GeothermEx, Inc. 3260 BLUME DRIVE, SUITE 220
RICHMOND, CALIFORNIA 94806

TELEPHONE: (510) 527-9876
FAX: (510) 527-8164
E-MAIL: mw@geothermex.com

MEMORANDUM

To: Mr. Ken MacLeod
Western GeoPower Corp.
Vancouver, BC
sent via email: kmacleod@geopower.ca

Date: January 9, 2008

C.C.: S.K. Sanyal, J.W. Lovekin, R.C. Henneberger, E.E. Granados, C.W. Klein

From: Rob Stacey/ Jim Lovekin

Subject: South Meager Project – MC-8 Evaluation

Results for MC-8 Flow Test

The results from the air-lift assisted flow test performed on MC-8 from 22 to 27 September 2008 are summarized below.

The downhole pressure response in MC-6 was measured at 2,750ft while MC-8 was air-lifted. This has allowed for a calculation of the effective reservoir permeability-thickness. The measured pressure response in MC-6 was matched with a permeability-thickness of 17,500 md-ft (Figure 1).

The effective Productivity Index (PI) for a well penetrating a 17,500 md-ft reservoir would be approximately 0.9 KPH/psi after 2 years, assuming no wellbore skin effects (Figure 2). This corresponds very well with the injectivity index of 1.0 KPH/psi (2.0 gpm/psi) measured for MC-8 in July 2005.

For comparison, a hypothetical well termed 'MC-Valley' has been modeled mathematically, starting from the valley floor and reaching the same production zone as was encountered in MC-8. The well trajectory for MC-Valley is shown in Figure 5. If we take into account the deviation required to intersect the fracture in MC-8, the wellbore length from the surface would be 6,325 feet, the kick-off point would begin at 1300ft KB, and the well deviation would build at 2°/100ft, reaching an angle of 50° (measured from horizontal) at a depth of 3,300ft KB. The true vertical depth of this hypothetical well would be 5,453 ft below the surface.

Using an effective PI equal to 0.9 KPH/psi, we performed a wellbore simulation to compare the production rates for three different well scenarios (Figure 3). The first scenario was MC-8 as drilled, with its measured temperature profile. The second scenario was MC-8 with the same

GeothermEx, Inc. 5221 CENTRAL AVENUE, SUITE 201
RICHMOND, CALIFORNIA 94804-5829

TELEPHONE: (510) 527-9876
FAX: (510) 527-8164
E-MAIL: mw@geothermex.com

temperature profile, but with coil tubing in the hole. Our wellbore simulation agreed with the flow test, which indicated that MC-8 would not sustain flow at commercial rates with coil tubing in the hole. The wellbore simulation indicated that, with the coil tubing in the hole, MC-8 would not sustain flow rates above 300 kph. The third scenario simulated was the hypothetical MC-Valley wellbore. For this analysis it was assumed that the MC-Valley well had the same temperature profile and casing configuration as MC-8, but with the top 1,500 feet of the MC-8 wellbore removed. Thus, where the 13-3/8-inch casing shoe is at 2,800 feet in MC-8, the 13-3/8-inch shoe in the hypothetical MC-Valley well was assumed to be at 1,300 feet. With this assumption, the MC-Valley well would be expected to produce with a higher flowing wellhead pressure. Figure 3 shows that the MC-Valley wellhead pressure would be approximately 70 psi higher when compared to MC-8 while producing from the same zone.

To calculate the reservoir fluid required per MW, a simple flash calculation was performed with estimated conversion efficiencies. For a reservoir fluid at 441.3°F (the measured temperature of the fracture zone in MC-8), the production enthalpy would be 410 BTU/lb. Using this enthalpy, the fluid was flashed at various pressures to determine the amount of steam required per kW-hr. For these reservoir conditions, approximately 110 lb/kW-hr is required with a 40-psia plant-inlet pressure (Figure 6). The net-to-gross MW ratio was assumed to be 90%.

Therefore, assuming that the flowing wellhead pressure would have to be 100 psi above the plant-inlet pressure, we can estimate the MW potential of MC-8 and the hypothetical MC-Valley well, as shown in the table below. The existing MC-8 well would not be expected to sustain flow at any rate with a wellhead pressure of 140 psig, so its effective MW rating is zero. In contrast, at a wellhead pressure of 140 psig, the MC-Valley well would flow at an estimated rate of 780 kph, equivalent to a power output of 6.4 MW. If the reservoir fluid encountered by MC-Valley were at a greater temperature than what was measured in MC-8, then the MW capacity for the MC-Valley well would increase accordingly.

