Purpose of Investigation

This study was initiated in response to a request by Walter Bergstrom, Resource Management District Supervisor of the Southwest Regional Office, Department of Ecology. The withdrawal of water by Olympic Mall, a shopping center under construction and nine duplexes which are hooked up to this water line, was protested by Westbridge Estates. It was feared that the water table of the area would be drawn down to the extent that the Westbridge well 900 feet away would be adversely affected. To determine possible effects, an aquifer test was conducted by pumping the Olympic Mall well and observing drawdown in both wells.

Location and Physical Features of Area

The Olympic Mall well is located in the NW1/4, NW1/4, NW1/4, of Section 21, Township 21N, Range 2E.W.M. Along the John Reid County Road. Approximately 900 feet S.E. lies the Westbridge Estates Well in the SW1/4, NE1/4, NW1/4, of Section 21, Township 21, Range 2E.W.M. The land slopes to the east and drops abruptly to the Puget Sound approximately 1200 to 1500 feet from the two wells. A third well, owned by the Pedersons, and 1/2 mile south of the Westbridge well was monitored.

The lithology consists of about three or four feet of top soil overlying glacial till with intermixed boulders and sand. Underlying this is about 200+ feet of waterbearing sand and fine pea gravel.

The Westbridge Estate driller's log was used to evaluate much of the data collected in the aquifer test as the Olympic Mall well log was not available.

The log suggests water table conditions. However, water level in the Olympic Mall well is reported to have come up once the water bearing formation had been penetrated. This would indicate artesian conditions in the Olympic Mall well. The overall aquifer then probably can be considered as semi-confined.

Aquifer Testing

Both the Westbridge and the Olympic Mall wells contain 8 inch casing. The former was cased to 250 feet where an 8" Johnson Everdur screen, #25 slot was installed down to 255 feet. The Olympic Mall well was drilled to 259 feet; it is unknown if a screen was installed at the bottom of the casing. During the test the Olympic Mall well was pumped at a discharge rate of 94 gpm. This was maintained throughout the test. The water levels in the Westbridge Estates and Pedersen wells were measured periodically as was the Olympic Mall well. Measuring equipment included soil test electric tapes which were placed in all three wells. The probes were allowed to hang within the well to eliminate as much stretch as possible. The water levels in the wells were found to rise and fall with the rise and fall of the tide in nearby Puget Sound with a change in the water level in the Westbridge and Olympic Mall wells of approximately .01 foot per foot of tidal change. The lag time for a high tide is about 630 to 640 minutes.

The pump was started in the Olympic Mall well at 10:00 hours on October 16, 1974, and flow was measured at 94 gallons per minute (gpm) as determined by timing the discharge into a 50 gallon barrel. A meter, recording discharge

placed in the outlet pipe also was monitored. This method indicated that discharge was maintained at a rate of 91 gpm. Within 1/2 minute of the start of the pump, water level in the Olympic Mall well had dropped over 7 feet (reading corrected for tides) and within five minutes the drawdown was 9.6 feet. In the next 35 minutes drawdown was only .4 feet and continued to decrease until 1300 of the next day when approximate equilibrium was reached. Reaction to pumping did not occur in the Westbridge well until five minutes into the test. Water levels decreased steadily until approximately 0300 of the 17th of October when near equilibrium was achieved after a drawdown of only 0.57 feet (see Table 1 for data). The Pedersen well did not appear to be affected by the pumping of the Olympic Mall well either because of the distance involved or because it is in a different aquifer.

Although existing aquifer conditions do not satisfy all of the assumptions necessary for application of the Theis nonequilibrium equation, this would nevertheless provide the best approximation for evaluation of the aquifer conditions present in the Reid Road area. The superposition of the tidal effects upon the time-drawdown (Figure 1) and time-recovery curves complicates the interpretation of the data. However, after corrections have been made for the tides a nearly steady drawdown can be shown (Figure 2) and a new time-drawdown curve (Figure 3) drawn; a comparison then can be made between this curve and a Theis type curve. The transmissivity and storage coefficients can be determined from corresponding points on the drawdown curve and the Theis curve.

To determine water levels in the observation well (Westbridge) as they relate solely to actual drawdown, the deviations in the curve caused by the tides must be removed. Noting that an incoming tide causes an increase and an outgoing tide causes a decrease in the water level in the well the divergence occurring after 1000 minutes of pumping can be assumed to be principally tidal influence since near equilibrium conditions occur at this time. Observing that the water level peaks occur approximately 630 to 640 minutes after tidal peaks (Figure 4) this then can be referred to as the lag time. A comparison can be made with other points on the tidal curve and a generalized ratio established for increase or decrease of tides to corresponding increase or decrease of the ground water level. It can be determined that for every foot of divergence from a tidal mean a similar change of .01 foot in ground water levels will occur. The true water level in the well when the pump was started is needed to calculate drawdown. Taking into account the time lag, the test was begun approximately at the time of low tide when very little change would result in ground water levels; as the tide moves toward flood a greater value will have to be subtracted from original data values. An original pumping level is established and from this original value corresponding drawdown figures can be subtracted or added to fit the ebb and flow of the tides.

Based upon the time-drawdown data derived from the corrected table (Table 1a), a curve can be plotted using values of $\frac{1440r^2}{t}$, where r = 900 feet, the distance from pumped well to observation well, t = time in minutes since pump started versus drawdown in feet. This curve then can be matched with the Theis type curve and values for transmissivity and storage established. The transmissivity coefficient (T) in this case is 120,651 gallons per day per foot or 1.2×10^5 gpd/ft. A coefficient of storage (S)

of 1.2×10^{-4} is derived and together with T are used to calculate time-distance-drawdown data (Table 2) which are shown graphically in Figure 5.

Because of the proximity of the test wells to Puget Sound, the possibility of salt water intrusion and possible well contamination should be taken into account in well development. From U.S. Geological Survey Topographic Quadrangles, the elevation of both wells above mean sea level (msl) is approximately 220 feet. The water level in each well can be drawn down to nearly 220 feet before a salt water problem may be introduced. It is recommended that a buffer zone of four or five feet above msl be established as a safety margin below which the water level in the wells in the aquifer cannot be drawn.

Conclusions

The data from Table 1a as well as the distance-drawdown graph (Figure 5) indicate that the immediate drawdown in the Olympic Mall well being pumped is due to the inefficiency of the well screen or the well in general. The water level drops nearly ten feet in the pumped well within five minutes of the start of the test and recovers nearly nine feet within 2 minutes of shutdown. The distance-drawdown graph indicates however, that even after 1000 days of pumping, the drawdown 1 foot away (i.e. in the aquifer) from the pumped well will be only 2.5 feet. Figure 6 shows, based upon available data, what will occur if the Olympic Mall well is pumped continuously for 100 days at 250 gpm while the Westbridge Estates well is pumped continuously at 100 gpm. Curve B indicates that drawdown at the pumped well will be 6.8 feet while 900 feet away at the Westbridge well drawdown will be only 4.8 feet.

