

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD

Details

Operator	Installation	Slot	Well
Black Hills E&P	D17 Pad	Slot #1 - WhF DHS3C-20 D17 998	WhF DHS3C-20 D17 998

Rig Details

Rig Name	Block Weight (klb)	Max Torque (lbf.ft)
H&P #319		

Hole Configuration

MD (ft)	TVD (ft)	Diameter (in)	Name	Open/Cased Hole
0.00		6.625	7 5/8in Intermediate Casing	Cased
5818.00	5355.28	9.875	9 7/8 Hole Section	Open
5830.00	5366.36	6.750	6 3/4 Hole Section	Open

Assembly Details

Name	Type	Length (ft)	OD (in)	ID (in)	Weight (lb/ft)	Material Grade
Equipment Group	Equipment Group	5811.28				
Casing Joint (API) - 5.5in - #20 ppf	Casing joint	42.00	5 1/2	4.778	20.00	P-110
Casing Coupling - 5.5 in - #20 ppf	Casing Coupling	0.73	6.036	4.865	34.17	P-110
Equipment Group	Equipment Group	854.60				
Casing Joint (API) - 5.5in - #17 ppf	Casing joint	42.00	5 1/2	4.892	17.00	P-110
Casing Coupling - 5.5 in - #17 ppf	Casing Coupling	0.73	5.944	4.874	30.98	P-110
Cross Over	Equipment Group	40.73				
Casing Joint (API) - 4.5in - #11.6 ppf	Casing joint	40.00	4 1/2	4.000	11.60	P-110
Casing Coupling - 5.5 in - #20 ppf	Casing Coupling	0.73	6.036	4.865	34.17	P-110
Equipment Group	Equipment Group	10289.84				
Casing Joint (API) - 4.5in - #11.6 ppf	Casing joint	42.00	4 1/2	4.000	11.60	P-110
Casing Coupling - 4.5 in - #11.6 ppf	Casing Coupling	0.52	4.898	3.985	21.71	P-110

Casing Inputs

Calculation Name	Wellbore	Wellpath	Assembly
5-1/2" x 4-1/2" Tapered String Analysis	WhF DHS3C-20 D17 998 (PWB)	WHF DHS3C-20 surveys 5-23-13_with Projection to TD	5-1/2" x 4-1/2" Tapered String

Start Depth(ft)	End Depth(ft)	Running Speed(ft/min)	Biaxial Type
24.00	6397.03	15.00	Full biaxial

