

Appendix A

Field Notes for Geothermal Test Well 5

(WGNHS ID 42000265)

5/14/2012 Drilling Geothermal Well 5 DSH

Fort McCoy

Arrived on-site @ 10:00 AM. met w/
driller, Chad, & helper Bryan. They mentioned
gravel will be delivered later today to make
berms to capture sediment.

Sunny. 70°F. Light west wind.

Drillers (Ground Source) setting up for 8"
mud rotary hole to sandstone.

Began drilling 10:40 AM

Description

- 0-5 Angular gravel, moderate brown
- 5-10 Angular gravel, moderate brown
- 10-15 Same as above
- 15-20 Fine grained sand, moderate brown
- 20-25 1. #14 sample. Some small clasts
of sandstone, moderate brown to
reddish brown. Likely bed rock
with flecks of ground quartz as
well. Drilling is slower.

25-30 Same as above

Driller will set 34 ft of casing
in the ground.

30-34 Same as above

Left site @ Noon. Casing was set
Driller got out after I left

5/15/2012 on-site 7:00 AM. Sunny, Light
Breeze 65°F.

35-40 Grayish Orange fine grained S.S.

40-45 Same as above

45-50 Same as above

50-55 Same as above

55-60 Same as above, w/ some iron
stain

60-65 Grayish orange fine grained S.S.

65-70 Same as above

70-75 Same as above

75-80 same as above w/ some iron
stain & clasts

80-85 Same as above w/ some iron
stain & clasts

85-90 Grayish orange fine grained
S.S. w/ clay. Came up as
a chunk.

90-95 Grayish orange fine grained
S.S.

95-100 Same as above w/ iron staining

100-105 Same as above

105-110 Same as above

110-115 Same as above

115-120 Grayish orange fine grained
S.S.

Depth (ft) Description

120-125 Grayish Orange fine grained
S.S. w/ ~~some~~ reddish & whitish
clasts of S.S.

125-130 Same as above

130-135 same as above w/ glauconite
clasts

135-140 same as above

140-145 Grayish orange med fine
grained sandstone

145-150 Same as above

150-155 Light Olive gray shale
and Grayish orange fine
grained S.S.

155-160 Grayish orange medium
grained S.S.

160-165 Same as above

165-170 same as above w/ several
cemented S.S. clasts

170-175 Grayish orange medium
grained S.S.

175-180 same as above w/ several
cemented S.S. clasts

Depth (ft) Description

180-185 Grayish Orange ^{medium grained} S.S.
and few shale light olive
gray

185-190 Grayish orange medium
grained sandstone

190-195 sandstone as above and
medium grey shale

195-200 medium grey shale

200-205 medium grey shale and
grayish orange coarse
grained S.S.

205-210 same as above

210-215 same as above except
S.S. is medium grained

215-220 same as above

220-225 same as above

225-230 medium grey shale and
dark grayish orange pink
well cemented S.S. clasts

230-235 same as above

235-240 same as above

240-245 medium grey shale and
grayish orange medium
grained S.S.

Depth Description

245-250' med. umgr. shale and dark greyish pink well cemented S.S. clasts.

250-255' med. umgr. shale and grayish orange med. um grained S.S.

255-260' same as above

260-265' grayish orange med. um grained S.S.

265-270' med. um gray shale and grayish orange med. um grained S.S.

270-275' medium grey shale and moderate red S.S. clasts.

275-280' grayish orange med. um grained S.S. w/ some med. grey shale clasts.

280-285' medium grey shale and moderate reddish orange S.S. clasts.

285-290' Same as above

290-295' Grayish orange med. um grained S.S. w/ moderate red S.S. clasts.

Depth Description

295-300' grayish orange med. um grained S.S.

300-305' grayish orange coarse grained S.S.

305-310' medium grey shale and moderate reddish orange S.S. clasts.

310-315' Grayish Brown ss. with quartz clasts. Not S.S. but gravel sized.

315-320' Grayish Brown ss. - looks like Rotten Granite w/ mica rich.

320-325' Same as above.

325-330' Same as above

330-335' Same as above - w/ some Bragg stuff

335-340' Same as above

340-345' Same as above

345-350' Same as above

350-355' same as above

355-360' same as above

360-365' same as above

365-370' same rotten looking mica rich rock w/ more competent looking pieces of feldspathic granite.

370-375' same but w/ less/smaller granitic looking rock.

375-380 - Same mica rich granite
380-385 - same as above.

385-390 - same w/ feldspathic granite up to MP.

390-395 - same as above

395-400 - less granite than above but seems more silty than the previous samples.

400-405 - very biotite rich w/ lit feldspar granite pebbles.

405-410 - same as above

410-415 - same but finer grained cuttings than previous samples

415-420 - same as above

420-425 - larger feldspathic granite pebbles. Very pink looking.

