PRODUCTION LOGGING SERVICES, INC.

E.P.A.-R.A.T.S. (RADIOACTIVE TRACER SURVEY)

Company	HYDRO RESOURCES
Well	ECCV DI-2
Field	WATTENBERG
County	ADAMS
State	COLORADO
Country	
Location:	NE/NE
API #:	
	SEC 1 TWP 1S RGE 66W
Other Services	
Permanent Datum	GROUND LEVEL
Elevation	5018'
Log Measured From	KELLY BUSHING 16' ABOVE G.L.
Drilling Measured From	KELLY BUSHING
Elevation	K.B. 5034' D.F. 5033' G.L. 5018'

Date	18-JULY-2017
Run Number	ONE
Depth Driller	10,100'
Depth Logger	10,050'
Bottom Logged Interval	10,050'
Top Log Interval	8,246'
Open Hole Size	
Type Fluid	WATER
Density / Viscosity	
Max. Recorded Temp.	
Estimated Cement Top	
Time Well Ready	
Time Logger on Bottom	
Equipment Number	21
Location	VERNAL
Recorded By	K. STRATTON
Witnessed By	FRED ROTHAGE / MICHELLE / PROBASCO

Borehole Record				Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To
				5 1/2"		SURF.	9027'
				PACKER		9027'	9030'

Casing Record	Size	Wgt/Ft	Top	Bottom
Surface String	10 3/4"	40.5	SURFACE	1757'
Prot. String	7 5/8"	26.4	SURFACE	9071
Production String				
Liner	4 1/2" SLOTTED	11.6	9043'	10,093'

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All interpretations are opinions based on inferences from electrical or other measurements and we cannot and do not guarantee the accuracy or correctness of any interpretation, and we shall not, except in the case of gross or willful negligence on our part, be liable or responsible for any loss, costs, damages, or expenses incurred or sustained by anyone resulting from any interpretation made by any of our officers, agents or employees. These interpretations are also subject to our general terms and conditions set out in our current Price Schedule.

Comments

REMARKS: RADIOACTIVE TRACER SURVEY

RAN RADIOACTIVE WATER TRACER SURVEYS TO DETERMINE INTERVALS OF INJECTION AND TO CHECK FOR CHANNELING ABOVE INJECTION ZONE.

DUE TO HIGH INJECTION RATE, STOP CHECK METHOD WAS USED FOR CALCULATING FLUID EXITS. A RATE OF 17 BBLS/MIN. (24,480 BBLS/DAY) AT 1400 P.S.I. WAS USED TO DETERMINE FLUID EXITS. WITH RATE ANY HIGHER UNABLE TO ACCURATELY DETERMINE FLUID LOSS.

****** FOR FINAL CHANNEL CHECK ABOVE SLOTTED LINER AT 9056'-9213' AND 7 5/8" CASING SHOE AT 9071' INJECTION RATE WAS INCREASED TO 37.5 BBLS/MIN. (54,000 BBLS/DAY) AT SURFACE PRESSURE OF 3050 P.S.I.

ALL RADIOACTIVE TRACER SLUGS WERE INJECTED INTO THE WELLBORE BETWEEN THE SLOTTED LINER INTERVALS TO OBTAIN FLUID INJECTION PERCENTAGE PROFILE.
RADIOACTIVE TRACER USED WAS I-131 RADIOACTIVE WATER TRACER. ALL GAMMA-RAY SURVEYS WERE RAN AT 50'-60' PER MINUTE WITH A TIME CONSTANT SET AT 1.

RADIOACTIVE TRACER SURVEYS CHECK TOP SLOTTED LINER AT 9056'-9213' AND 7 5/8" CASING SHOE AT 9071' OK.

REMARKS: RAN RADIOACTIVE WATER TRACER SURVEYS TO DETERMINE INTERVALS OF INJECTION AND TO CHECK FOR CHANNELING ABOVE INJECTION ZONE.

METERED INJECTION RATE:	24,480 B/D.
TUBING PRESSURE:	1400 P.S.I.
P.L.S. DOWNHOLE INJECTION RATE:	24,762 B/D.