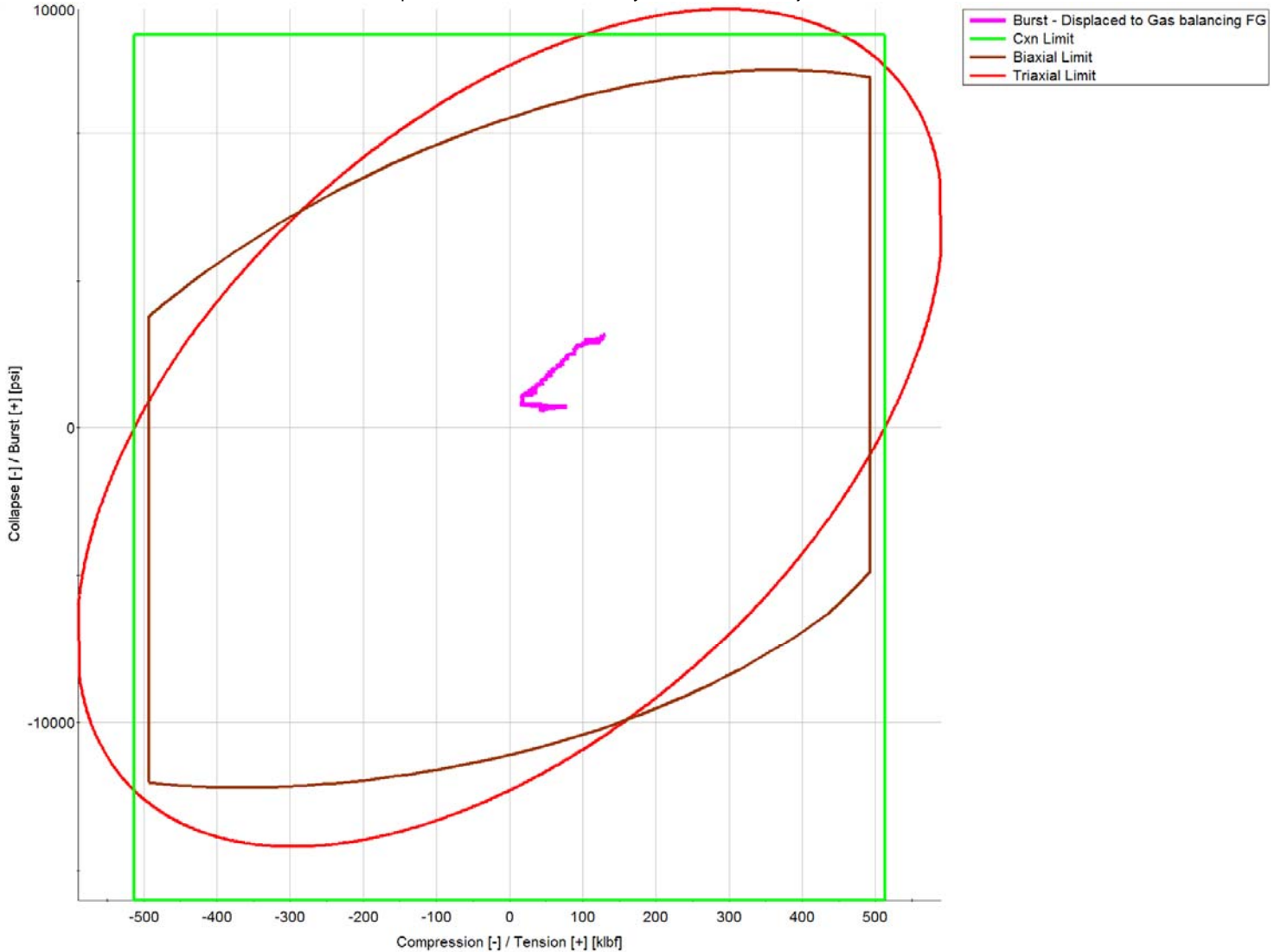
Summary Results

Load Case	Axial	Burst	Collapse	Triaxial	Worst Case Depth (ft)	Worst Case Type	Worst Case SF	Worst Case DF	Limiting Component
Burst - Displaced to Gas balancing FG	Passed	Passed	Passed	Passed	24.00	Burst	3.41	1.20	Casing
Burst - Displaced to Gas balancing PP	Passed	Passed	Passed	Passed	158.45	Triaxial	4.05	1.25	Casing
Collapse - Evacuated	Passed	Passed	Passed	Passed	6097.92	Triaxial	3.17	1.25	Casing
Collapse - Evacuated	Passed	Passed	Passed	Passed	6097.92	Triaxial	3.17	1.25	Casing
Worst Case	Passed	Passed	Passed	Passed	6097.92	Triaxial	3.17	1.25	Casing

Minimum Safety Factors

Type	Load Case	Min SF	Min DF	Depth (ft)	Design Load (klbf)	Design Pressure (psi)	Design Stress (psi)
Axial	Burst - Displaced to Gas balancing PP	4.34	1.30	500.29	163.54		
Burst	Burst - Displaced to Gas balancing FG	3.41	1.20	24.00		4084.39	
Collapse	Collapse - Evacuated	3.17	1.00	6397.03		3424.51	
Triaxial	Collapse - Evacuated	3.17	1.25	6097.92			43330.16

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD



Burst - Displaced to Gas balancing PP

Type		Axial Tension DF		Axial Compression DF		Burst DF		Collapse DF		Triaxial DF
Post Cemented		1.30		1.30		1.20		1.00		1.25
Applied Pressure Internal (psi)	Applied Pressure External (psi)	Applied Axial Load (klbf)	Piston Forces	Shock Loads	Cement Is Set	Thermal Yield Strength Reduction	Bending Stress	Thermal Axial Loads	Wear Profile	Formation Squeeze Loads
			No	No	Yes	No	Yes	No	No	No

