Isolation Scanner

Interpretation Report

COMPANY : SWEPI LP
WELL : LHW 8118
FIELD : Colorado East LHT Pilot Project
COUNTRY : USA

Log Date	**08-Sep-2013 & 27-Nov-2013**
Analyzed by	**Nilesh Kadam**
Reviewed by	**Mariela Araujo and Florentino Vuelvas**
Analysis Date	**09-Dec-2013**
Version	**Version 1.0**

History

V1.0 Analysis dated 09-Dec-2013.

Table of Contents

Executive Summary for CBL-VDL-IS Logs dated 08-Sep-2013

Purpose: Evaluate the cement bond in the well LHW 8118.

Solution Methodology: Survey the casing with Isolation Scanner and CBL-VDL Logs.

General: The well LHW 8118 is a heater well with an 8-1/2" lateral open hole below a 9-5/8" casing from surface to 2853ft inside a 12-1/4" hole. The float collar is at 2850ft. The well has a 1/4" bubbler tube instrumentation line on the back side of the 9-5/8" casing. CBL-VDL and Isolation Scanner Tool was tractor conveyed from 2650ft to surface as the tool string could not go below 2650ft. This report covers a combined CBL-VDL and Isolation Scanner presentation.

During the cementing operations, LiteCrete cement of 9.5ppg and tail slurry of 15.7ppg was pumped in. No returns to surface were achieved during the cementing jobs with 190bbls of the displacement away. A copy of the EP Wells Daily Operation Report dated 27-Aug-2013 is presented on page 12 of the report.

The Schlumberger's Isolation Scanner cement evaluation service provides more certainty for light weight cements by combining the pulse-echo technique with a new ultrasonic technique that induces a flexural wave in the casing with a transmitter and measures the resulting signal at two receivers. The attenuation calculated between the two receivers provides an independent response that is paired with the pulse echo measurement and compared with a laboratory – measured database to produce an image of the material behind the casing. By measuring radially beyond traditional cement evaluation boundaries, Isolation Scanner service confirms zonal isolation.

Both the conventional CBL-VDL and ultra sonic pulse-echo techniques rely on a significant contrast in acoustic impedance between the cement and the displaced drilling mud to determine whether or not: a) there is cement behind the casing rather than drilling mud and b) the cement is bonded to the casing and the formation. Due to the use of light weight cement in this well which results in lower contrast, the conventional CBL-VDL and ultra sonic pulse-echo techniques have to be supported with the Schlumberger's Isolation Scanner tool.

Summary of Findings: The Isolation Scanner Log from the raw curve measurements and all the images indicate Top of Cement (TOC) at 1180ft. A one page CBL-VDL and Isolation Scanner Presentation is shown on page 8 of the report.

Four different zones of cement bond log quality can be seen from the analysis as follows:

Zone 1 - 2198ft – 2650ft: The top of the tail cement is at approximately 2198ft with fair cement. This is close to expected top of slurry (using 0% excess calculation). This suggest that circulation was lost above this depth. Adequate isolation exists with this tail cement bonded interval to isolate the open hole below the casing shoe. There is indication of good azimuthally covered solids from the bottom log interval to the lead/tail interface at 2198ft from the cement maps.

Zone 2 1453ft – 2198ft: This is interval where Lite Cement is present. The flexural image map

Zone 3 - : 1180ft – 1453ft: This is interval of transition from good Lite Crete cement to free pipe. The transition consists of fluid filled channeled cement.

Zone 4 - : Surface – 1180ft: There is no cement in the annulus and the pipe is free.

Conclusions: The Isolation Scanner Cement Bond Analysis indicates that cement bond is present in the annulus behind the casing from 1453ft to bottom logged interval. Adequate bonding exists to isolate the production zone and the saline water interval from the overlying fresh water bearing intervals. The Top of Cement (TOC) is at 1180ft.

The TOC at 1180ft warranted a cement remedial job. This was done on 24-Sep-2013 which consisted of setting in the 9-5/8" casing a composite bridge plug at 1150ft, circulate the wellbore to fresh water, squeeze perforating 3ft 4shots per foot at 1098 -1101ft. Cement Retainer was set at 1082ft and 15.8 ppg tail cement was pumped in with cement returns to surface. About 2bbls of 26ft cement was set on top of the cement retainer. A copy of the EP Wells Daily Operation Report dated 24-Sep-2013 is presented on page 13 of the report.

