AQUIFER-TEST REPORT FOR ASAMERA MINERALS (USA), INC. TEST WELL WS-1

INTRODUCTION

The U.S. Geological Survey began a water-resources investigation of the Tracy Segment hydrographic area in cooperation with Storey County, Nevada. Part of the investigation was planned to evaluate the distribution and movement of ground water in fractured volcanic rock aquifers. From January 23 to June 21, 1996, Asamera Minerals (U.S.A.) Inc. drilled 17 exploratory wells to "… realize the potential of groundwater yield within a proposed 5,000 acre industrial site" (Consulting Services Associates, Inc, 1997). Seven of the exploratory wells produced less than 10 gallons per minute (gpm) and consequently, were abandoned. Step drawdown and recovery tests were performed on selected wells by private consultants to estimate hydraulic properties in anticipation of constructing supply wells for the proposed development. Results of this drilling and testing effort were made available to USGS to supplement the water-resources investigation.

SITE LOCATION AND HYDROGEOLOGIC SETTING

Well WS-1 was drilled near the proposed industrial site and the Truckee River (39° 33' 23'' north latitude and 119° 32' 24'' west longitude; figure 1). Lithologic data found in a driller's log completed by McKay Drilling Inc. shows that the well was drilled into unconsolidated sediments and volcanic rock to a total depth of 350 ft below land surface. The first 198 ft is composed primarily of unconsolidated cobble sand, and clay. A zone of fractured volcanic rock extends from 198 ft below land surface to 259 ft below land surface, and the remaining 91 ft consists primarily of a tan and green clay. The static water level measured at the end of drilling was 52 ft below land surface.

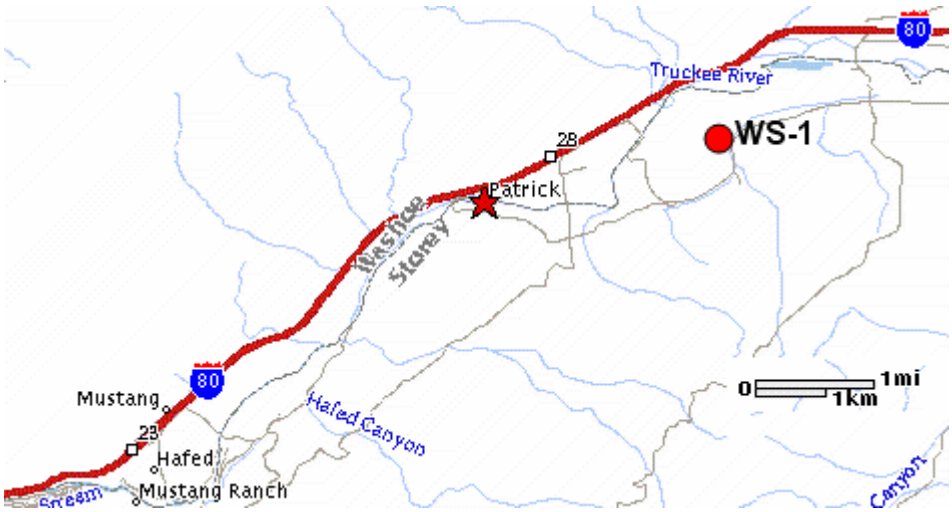

Figure 1 Location of Well WS-1

WELL CONSTRUCTION

The following description detailing the construction of well WS-1 was found in the driller's log completed by McKay Drilling Inc.: "Well WS-1 was drilled over a period of 9 days from 2/27/96 to 3/7/96. The borehole diameter is 12 3/4 in for the length of the well, with a casing 8 5/8 in. in diameter and .188 in. thick that extends from 1.5 feet above land surface to 350 feet below land surface. The well is screened from 140 feet to 270 feet below land surface, and gravel packed from 100 feet to 350 feet below land surface (figure 2). The screens were bored with 1/8 X 3 in. perforations. Single perforations extend from 140 feet to 150 feet below land surface, 225 feet to 240 feet below land surface and 260 feet to 270 feet below land surface. Double perforations extend from 170 feet to 220 feet below land surface."