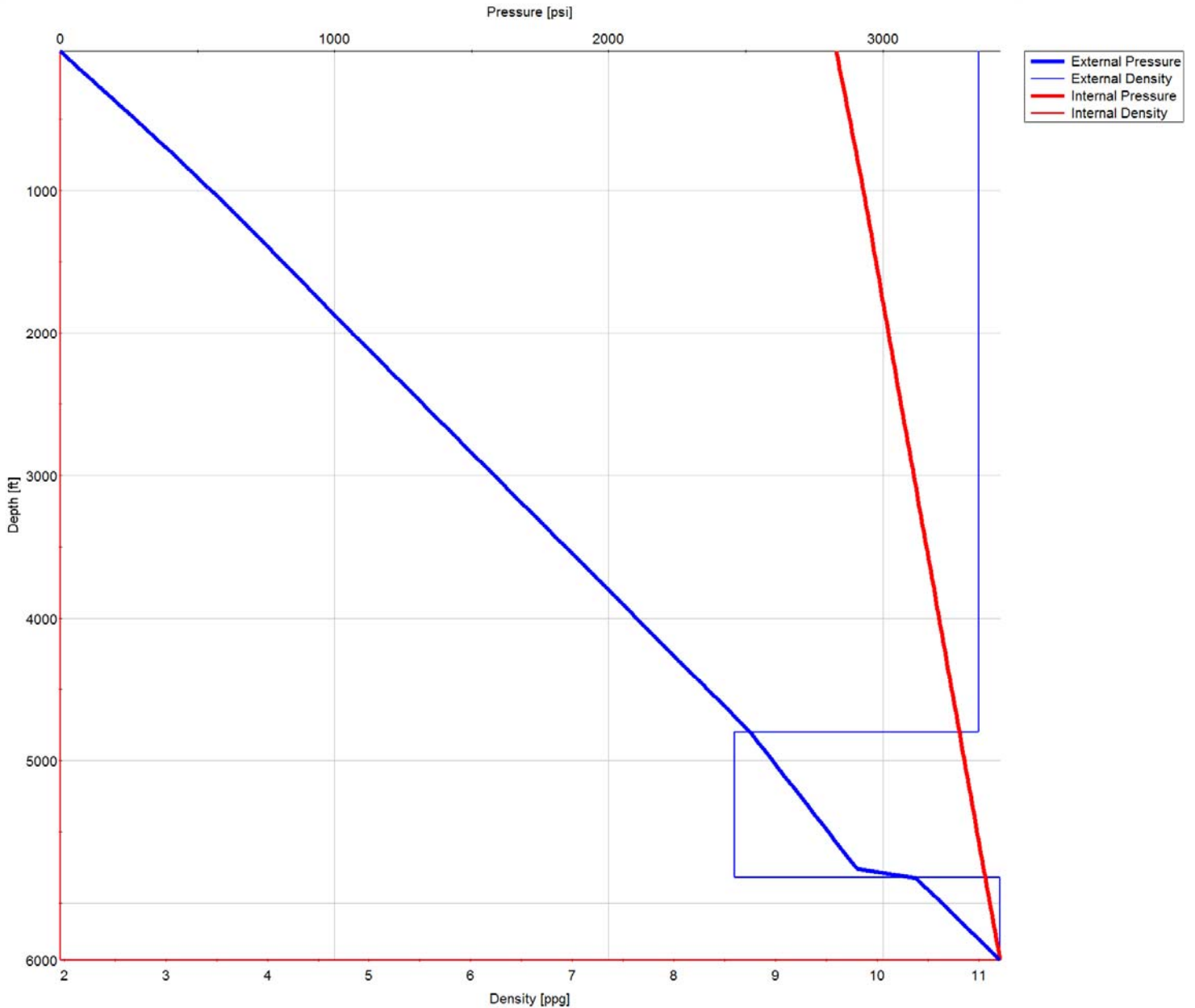
External Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure	Applied Axial Load
Fluid Gradient		Packer	24.00	Mix Water	11.00	Pore Pressure		
Fluid Gradient		Casing Shoe	4800.00	Cement Lead	8.60			
Gradient Profile		ML/GL	5818.00					