The amount of water which can be withdrawn without producing undesirable effects is limited in the Reid Road area by the proximity of the wells to the salt water. Withdrawing the water in the wells to a level below sea level will eventually result in upward coning of brackish water and contamination of the fresh water. Mean sea level is equivalent to approximately 220 feet below the pump house floor or about 25 feet below present static water level. To prevent lowering of the water level below this critical depth it is suggested that pump intakes be installed such that no withdrawal is possible below this level.

Table 1
Original Aquifer Test Data - Gig Harbor - Reid Rd.

Minutes	(Time)	Olympic Mall Static Water Level (feet)	Olympic Mall D.D. (feet)	Westbridge (Obs.) Static Water Level (feet)	Westbridge (Obs.) D.D. (feet)	Pedersen (Obs.) Static Water Level (feet)
0	1000	198.41	0.0	195.30	0.0	168.83
.5		205.49	7.08	195.30	0.0	
1.0	1001			195.30	0.0	
1.5				195.30	0.0	
2.0	1002			195.30	0.0	
2.5				195.30	0.0	
3.0				195.30	0.0	
3.5				195.31	0.01	
4.0				195.32	0.02	
4.5		208.0	9.59	195.32	0.02	
5.0	1005			195.32	0.02	
6.0				195.34	0.04	
7.0				195.35	0.05	
8.0				195.37	0.07	
9.0				195.38	0.08	
10.0	1010			195.40	0.10	
11.0				195.40	0.10	
12.0		208.13	9.77	195.41	0.11	
13.0				195.41	0.11	
14.0				195.42	0.12	
15.0	1015	208.19	9.78	195.42	0.12	
18.0		208.24	9.83			
20.0				195.45	0.15	
22.0		208.29	9.88			
25.0		208.30	9.89	195.47	0.17	
30.0	1030	208.35	9.94	195.48	0.18	
35.0		208.37	9.96	195.50	0.20	
40.0		208.41	10.00	195.52	0.22	
45.0		208.41	10.00	195.53	0.23	
50.0		208.43	10.02	195.53	0.23	
60.0	1100	208.47	10.06	195.55	0.25	
70.0		208.48	10.07	195.57	0.27	
80.0		208.50	10.09	195.57	0.27	168.835
90.0	1130	208.51	10.10			
100.0		208.52	10.11	195.58	0.28	
110.0		208.52	10.11	195.59	0.29	
120.0	1200	208.52	10.11	195.59	0.29	
150.0		208.52	10.11	195.59	0.29	
180.0	1300	208.52	10.11	195.59	0.29	168.83
210.0		208.51	10.10			
240.0	1400	208.51	10.10	195.57	0.27	168.83
270.0		208.51	10.10	195.57	0.27	
300.0		208.51	10.10	195.56	0.26	168.80
360.0	1600	208.51	10.10	195.55	0.25	168.82

Minutes	(Time)	Olympic Mall Static Water Level (feet)	Olympic Mall D.D. (feet)	Westbridge (Obs.) Static Water Level (feet)	Westbridge (Obs.) D.D. (feet)	Pedersen (Obs.) Static Water Level (feet)
420.0	1700	208.51	10.10	195.56	0.26	168.81
480.0	1800	208.55	10.14	195.57	0.27	168.81
540.0	1900	208.60	10.19	195.63	0.33	168.85
600.0	2000	208.65	10.24	195.66	0.36	168.80
660.0	2100	208.69	10.28	195.68	0.38	168.80
720.0	2200	208.71	10.30	195.71	0.41	168.80
780.0	2300	208.72	10.31	195.72	0.42	168.80
840.0	0000	208.71	10.30	195.74	0.44	
900.0	0100	208.67	10.26	195.70	0.40	168.82
960.0	0200	208.67	10.26	195.70	0.40	
1020	0300	208.69	10.28	195.68	0.38	168.80
1080	0400	208.69	10.28	195.68	0.38	
1140	0500	208.69	10.28	195.69	0.39	
1200	0600	208.73	10.32	195.72	0.42	
1260	0700	208.76	10.35	195.75	0.45	
1320	0800	208.76	10.35	195.81	0.51	168.92
1380	0900	208.81	10.40	195.81	0.51	
1440	1000	208.82	10.41	195.81	0.51	
1500	1100	208.83	10.42	195.83	0.53	168.96
1560	1200	208.87	10.46	195.81	0.51	168.95
1620	1300	208.85	10.44	195.78	0.48	168.93
1680	1400	208.83	10.42	195.75	0.45	168.88
1740	1500	208.79	10.38	195.72	0.42	168.85
1800	1600	208.77	10.36	195.69	0.39	168.90
1860	1700	208.76	10.35	195.68	0.38	168.85
1920	1800	208.75	10.34	195.68	0.38	168.85
1980	1900	208.78	10.37	195.71	0.41	168.87
2040	2000	208.80	10.39	195.73	0.43	168.88
2100	2100	208.83	10.42	195.76	0.46	
2160	2200	208.85	10.44	195.77	0.47	
2220	2300	208.86	10.45	195.78	0.48	
2280	2400	208.82	10.41	195.78	0.48	
2340	0100	208.79	10.38	195.78	0.48	
2400	0200	208.78	10.37	195.73	0.43	
2460	0300	208.77	10.36	195.71	0.41	
2520	0400	208.72	10.31	195.68	0.38	
2580	0500	208.70	10.29	195.65	0.35	
2640	0600	208.71	10.30	195.68	0.38	
2700	0700	208.73	10.32	195.68	0.38	
2760	0800	208.73	10.32	195.70	0.40	
2820	0900	208.76	10.35			
2880	1000	208.77	10.36	195.72	0.42	