425-430 - same but w/ smaller granite pieces.

430-435 - same black - dark gray mica rich rock w/ lit pink granite.

435-440 - same as above

440-445 - Drilling rate slowed considerably. Black igneous w/ epidote & white clay mineral.

445-450 - Black gray granite w/ some Kspar. Much very well defined micas throughout. Biotite & possibly muscovite? Some Epidote

450-455 - same as above.

455-460 - same as above

460-465 - same as above

465-470 - same as above w/ less pink granite and some large pieces of clay mineral kaolinite?
Drilling Rate is @ ~30m/20ft

470-475 - same as above

475-480 - same as above.

480-485 - same w/ some large pebbles of Qtz

485-490 - same as above

490-495 - same w/ lit more epidote

495-500 - same as above.

500-505 - lots of micas, some epidote etc. smaller quartz of kaolinite.

505-510 - same Blk/gray
mica rich granite w/
some epidote throughout
lt K-spar.

510-515 - same as above

515-520 - Bit speed dropped
significantly. This could
mean it's more quartz rich
which you can tell a slight
change in cuttings or bit
has become less productive.

520-525

Very slow drilling -
more Qtz rich & seems to
be a Green Brown mineral throughout
could be hornblende, less mica
in this sample as well could
also have some plagioclase as well.

525-530

Same but there seems to
be some calc in from the
S.S. above or finely grained
Qtz in this sample.

530-535 - Black rock w/ trace
Pyrite & Cpx finely dis.
throughout.

535-540 -

more Hfs & Qtz than
the previous sample. Much
finer grained too, less
Py & Cpx but still present.

540-545

Similar to Above but
more Cpx & Py crystals,
along w/ some K-spar.

545-550 - same but no K-spar.

550-555 - same as above

555-560 - same as above

560-565 - same black lg rock
w/ less Cpx/Py and more
Qtz than previous samples.

565-570

same as above

570-575

same as above

575-580

Black/Grey Rock w/ Qtz
Epidote + Pyr being the most
distinguishable Minerals.
Large Pebble of Clay rock in
the sample.

580-585 - last for day 10:00

same as above but
there could be some mica
in this, hard to tell.

Day 3 - Wends.

5/15/12 Geothermal well for
Ft. McCoy, Wyo. Sunny cool
Morning. On site @ 7:00am.

Drillers changed bits last night
before packing up so starting
w/ new bit. Started drilling @
7:45am, same speed as bit change.

585-590.

Black/Grey Ig rock w/ mica
Some large Qtz, some white clay
possibly some Epidote.

590-595 same as above.

595-600 - Black Ig rock w/ pink
Qtz pebbles up to 1/4". See some
evidence of mica. Can see layering
in clay mineral. Green mineral
can also be seen, Epidote?
Micas look like Biotite.

600-605 Drilling speed picked up
a little towards the end of the
run. Much more K-spar coming
out of this one w/ what looks
to be chlorite mixed in. Still
mafic looking overall but
depending on the next few
samples we could be getting
out of a dike and into the
Precambrian Red granite.
Some biotite micas in sample.

605-610

Similar to about 50 statement
about dike is most likely false.
Rt speed slowed again, less K-spar
than previous sample. There were
also less cutting chips in bucket
so we could be grinding it finer
than previous making for less sample.

610-615 - took 20 min to drill
5' looks very similar to
600-605. More K-spar and
pale green Mta (chloride) the amount
of chloride present makes me
think this is altered granite
still some biotite seen.
Rt Qtz.

615-620 same as above but
finer grained. This is most
likely due to drillers they
have been trying to pick but
speed up.

620-625
same as above
w/ less K-spar.

625-630 - same as above, maybe
a little more chloride.

630-635 - Much more Mod Red Granite
in this sample, more biotite in
Granite and seems to be chlorite
in the black mafic rock. Could
be some Pfr but very fine and
tough to see original structure.

635-640 - Bit speed picked up
then slowed again sample is
same as above.

640-645 - Same mafic rock w/ less
red granite than previous samples. The
granite also has more chloride than
previous samples.

645-650 same as above w/ more
mod Red Granite.

650-655 same w/ 1st less Granite.

655-660 - same as above.

660-665 - Finer grained mafic ig.
rock w/ some mod Red granite
MP. Much less chlorite and much
more biotite in both granite and
black ig.

665-670 - same as above but
I can see fragments of
Cpx or Py on some of the
pebbles, both granite & mafic.

670-675 - similar to above w/
no real trace of Cpx or Py lots of
Biotite however.

675-680 - same as above but
w/ more chloride than previous
samples.

680-685 - same as above

685-690 - Same but w/ less
granite and the chips are smaller
than previous samples. At 1100 gals/min
noticed drop in speed.

690-695 - Same black ign rock
but this is much finer
grained than most other samples.
It also seems to have a
bit of sand in it, lots of
biotite.