ALL DEPTHS CORRELATED TO RELIANCE TEMPERATURE, GAMMA-RAY AND CASING COLLAR LOG DATED 09-AUG-2016.

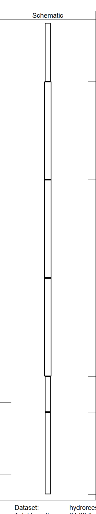
TOOL SPACING
EJECTOR PORT TO GAMMA-RAY DETECTOR 24' 2"

REMARKS: FOUND FLUID EXITS THROUGH INTERVALS AS SHOWN

SLOTTED LINER INTERVAL

9056'-9213'	35% FLUID EXIT
9494'-9625'	49% FLUID EXIT
9653'-9728'	11% FLUID EXIT
9762'-9838'	2% FLUID EXIT
9866'-9903'	1% FLUID EXIT
9941'-10093'	2% FLUID EXIT

**NOTE ZERO FLOW TRACER AT 10,038'.

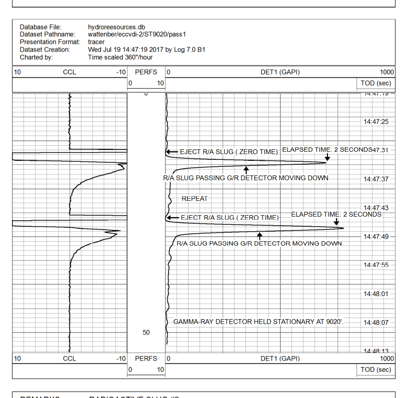


Sensor	Offset (ft)	Description	Len (ft)	OD (in)	Wt (lb)
		TREJCT-EJT (EJECT) Ejector	3.00	1.38	5.00
		169x5	5.00	1.69	43.00
		169x5	5.00	1.69	43.00
		169x5	5.00	1.69	43.00
CCL	3.67	CCL-138Log (138L)	1.83	1.38	5.00
DET#2	0.00	TRDET #2 -Scint (SGR) Scintillation	4.17	1.38	10.00

Dataset: hydroreesources.db: wattenber/eccvdi-2/tr10010/pass4
Total Length: 24.00 ft
Total Weight: 149.00 lb
O.D. 1.69 in

REMARKS: RADIOACTIVE SLUG #1
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 8996' WITH GAMMA-RAY DETECTOR STATIONARY AT 9020'. LOGGED ON TIME DRIVE.
CALCULATED RATE: 24,672 B/D.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/ST9020/pass1
Presentation Format: tracer
Dataset Creation: Wed Jul 19 14:47:19 2017 by Log 7.0 B1
Charted by: Time scaled 360"/hour



REMARKS: RADIOACTIVE SLUG #2
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 9452' WITH GAMMA-RAY DETECTOR STATIONARY AT 9476'. LOGGED ON TIME DRIVE.
CALCULATED RATE: 16,116 B/D.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/st9475/pass1
Presentation Format: tracer
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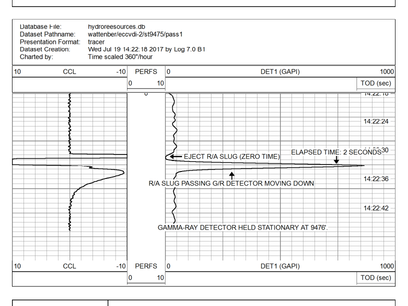
Charted by: Time scaled 360"/hour