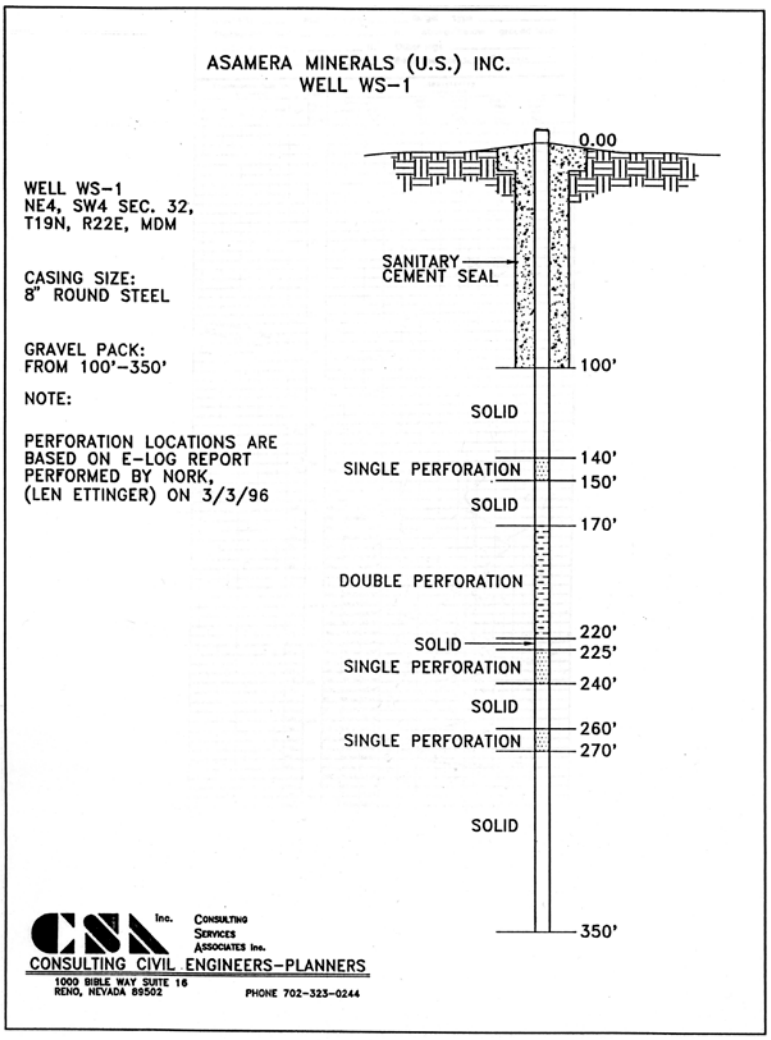

Figure 2 Well WS-1 Construction

TEST DESCRIPTION

Pumping of well WS-1 began on March 13, 1996 at 9:30 and continued 5 hours and 55 minutes to 15:25. The well was pumped at 100 gpm for the first hour and 10 minutes, 200 gpm for an additional 25 minutes, and 310 gpm for the remaining 4 hours and 20 minutes until 15:25. The water level declined about 67 ft from 54.9 ft below land surface to 122.15 ft below land surface (table 1). The water level recovered almost 63 ft from 122.15 ft below land surface to 59.3 ft below land surface 65 minutes after pumping ceased.

AQUIFER TEST RESULTS

A transmissivity of 2,000 ft^2/d was estimated with using a method of superposition (Lee,1982). Transmissivity was estimated with a straight line that was fitted to a plot of $\frac{s}{Q_{NSTEP}}$ against $\sum_{i=1}^{NSTEP} \frac{Log(\Delta t_i)\Delta Q_i}{Q_{NSTEP}}$ (Lee, 1982) (fig. 3), where Δt_i is the elapsed time since the beginning of the ith step, ΔQ_i is the change in discharge at the beginning of the ith step, and Q_{NSTEP} is the discharge when s was measured. Wellbore skin was estimated also so that simulated and measured drawdowns could be compared directly (fig. 4). A storage coefficient of 0.0001 was assigned because of the rigidity of the aquifer material. The storage coefficient was not estimated because storage coefficient and skin are correlated highly.

WELL ID: WS-1

INPUT		
Construction:		
Casing dia. (d_c)	8.625	Inch
Annulus dia. (d_w)	12.75	Inch
Screen Length (L)	250	Feet
Depths to:		
water level (DTW)	220	Feet
Top of Aquifer	184	Feet
Base of Aquifer	UNKNOWN	
Annular Fill:		
across screen --	Gravel	
above screen --	Cement	
Aquifer Material --	Permeable Basalt	
ASSUMED S =	0.0001	d'less

Local ID: WS-1
Date: 3/13/1996
Time: 9:30

COMPUTED

Input is consistent.

