COMPANY: NORTHWEST NATURAL GAS

WELL: OM-32-22-65

FIELD: CALVIN CREEK GAS STORAGE

COUNTY: COLUMBIA STATE: OREGON

COUNTY: COLUMBIA
Field: CALVIN CREEK GAS STORAGE
Location: 1884.04 S & 1261.26 E FROM
Well: OM-32-22-65
Company: NORTHWEST NATURAL GAS

Schlumberger

PLATFORM EXPRESS
ARRAY INDUCTION/SP/ML/SP
DENSITY/NEUTRON/SONIC

LOCATION

1884.04' S & 1261.26' E FROM THE
NE CORNER OF SECTION 22

Elev.: K.B. 762 F
G.L. 753 F
D.F.

Permanent Datum:	GROUND LEVEL	Elev.:	753 F
Log Measured From:	KELLY BUSHING	9.0 F	above Perm. Datum
Drilling Measured From:	KELLY BUSHING		

API Serial No.	SECTION	TOWNSHIP	RANGE
	22	6N	5W

		Run 1		Run 2	
Logging Date		22-JUL-1998			
Run Number		ONE			
Depth Driller		2365 F			
Schlumberger Depth		2365 F			
Bottom Log Interval		2357 F			
Top Log Interval		425 F			
Casing Driller Size @ Depth		8.625 IN	@ 425 F		@
Casing Schlumberger		425 F			
Bit Size		7.875 IN			
Type Fluid In Hole		CYPAN			
MUD Density	Viscosity	9.5 LB/G	45 S		
Fluid Loss	PH	7.8 C3	8		
Source Of Sample		FLOWLINE			
RM @ Measured Temperature		1.870 OHMM	@ 80 DEGF		@
RMF @ Measured Temperature		1.910 OHMM	@ 70 DEGF		@
RMC @ Measured Temperature		1.650 OHMM	@ 70 DEGF		@
Source RMF	RMC	PRESS	PRESS		
RM @ MRT	RMF @ MRT	1.579 @ 96	1.427 @ 96	@	@
Maximum Recorded Temperatures		96 DEGF			
Circulation Stopped	Time	22-JUL-1998	2:30		
Logger On Bottom	Time	22-JUL-1998	5:30		
Unit Number	Location	3152	SACRAMENTO		
Recorded By		JASON GENDUR			
Witnessed By		JACK MEYER			

		Run 1	Run 2
Logging Date			
Run Number			
Depth Driller			
Schlumberger Depth			
Bottom Log Interval			
Top Log Interval			
Casing Driller Size @ Depth		@	
Casing Schlumberger			
Bit Size			
Type Fluid In Hole			
MUD Density	Viscosity		
Fluid Loss	PH		
Source Of Sample			
RM @ Measured Temperature		@	
RMF @ Measured Temperature		@	
RMC @ Measured Temperature		@	
Source RMF	RMC		
RM @ MRT	RMF @ MRT	@	@
Maximum Recorded Temperatures			
Circulation Stopped	Time		
Logger On Bottom	Time		
Unit Number	Location		
Recorded By			
Witnessed By			

@
@ @ @ @
@

Run 3

Run 4

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 INTERPRETATIONS, 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 CLAUSE 4 OF OUR GENERAL TERMS AND CONDITIONS AS SET OUT IN OUR CURRENT PRICE SCHEDULE.

OTHER SERVICES1	OTHER SERVICES2
OS1:	OS1:
OS2:	OS2:
OS3:	OS3:
OS4:	OS4:
OS5:	OS5:
REMARKS: RUN NUMBER 1	REMARKS: RUN NUMBER 2
Thank you for choosing Schlumbeger!	
AIT run with 1" standoffs.	
CNL run with bowspring for eccentralization.	
Log run on sandstone matrix = 2.65 g/c3.	
Your crew today is Forehand & Tye.	

RUN 1	RUN 2
SERVICE ORDER #: 1222172	SERVICE ORDER #:
PROGRAM VERSION 8C1-205	PROGRAM VERSION
FLUID LEVEL:	FLUID LEVEL:

LOGGED INTERVAL	START	STOP	LOGGED INTERVAL	START	STOP

EQUIPMENT DESCRIPTION

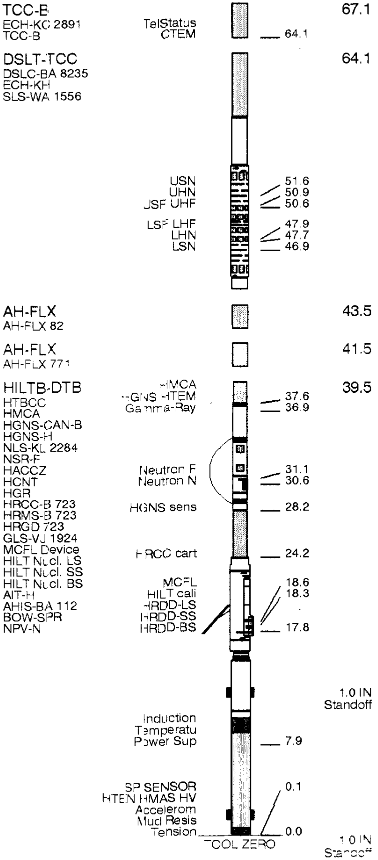
RUN 1	RUN 2

SURFACE EQUIPMENT

GSR-UY
NCT-B
CNB-AB
NCS-VB
WITM (CTS)-A

DOWNHOLE EQUIPMENT

LEH-Q 69.3
LEH-Q 3052



MAXIMUM STRING DIAMETER 5.88 IN
MEASUREMENTS RELATIVE TO TOOL ZERO
ALL LENGTHS IN FEET

Input DLIS Files

DEFAULT	HILTB .037	FN:1	FIELD	22-Jul-1998 12:54	2370.0 FT	249.7 FT

Output DLIS Files

DEFAULT	HILTB .038	FN:31	FIELD	22-Jul-1998 13:19	2370.0 FT	250.0 FT

Integrated Hole/Cement Volume Summary

Hole Volume = 769.61 F3
Cement Volume = 449.46 F3 (assuming 5.50 IN casing O.D.)
Computed from 2365.0 FT to 425.0 FT using data channel(s) HCAL

OP System Version: 8C1-205

MCM

HILTB-DTB	APCW-98Q1	DSLT-TCC	8C1-205
TCC-B	APCW-98Q1		

PIP SUMMARY

⊢ Integrated Hole Volume Minor Pip Every 10 F3
⊢ Integrated Hole Volume Major Pip Every 100 F3
⊣ Integrated Cement Volume Minor Pip Every 10 F3
⊣ Integrated Cement Volume Major Pip Every 100 F3

■ Time Mark Every 60 S

Env.Corr.Thermal Neutron Porosity (TNPH)
1.2 (V/V) 0.6

Crossover

Micro-resistivity (RXOI)
0.2 (OHMM) 20

Env.Corr.Thermal Neutron Porosity (TNPH)
0.6 (V/V) 0

Micro Normal Resistivity (HMNO) (OHMM)
0 30

AIT-H 90 Inch Investigation (AHO90)
0.2 (OHMM) 20

Tension (TENS)
10000 (LBF) 0

Micro Inverse Resistivity (HMIN) (OHMM)
0 30

AIT-H 60 Inch Investigation (AHO60)
0.2 (OHMM) 20

Sonic Porosity (SPHI)
0.6 (V/V) 0

RWA (RWA)
0 (OHMM) 3

Resistivity standoff (RSOZ)
2 (IN) 0

AIT-H 30 Inch Investigation (AHO30)
0.2 (OHMM) 20

Formation Pe (PEFZ)
-1 (----) 9

Caliper (HCAL)
6 (IN) 16

AIT-H 20 Inch Investigation (AHO20)
0.2 (OHMM) 20

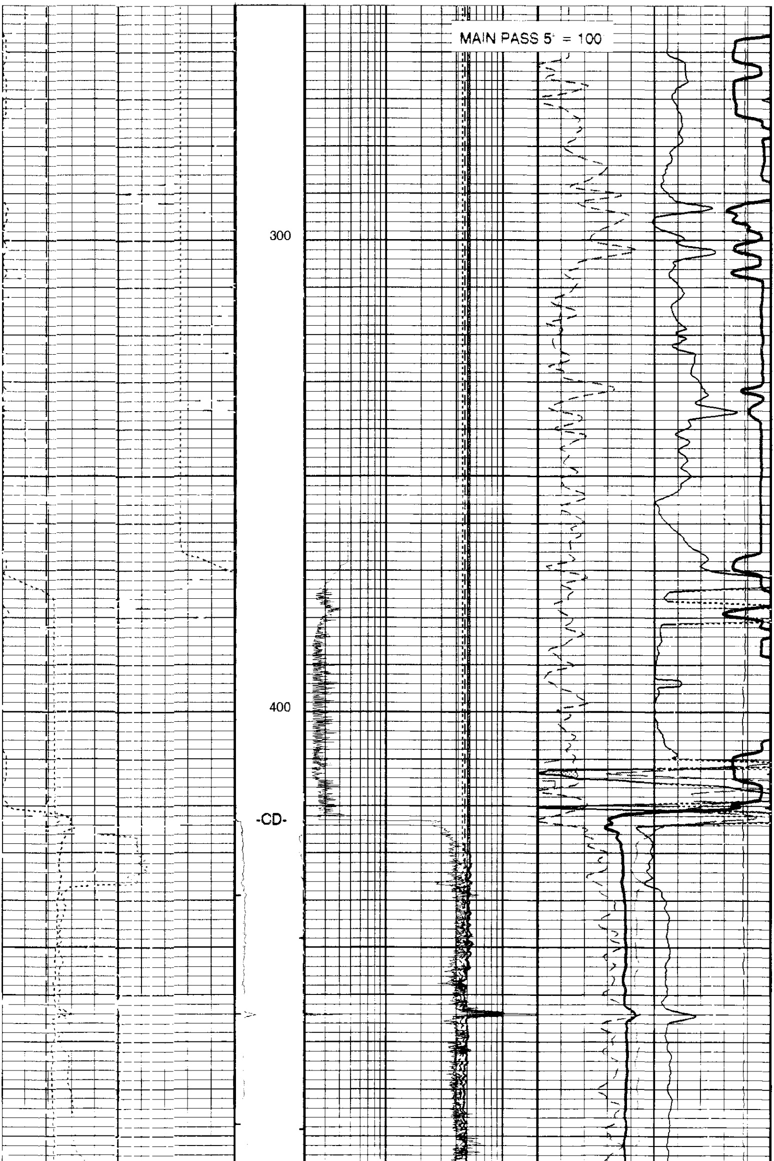
Std Res Density Porosity (DPHZ)
1.2 (V/V) 0.6