	MC-8		*MC-Valley*	
Production Rate (KPH)	**Pressure (psig)**	**MC-8 MW-net**	**Pressure (psig)**	**MC-Valley MW-net**
50	47.1	0	202.7	0.4
100	93.7	0	180.6	0.8
200	122.6	0	181.0	1.6
300	132.9	0	198.7	2.5
400	130.3	0	200.0	3.3
500	121.3	0	193.1	4.1
600	107.1	0	181.7	4.9
700	82.3	0	161.7	5.7
780	64.0	0	140.4	6.4

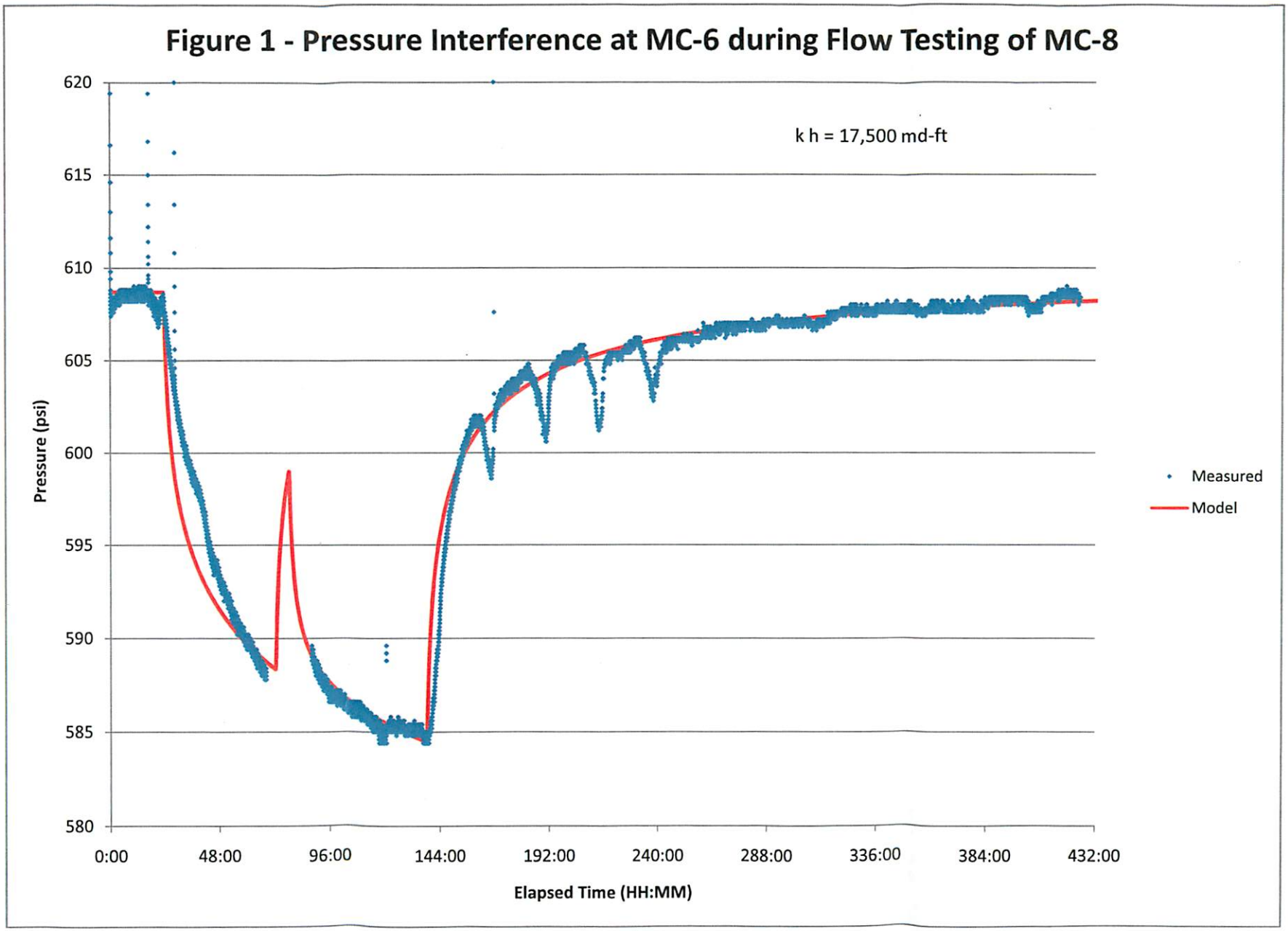


Figure 1 - Pressure Interference at MC-6 during Flow Testing of MC-8
k h = 17,500 md-ft
Pressure (psi)
620
615
610
605
600
595
590
585
580
0:00
48:00
96:00
144:00
192:00
240:00
288:00
336:00
384:00
432:00
Elapsed Time (HH:MM)
Measured
Model