Recovery

Minutes	(Time)	Static Water Level (feet)	Recovery (feet)	Static Water Level (feet)	Recovery (feet)
0	1000	208.77	0.00	195.72	0.00
0.25				195.72	0.00
0.50				195.72	0.00
0.75				195.72	0.00
1.00	1001			195.72	0.00
1.25				195.72	0.00
1.50				195.72	0.00
1.75				195.72	0.00
2.0	1002	199.96	8.81	195.73	-0.01
2.5				195.73	-0.01
3.0	1003	199.36	9.41	195.72	0.00
3.5				195.72	0.00
4.0		199.36	9.41	195.72	0.00
4.5				195.72	0.00
5.0	1005	199.33	9.44	195.71	0.01
6.0				195.70	0.02
7.0				195.69	0.03
8.0				195.68	0.04
9.0				195.67	0.05
10.0	1010			195.66	0.06
11.0				195.65	0.07
12.0		199.33	9.44	195.64	0.08
13.0		199.10	9.67	195.63	0.09
14.0		199.07	9.70	195.63	0.09
15.0	1015	199.05	9.72	195.62	0.10
20.0		198.99	9.78	195.59	0.13
25.0		198.95	9.82	195.57	0.15
30.0	1030	198.91	9.86	195.54	0.18
35.0		198.90	9.87	195.52	0.20
40.0		198.88	9.89	195.52	0.20
45.0		198.86	9.91	195.50	0.22
50.0		198.84	9.93	195.49	0.23
60.0	1100	198.82	9.95	195.48	0.24
70.0		198.80	9.97	195.46	0.26
80.0		198.79	9.98	195.45	0.27
90.0	1130	198.78	9.99	195.44	0.28
100.0		198.76	10.01	195.43	0.29
110.0		198.75	10.02	195.42	0.30
120.0	1200	198.73	10.04	195.41	0.31
150.0		198.70	10.07	195.38	0.34
180.0	1300	198.66	10.11	195.35	0.37
210.0		198.62	10.15	195.33	0.39
240.0	1400	198.66	10.11	195.30	0.42
300.0	1500	198.55	10.22	195.27	0.45
360.0	1600	198.52	10.25	195.25	0.47
420.0	1700	198.47	10.30	195.21	0.51
480.0	1800	198.45	10.32	195.18	0.54
540.0	1900	198.44	10.33	195.16	0.56

Table 1A
Aquifer Data Corrected for Tides

Minutes	(Time)	Olympic Mall Static Water Level (feet)	Olympic Mall D.D. (feet)	Westbridge (Obs.) Static Water Level (feet)	Westbridge (Obs.) D.D. (feet)	$\frac{1440r^2}{t}$
0		198.48	0.0	195.37	0.0	
0.5		205.56	7.08			
2.0					0.0	5.83×10^8
3.5					0.01	3.33×10^8
4.0					0.02	2.92×10^8
4.5		208.07	9.59			
5.0					0.02	2.33×10^8
6.0					0.04	1.94×10^8
7.0					0.05	1.67×10^8
8.0					0.07	1.46×10^8
9.0					0.08	1.30×10^8
10.0				195.47	0.10	1.17×10^8
11.0					0.10	1.06×10^8
12.0		208.25	9.77		0.11	9.72×10^7
13.0					0.11	8.97×10^7
14.0					0.12	8.33×10^7
15.0		208.26	9.78		0.12	7.78×10^7
18.0			9.83			
20.0					0.15	5.83×10^7
22.0			9.88			
25.0			9.89		0.17	4.67×10^7
30.0			9.94		0.18	3.89×10^7
35.0			9.96	195.57	0.20	3.33×10^7
40.0			10.00		0.22	2.92×10^7
45.0			10.00	195.60	0.23	2.59×10^7
50.0			10.02		0.23	2.33×10^7
60.0	1100		10.06		0.25	1.94×10^7
70.0			10.07		0.27	1.67×10^7
80.0			10.09		0.27	1.46×10^7
90.0			10.10			
100.0	1140	208.59	10.11		0.28	1.17×10^7
110.0			10.11		0.29	1.06×10^7
120.0	1200		10.12		0.30	9.72×10^6
150.0			10.13		0.31	7.78×10^6
180.0	1300		10.14		0.32	6.48×10^6
210.0			10.15		0.33	5.55×10^6
240.0	1400		10.16		0.34	4.86×10^6
270.0			10.18		0.36	4.32×10^6
300.0	1500		10.19		0.37	3.89×10^6
360.0	1600		10.21		0.39	3.24×10^6
420.0	1700		10.23		0.41	2.78×10^6
480.0	1800		10.24		0.42	2.43×10^6
540.0	1900		10.27		0.45	2.16×10^6
600.0	2000		10.29		0.47	1.94×10^6
660.0	2100		10.31		0.47	1.77×10^6

Minutes	(Time)	Olympic Mall Static Water Level (feet)	Olympic Mall D.D. (feet)	Westbridge (Obs.) Static Water Level (feet)	Westbridge (Obs.) D.D. (feet)	$\frac{1440r^2}{t}$
720.0	2200		10.32	195.87	0.50	1.62×10^6
780.0	2300		10.33		0.51	1.50×10^6
840.0	2400		10.35		0.53	1.39×10^6
900.0	0100		10.36		0.54	1.30×10^6
960.0	0200		10.37		0.55	1.22×10^6
1020	0300		10.39		0.57	1.14×10^6
1080	0400		10.39		0.57	1.08×10^6
1140	0500		10.39		0.57	1.02×10^6
1200	0600		10.41		0.57	9.72×10^5
1260	0700		10.42		0.57	9.26×10^5
1320	0800		10.42		0.57	8.84×10^5
1380	0900		10.44		0.57	8.45×10^5
1440	1000		10.44		0.57	8.10×10^5
1500	1100		10.45		0.57	7.78×10^5
1560	1200		10.46		0.57	7.48×10^5
1620	1300		10.47		0.57	7.2×10^5
1680	1400		10.47		0.57	6.94×10^5
1740	1500		10.47		0.57	6.7×10^5
1800	1600	208.95	10.47	195.94	0.57	6.48×10^5
1860	1700		10.47		0.57	6.27×10^5
1920	1800		10.47		0.57	6.08×10^5
1980	1900		10.47		0.57	5.89×10^5
2040	2000		10.47		0.57	5.72×10^5
2100	2100		10.47		0.57	5.55×10^5
2160	2200		10.47		0.57	5.40×10^5
2220	2300		10.47		0.57	5.25×10^5
2280	2400		10.47		0.57	5.12×10^5
2340	0100		10.47		0.57	4.98×10^5
2400	0200		10.47		0.57	4.86×10^5
2460	0300		10.47		0.57	4.74×10^5
2520	0400		10.47		0.57	$4,63 \times 10^5$
2580	0500		10.47		0.57	4.52×10^5
2640	0600		10.47		0.57	4.42×10^5
2700	0700		10.47		0.57	4.32×10^5
2760	0800		10.47		0.57	4.23×10^5
2820	0900	208.95	10.47	195.94	0.57	4.14×10^5