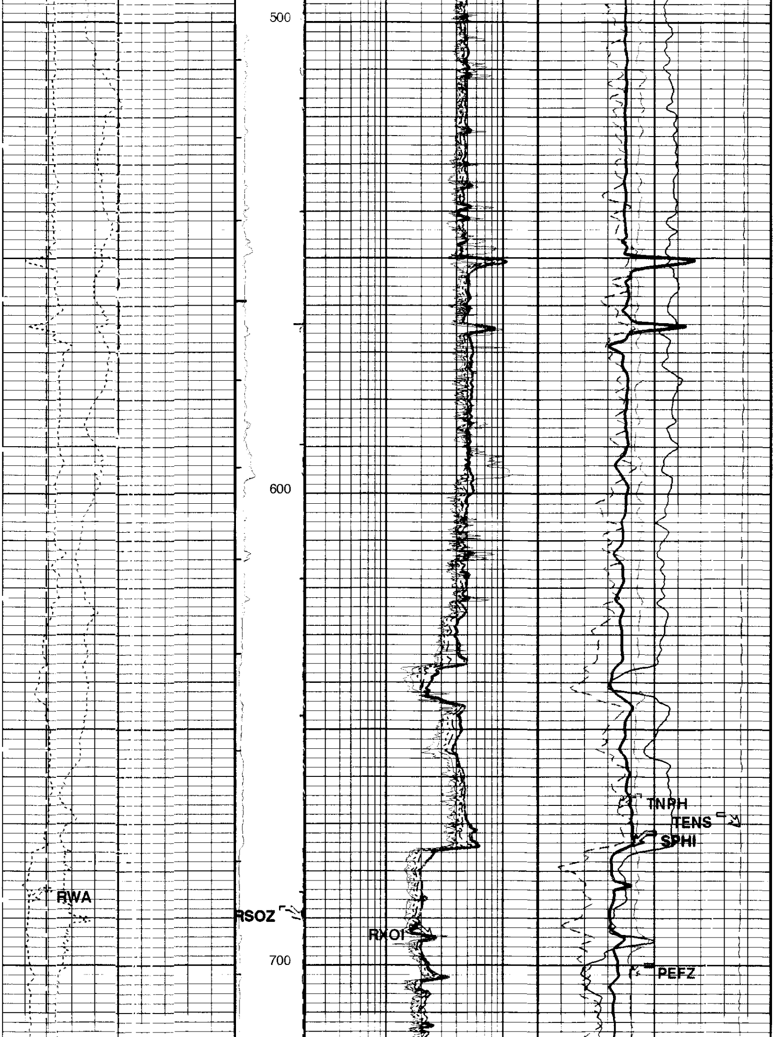
Bit Size (BS)
6 (IN) 16

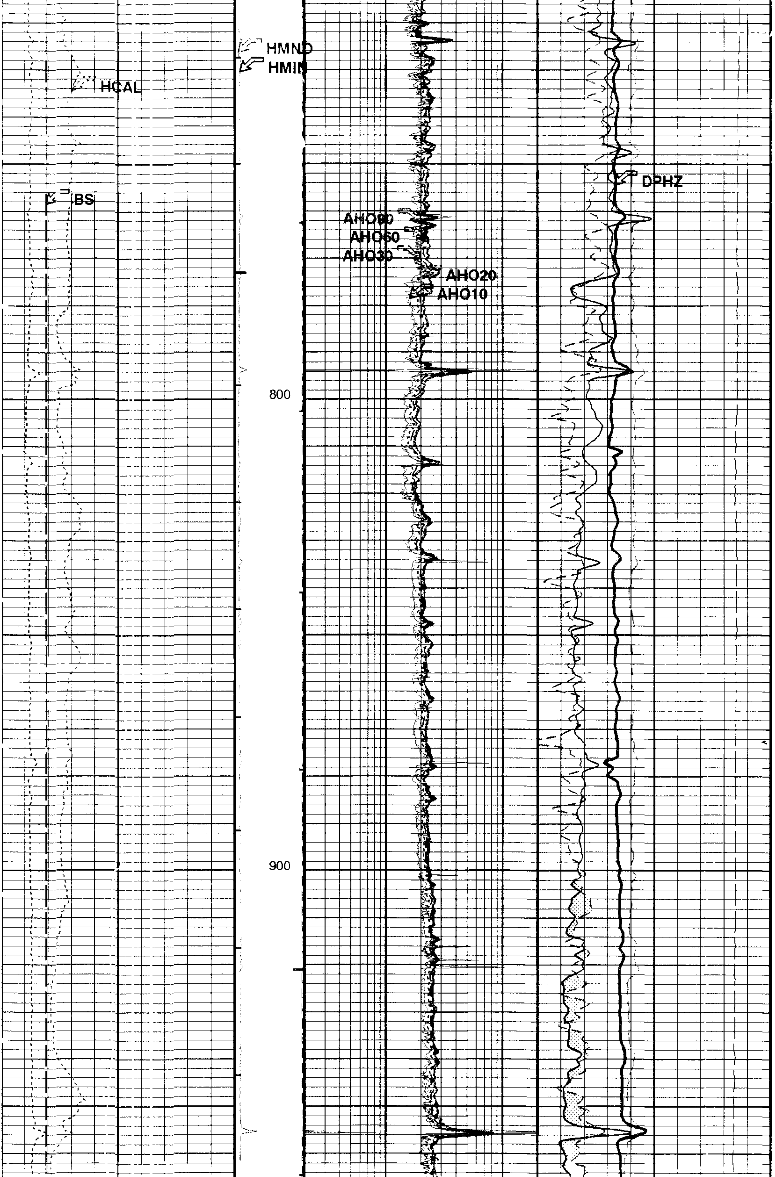