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REPEAT

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/st9475/pass2
Presentation Format: tracer
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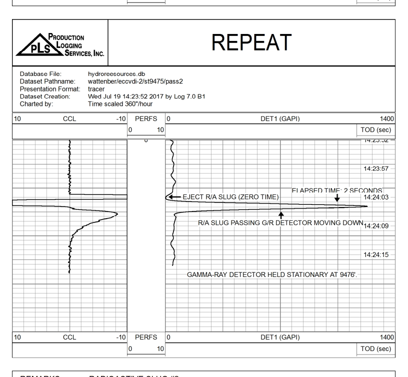
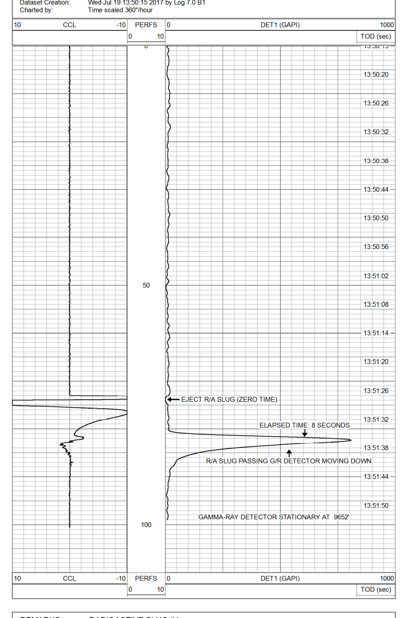
Charted by: Time scaled 360"/hour



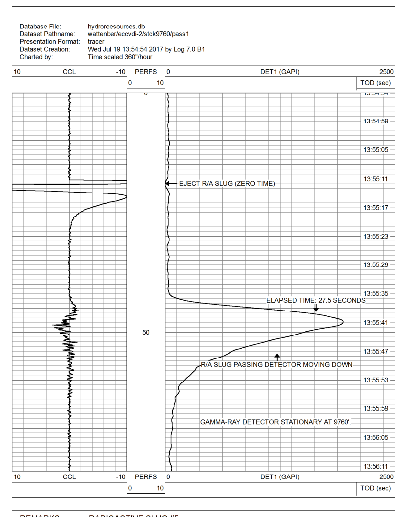
REMARKS: RADIOACTIVE SLUG #3
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 9628' WITH GAMMA-RAY DETECTOR STATIONARY AT 9652'. LOGGED ON TIME DRIVE.
CALCULATED RATE: 4,030 B/D.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/stck9652/pass2
Presentation Format: tracer
Dataset Creation: Wed Jul 19 13:50:15 2017 by Log 7.0 B1
Charted by: Time scaled 360"/hour



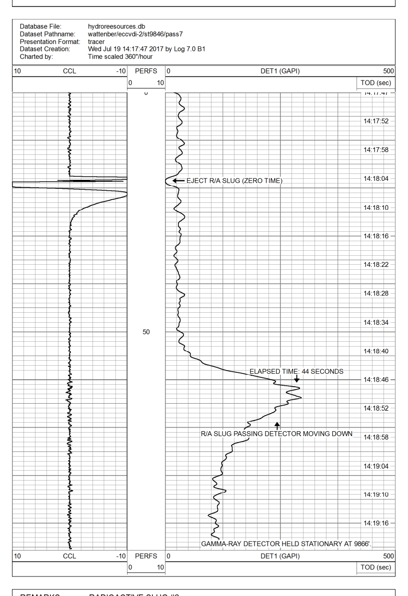
REMARKS: RADIOACTIVE SLUG #4
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 9736' WITH GAMMA-RAY DETECTOR STATIONARY AT 9760'. LOGGED ON TIME DRIVE.
CALCULATED RATE: 1,172 B/D.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/stck9760/pass1
Presentation Format: tracer
Dataset Creation: Wed Jul 19 13:54:54 2017 by Log 7.0 B1
Charted by: Time scaled 360"/hour



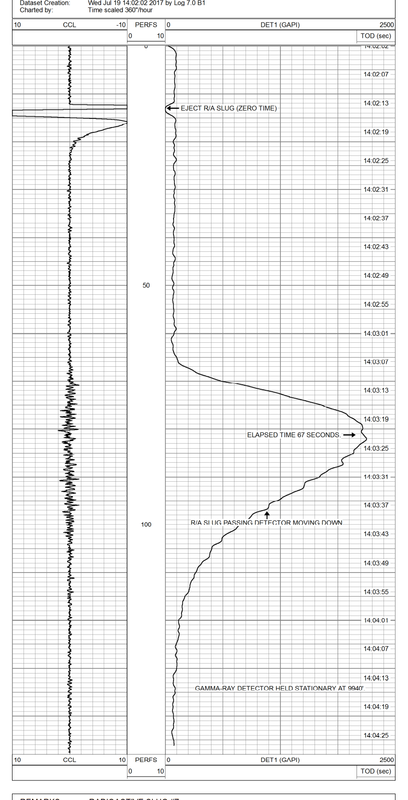
REMARKS: RADIOACTIVE SLUG #5
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 9842' WITH GAMMA-RAY DETECTOR STATIONARY AT 9866'. LOGGED ON TIME DRIVE.
CALCULATED RATE: 732 B/D.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/st9846/pass7
Presentation Format: tracer
Dataset Creation: Wed Jul 19 14:17:47 2017 by Log 7.0 B1
Charted by: Time scaled 360"/hour