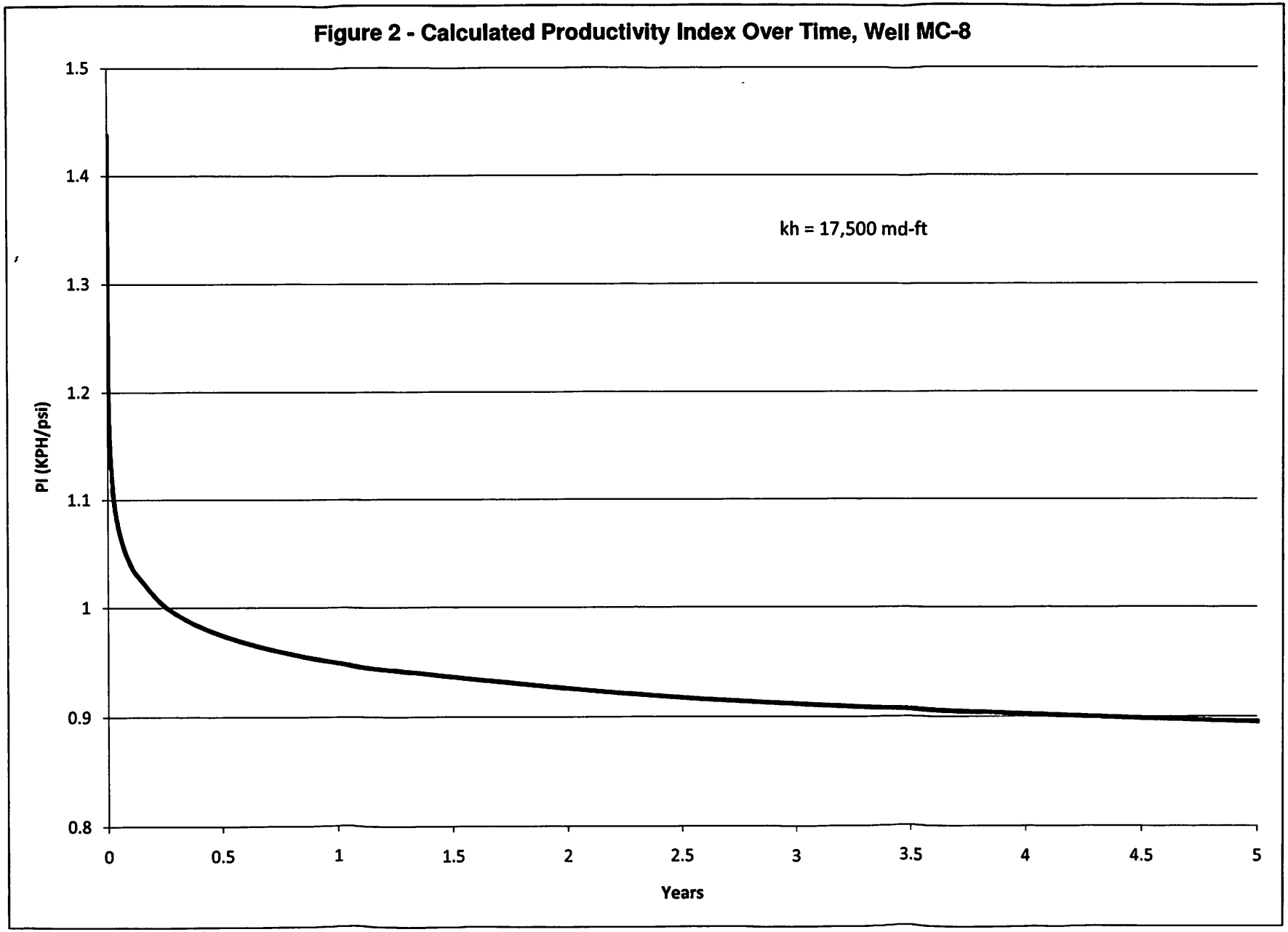