T =	2,000	Feet²/Day
S =	0.0001	d'less
$K_{annular}$ =	0.8	Feet/Day
Skin =	3	d'less

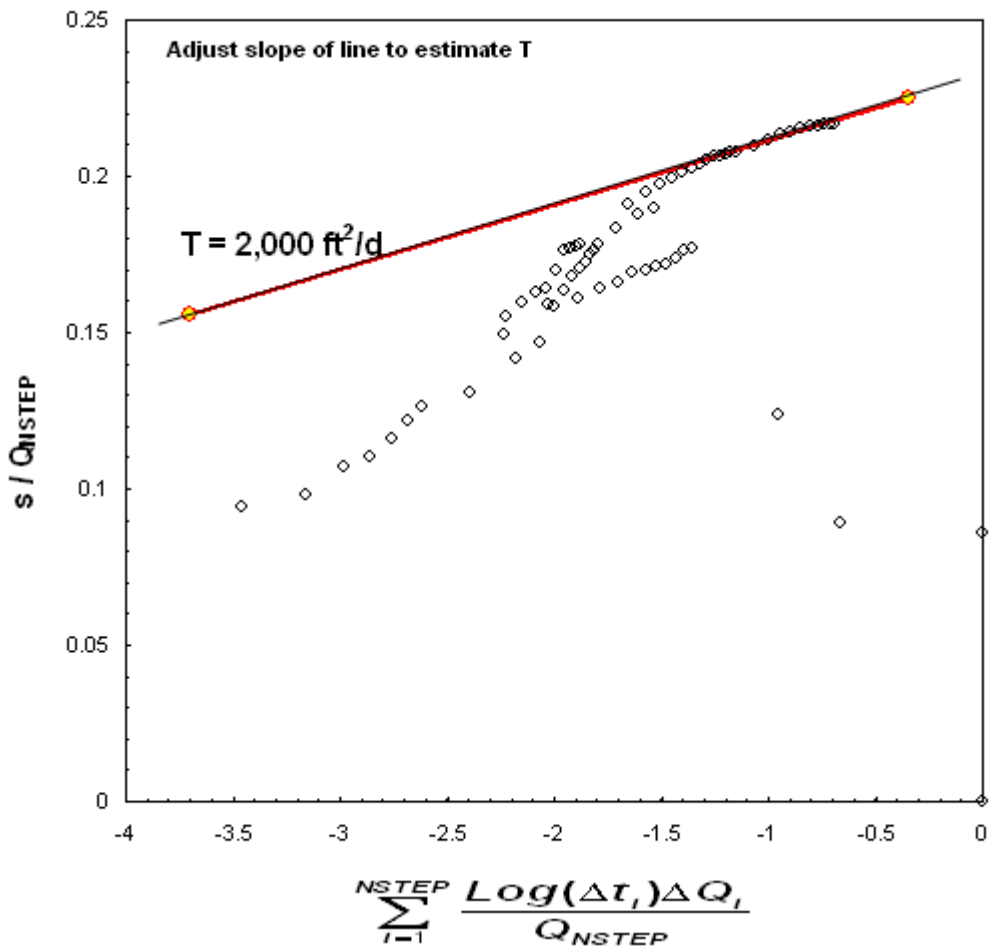

Figure 3a. Simulated and measured drawdowns in transformed coordinated.