695-700 - Bit only went 15' in
1 hr. Same as above

700-705 - same as above

705-710 - Black Mafic rock
w/ large quartz chips throughout
looks like Epidote or Chlorite.
Biotite as well.

710-715
same as above

715-720
same as above (less sample
came up)

720-725 - same as above

725-730 - same as above

730-735 - same as above w/
larger chips

735-740 - same as above

740-745 - same as above w/
as much pink granite.

745-750 - same black ign rock
w/ much biotite, tr. Epidote.
cube in S.S. Qtz crystals.

750-755 - looks like Gray/Black
S.S. w/ some sort of metallic
looking mineral (Biotite)

755-760 - same as above but
a little coarser and with
biotite that can be seen.

760-765
same as above

End Day off site @ 5:30pm

5/17 - chilly morning, partly cloudy,
on site @ 7:00am. Drillers are
putting the rod back down the hole
after tripping it out last night
to check the bit condition.
We have been in the black ign rock
or intrusion since I would say
around 300' the top 300' were much
easier to drill most likely because they
have been decomposed by ground water.
Drilling has been about 1-1.5 in/rod
making this very solid rock. we'll see
how far we can get today, most likely
~140-160' leaving us hopefully ~100' to
drill tomorrow. Started drilling @ 7:45

765-770 - Black Eg rock. Much biotite. Tr. amts. of pink granitic, white clay min. 1. + Qtz crystals. Some carved in S.S. is also present in the sample.

770-775 - Same as above w/ more Qtz and K-spar. Drillers also noted pick up in speed due to changing size of bit from $6\frac{1}{4}$ to $6\frac{1}{2}$. They also changed from $6\frac{1}{2}$ to $6\frac{1}{4}$ yesterday morning.

775-780 some mafic igneous rock but has much pink granitic throughout. There is also some chlorite in this sample along w/ biotite. There seems to be patches of the pink granitic that were not fully melted during the intrusion and can be seen in the alteration of biotite \rightarrow chlorite which is only seen around these intervals.

780-785 - Same as above, however less chlorite and granitic is more of a moderate red than pink color.

785-790 - Same as above w/ little more sand than the last sample.

790-795 - Same as above.

795-800 - Same but very small sample came into the bucket and drilling slowed again to a crawl. We were going at a faster rate than yesterday. Now it is similar.

800-805 - Black Mafic Rock w/ little Qtz, K-spar, chlorite. Much Biotite.

805-810 - The only thing recommended was a large piece of Qtz w/ some clay mineral in it, only other thing seen was carved sand from in the bucket, fracture?

810-815 - Black Mafic Rock w/ little Qtz, K-spar, chlorite. Much Biotite. Drillers report 805-815 took 20 min as opposed to the 5 ft. 20 min. drilling has slowed but is still faster than the 5 ft/20 min rate from before.

815-820 - Same as above, drilling speed slowed a little more back to normal pace.

820-825 - Same as above.

825-830 - Same as above.

830-835 - Mafic igneous rock w/ little red K-spar, chlorite, Qtz. Much biotite. Finer grained overall than previous samples. Also there may be Tr. Epidote, thought to distinguish from chlorite however.

835-840 - Same as above.

840-845 - Similar to above but w/ much less K-spar and more well crystallized Qtz. Also less chlorite/Epidote.

845-850 - Same as above.

850-855 - Same as above.

855-860 - Similar to previous samples but much more cement in S.S. and a little more Pink K-spar along w/ an increase in Chlorite. Drilling still slow.

860-865 - More Pink K-spar than above. I can also see Chlorite crystals less sand in this sample as well, less large Qtz crystals than previous 5 ft.

865-870 - Same as above, nice pink to mod red granite lots of biotite and some chlorite, possibly some Epidote as well.

870-875 - same but less of everything but biotite.

875-880 - same as above but w/ more chlorite visible especially in the granite pieces.

880-885 - same as above

885-890 - same as above.

890-895 - very little pink or mod red granite - still seeing some chlorite, Epidote? Some very good distinctive Qtz seen as well.

895-900 - same as above
2:30pm

900-905 - Same black camp igneous rock, almost no granite in this sample but chlorite is still there in a decent amount. - slowed to 500 rpm

905-910 - hardly no granite, all mafic igneous rock, still much biotite, lots of chlorite. Very slow drilling pace, lots of good Qtz crystals.

910-915 - same as above, seems quartz heavy which is probably not making drilling easy.

915-920 - same as above.

920-925 - same as above, No K-spar, very hard

925-930 - same as above
4:25pm
last rod
of day

930-935 - same as above

935-940 - same as above

940-945 - same as above

End Run @ 5:30pm

off site @ 5:40pm

5/18/12 sunny high of low-mid 80's. Friday, End of hole.

on site @ 7:15 drillers have started already. We will be doing the last 60ft in the morning and pull out and head home.