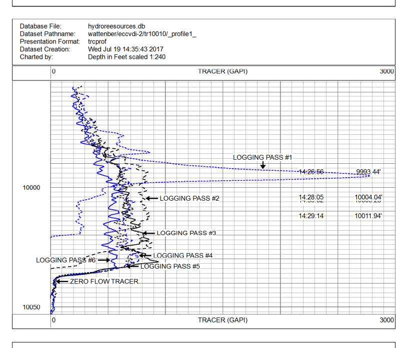
REMARKS: RADIOACTIVE SLUG #6
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 9916' WITH GAMMA-RAY DETECTOR STATIONARY AT 9940'. LOGGED ON TIME DRIVE.
CALCULATED RATE: 481 B/D.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/stck9940/pass1
Presentation Format: tracer
Dataset Creation: Wed Jul 19 14:02:02 2017 by Log 7.0 B1
Charted by: Time scaled 360"/hour



REMARKS: RADIOACTIVE SLUG #7
A .5 MCI SLUG OF RADIOACTIVE WATER WAS INJECTED INTO THE FLOWSTREAM AT 9990'. THIS SLUG WAS THEN LOGGED ON DEPTH VS. TIME AS IT MOVED DOWNHOLE AND EXITED INTO THE FORMATION AT 10,038'.
ZERO FLOW TRACER 10,038'

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/tr10010/_profile1_
Presentation Format: trcprof
Dataset Creation: Wed Jul 19 14:35:43 2017
Charted by: Depth in Feet scaled 1:240



REMARKS: TOP OF SLOTTED LINER AND CASING SHOE CHECK

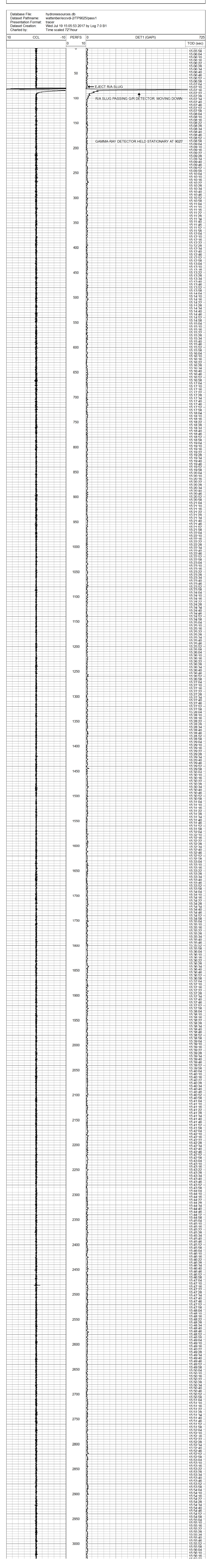
INJECTION RATE WAS INCREASED TO 37.5 BBLS/MIN. (54,000 BBLS/DAY) AT 3050 P.S.I.