Recovery Corrected for Tides

Minutes From Pump Shutdown	Olympic Mall Static Water Level (feet)	Olympic Mall Recovery (feet)	Westbridge (Obs.) Static Water Level (feet)	Westbridge (Obs.) Recovery (feet)
0	208.95	0.0	195.94	0.0
2.0	200.14	8.81		
3.0	199.54	9.41		
5.0	199.51	9.44	195.93	0.01
10.0			195.88	0.06
13.0	199.28	9.67	195.85	0.09
25.0	199.14	9.81	195.80	0.14
50.0	199.03	9.92	195.72	0.22
100.0	198.96	9.99	195.67	0.27
150.0	198.93	10.02	195.65	0.29
180.0	198.90	10.05	195.63	0.31
210.0	198.88	10.07	195.62	0.32
300.0	198.83	10.12	195.59	0.35
360.0	198.81	10.14	195.58	0.36
420.0	198.76	10.19	195.54	0.40
480.0	198.74	10.21	195.52	0.42
540.0	198.71	10.24	195.48	0.46

Table 2
Distance-Drawdown Curves

$u = \frac{1.87\ r^2 S}{Tt}$ $\qquad$ $D = \frac{114.6Q \times W(u)}{T}$

$T = 120{,}651$ gpd/ft. $= 1.2 \times 10^5$

$S = 1.2 \times 10^{-4}$

$r_1 = 1$ ft.
$r_2 = 10$ ft.
$r_3 = 100$ ft.
$r_4 = 1000$ ft.
$r_5 = 10{,}000$ ft.

t = days of pumping

Q = 94 gpm

	Time	U	W(u)	D
One foot from pumped well	1	1.87×10^{-9}	19.5	1.75
	10	1.87×10^{-10}	21.8	1.96
	100	1.87×10^{-11}	24.1	2.16
	1000	1.87×10^{-12}	26.4	2.37
Ten feet from pumped well	1	1.87×10^{-7}	14.9	1.34
	10	1.87×10^{-8}	17.2	1.54
	100	1.87×10^{-9}	19.5	1.75
	1000	1.87×10^{-10}	21.8	1.96
One hundred feet from pumped well	1	1.87×10^{-5}	10.3	0.92
	10	1.87×10^{-6}	12.6	1.13
	100	1.87×10^{-7}	14.9	1.34
	1000	1.87×10^{-8}	17.2	1.54
One thousand feet from pumped well	1	1.87×10^{-3}	5.7	0.51
	10	1.87×10^{-4}	8.0	0.72
	100	1.87×10^{-5}	10.3	0.92
	1000	1.87×10^{-6}	12.6	1.13
Ten thousand feet from pumped well	1	1.87×10^{-1}	1.3	0.12
	10	1.87×10^{-2}	3.4	0.31
	100	1.87×10^{-3}	5.7	0.54
	1000	1.87×10^{-4}	8.0	0.72

Using Q = 100 gpm

	Time	U	W(u)	D
One foot from pumped well	1	1.86×10^{-9}	19.5	1.86
	10	1.86×10^{-10}	21.8	2.08
	100	1.86×10^{-11}	24.1	2.29
	1000	1.86×10^{-12}	26.4	2.51
Ten feet from pumped well	1	1.86×10^{-7}	14.9	1.42
	10	1.86×10^{-8}	17.2	1.63
	100	1.86×10^{-9}	19.5	1.86
	1000	1.86×10^{-10}	21.8	2.08
One hundred feet from pumped well	1	1.86×10^{-5}	10.3	0.98
	10	1.86×10^{-6}	12.6	1.20
	100	1.86×10^{-7}	14.9	1.42
	1000	1.86×10^{-8}	17.2	1.64
One thousand feet from pumped well	1	1.86×10^{-3}	5.7	0.54
	10	1.86×10^{-4}	8.0	0.76
	100	1.86×10^{-5}	10.3	0.98
	1000	1.86×10^{-6}	12.6	1.20
Ten thousand feet from pumped well	1	1.86×10^{-1}	1.3	0.12
	10	1.86×10^{-2}	3.4	0.32
	100	1.86×10^{-3}	5.7	0.54
	1000	1.86×10^{-4}	8.0	0.76