Perm Indicator

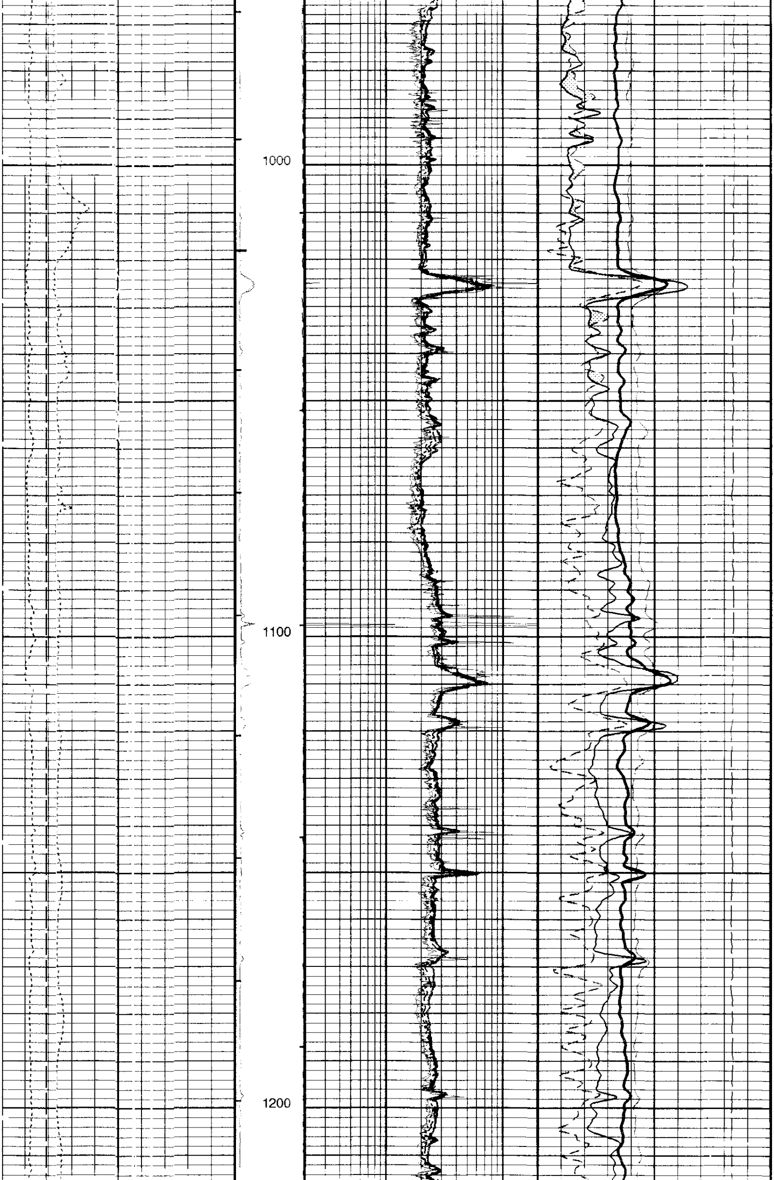
AIT-H 10 Inch Investigation (AHO10)
0.2 (OHMM) 20