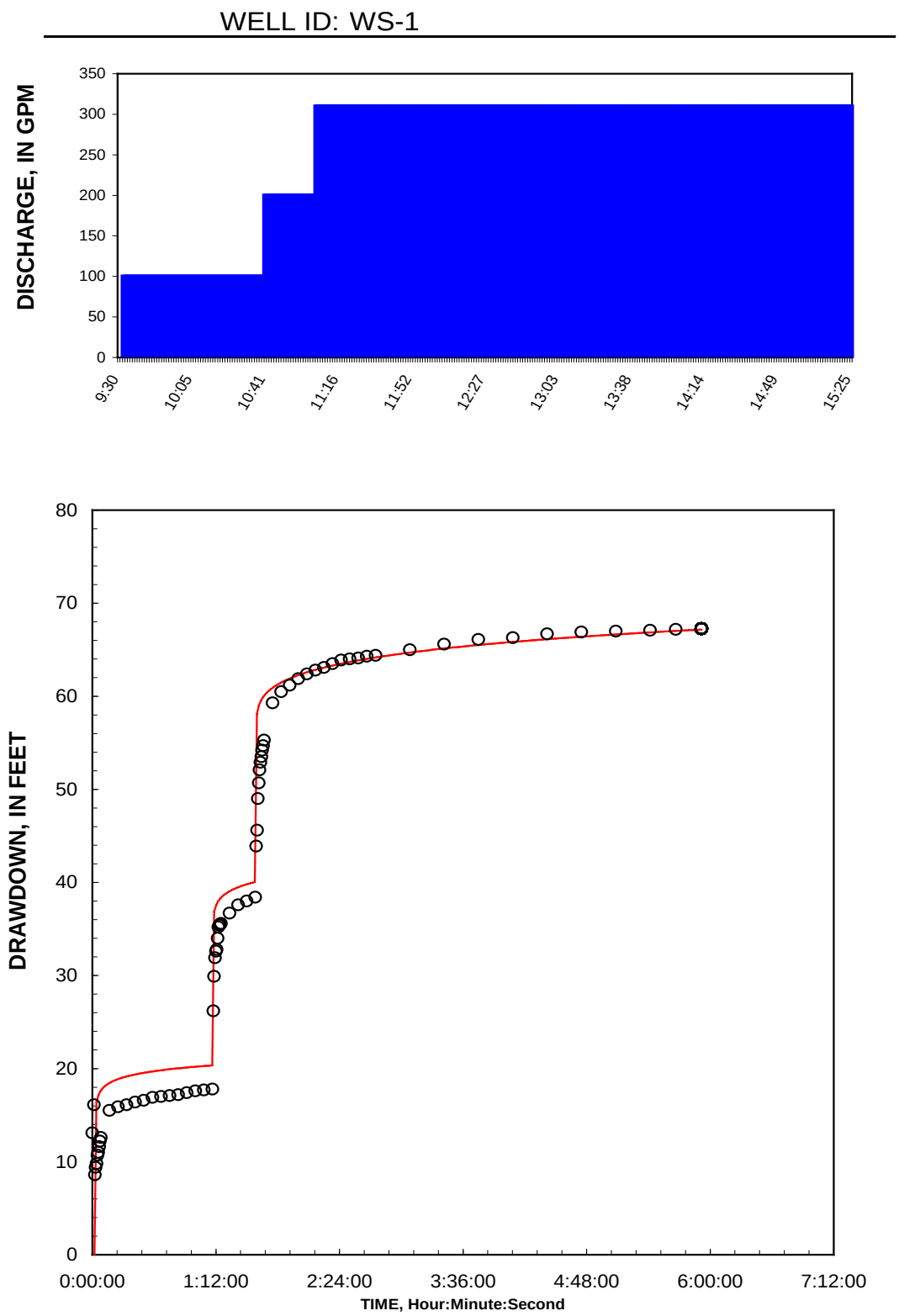

Figure 3b Simulated and measured drawdowns and production history during step-drawdown test.

Table 1.—Reduced time and water level data from Well WS-1 during step-drawdown test on 3/13/1996.

Entry	Time, Hr:Min:Sec	Water Level Feet
1	9:30:00	54.90
2	9:30:00	68.00
3	9:31:00	71.00
4	9:31:30	63.50
5	9:32:00	64.30
6	9:32:30	64.70
7	9:33:00	65.60
8	9:33:30	65.90
9	9:34:00	66.50
10	9:34:30	67.10
11	9:35:00	67.50
12	9:40:00	70.40
13	9:45:00	70.80
14	9:50:00	71.00
15	9:55:00	71.30
16	10:00:00	71.50
17	10:05:00	71.80
18	10:10:00	71.90
19	10:15:00	72.00
20	10:20:00	72.10
21	10:25:00	72.30
22	10:30:00	72.50
23	10:35:00	72.60
24	10:40:00	72.70
25	10:40:30	81.10
26	10:41:00	84.80
27	10:41:30	86.80
28	10:42:00	87.50
29	10:42:30	87.70
30	10:43:00	88.90
31	10:43:30	90.10
32	10:44:00	90.30
33	10:44:30	90.40
34	10:45:00	90.50
35	10:50:00	91.60
36	10:55:00	92.50
37	11:00:00	92.90
38	11:05:00	93.30
39	11:05:30	98.80
40	11:06:00	100.50
41	11:06:30	103.90
42	11:07:00	105.60
43	11:07:30	107.00
44	11:08:00	107.80
45	11:08:30	108.40
46	11:09:00	109.10
47	11:09:30	109.60
48	11:10:00	110.20
49	11:15:00	114.20
50	11:20:00	115.40
51	11:25:00	116.10
52	11:30:00	116.80
53	11:35:00	117.30
54	11:40:00	117.70
55	11:45:00	118.00
56	11:50:00	118.40
57	11:55:00	118.80
58	12:00:00	118.90
59	12:05:00	119.00
60	12:10:00	119.20
61	12:15:00	119.30
62	12:35:00	119.90
63	12:55:00	120.50
64	13:15:00	121.00
65	13:35:00	121.20
66	13:55:00	121.60
67	14:15:00	121.80
68	14:35:00	121.90
69	14:55:00	122.00
70	15:10:00	122.10
71	15:25:00	122.15

REFERENCES

Consulting Services Associates Inc., 1997, Asamera Minerals (U.S.) Inc. Water Rights Report, 77 p.

Halford, K.J. and Kuniansky, E.L., 2002, Documentation of spreadsheets for the analysis of aquifer-test and slug-test data: U.S. Geological Survey Open-File Report 02-197, http://water.usgs.gov/pubs/of/ofr02197/

Lee, John, 1982, Well Testing Society of Petroleum Engineers of AIME: New York, 159 p.