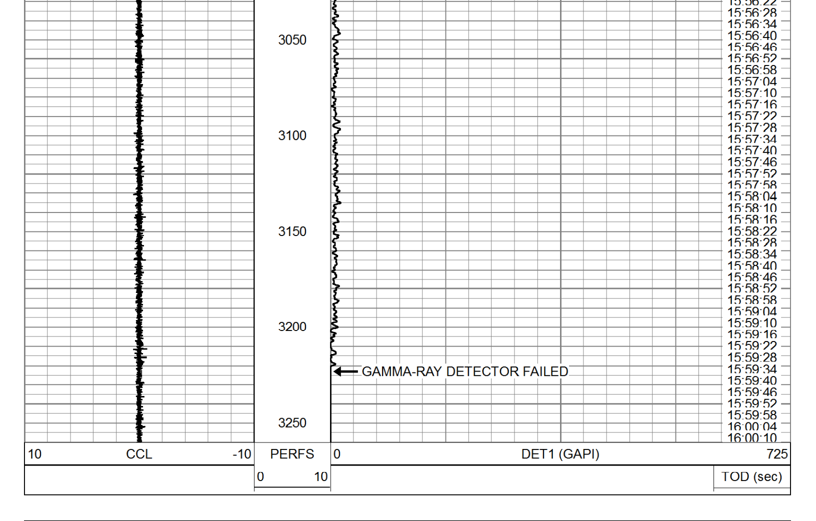
HELD LOGGING INSTRUMENTS STATIONARY WITH GAMMA-RAY DETECTOR POSITIONED AT 9025'. INJECTED A .5 MCI SLUG OF RADIOACTIVE MATERIAL INTO THE FLOWSTREAM. LOGGED ON TIME DRIVE.

LOGGED ON TIME DRIVE FOR 52 MINUTES (GAMMA-RAY DETECTOR FAILED)

INJECTION RATE AT 54,000 B/D. R/A SLUG TRAVELING AT 2412' PER MINUTE INSIDE 4 1/2" SLOTTED LINER.

Database File: hydroreesources.db
Dataset Pathname: wattenber/eccvdi-2/TP9025/pass1
Presentation Format: tracer
Dataset Creation: Wed Jul 19 15:05:53 2017 by Log 7.0 B1
Charted by: Time scaled 72"/hour





REMARKS: AFTER TOP OF SLOTTED LINER AND CASING SHOE CHECK

AFTER GAMMA-RAY DETECTOR FAILED, CEASED ALL PUMPING OPERATIONS, CAME OUT OF HOLE AND REPAIRED GAMMA-RAY DETECTOR. RAN BACK IN HOLE AND MADE TWO UP LOGGING PASSES ACROSS TOP OF SLOTTED LINER AND CASING SHOE.

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UP LOGGING PASS #1

Database File: hydroresources.db
Dataset Pathname: wattenber/eccvdi-2/aftpkr/pass1
Presentation Format: tracer
Dataset Creation: Wed Jul 19 18:30:01 2017 by Log 7.0 B1
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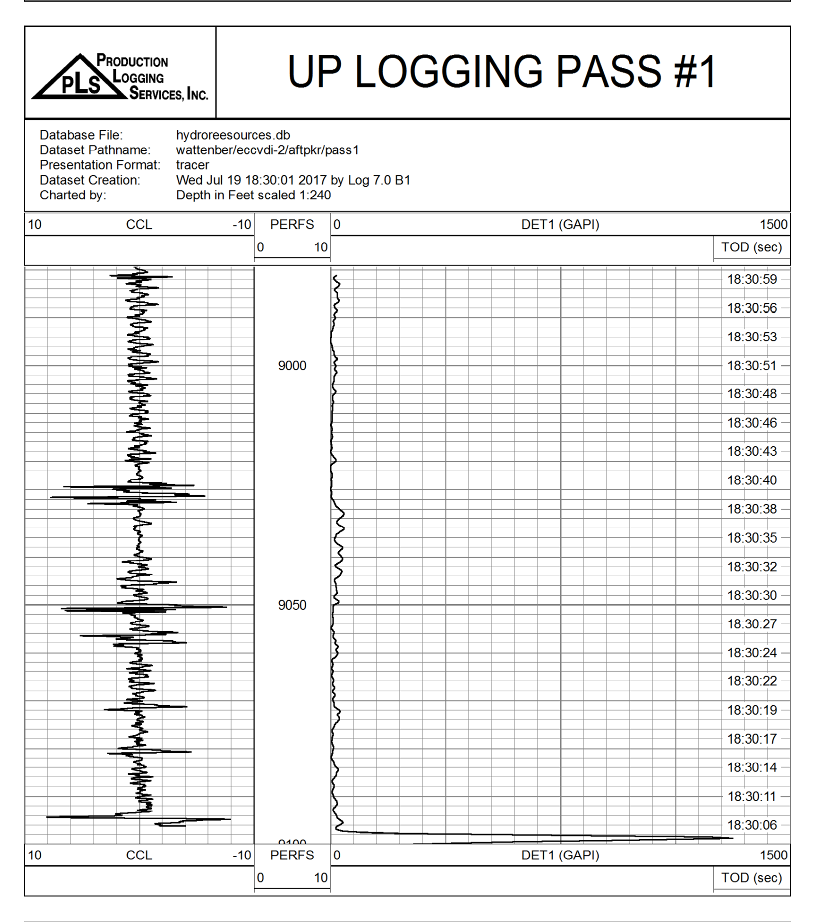