945-950 - black mafic rock, w/
biotite, quartz crystals. One
very large Qtz crystal that most
likely came from above the hole.

950-955 - same as above w/o large corundum
pebbles, and smaller ones.

955-960 - same as above

960-965 - same as above

965-970 - same as above w/ less
Qtz.

970-975 - same as above

975-980 - same as above

980-985 - same as above.

985-990 - same as above but
found 1 single piece of py crystal
in sample.

990-995 - same as above w/ no py
found in this sample.

995-1000 - same as above

1000-1005 - same as above
Bottom

GPS Taken 6/21/12

44° 01' 06.100" N

90° 39' 00.954" W

CONTENTS

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Location Geothermal #4 Packer Test Date 9/7/2012

Project / Client Arlington Farms

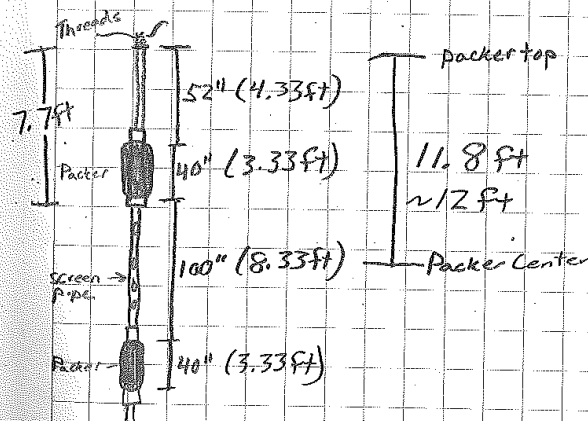
Dave Harg, Pete Chase, Bob Bradbury

Objective: Measure head and Transmissivities of selected intervals in geothermal #4.

Arrived on site @ 9:15 Am, Overcast
65°F. Slight wind.

Depth to water from Top of Casing (TOC)
92.87ft @ 9:30Am

Packer Diagram (not all couplings shown)
Using Baski sliding head packers.



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Location _____ Date _____

Project / Client _____

Interval 11 same packer depth as interval 10 except the bottom packer was deflated, leaving the open interval from 744 to 1000 ft.

Transducer was left at the same location so depths to water should translate (same datum). The logger was stopped and restarted for interval 11.

Bottom packer deflated at 2:26 pm.
Deflation completed at 2:29 pm.

Slug in at 2:31 pm.

Slug out at 2:37 pm (v)

Depth to water (rod stick up) 95.08 ft @ 2:44

File saved as #interval 11.1.vi

Location Fort McCoy

Date 9/12/2012

11

Project / Client Geothermal #5 Pumping Test + Sampling

Objective - Conduct 12 hour steady rate pumping test, ^{8 hour} stepped rate pumping test, stressed flow log & sampling.

Arrived on site at 8:30 AM. Pulled trailer over well and set up rig.

Depth to water (TOC) 14.80 ft @ 9:22 AM
Casing stick up from ground surface 1.8 ft

Spinner calibrated in casing and lowered to 50 ft.

Level logger installed at ~45 ft and started at 10:20 AM.

Depth to water @ 10:26 AM 15.65 ft (TOC)

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Location _____ Date _____

Project / Client _____

Pumping Test Data

Time	Depth(ft)	
10:44:00	15.80	
10:45	Start Pump 5 gal/5 seconds	
10:45:45	19.00	
10:47:00	19.45	
10:47:20	19.50	
10:47:39	19.55	
10:48:03	19.60	
10:48:28	19.65	
10:48:58	19.70	
10:49:23	19.75	
10:50:07	19.80	
10:50:45	19.85	
10:51:36	19.90	
10:52:00	19.94	
10:53:00	19.98	
10:55:00	20.06	
5 gal/5 sec @ 10:55		
11:00	20.21	
11:05	20.32	
11:10	20.40	
11:15	20.47	
11:25	20.61	
11:40	20.75	

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Location _____ Date _____

Project / Client _____

Time	Depth(ft)	Time	Depth
12:31	20.10	10:31:20	16.55
1:27	19.91	31:37	16.50
4:11	20.80	32:06	16.45
6:30	20.32	32:44	16.40
7:45	20.13	33:13	16.35
Rain started at 7:00pm		34:03	16.30
Steady Drizzle.		34:58	16.25
8:58	20.08	36:04	16.20
9:28	20.07		
9:59	20.07	Offsite at 10:40	
10:26	20.06		

D

70:28:45	Pump off (Computer Time)
29:27	16.99
31	16.95
39	16.90
49	16.85
58	16.80
30:08	16.75
24	16.70
37	16.65
52	16.60

~ 8 seconds faster than recorded watch time)

265-6330
 14 Location Fort McCoy Date 9/13/2012
 Project / Client Geothermal #5 Stepped Drawdown Test

Arrived onsite at 8:10 AM. Overcast
 w/ Drizzle.
 Casing ID - 8".
 Depth to Water (TOC) 15.10 ft @ 8:15 AM

Recovery File downloaded and
 saved. Level logger restarted
 w/ 2 second interval several minutes before pump
 Flow rate at hose end 20 gpm. ~ 3 gpm
 at leaks. Pump started at 8:31:20 AM.