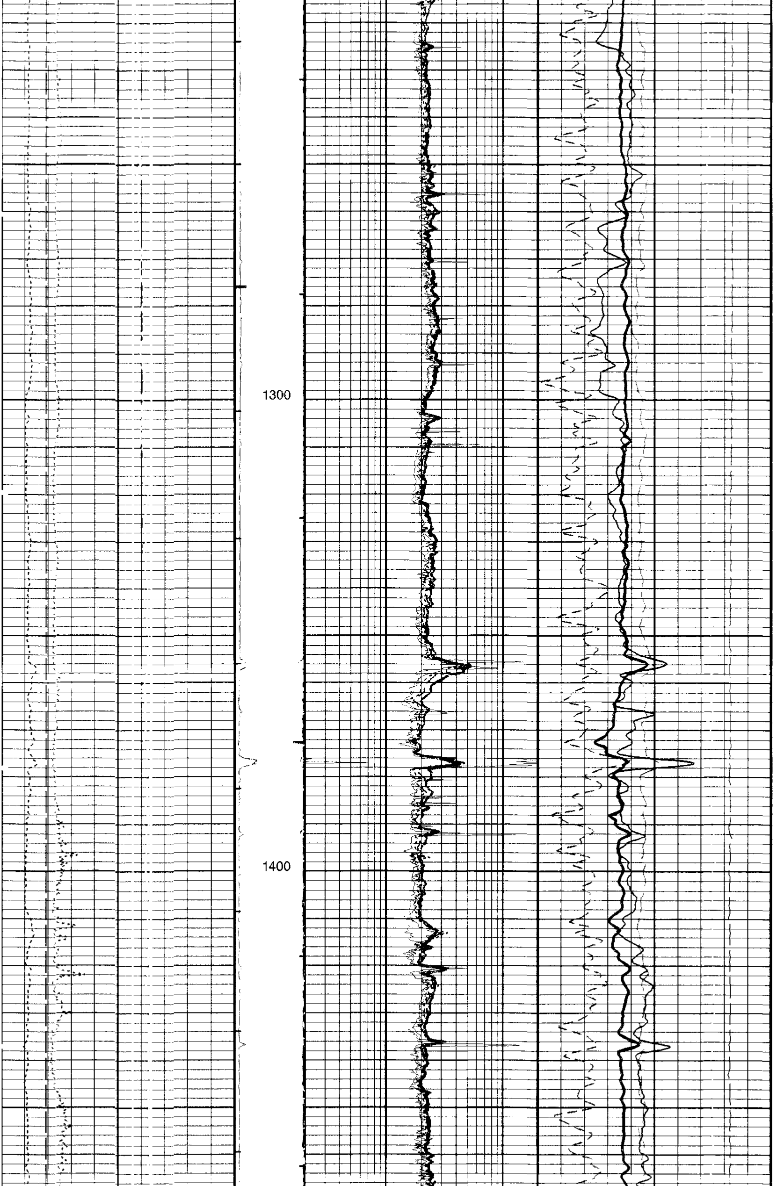
Std Res Density Porosity (DPHZ)
0.6 (V/V) 0