Internal Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure
Fluid Gradient		Top Casing	24.00	Gas	1.96	Pore Pressure	3427.37
Gradient Profile @ Depth		Top Cement Lead	6397.03		11.21		

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD



Burst - Displaced to Gas balancing FG

Type	Axial Tension DF	Axial Compression DF	Burst DF	Collapse DF	Triaxial DF
Post Cemented	1.30	1.30	1.20	1.00	1.25

Applied Pressure Internal (psi)	Applied Pressure External (psi)	Applied Axial Load (klbf)	Piston Forces	Shock Loads	Cement Is Set	Thermal Yield Strength Reduction	Bending Stress	Thermal Axial Loads	Wear Profile	Formation Squeeze Loads
			No	No	Yes	No	Yes	No	No	No

External Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure	Applied Axial Load
Fluid Gradient		Packer	24.00	Mix Water	11.00			
Fluid Gradient		Casing Shoe	4800.00	Cement Lead	8.60			
Gradient Profile		ML/GL	5818.00			Pore Pressure		

Internal Pressure Profile

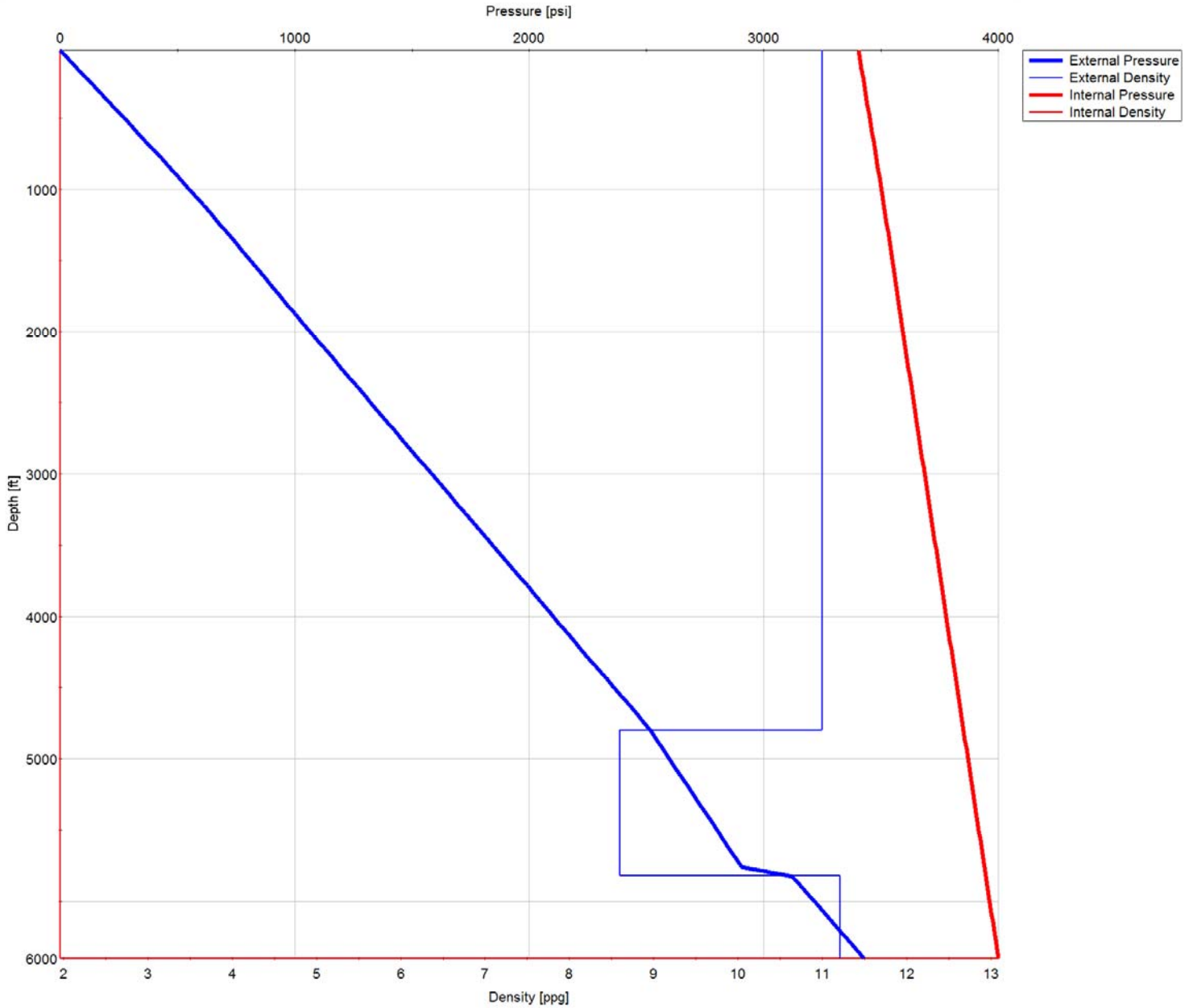
Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure
Fluid Gradient		Top Casing	24.00	Gas	1.96		