Time	Depth
31:50	17.25
32:06	17.00
32:27	16.70
33:08	16.80
33:50	16.75

Pump off at 9:43:50 to
 replace old hose w/ new hose.
 Lot of leaks in old hose.
 Pump back on at 9:45:34.
 Pump off at 9:49 and
 back on at 9:51:10 & 10
 fix leaks.

Depth to water @ 10:26 16.52 ft

15 Location _____ Date _____
 Project / Client _____

Flow rate in new hose 5 gpm/27 seconds
 Flow reduced by ~ 1/2 resulted in step up
 in water levels.

Did spinner logs down & up.
 Depth to water 16.22 ft. Level seems to
 be near steady state.

Opened valve to attempt 20 gpm. Set
 rate to 5 gal/12 seconds, at ~ 11:13.
 Did spinner flow logs up & down.
 Uncertain why initial drawdown
 with old hose was so much larger
 than current drawdown. May be
 due to pumping at other wells.

Opened valve to 5 gal/8 seconds. 37.5 gpm
 at ~ 12:30 PM.
 Logged down and up.

Opened valve to 5 gal/5 seconds (60 gpm)
 at ~ 1:10 PM.

Logged down to ~ 300 ft
 Generator ran out of gas at ~ 1:30.

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Location _____

Date _____

Project / Client _____

Mike returned w/gas at 1:40 PM and generator restarted at 1:45 PM. Pumping rate is 5 gal/5 seconds. Water Levels reaching steady state at 60 gpm rate. Depth to water 18.40 ft at 2:15 PM.

~~Bar~~ Had brought tool up to 2.50 ft and logged down again. Then logged up.

Opened valve all the way pumping rate increased to 75 gpm @ 2:20 PM.

Logged down and up.

Depth to water @ 3:07 PM 19.85 ft.

Pump off at 3:15 PM.

Loading up & off site 5:00 PM.

Location Fort McCoy Geothermal #5 Date 10/16/2012

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Project / Client Packer Testing in Geothermal #5

Dave Hart, Mike Hirsch, Pete Chase

Partly Sunny 15 mph winds 55°F. Arrived on site at 10:30 AM w/pick up and trailer. Pete was already over the well with the ~~pack~~ drill rig.

Unless noted all depths are from the top of casing.

Depth to water @ 10:36 AM 14.60 ft. Packer String has the same dimensions as was used in the Arlington study (page 3)

Barallogger was started yesterday and was placed by drill rig.

Level logger was taped to a water level tape and started to record at 5 s intervals. This will be used for the above top packer water levels.

The cabled level logger will be used for the packed interval.

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Location _____

Date _____

Project / Client _____

Interval #1 4 rod n hole.

Packer center at 48 ft.

Before inflation

Depth to water (DTW) above packer - 14.60 ft

DTW in packer (from packer riser pipe top)

18.60 ft

Riser Pipe stickup from TOC, 4.0 ft

Level logger placed above top packer

Packers inflated to 120 psi. Bottom fast

at ~ 11:35 AM.

DTW 14.55 ft @ 12:03

DTW in packer 18.58 @ 12:04

Dump on at 12:05

Pumping rate 5 gal / 90 seconds (checked

tw. ce.

$$\frac{\left(\frac{7.5 \text{ gpm}}{4 \text{ ft}}\right)}{300 \text{ ft}} = \frac{\left(\frac{3.5 \text{ gpm}}{2 \text{ ft}}\right)}{18 \text{ ft}}$$

$$0.5 = \frac{3.5 \text{ gpm}}{x}$$

DTW in packer is always from riser pipe

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Location _____

Date _____

Project / Client _____

DTW (Not measured)

DTW in packer 18.83 ft @ 12:20

Interval #2 9 rod n hole

Packer center at 100 ft.

Before inflation

2.0 ft of stickup.

DTW 14.60 ft

DTW in packer 16.58 ft

Pump lowered in packer string.

Level logger set in place at 12:40 PM.

Packers inflated to 140 psi @ 12:45

Pump started @ ~ 12:47 PM.