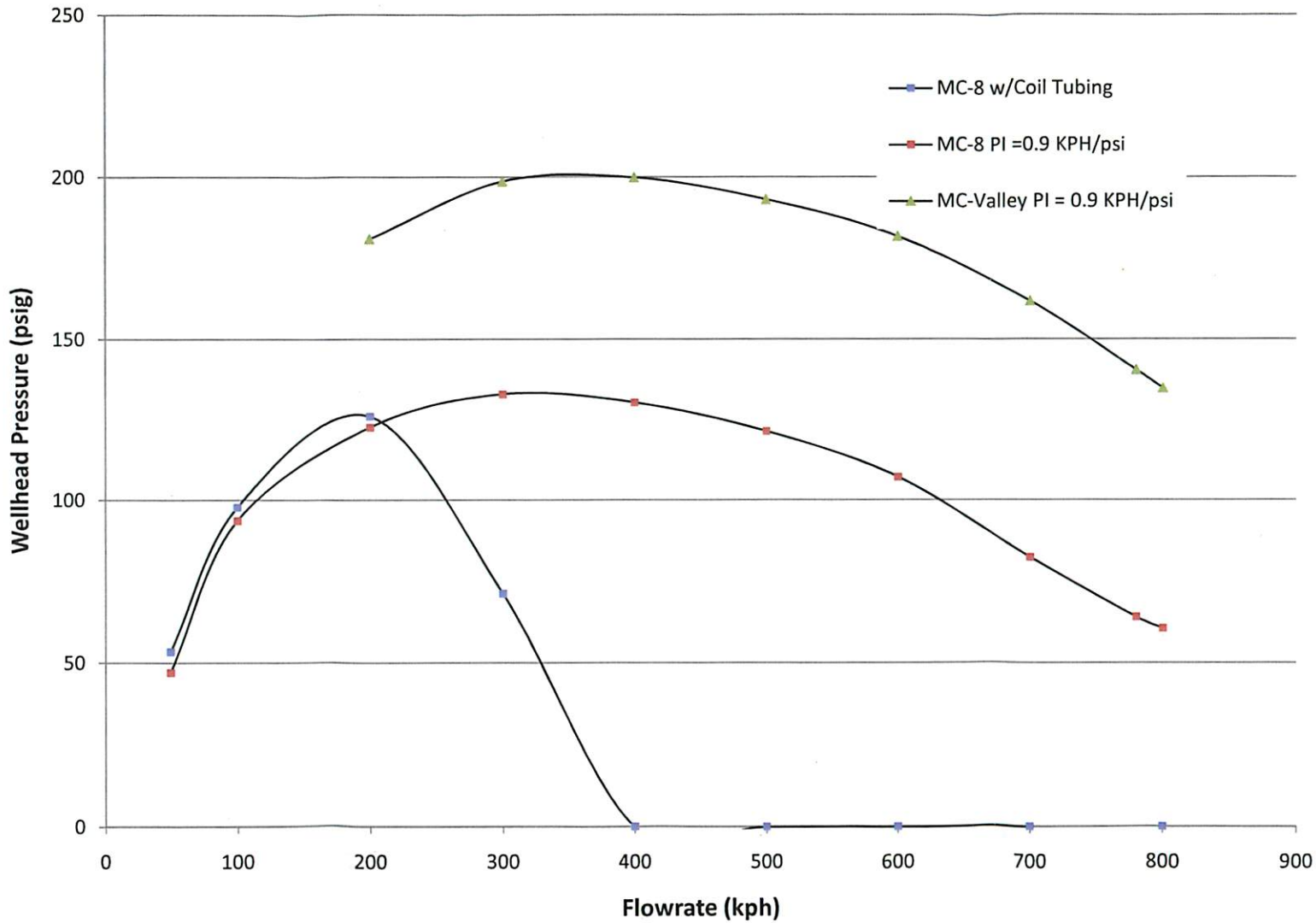