A repeat CBL-VDL was done on 27-Nov-2013 to verify the cement isolation.

Executive Summary for CBL-VDL Logs dated 27-Nov-2013 after remedial cement squeeze job

Purpose: Evaluate the cement bond in the well LHW 8118 after remedial squeeze job.

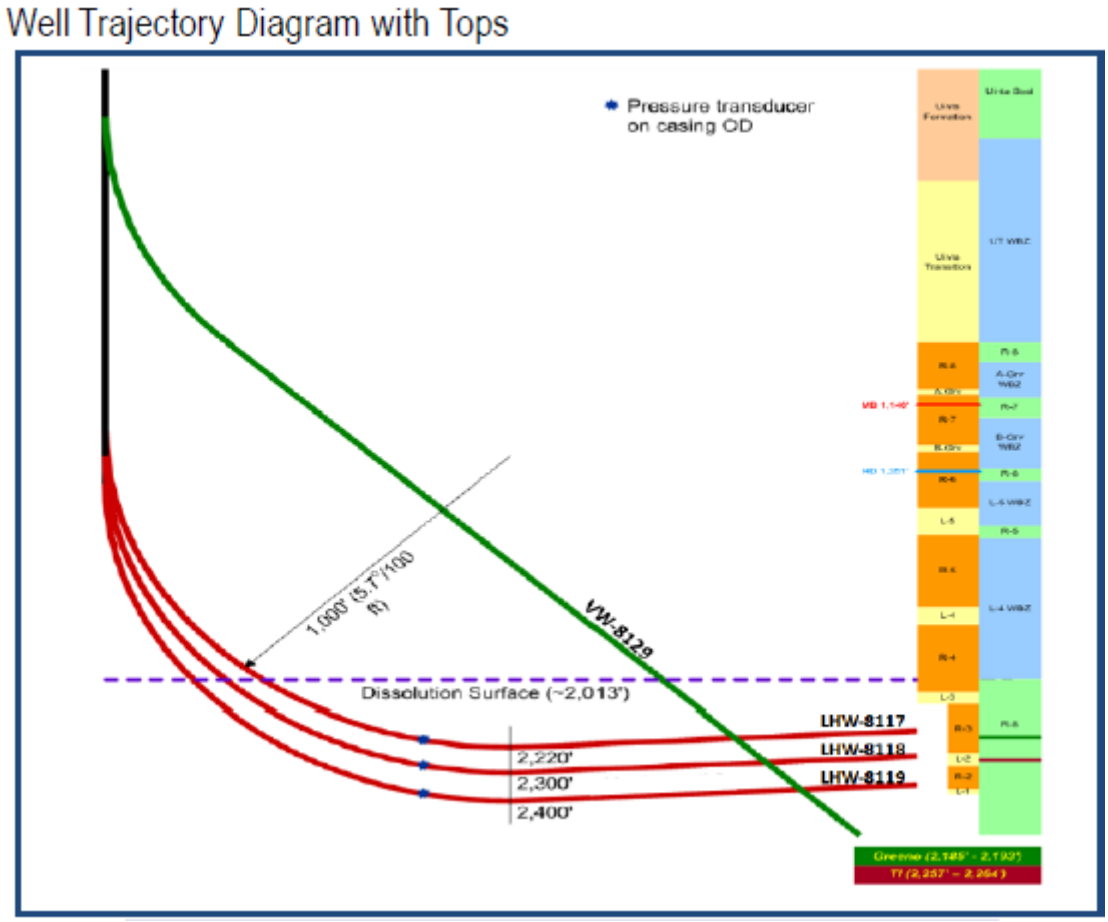
Solution Methodology: Survey the casing with CBL-VDL Logs.

Summary of Findings: The CBL-VDL indicates the Top of Cement (TOC) at 138ft.

The cement bond log quality can be seen from the analysis as follows:

Zone 1 - 138ft – 1015ft: The top of the tail cement is at approximately 138ft with fair to good cement. Adequate isolation exists with this tail cement bonded interval.