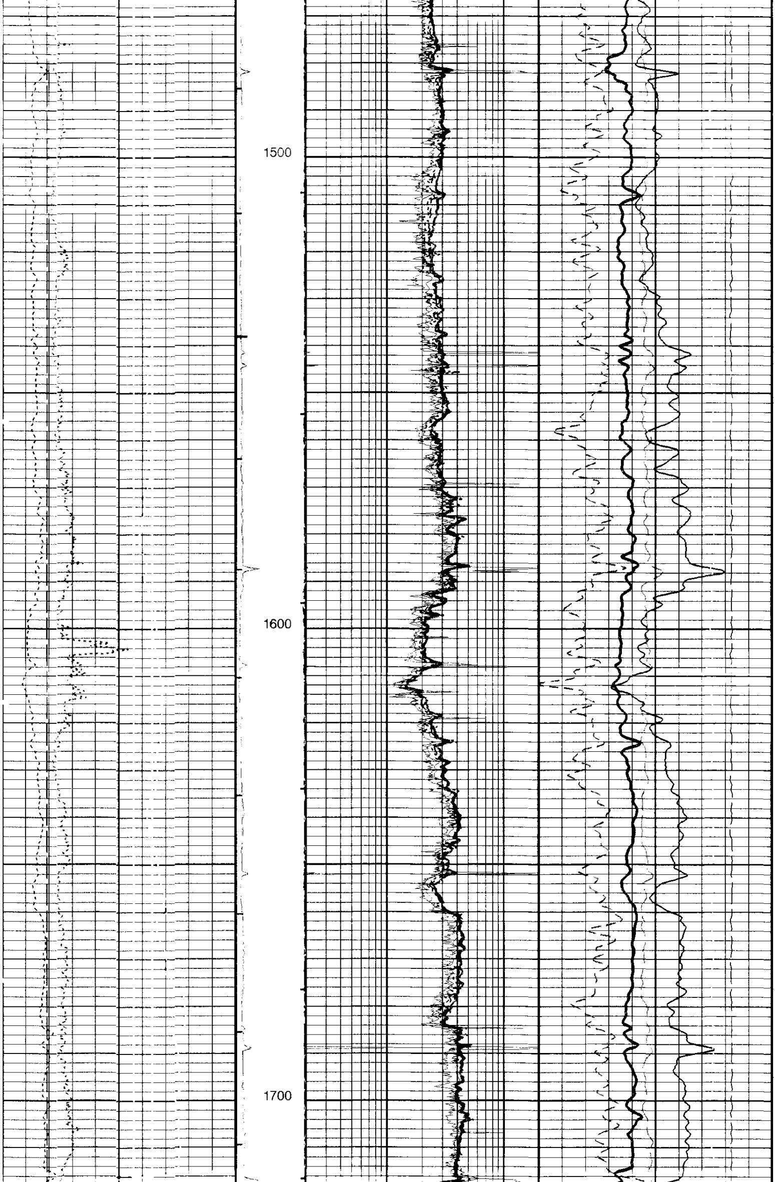


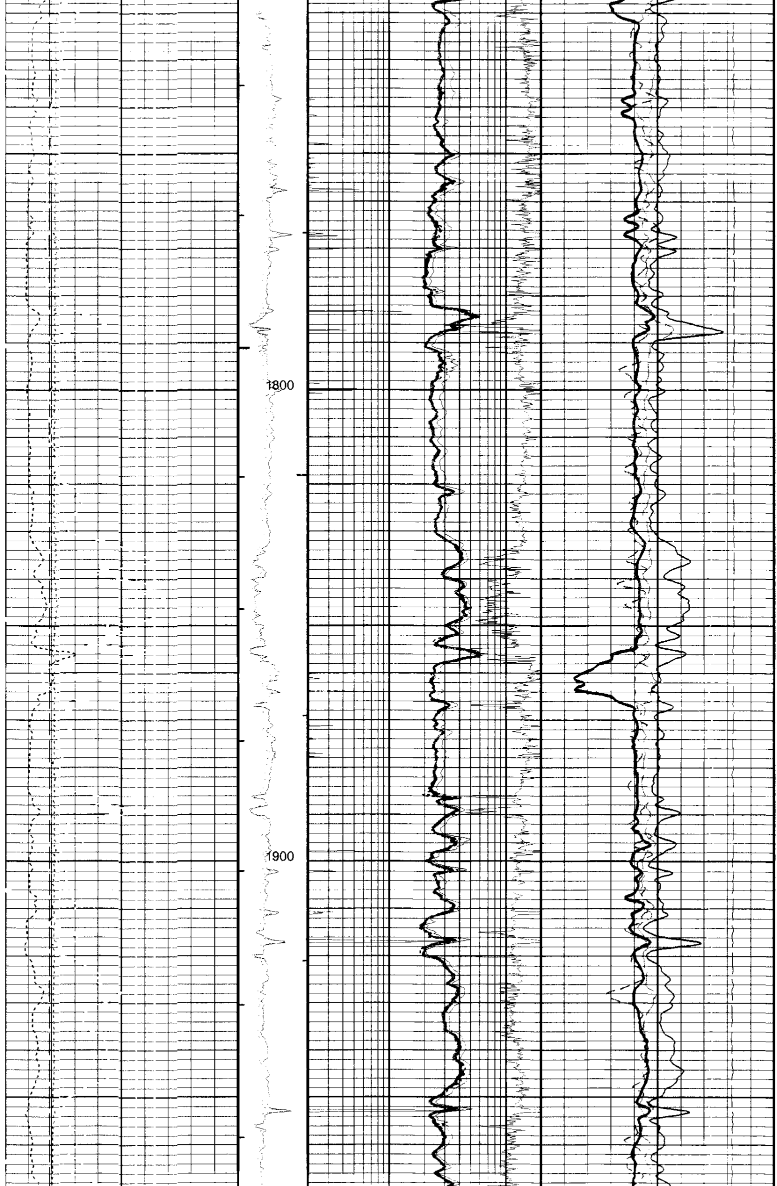


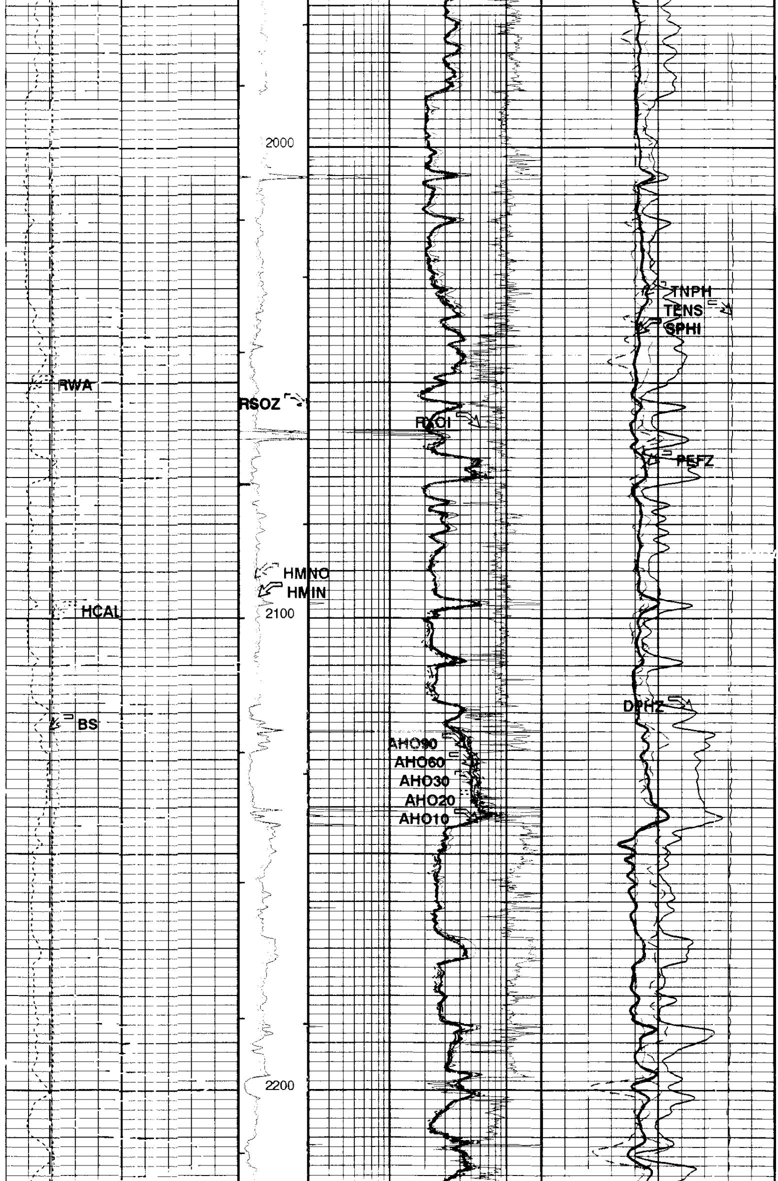


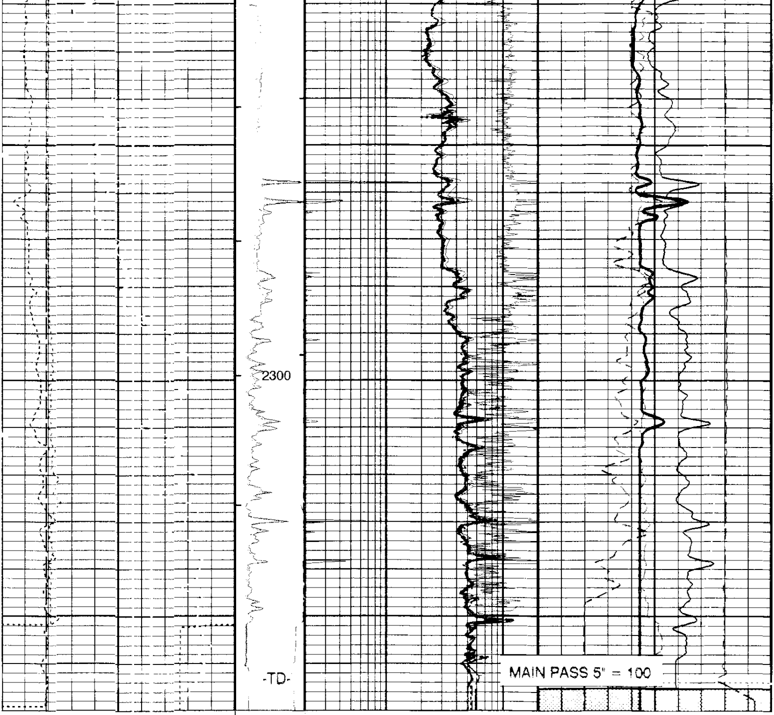












Bit Size (BS) 6 (IN) 16	Perm Indicator	AIT-H 10 Inch Investigation (AHO10) 0.2 (OHMM) 20	Std Res Density Porosity (DPHZ) 0.6 (V/V) 0
Caliper (HCAL) 6 (IN) 16		AIT-H 20 Inch Investigation (AHO20) 0.2 (OHMM) 20	Std Res Density Porosity (DPHZ) 1.2 (V/V) 0.6
RWA (RWA) 0 (OHMM) 3	Resistivity standoff (RSOZ) 2 (IN) 0	AIT-H 30 Inch Investigation (AHO30) 0.2 (OHMM) 20	Formation Pe (PEFZ) -1 (----) 9
	Micro Inverse Resistivity (HMIN) (OHMM) 0 30	AIT-H 60 Inch Investigation (AHO60) 0.2 (OHMM) 20	Sonic Porosity (SPHI) 0.6 (V/V) 0
	Micro Normal Resistivity (HMNO) (OHMM) 0 30	AIT-H 90 Inch Investigation (AHO90) 0.2 (OHMM) 20	Tension (TENS) 10000 (LBF) 0
		Micro-resistivity (RXOI) 0.2 (OHMM) 20	Env.Corr.Thermal Neutron Porosity (TNPH) 0.6 (V/V) 0
			Crossover

Env.Corr.Thermal Neutron Porosity
(TNPH)
1.2 (V V) 0.6

PIP SUMMARY

⊢ Integrated Hole Volume Minor Pip Every 10 F3
⊢ Integrated Hole Volume Major Pip Every 100 F3
⊣ Integrated Cement Volume Minor Pip Every 10 F3
⊣ Integrated Cement Volume Major Pip Every 100 F3

■ Time Mark Every 60 S

AIT-H Answer Product Processing Summary. Data taken with tool # 112 (AHTNO)

...Acquired data from HILT/HAIT

***** Bhole Correction *****

Effective Tool Standoff computed. Borehole diameter and mud res. taken as input (see GCSE and GRSE parameters)

Tool is run in ECCENTERED mode with a tool stand-off of 1.00 IN. Bit Size is 7.88 IN.