5 gal / 70 s pumping rate

Pump off at 1:05

DTW in packer 16.62 ft @ 1:11

DTW 14.65 ft @ 1:12

Transducers removed @ 1:13

Packers deflated and pump removed @ 1:14

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Location _____

Date _____

Project / Client _____

Interval #3

Center of Packer 144 ft

Placed pump and Level loggers in
the well @ 12:26 1:26

DTW ~ 15.07 ft @ 1:28

DTW in packer 18.05 ft @ 12:27 1:27

3 ft of stickup

Packers inflated to 160 psi, bottom first @ 1:34

Completions
TopWaited till 1:59 to start pump, to allow
water levels to equilibrate. Levels had
dropped ~ 0.6 ft. Pump stopped after ~ 20s

Pumping rate with overcurrent error

Pump Transducer removed at 2:05. Then

the pump was removed

Transducer placed back in well at 2:11 PM

The data was downloaded at 2:20 PM

DTW 15.82 ft @ 2:32

DTW in packer 18.81 ft @ 2:33

Slug test @ 3:18, Oscillatory response,

Slug test @ 3:20 Oscillatory response,

Transducer removed at 3:25 and

Pump set back in well at 3:28

Transducer set back in well

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Location _____

Date _____

Project / Client _____

but ~ 2 ft higher to avoid hitting pump,
at 3:29.

Pump Started at 3:29. 5 gal / 92 sec.

DTW 15.40 ft @ 3:32

DTW in packer 18.40 @ 3:32

Pump off at 3:35. Oscillatory response,

DTW 15.19 ft @ 3:38

DTW in packer 18.14 @ 3:38

Transducers removed @ 3:39

Pump removed and packers deflated @ 3:40.

Interval #4 14 rods in hole.

Center of Packer 151.6 ft

Stickup height 7"

DTW 15.07 ft 3:47

DTW in packer 15.67 @ 3:48

Transducers and the pump placed in the
well at 3:51 PM.

Packers filling at 3:50

Packers filled and water level at equilibrium
at 4:00.

Pump started at 4:02.

Pumping rate 5 gal / 92 sec.

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Location _____ Date _____

Project / Client _____

DTW 15.66 ft @ 4:12

DTW in packer 16.30 @ 4:11

Pump off at 4:12

Transducer in packer removed early

DTW 15.45 ft @ 4:18

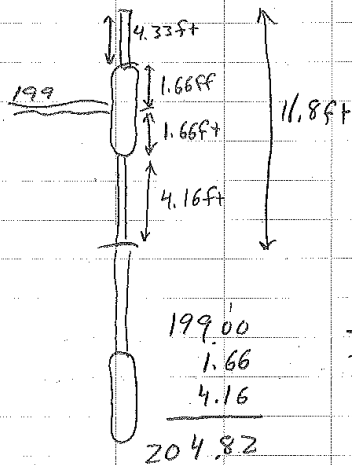
DTW in packer 16.03 @ 4:18

Interval #5 19 rod in hole,

Calculation for depth.

want top packer across shale layer
at 199 ft

Depth to packer center 204.8 ft



23

Location _____ Date _____

Project / Client _____

2 ft of Stickup

Depth TW in packer 16.80 ft @ 4:40

DTW 14.93 ft @ 4:40

Pump and transducers in place @ 4:44

Packer being inflated Bottom inflated @ 4:46

Packer inflated to 180 psia at 4:53

DTW in packer 16.87 ft @ 4:55

DTW 15.32 ft @ 4:56

Pump on at 4:59

5 gal / 94 seconds pumping rate

DTW in packer 17.12 ft @ 5:05

DTW 15.49 ft @ 5:06

Pump off @ 5:11

DTW in packer 16.83 ft @ 5:15

DTW 15.30 ft @ 5:16

Packer Level logger data downloaded
and saved. Sample interval reset to
20 seconds and transducer replaced
in packer.

Purge volumes - Packer interval + riser pipe
 $V = \pi [(0.25 \text{ ft})^2 + (0.11 \text{ ft})^2] \cdot 8.33 \text{ ft} + \pi (0.11 \text{ ft})^2 \cdot 190 \text{ ft}$
 $= 1.3 \text{ ft}^3 + 5.84 \text{ ft}^3 \Rightarrow 53 \text{ gallons} \times 3 = 160$

40 minutes purge time @ 4 gpm.
Offsite at ~5:00-5:30 PM.

24

Location _____

Date 10/17/2012

Project / Client _____

Onsite at 7:40 AM. Installed pump in well

DTW 14.91 ft @ 7:51 AM

DTW in packer 16.48 ft @ 7:52 AM

Bottom packer pressure 170 psi

Upper packer pressure 190 psi

Pump on at 7:56 AM

~~BP~~ upper transducer placed in well at 7:58.

Pumping Rate 5 gal/90 sec = 3.33 gpm

160 gallons to purge 3 volumes / 3.33 gpm = 48 minutes

Transducer above packer installed at 8:09 AM

Times in log book ~~and~~ (my watch) are

1 minutes ahead of the loggers' times.

They were synchronized to the computer before startup.