Well Sketch


Well Trajectory Diagram with Tops
Pressure transducer on casing OD
1,000' (5.7°/100 ft)
VW-8129
Dissolution Surface (~2,013')
LHW-8117
LHW-8118
LHW-8119
2,220'
2,300'
2,400'

Log Header dated 08-Sep-2013

Schlumberger

Company: SWEPI, LP

Well: LHW-8118
Field: COLORADO OIL SHALE
County: RIO BLANCO State: COLORADO

ISOLATION SCANNER
CEMENT EVALUATION
GAMMA RAY, CCL

County: RIO BLANCO
Field: COLORADO OIL SHALE
Location: SHL: 1773' FNL & 2359' FWL
Well: LHW-8118
Company: SWEPI, LP

LOCATION

SHL: 1773' FNL & 2359' FWL
LAT: 39.907713, LONG: -108.396994

Elev.: K.B. 6650.70 ft
G.L. 6622.70 ft
D.F. 6649.70 ft

Permanent Datum: GROUND LEVEL Elev.: 6622.70 ft
Log Measured From: KELLY BUSHING 28.00 ft above Perm. Datum
Drilling Measured From: KELLY BUSHING

API Serial No.	Section	Township	Range
05-103-82065-00	4	2S	98W

Logging Date		8-Sep-2013			
Run Number		1			
Depth Driller		2902 ft			
Schlumberger Depth		2853 ft			
Bottom Log Interval		2853 ft			
Top Log Interval		0 ft			
Casing Fluid Type		WATER			
Salinity					
Density		8.5 lbm/gal			
Fluid Level		0 ft			
BIT/CASING/TUBING STRING					
Bit Size		12.250 in			
From		0 ft			
To		2902 ft			
Casing/Tubing Size		9.625 in			
Weight		40 lbm/ft			
Grade		K55			
From		0 ft			
To		2853 ft			
Maximum Recorded Temperatures					
Logger On Bottom	Time	8-Sep-2013	23:30		
Unit Number	Location	9108 VERNAL			

Log Header dated 27-Nov-2013 after remedial cement squeeze job

HALLIBURTON

ACOUSTIC CEMENT BOND LOG

Company SHELL OIL COMPANY
Well LHW - 8118
Field COLORADO OIL SHALE
County RIO BLANCO State CO

Company SHELL OIL COMPANY
Well LHW - 8118
Field COLORADO OIL SHALE
County RIO BLANCO State CO

API No.: 05-103-82065-0000 Serv #: 900920243
Location: SURFACE HOLE LOCATION:
1773' FNL & 2359' FWL
LAT: 39.907713
LONG: -108.396994