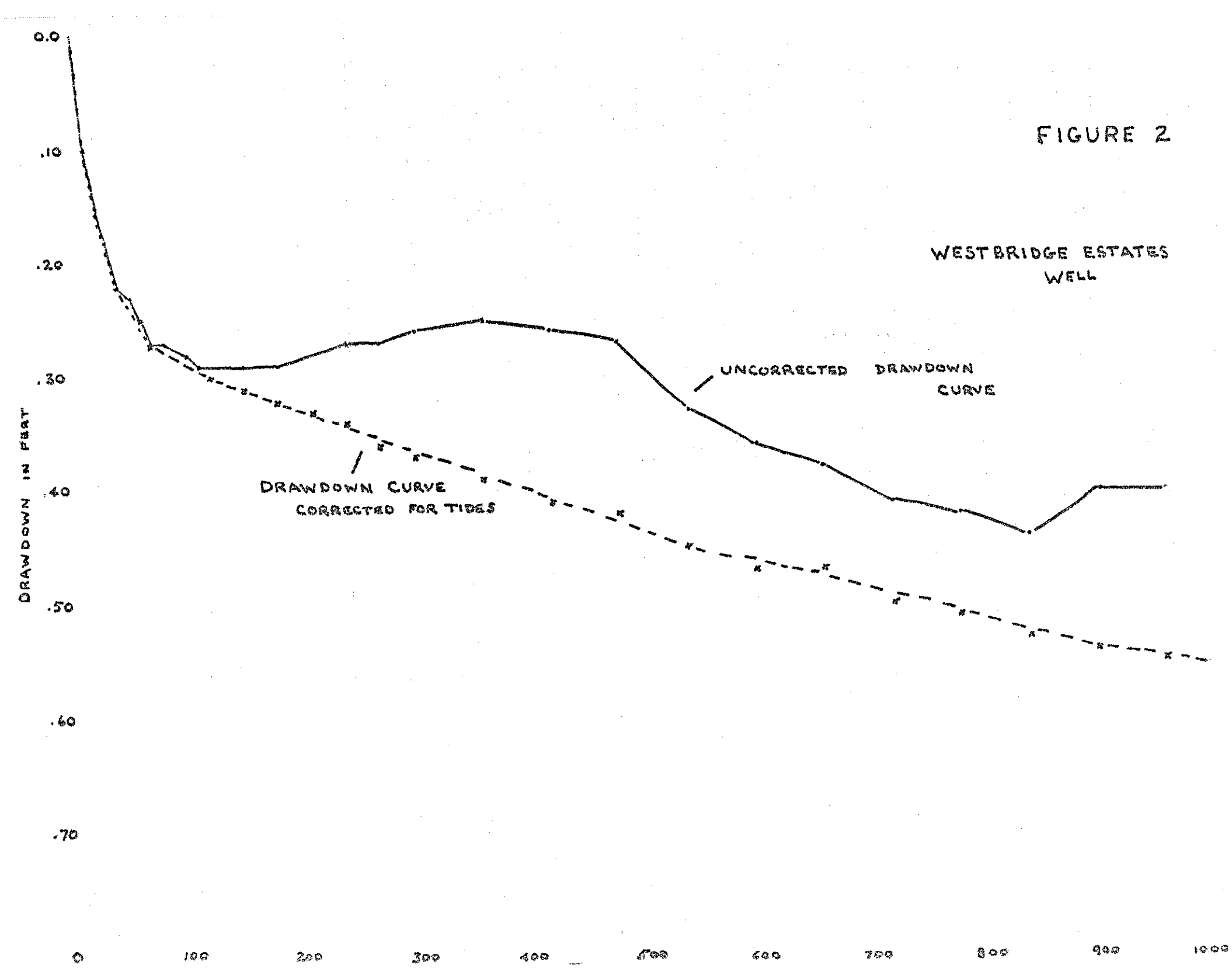


FIGURE 2
WESTBRIDGE ESTATES
WELL
UNCORRECTED DRAWDOWN CURVE
DRAWDOWN CURVE CORRECTED FOR TIDES
DRAWDOWN IN FEET
0.0
.10
.20
.30
.40
.50
.60
.70
0
100
200
300
400
500
600
700
800
900
1000

K+E LOGARITHMIC 46 7522
3 X 5 CYCLES MADE IN U.S.A.
KEUFFEL & ESSER CO.