DTW 15.17 ft @ 8:15:30

DTW in packer 16.76 @ 8:17:00

Δh above packer 0.26 ft

Δh in packer 0.28 ft

DTW 15.18 ft @ 8:37:30

DTW in packer 16.79 @ 8:38:45

Collected samples at 9:00 AM.

25

Location _____

Date _____

Project / Client _____

Did slug-in test at 9:47 AM. Oscillatory response
Slug out at 9:50 AM

DTW 14.97 ft @ 9:52 AM

DTW in packer 16.49 ft @ 9:54:00

Deflated packers at 9:57 AM.

DTW in packer 16.41 ft @ 9:58

DTW 14.53 ft @ 9:59

Transducers removed and rod added 10:00 AM.

Interval #6 24 rod in hole

Depth to packer center 250 ft

2 ft of stickup

DTW in packer 16.40 ft @ 10:15

DTW 14.52 ft @ 10:15

Transducers in well at 10:17

Filling packers at 10:18 (bottom first)

Checked transducer (it was working) @ 10:26

DTW 14.61

DTW in Packer 16.44 @ 10:28

Pump installed and on at 10:32

Pumping rate 5 gal/90 seconds

DTW in packer 16.70 ft @ 10:43:20

DTW 14.89 ft @ 10:44

Pump pulled packers deflated and transducers removed @ 10:46.

26

Location _____

Date _____

Project / Client _____

Interval #7

Depth to center interval 274

DTW in packer 17.51 ft @ 10:55

DTW 14.44 ft @ 10:55:45

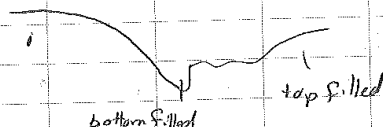
3 ft of stickup.

Transducers installed at 10:57.

Packers inflated to 215 psi.

Bottom packer then top

Packer water levels during packer fill.



Pump installed at 11:17

5 gals / 1 min 30 sec = 0

DTW in packer 17.95 ft @ 11:22

DTW 15.12 ft @ 11:22

Pump off removed at 11:29

DTW in packer 17.68 ft @ 11:37

DTW 14.97 @ 11:38

Transducers removed at 11:39

Packers deflated @ 11:39

27

Location _____

Date _____

Project / Client _____

Interval #8

Depth to center interval 317.35 ft (assumes 12A)
not 11.8

0.65 ft stickup

DTW in packer 15.14 ft @ 11:52

DTW 14.52 ft @ 11:53

Transducers installed at 11:54

Packers inflated start 11:54

Packers inflated to 230 psi.

DTW in packer 14.89 ft @ 12:12

DTW 14.59 ft @ 12:12

Pump installed and on at 12:14.

Pumping rate 5 gals / 92 seconds.

Reduced pumping rate at 12:32 to 5 gals / 180 sec.

Pumping off at 12:37 (both changes gave oscillatory response)

Pump pulled at 12:40

Slug in at 12:47

Slug out at 12:49

DTW in packer 14.83 @ 1:31

DTW 14.60 @ 1:32

Interval #9

Depth to center interval 400 ft

2.0 ft stickup

DTW in packer 16.40 ft @ 1:58

28

Location _____

Date _____

Project / Client _____

DTW 14.52 @ 1:58

Installed transducers and inflated packers

Packers inflated to 265 psi

DTW in packer 16.40 @ 2:24

DTW 14.51 @ 2:25

Little drawdown. Pump installed. Little drawdown (K.O. 5 ft) during pumping so we will pull the packer string to inspect it.

Pulled all 400 ft and checked packers. Did not find anything to suggest flow past the packer in the tubing. Packer seemed fine. Inflated it to 150 psi. O.D. of packer was 0.6 ft. We suspect packer is not inflating to seal the hole. We Pete called Baski. They suggested we inflate to 350 over hydrostatic to get a better seal. We had been inflating to recommended pressure of 150 over hydrostatic, & we had been doing it properly.

We will place the packer at 170' and run a test to see if we get a seal.

29

Location _____

Date _____

Project / Client _____

That portion of the boring is relatively smooth and at 6" by the caliper log.

Intervall 17.5 ft

Depth to packer center 170 ft

DTW 15.81 ft @ 4:37

DTW in packer 17.81 ft @ 4:37

2.0 of stickup

Install started and installed level loggers at 4:38.

Inflating top packer to 220 psi. Ultimately inflated it to 270 psi. Saw ~5 feet of head rise below top packer.

DTW in packer 11.78 ft @ 5:00 PM

DTW 24.31 ft @ 5:01 PM

Transducer above packer lowered an additional 10 ft @ 5:01 PM.

Inflating bottom packer to 270 psi at 5:03 PM.

DTW in packer 27.11 ft @ 5:12 PM

DTW 24.49 ft @ 5:13 PM

30

Location _____

Date _____

Project / Client _____

Transducer in packer lowered an additional 10 ft. to prevent dewatering at 5:14 PM.

