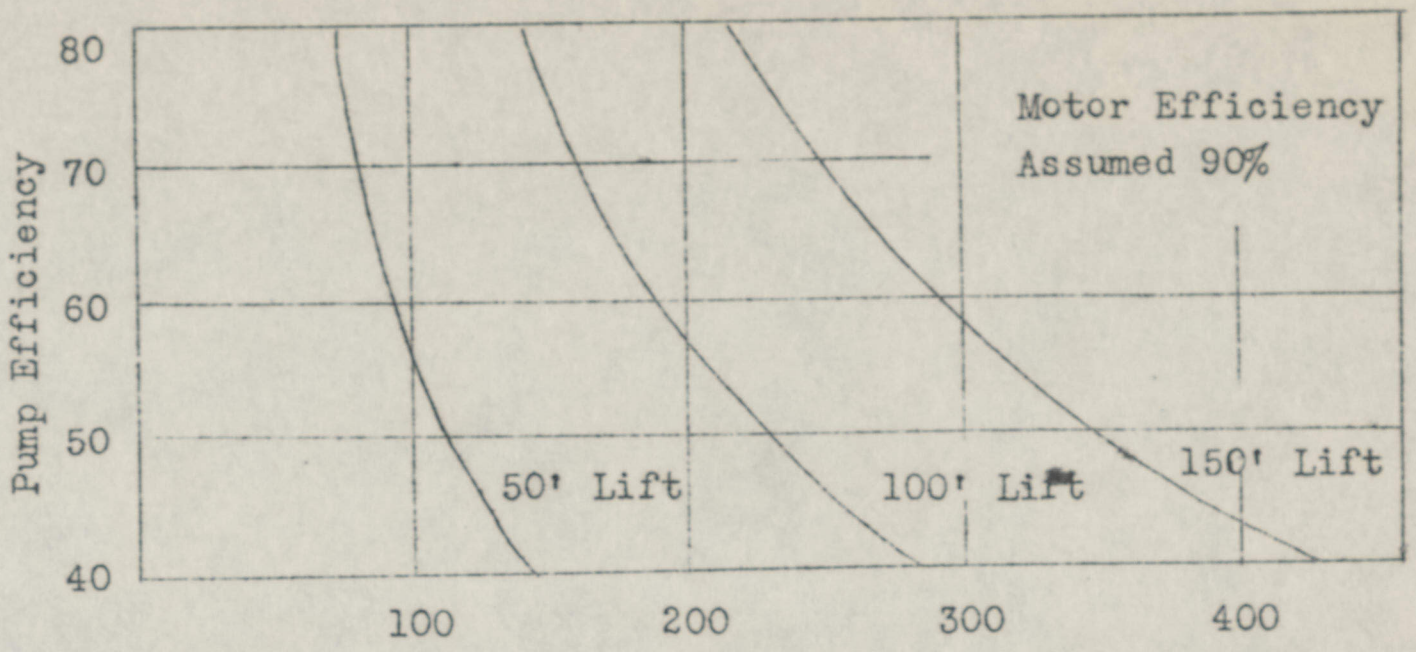
* * * * * *

Discharge--The discharge of a centrifugal pump is fixed by the speed and the design, and not by the service. At a given speed and head, the discharge is fixed by the design. To change the discharge, either the head must change or the speed must change.


Well Diameter-Inches
25
20
15
10
5
0
Usual Minimum
Usual Maximum
Efficiency
Capacities of a Typical Deep-Well Turbine Pump
60%
55
50
45
Overall Efficiency
0
1000
2000
3000
4000
5000
G. p. m.
(450 G. p. m. = 1 Second Foot)
100
80
60
40
20
0
Motor Efficiency - %
← ½ H.P.
← ¼ H.P.
1/6 H.P.
H.P. input at Meter
K.W. input at Meter
Kilowatt Hours to Pump One Acre Foot
KW.-HR. = 1.024 h/e
h = head in feet
e = % Pump efficiency x % Motor efficiency / 100 x 100
0
20
40
60
80
100
Rated H. P. of 3 Phase Motors