Figure 2 - Calculated Productivity Index Over Time, Well MC-8
kh = 17,500 md-ft
PI (KPH/psi)
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Years

Figure 3 - Calculated Well Production Rates



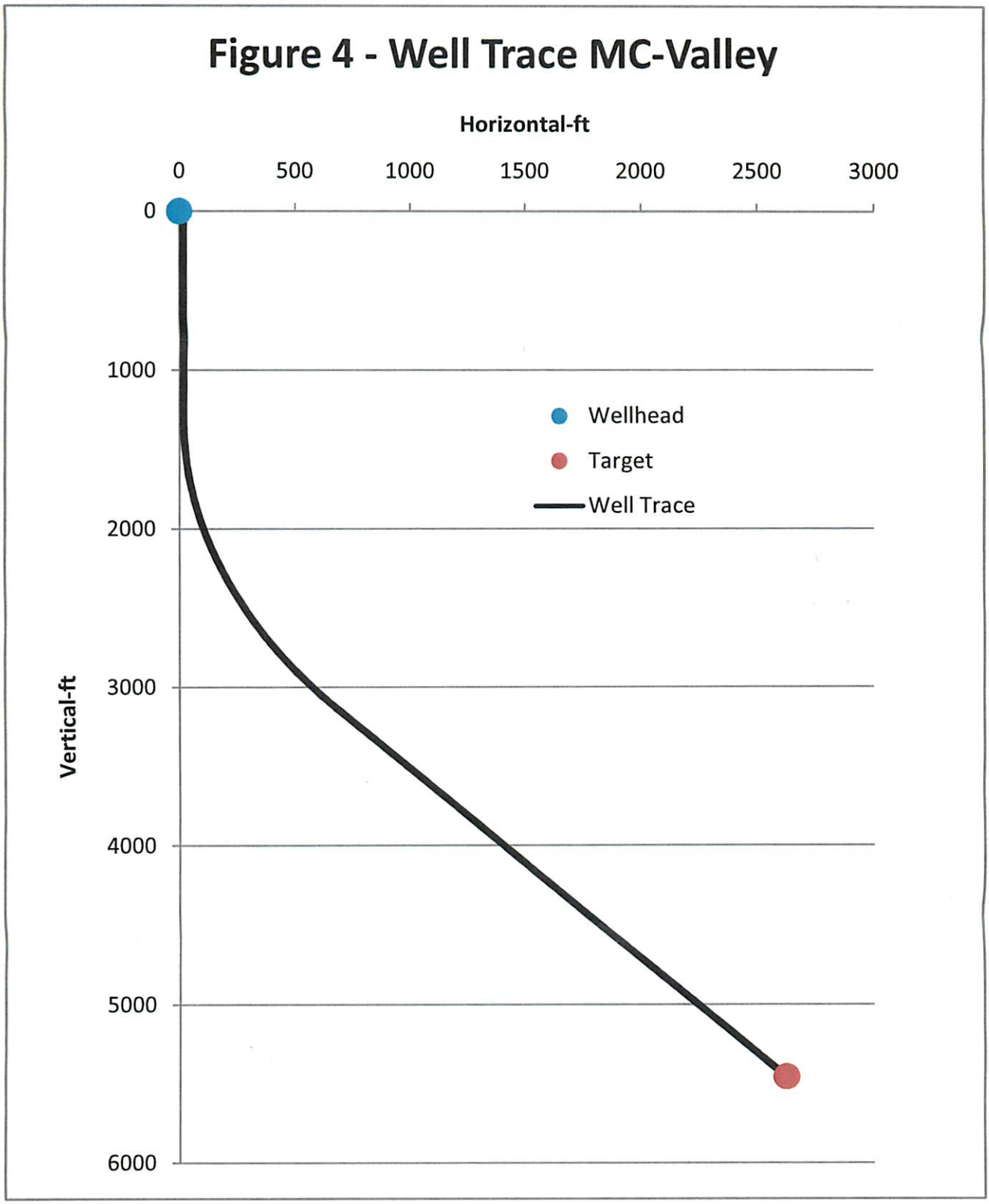
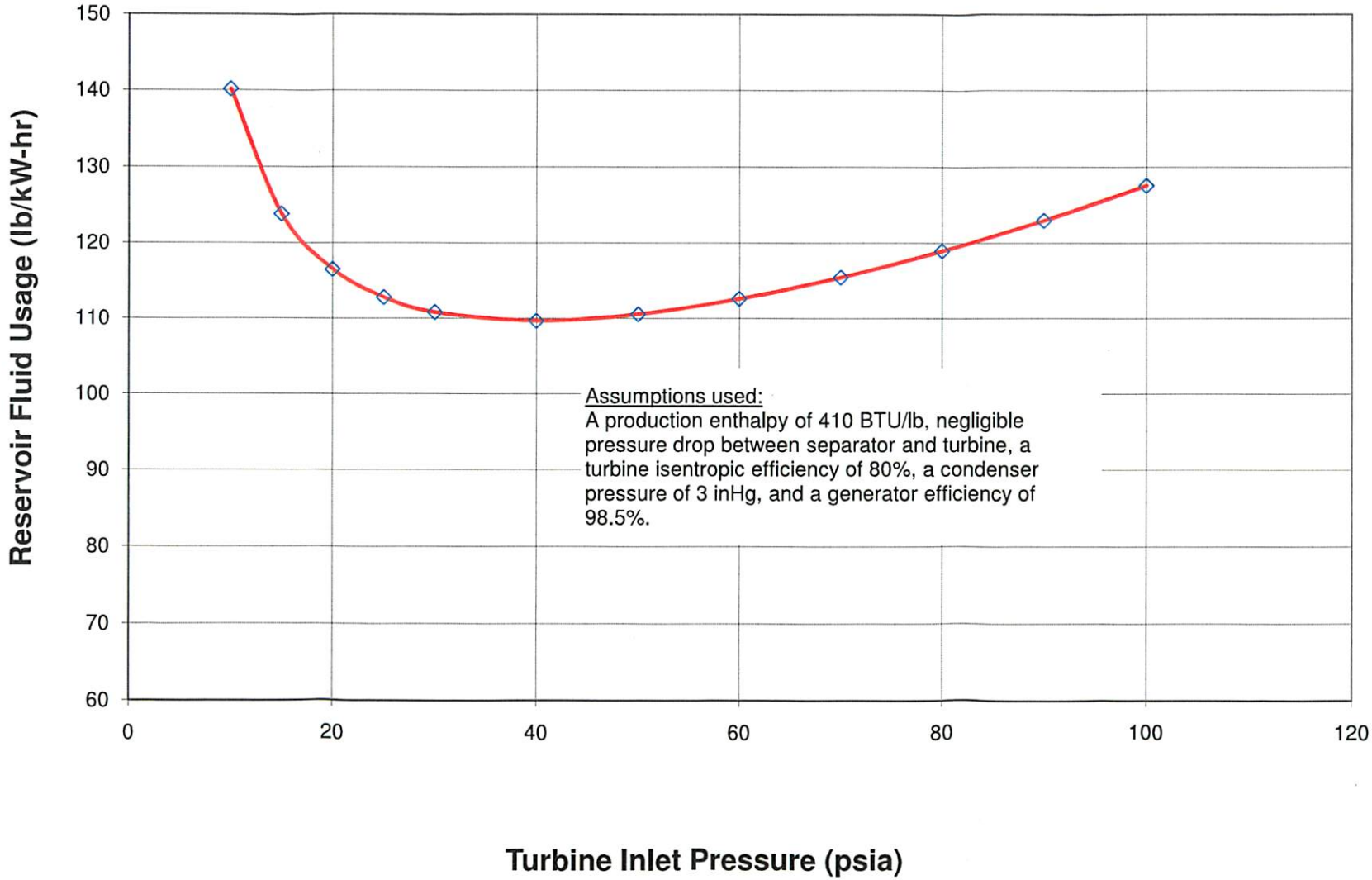


Figure 4 - Well Trace MC-Valley
Horizontal-ft
0
500
1000
1500
2000
2500
3000
Vertical-ft
0
1000
2000
3000
4000
5000
6000
Wellhead
Target
Well Trace

Figure 5 - Estimated Reservoir Fluid Usage with Measured Reservoir Temperature Fluid, 441 °F



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