All data is in Feet unless otherwise stated
Prepared by
Date Printed: 31-May-2013

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD

Internal Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure
Gradient Profile @ Depth		Top Cement Lead	6397.03		13.09	Fracture Pressure	4000.77



Initial

Type	Axial Tension DF		Axial Compression DF		Burst DF		Collapse DF		Triaxial DF	
Initial										
Applied Pressure Internal (psi)	Applied Pressure External (psi)	Applied Axial Load (klbf)	Piston Forces	Shock Loads	Cement Is Set	Thermal Yield Strength Reduction	Bending Stress	Thermal Axial Loads	Wear Profile	Formation Squeeze Loads
			Yes	No	No	No	Yes	No	No	No

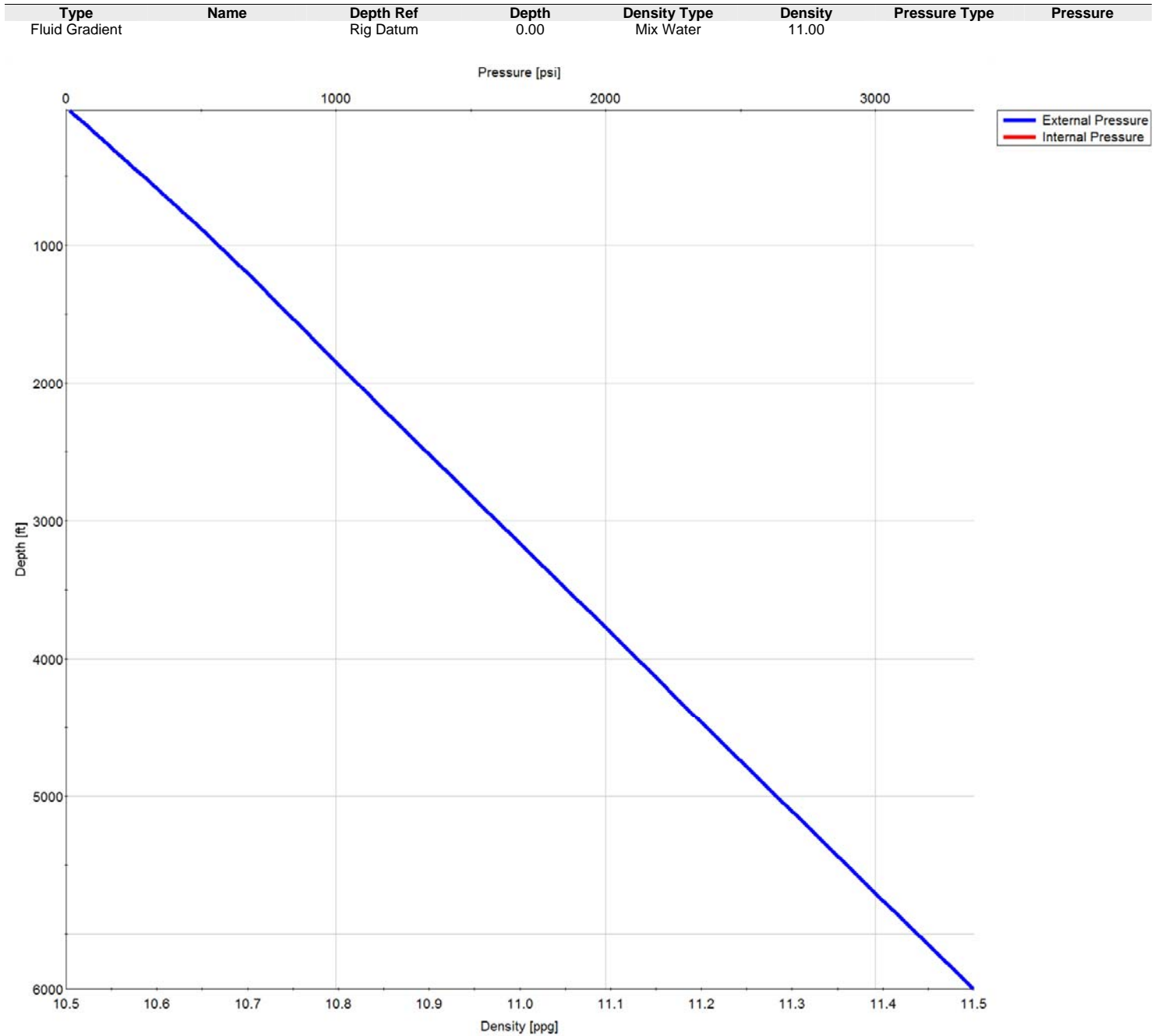
External Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure	Applied Axial Load
Fluid Gradient		Rig Datum	0.00	Mix Water	11.00			