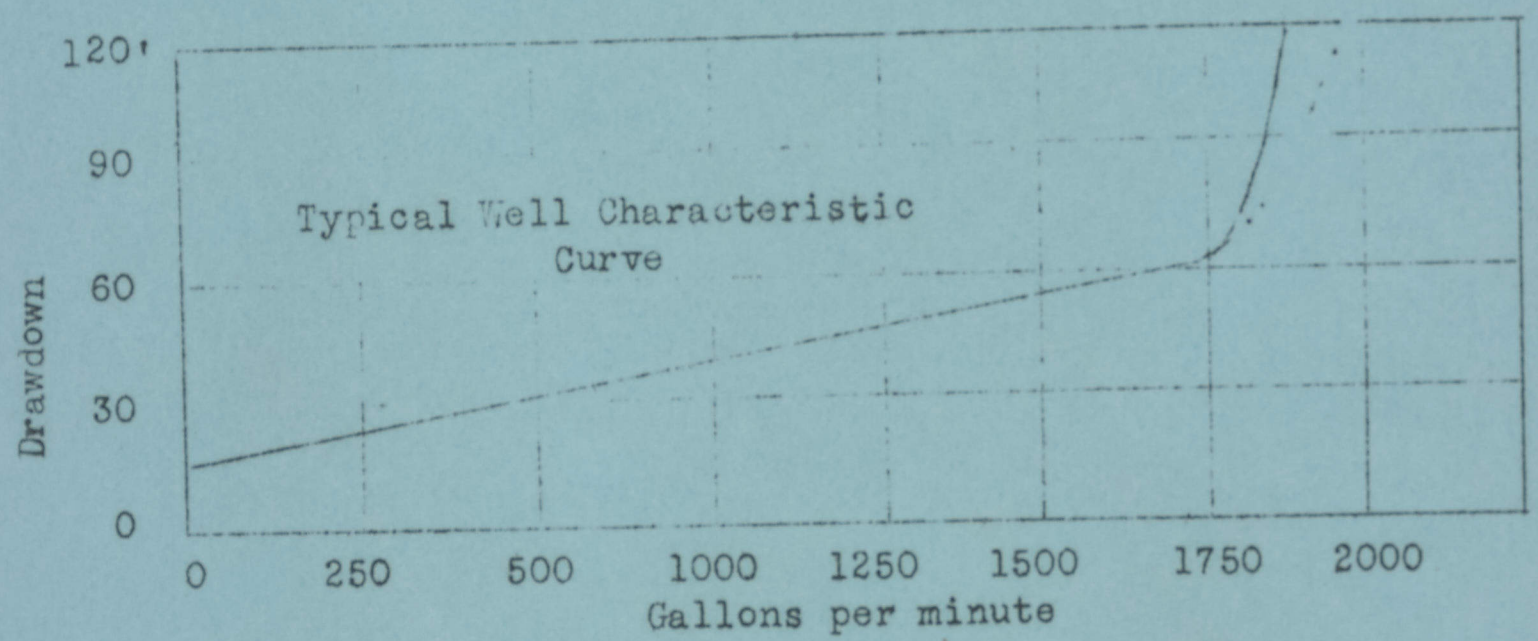
Pump size	Ave. gpm	R.P.M. of Motor Maximum Head 20'	35'	50'	60'	75'
2	100	1740			1740	
2½	150	1120	1120	1740	1740	1740
3	225	850	1120	1740	1740	1740
3½	300	850	1120	1740	1740	1740
4	400	850	1120	1120	1120	1120
5	700	850			1120	1120
	600		1120	1120		
6	900	850	1120	1120	1120	1120
7	1200	695	850	850	850	850
8	1600	695	695	850	850	850
10	2500	565	695	695	695	850
12	3500	565	565	695	695	850