FIGURE 3

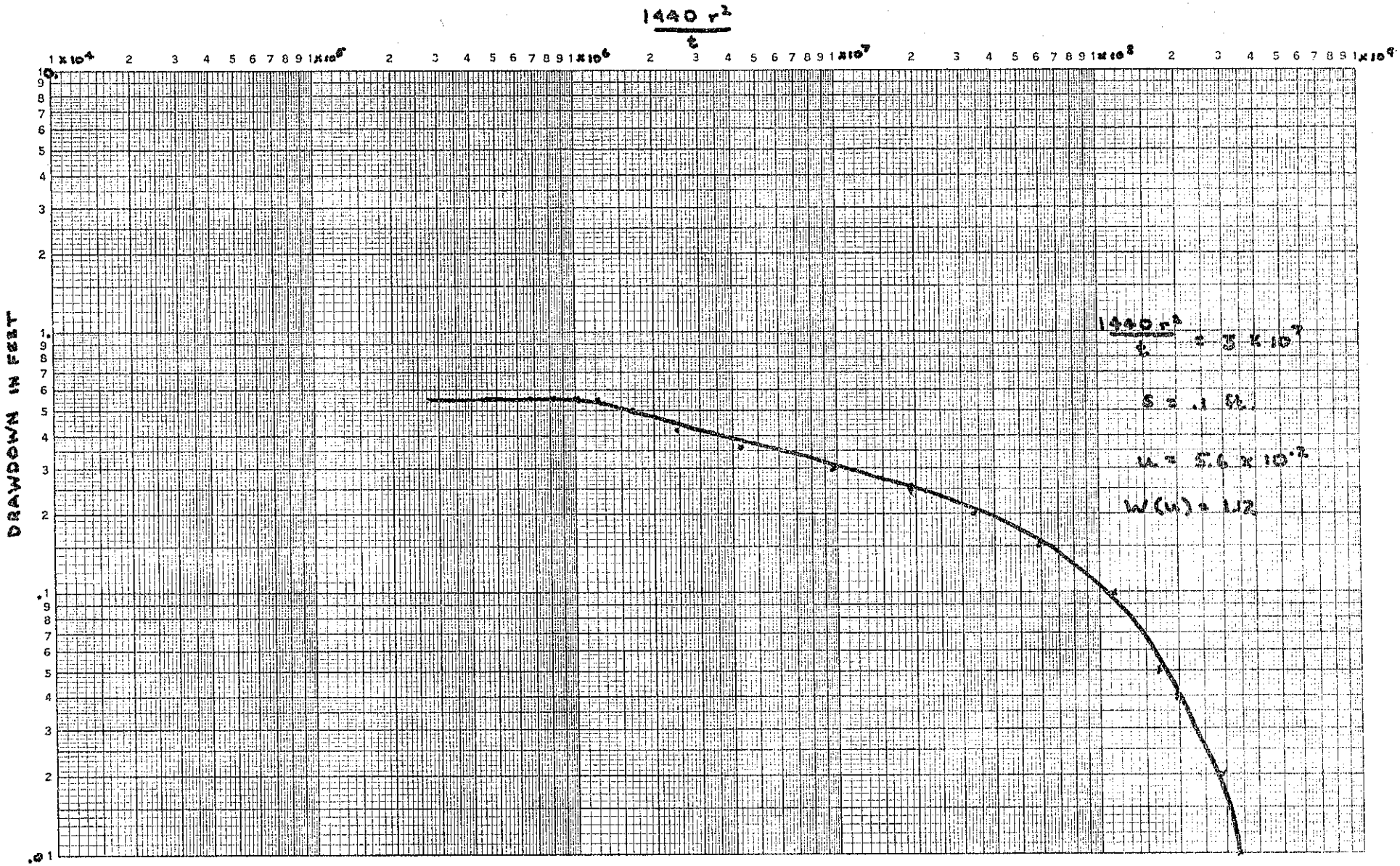


FIGURE 5

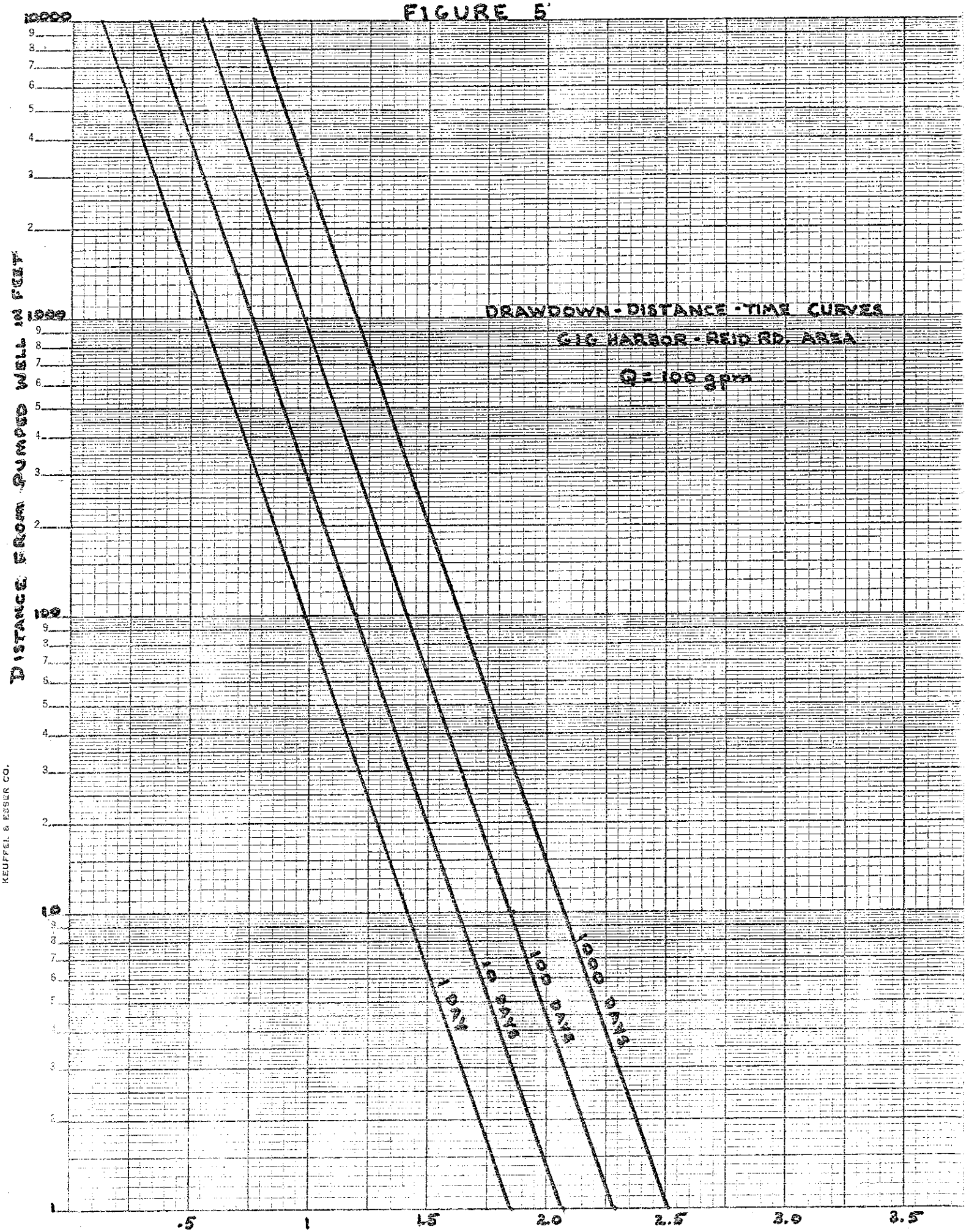
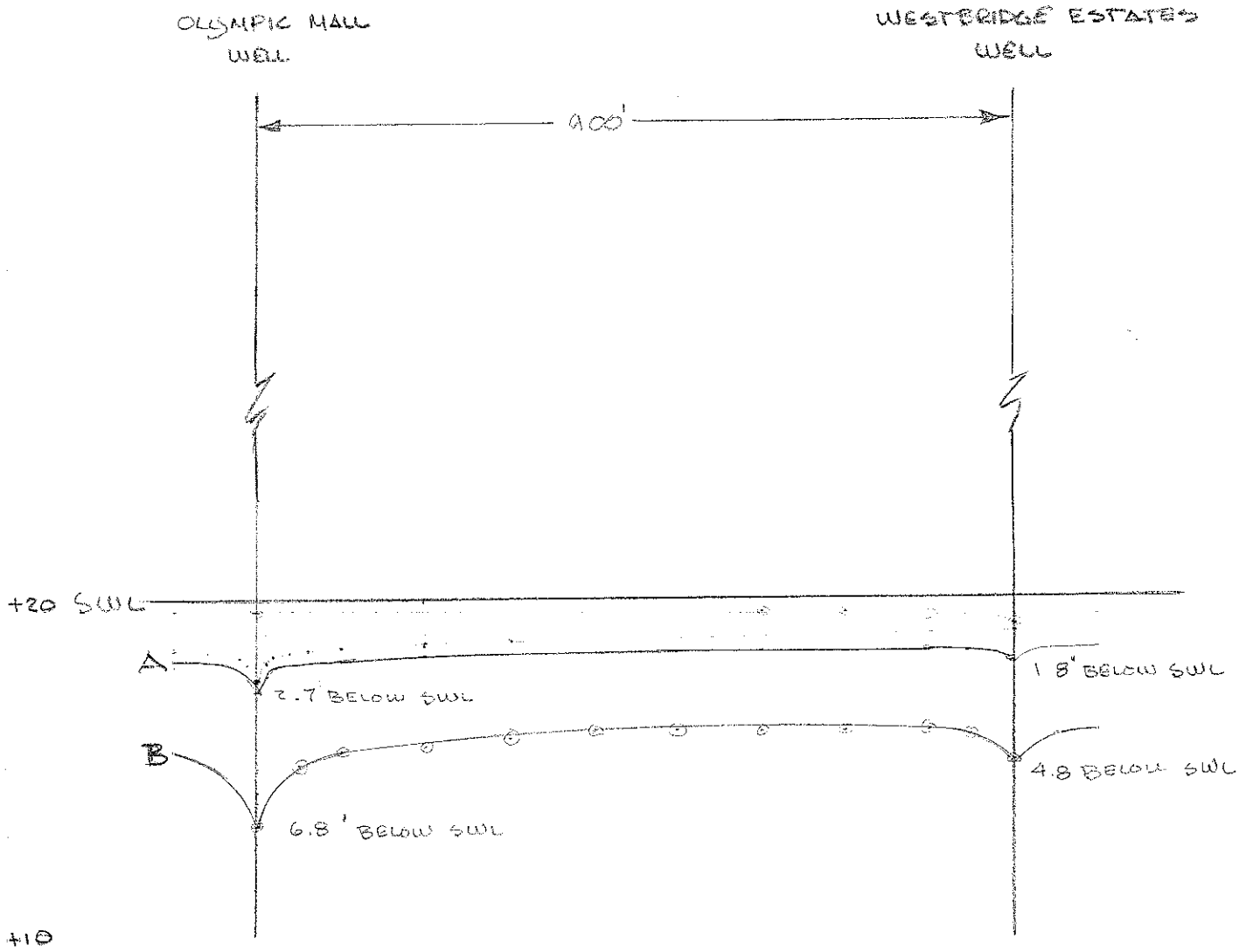

DISTANCE FROM PUMPED WELL IN FEET
10000
9
8
7
6
5
4
3
2
1000
9
8
7
6
5
4
3
2
100
9
8
7
6
5
4
3
2
10
9
8
7
6
5
4
3
2
1
.5
1
1.5
2.0
2.5
3.0
3.5
1 DAY
10 DAYS
100 DAYS
1000 DAYS
DRAWDOWN - DISTANCE - TIME CURVES
GIG HARBOR - REID RD. AREA
Q = 100 gpm
SEMI-LOGARITHMIC
4 CYCLES X 150 DIVISIONS
KEUFFEL & ESSER CO.
47 6012
MADE IN U.S.A.