Slug in at 5:15 PM

Slug out at 5:19 PM

DTW in packer 26.62 ft @ 5:23

DTW 23.87 ft @ 5:24

Pump installed in well. @ 5:24

Pump on at 5:28

Pumping rate 5 gallons/3m 15s.

Pump rate increased 5:33 PM

Pumping rate 5 gallons/1m 44s.

DTW in Packer 30.26 ft @ 5:38

DTW 23.35 ft @ 5:39

Packers deflated and transducers pulled at 5:42

Location _____

Date 10/18/2012

31

Project / Client _____

Overcast 45°F

Arrived on-site 7:45 AM.

DTW in packer 16.76 ft @ 7:58

DTW 14.80 @ 7:58

Interval #12

Depth to packer center 224 ft

Transducers installed @ 8:15 AM.

DTW in packer 17.75 ft @ 8:16

DTW 14.80 ft @ 8:16.30

3.0 ft of stick up

Packer inflation to 290 psi.

Top packer inflated at 8:28

DTW in packer 11.65 ft @ 8:28

DTW 21.34 ft @ 8:29

Bottom packer inflation started @ 8:30

Inflation complete @ 8:37

DTW in packer 12.46 ft @ 8:39

DTW 21.61 ft @ 8:38

Slug in at 8:42 AM

Slug out at 8:44 AM

Pump installed in well @ 8:45

Pump on at 8:48.

Ran it at 3 different rates, then motor kicked out. 5 gals/2m 8s at 1st pumping rate other rates not collected.

32

Location _____

Date _____

Project / Client _____

DTW in packer 12.24 ft @ 8:56
 DTW 21.77 ft @ 8:56:30

Interval #13

Downloaded packer data

Lowered packer to ~321 center
 0.75 ft stickup

Placed transducers in well

DTW in packer 15.30 ft @ 9:33

DTW 14.65 ft @ 9:34

Started packer transducer at 9:35

Inflated top packer to 370 psi
 at 9:38 AM

DTW in packer 15.36 ft @ 10:11

DTW 14.70 ft @ 10:11

Slug in and slug out tests done at 10:12-10:18

It ~~is~~ is likely that there is not a good seal. The slug response is oscillatory.

Did a pumping test that also suggested a poor seal. The data was saved as

Interval 13 - 321 ft geothermal 5...

Pumping rate was 5 gal / 2 min

33

Location _____

Date _____

Project / Client _____

Depth to water in packer 15.40 ft @ 11:30
 after packer was deflated.

~~10~~ Ran out of ^{nitrogen} gas. Waiting for Pettit to return
 from La Crosse w/ tank.

Interval #14

Depth to packer center 310 ft

2 ft stickup

DTW in packer 16.74 ft @ 12:32

DTW 14.85 ft @ 12:32

Inflating top packer to 330 psi @ 12:34

Set transducer too deep so ^{hit max reading} it was raised
 several feet to give a reading.

Depth to water in packer 11.95 @ 12:43

DTW 16.63 @ 12:43

Inflating bottom packer to 330 psi at 12:45

DTW in packer 11.82 @ 12:52 filled at 12:50

DTW 16.90 @ 12:52

Slug in at 12:53 slug out @ 12:55

Pump on at 12:57

Pumping rate 5 gal / 2 min / 10 s.

34

Location _____ Date _____

Project / Client _____

Pumping rate increased at 1:00.
 Pumping rate 5gal/1m 22s.
 Rechecked packer pressure + rechecked
 transducers at 1:05.

Interval #15

Packer Center Set at 260 Feet

2.0 ft of stickup

Transducers placed in well @ 1:21

DTW in packer 17.63 ft @ 1:22

DTW 15.72 ft @ 1:22

Top packer inflated to 310 psi.

DTW in packer 14.08 ft @ 1:34

DTW 18.26 ft @ 1:35

Bottom packer inflated to 310 psi.

DTW in packer 16.35 ft @ 1:43

DTW 19.11 ft @ 1:43

Slug in at 1:44

Slug out at 1:45

Pump installed and on at 1:47.

Waited for equilibrium between inst
 and power on.

35

Location _____ Date _____

Project / Client _____

Pumping Rate 5gal/1m 28s.

Interval #16

Packer Center Set at 150 ft.

2.0 ft of stickup

Transducers in

DTW in packer 17.97 @ 2:16

DTW 15.92 @ 2:17

Bottom packer inflated to 260 psi.

DTW in packer 24.58 ft @ 2:27

DTW 22.55 ft @ 2:28

Top packer inflated to 260 psi.

DTW in Packer 24.66 ft @ 2:34

DTW 22.64 ft @ 2:35

Slug in at 2:36

Slug out at 2:37

Pump installed at 2:39

Pump on at 2:41

Pumping Rate 5gal/1m 30s.

Packed up + offsite