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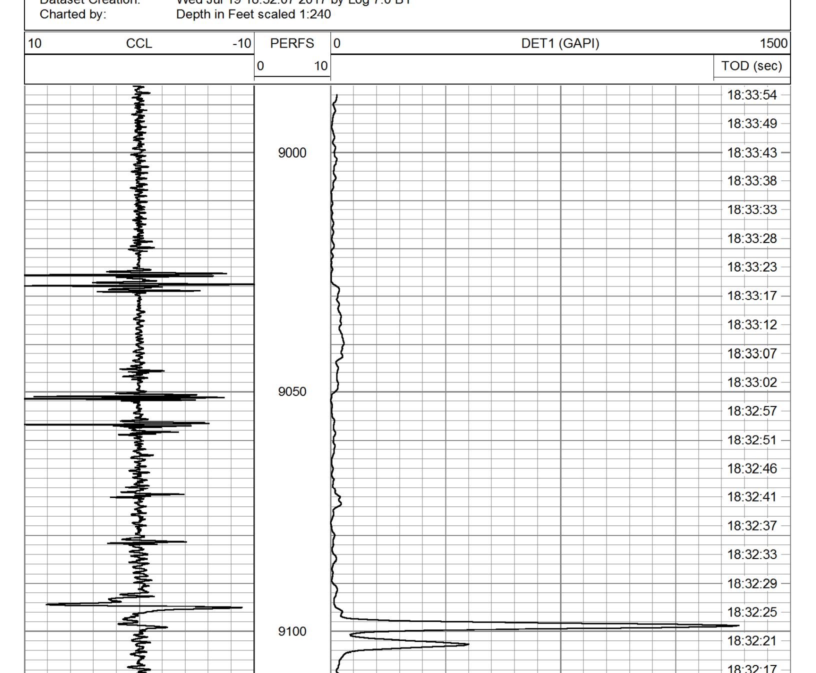
UP LOGGING PASS #2

Database File: hydroresources.db
Dataset Pathname: wattenber/eccvdi-2/aftpkr/pass2
Presentation Format: tracer
Dataset Creation: Wed Jul 19 18:32:07 2017 by Log 7.0 B1
Charted by: Depth in Feet scaled 1:240



REMARKS: GAMMA-RAY/COLLAR LOCATOR SURVEYS

A GAMMA-RAY/CCL LOG (SOLID LINE) WAS RAN FROM JUST ABOVE T.D. TO AT LEAST 500' ABOVE THE PACKER BEFORE ANY RADIOACTIVE MATERIAL WAS RELEASED.

A SECOND GAMMA-RAY/CCL LOG (DOTTED LINE) WAS RAN AFTER ALL RADIOACTIVE TRACER SURVEYS WERE COMPLETED.

LOGS WERE THEN MERGED AND ARE SHOWN BELOW.

Database File: hydroresources.db
Dataset Pathname: wattenber/eccvdi-2/GRMERGE/pass1
Presentation Format: gr-ccl
Dataset Creation: Tue Jul 25 10:55:42 2017
Charted by: Depth in Feet scaled 1:240