FIGURE 6



-0 MEAN SEA LEVEL

NOTE: CURVES SHOW DRAWDOWN AFTER 100 DAYS OF CONTINUOUS PUMPING

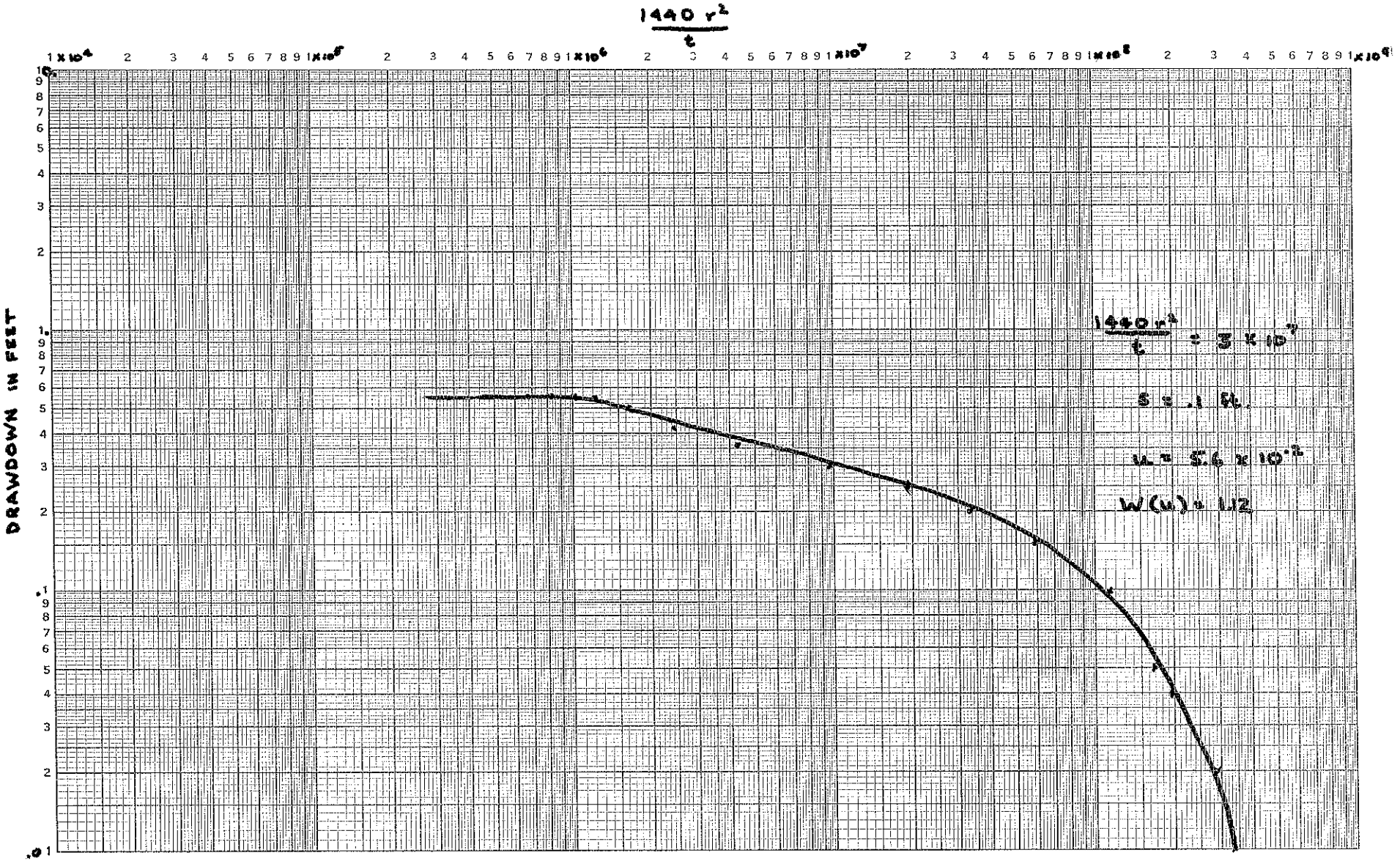
	OLYMPIC MALL	WESTBRIDGE
CURVE A-	100 GPM	35 GPM
CURVE B-	250 GPM	100 GPM

ELEVATION CONTROL FROM GIG HARBOR QUADRANGLE

10-31-74
PG

K+E LOGARITHMIC 46 7522
3 X 5 CYCLES MADE IN U.S.A.
KEUFFEL & ESSER CO.