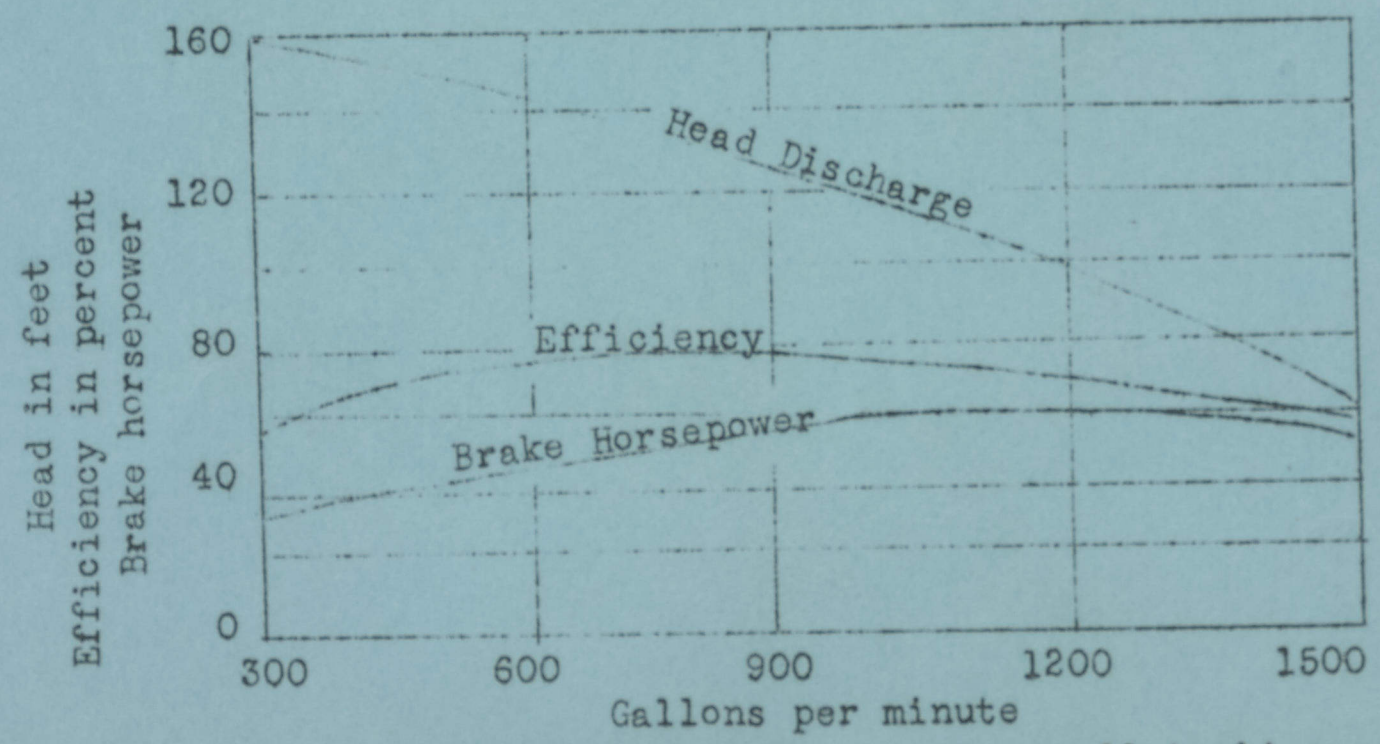
DEEP-WELL TURBINE PUMPS

For every 15-30 feet of lift, add one stage or bowl.

APPROXIMATE PUMP SIZES AND CAPACITIES

Outside Diameter of Bowls	Range of Capacity in Gallons per Minute	Minimum Diameter of Well Which Pump Will Enter	Preferred Minimum Diameter of Well
	(Conventional Semi-Enclosed Type of Impeller)		
5½"	40 - 200	6"	7"
7¼"	125 - 500	8"	10"
9½"	150 - 750	10"	12"
9 15/16"	200 - 900	11"	12"
11¼"	250 - 1350	12"	14"
13½"	400 - 2200	14"	16"
15½"	300 - 3300	16"	18"
17 3/8"	600 - 4000	18"	20"
19 3/8"	750 - 5200	20"	22"
22 3/4"	1000 - 7000	24"	26"
	(Screw or Propeller Type)		
6 3/8"	175 - 475	7"	8"
6 3/8"	200 - 625	7"	10"
7 1/4"	300 - 1100	8"	10"
9 1/4"	500 - 2100	10"	12"
11 1/4"	1000 - 4300	12"	14"
13 1/4"	1400 - 6500	14"	16"





Typical characteristic curves for deep-well turbine pump operating at a constant speed.