Sec: 04 Twp: 02S Rge: 98W

Other Services

NONE

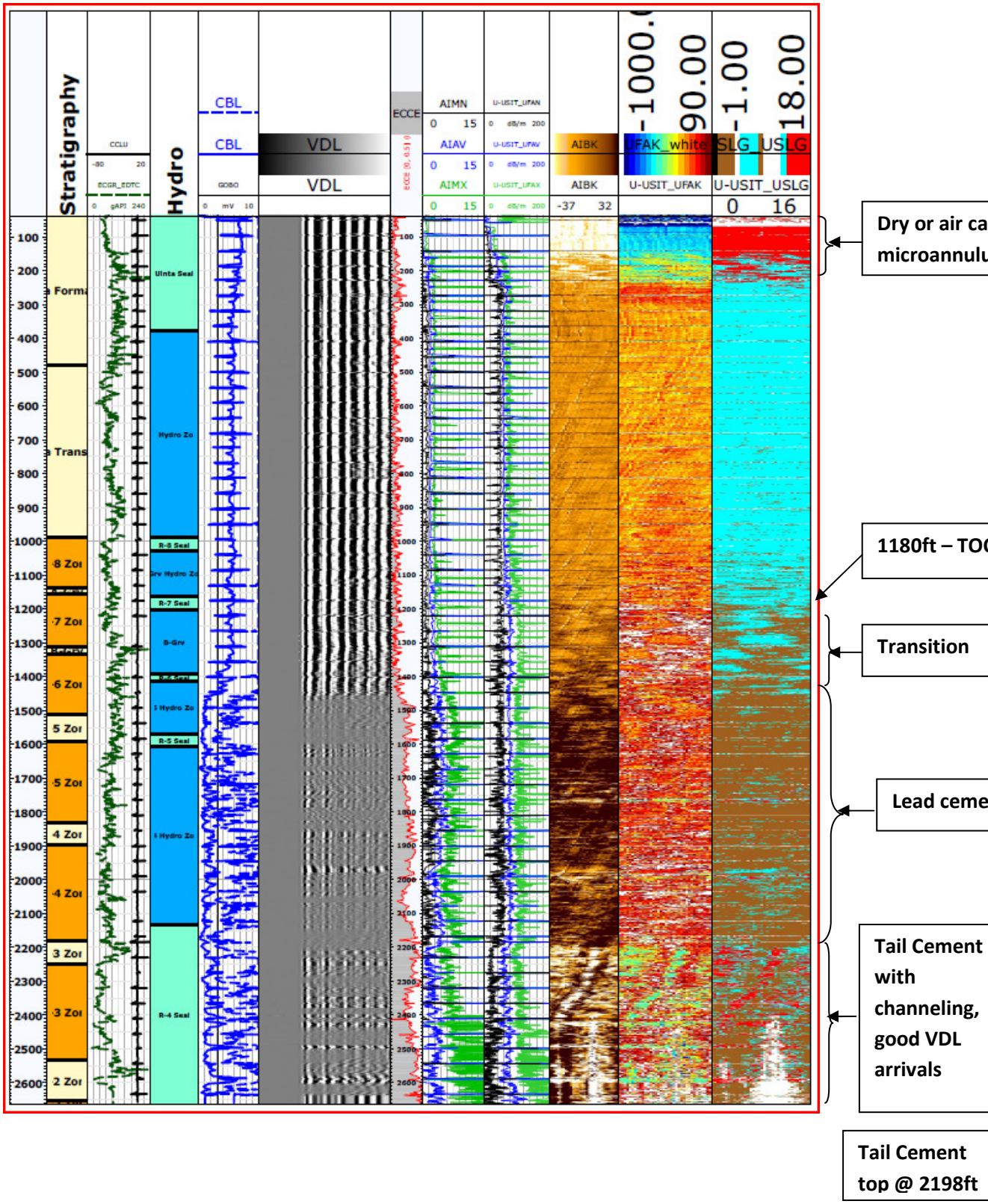
Permanent Datum	GROUND LEVEL	Elevation 6622.7'	Elevation
Log Measured From	KB , 28 Ft. above perm. datum		K.B. 6650.7'
Drilling Measured From	KB		D.F. 6649.7'
			G.L. 6622.7'

Date @ Time Logged	27 NOV 2013	Type Fluid in Hole	WATER
Run No.	TWO	Density of Fluid	8.4#
Depth - Driller	2902'	Fluid Level	FULL
Depth - Logger	1015'	Cement Top Est. Logged	SEE LOG
Bottom - Logged Interval	1015'	Equipment / Location	10971668 / G.J.
Top - Log Interval	SURFACE	Recorded by	SOLIS / RIDDEL
Max. Recorded Temp.	64 DEG F	Witnessed by	P. URISTA