All data is in Feet unless otherwise stated
Prepared by
Date Printed: 31-May-2013

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD

Internal Pressure Profile



Collapse - Evacuated

Type		Axial Tension DF		Axial Compression DF		Burst DF		Collapse DF		Triaxial DF
Post Cemented		1.30		1.30		1.20		1.00		1.25
Applied Pressure Internal (psi)	Applied Pressure External (psi)	Applied Axial Load (klbf)	Piston Forces	Shock Loads	Cement Is Set	Thermal Yield Strength Reduction	Bending Stress	Thermal Axial Loads	Wear Profile	Formation Squeeze Loads
		No	No	Yes	No	Yes	No	No	No	No

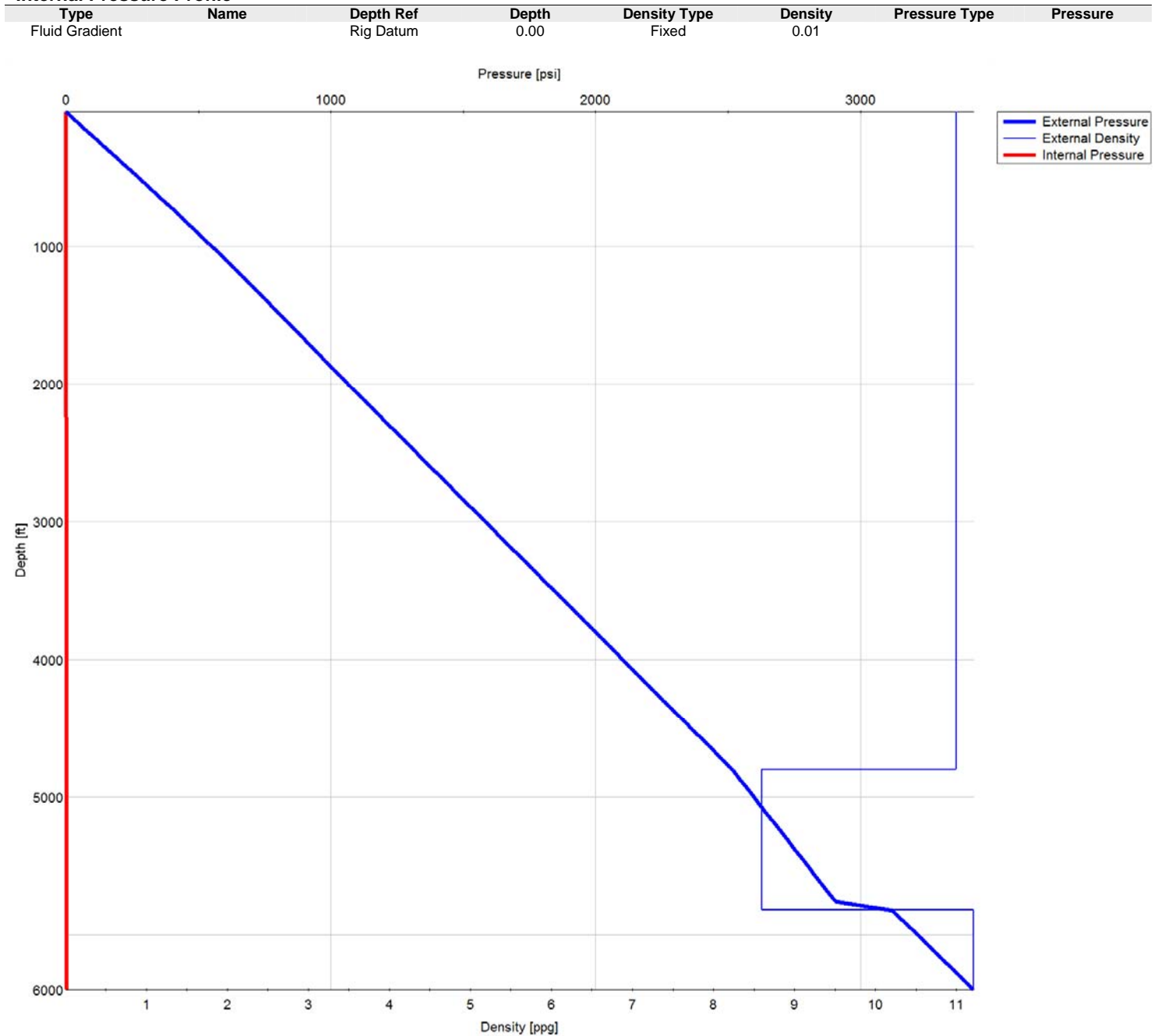
External Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure	Applied Axial Load
Fluid Gradient		Packer	24.00	Mix Water	11.00			
Fluid Gradient		Casing Shoe	4800.00	Cement Lead	8.60			
Gradient Profile		ML/GL	5818.00			Pore Pressure		

All data is in Feet unless otherwise stated
Prepared by
Date Printed: 31-May-2013

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD

Internal Pressure Profile



Collapse - Evacuated