FIGURE 3



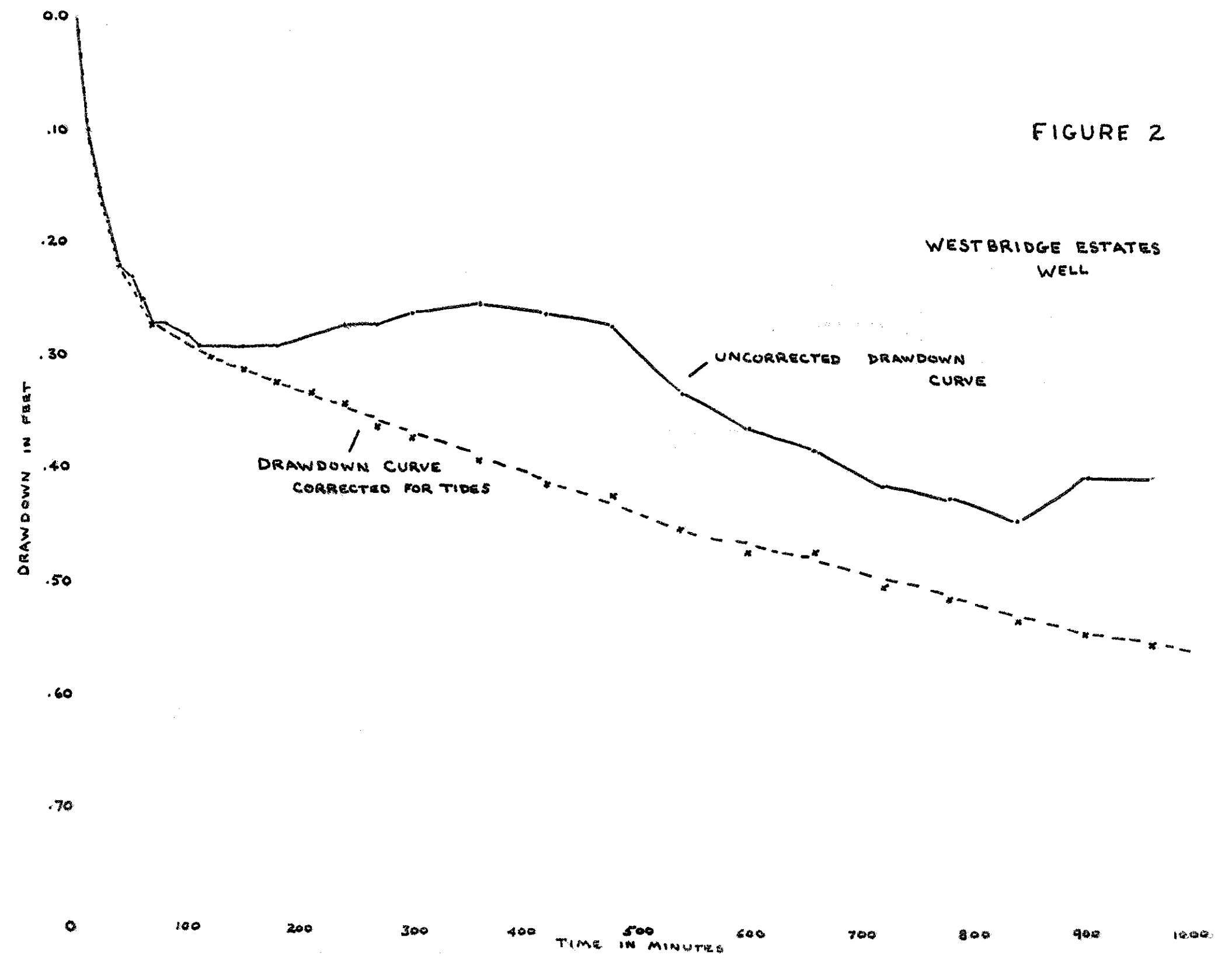


FIGURE 2
WESTBRIDGE ESTATES
WELL
UNCORRECTED DRAWDOWN CURVE
DRAWDOWN CURVE CORRECTED FOR TIDES
DRAWDOWN IN FEET
0.0
.10
.20
.30
.40
.50
.60
.70
0
100
200
300
400
500
600
700
800
900
1000
TIME IN MINUTES

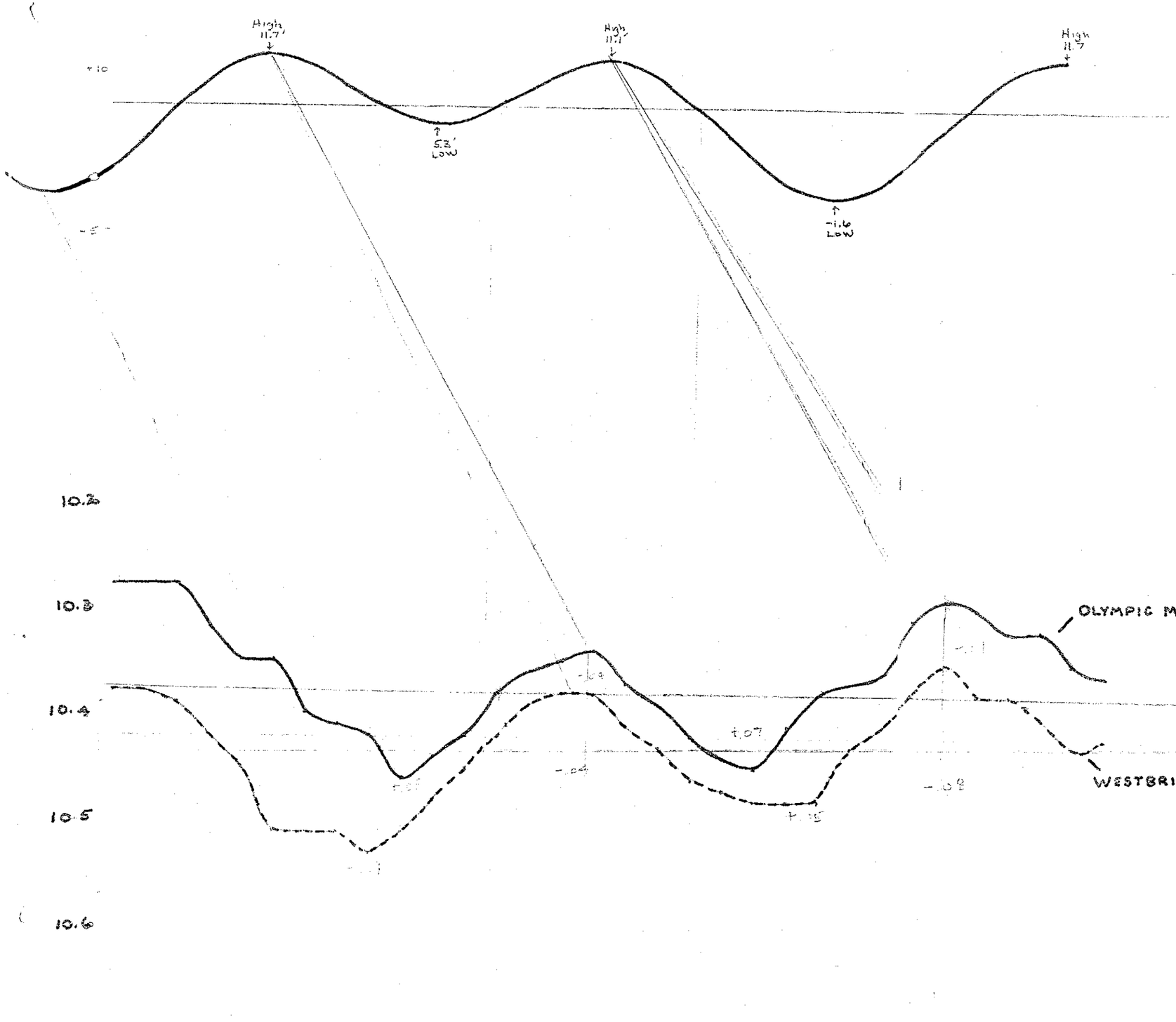
FIGURE 1

TIME - DRAWDOWN CURVE
GIG HARBOR AQUIFER TEST
START - 1000 HRS., OCT. 16, 1974
Q = 94 gpm

WESTBRIDGE ESTATES WELL

OLYMPIC MALL WELL

FIGURE 4



LAG TIME
~ 630 - 640 MINUTES