***** Input Selections to AIT Answer Product processing *****

Caliper (GCSE): HCAL Mud Resistivity (GRSE): AHMF Temperature (GTSE): LINEAR_ESTIMATE Porosity (FPHI): SPHI

***** Other parameters used by AIT-H Answer Product processing *****

Surface Hole Temperature (SHT)	68.000 DEGF	Bottom Temperature (BHT)	96.000 DEGF
Total Depth (TD)	2365.000 FT		
Form Factor Exponent (FEXP)	2.000	Form Factor Numerator (FNUM)	1.000
Mud Filtrate Sample Resistivity (RMFS)	1.910 OHMM	Mud Filtrate Sample Temperature (MFST)	70.000 DEGF
Resitivity Connate Water (RW)	1.000 OHMM		

***** AIT-H Answer Product processing control parameters *****

Playback Mode: NORMAL

Parameters

DLIS Name	Description	Value	
AHBHM	AIT-H Bhole Correction Mode	2_ComputeStandoff	
AHBLM	AIT-H Basic Logs Mode	6_One_Two_and_Four	
AHCDE	AIT-H Casing Detection Enable	Yes	
AHCEN	AIT-H Tool Centering Flag (in Borehole)	Eccentered	
AHCSED	AIT-H Casing Shoe Estimated Depth	-50000	FT
AHMRF	AIT-H Mud Resistivity Factor	1	
AHSTA	AIT-H Tool Standoff	1	IN
ARTS	AIT Rt Selection (for ALLRES computation)	13_AHT90	
BHFL	Borehole Fluid Type	WATER	
BHS	Bore Hole Status	OPEN	
BHT	Bottom Hole Temperature (used in calculations)	96	DEGF
BS	Bit Size	7.875	IN
BSAL	Borehole Salinity	-50000.00	PPM
BSCO	Borehole Salinity Correction Option	NO	
CCCO	Casing & Cement Thickness Correction Option	NO	
CDTS	C-Delta-T Shale	100	US/F
CWEI	Casing Weight	-50000.00	LB/F
DFD	Drilling Fluid Density	9.50	LB/G
DHC	Density Hole Correction	BS	
DO	Depth Offset	0.0	FT
DTF	Delta-T Fluid	189	US/F
DTM	Delta-T Matrix	56	US/F
FD	Fluid Density	1	G/C3
FEXP	Form Factor Exponent	2	
FNUM	Form Factor Numerator	1	
FPHI	Form Factor Porosity Source	SPHI	
FSAL	Formation Salinity	-50000	PPM
FSCO	Formation Salinity Correction Option	NO	
GCSE	Generalized Caliper Selection	HCAL	
GDEV	Average Angular Deviation of Borehole from Normal	0	DEG
GGRD	Geothermal Gradient	0.01	DF/F
GRSE	Generalized Mud Resistivity Selection	AITH_RESIST	
GTSE	Generalized Temperature Selection	LINEAR_ESTIMATE	
HSCM	HILT Speed Correction Mode	TSCD_SPEED_CORRECTION	
HSCO	Hole Size Correction Option	YES	
HSTI	STI Uses HILT Acceleration	YES	
MATR	Rock Matrix Type	SANDSTONE	
MCCO	Mud Cake Correction Option	NO	
MCOR	Mud Correction	NATU	
MDEN	Matrix Density	2.65	G/C3
MPOF	MCFL Processing Operation Mode	ON	

MST	Mud Sample Temperature	80.00	DEGF
MWCO	Mud Weight Correction Option	NO	
NMT	HILT Nuclear Mud Type	NOBARITE	
NPRM	HRDD Processing Mode	StdRes	
NSAR	HRDD Depth Sampling Rate	1	IN
PP	Playback Processing	NORMAL	
PTCO	Pressure Temperature Correction Option	NO	
RMFS	Resistivity of Mud Filtrate Sample	1.9100	OHMM
RTCO	RTCO - Rt Invasion Correction	YES	
RW	Resistivity of Connate Water	1.0000	OHMM
SDAT	Standoff Data Source	SOCN	
SHT	Surface Hole Temperature	68	DEGF
SOCN	Standoff Distance	0.125	IN
SOCO	Standoff Correction Option	NO	
SPFS	Sonic Porosity Formula	RAYMER_HUNT	
SPNV	SP Next Value	-15	MV
SPSO	Sonic Porosity Source	DT	
TD	Total Depth	2365	FT
TDL	Total Depth - Logger	2365.00	FT
TWS	Temperature of Connate Water Sample	100.00	DEGF

Format: S5 Vertical Scale: 5" per 100' Graphics File Created: 22-Jul-1998 13:19

OP System Version: 8C1-205

MCM

HILTB-DTB	APCW-98Q1	DSLT-TCC	8C1-205
TCC-B	APCW-98Q1		

Speed Corrected - Depth Matched LOG

Input DLIS Files

DEFAULT	HILTB .037	FN:1	FIELD	22-Jul-1998 12:54	2370.0 FT	249.7 FT

Output DLIS Files

DEFAULT	HILTB .038	FN:31	FIELD	22-Jul-1998 13:19

COMPANY:	NORTHWEST NATURAL GAS	BOTTOM LOG INTERVAL	2357 F
		SCHLUMBERGER DEPTH	2365 F
WELL:	OM-32-22-65	DEPTH DRILLER	2365 F
FIELD:	CALVIN CREEK GAS STORAGE	KELLY BUSHING	762 F
COUNTY:	COLUMBIA	DRILL FLOOR	
STATE:	OREGON	GROUND LEVEL	753 F

Schlumberger

PLATFORM EXPRESS
ARRAY INDUCTION/SP/ML/SP
DENSITY/NEUTRON/SONIC