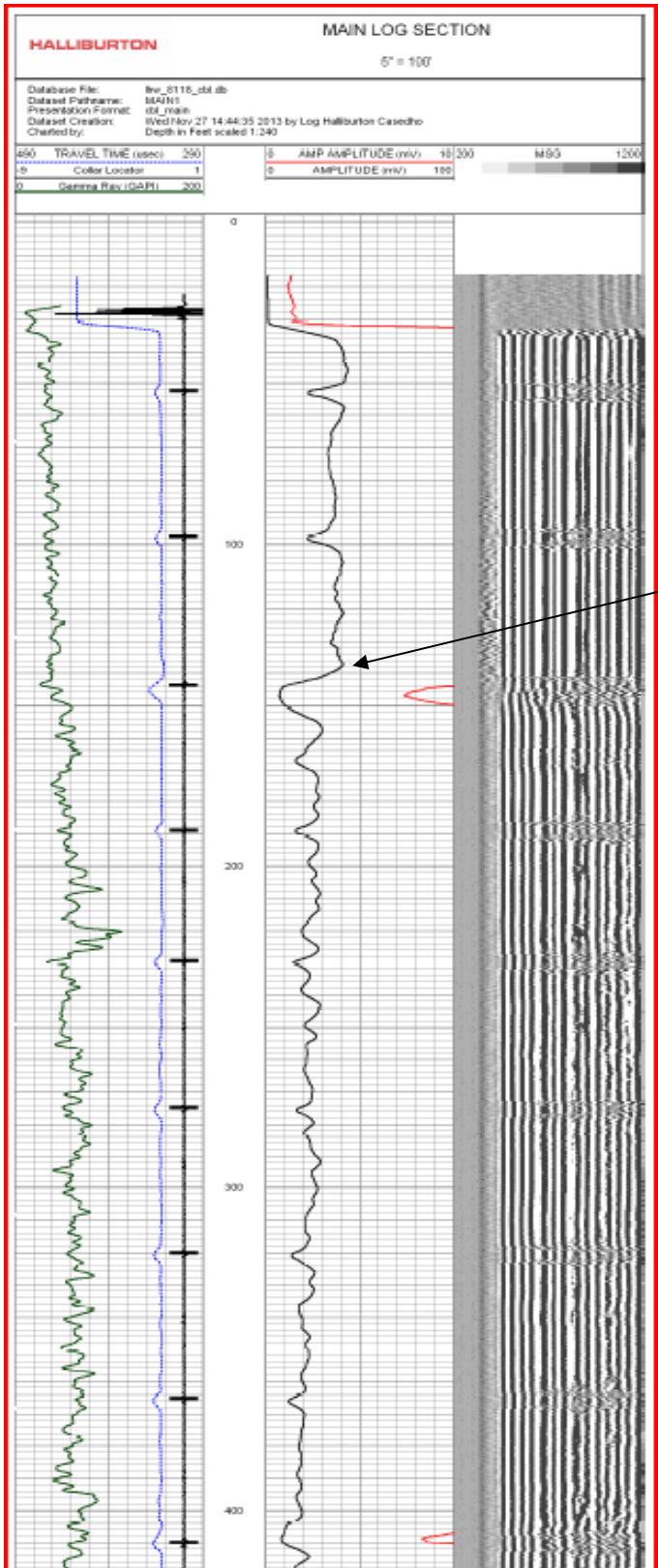
CEMENTING DATA	Surface String	Protection String	Production String	Liner
Date / Time Cemented	N/A	N/A	N/A	N/A
Primary / Squeeze				
Expected Compressive Strength	psi@ hrs	psi@ hrs	psi@ hrs	psi@ hrs
Cement Volume				
Cement Type / Weight	/	/	/	/
Formulation				
Mud Type / Mud Wgt.	/	/	/	/

Borehole Record				Casing & Tubing Record			
Run Number	Bit	From	To	Size	Weight	From	To
ONE	12.25"	SURFACE	2902'	9.625"	40.0#	SURFACE	2853'

CBL-VDL and Isolation Scanner Cement Presentation 1 page 08-Sep-13



CBL-VDL Presentation 1 page 27-Nov-13 after remedial squeeze job



EP Wells Daily Operation Report during cementing operations 27-Aug-2013

Time Summary

Start	Hours	PH	OPN	WS OPN	Drilled Depth (ft)	NPT level	Rig Rate	Description
0:00	4.50	C12	NOA		2,902.00	1		NPT: Wait on water to cement.
4:30	0.50	C12	SAF		2,902.00	0		JSA to R/U Schlumberger Cementers.
5:00	0.50	C12	RUD		2,902.00	0		R/U to cement.
5:30	5.00	C12	CLC		2,902.00	0		Test lines to 500 and 3500 psi. Pump 5 bbls water. Pump 40 bbls Mud push at 9 .0 ppg. Mix and pump 220 bbls 9.0 ppg Lite Crete w/ 0.05% BWOC of D065, 0.3% BWOC of D167, 0.2% BWOC of D46, 2.0% of D174 BWOC at 9.5 ppg.at 5 bpm. Mix and pump 44 bbls 15.8 ppg Easy BLOK w/ 0.08% BWOC of D400, 0.2% BWOC of D046, 8.0% BWOC of D154, 0.70% BWOC of D202, and 30.0% BWOC of D066 at 5 BPM. Drop plug and displace with 218.8 bbls fresh water at 5 bpm. Slowed to 2 bpm last 20 bls. No returns while pumping till last 15 bbls. No cement at surface. Plug bumped with 1150 psi. Floats holding. Test casing to 1500 psi.. OK.
10:30	1.50	C12	RUD		2,902.00	0		N/D flowline, fill up lines and manifold. L/D conductor.
12:00	4.00	RD	PMO		2,902.00	0		Cut off casing. Remove well head. Secure Petrospec bubbler tube. Remove valves f/ well head. Clean out cellar. Release rig to LHW 8117 at 16:00 hrs on 8/27/13.