Type	Axial Tension DF	Axial Compression DF	Burst DF	Collapse DF	Triaxial DF
Post Cemented	1.30	1.30	1.20	1.00	1.25

Applied Pressure Internal (psi)	Applied Pressure External (psi)	Applied Axial Load (klbf)	Piston Forces	Shock Loads	Cement Is Set	Thermal Yield Strength Reduction	Bending Stress	Thermal Axial Loads	Wear Profile	Formation Squeeze Loads
			No	No	Yes	No	Yes	No	No	No

External Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure	Applied Axial Load
Fluid Gradient		Packer	24.00	Mix Water	11.00			
Fluid Gradient		Casing Shoe	4800.00	Cement Lead	8.60			

All data is in Feet unless otherwise stated
Prepared by
Date Printed: 31-May-2013

SYSDRILL
Casing & Tubing Analysis Report
Wellbore: WhF DHS3C-20 D17 998 (PWB)
Wellpath: WHF DHS3C-20 surveys 5-23-13_with Projection to TD

External Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure	Applied Axial Load
Gradient Profile		ML/GL	5818.00			Pore Pressure		

Internal Pressure Profile

Type	Name	Depth Ref	Depth	Density Type	Density	Pressure Type	Pressure
Fluid Gradient		Rig Datum	0.00	Fixed	0.01		