EP Wells Daily Operation Report during remedial cement squeeze operations 24-Sep-2013

Time Summary

Start	Hours	PH	OPN	WS OPN	Drilled Depth (ft)	NPT level	Rig Rate	Description
0:00	0.50	PR	PMO		4,071.00	0		Skid rig f/ LHW 8119.
0:30	0.50	E09	RUD		4,071.00	0		N/U conductor and flow line. Put grating back in sub.
1:00	0.50	E09	SAF		4,071.00	0		PJSM w/ Schlumberger W/L, Weatherford and rig crew to rig up.
1:30	4.50	E09	ELO		4,071.00	0		R/U Schlumberger wire line. Run in hole with 9 5/8" composite bridge plug. Collar locator not working. Got CCL working. Set bridge plug at 1150'. POOH. R/D
6:00	0.50	E09	SAF		4,071.00	0		JSA for TIH.
6:30	0.50	E09	DRT		4,071.00	0		TIH open ended to 1135'.
7:00	1.00	E09	PCD		4,071.00	0		Circ fresh water.
8:00	0.50	E09	DRT		4,071.00	0		POOH
8:30	4.00	E09	ELO		4,071.00	0		JSA. R/U e-line unit. P/U perf guns. TIH and shot 3' 60 phasing w/ 4 spf at 1101-1098' POOH. P/U cement retainer. TIH and set at 1078'. POOH and R/D Schlumberger e-line unit.
12:30	1.50	E09	RUD		4,071.00	0		L/D BHA while waiting on replacement Weatherford service hand.
14:00	3.00	E09	CSR		4,071.00	0		JSA. P/U stinger and TIH to 1082'. Sting into cmt. retainer. Est. injection rate at 2 BPM w/ 100 psi. Circulation to surface.
17:00	0.50	E09	SAF		4,071.00	0		JSA to R/U to cement.
17:30	2.50	E09	RUD		4,071.00	0		R/U Schlumberger and spotting vac trucks.
20:00	2.50	E09	SCP		4,071.00	0		Test lines to 200-2500 psi. Pump 20 bbls S001 solution, 10 bbls water, 20 bbls zone lock, 10 bbls water, 30 bbls CemNet plus, 91 bbls 14.0 ppg Easyblok w/ 0.9% BWOB of D400, + 0.3% D046 BWOB, + 0.9% D202 BWOB, + 6.00% D154 BWOC, + 20% D066 BWOB, followed by 40 bbls Hot Squeeze at 15.8 ppg w/ 0.45% BWOB D167, + 0.20% D046 BWOB, + 0.40% D065 BWOB, + 3.0% S001 followed by 10 bbls water. Full returns entire job at 3 bpm. Got 78 bbls cmt back to surface. Final pump psi 615 psi at 2.8 bpm.
22:30	0.50	E09	CSR		4,071.00	0		Pull stinger out, pull one stand and circ out. Left 2 bbls cement on top of cement retainer. 26 feet cement.
23:00	1.00	E09	RUD		4,071.00	0		Finish pumping out cellar. Install well head cap. Prep to L/D DP. Put grating back around cellar.

06.00 Update

0:00	1.00				4,071.00	0	L/D DP and Weatherford stinger.
1:00	1.00				4,071.00	0	R/D Franks hanging cable and cleamp out of derrick.
2:00	4.00				4,071.00	0	TIH w/ 10 stands and L/D same. Repeat same TIH and L/D DP.