

GEOLOGIC & DRILLING PROGNOSIS

Prepared: 18-Feb-21 DC

WELL NAME: RG 344-7-297
Directional from the pad RG 41-18-297

API: 05-103-12463-00
STATE: CO
COUNTY: RIO BLANCO
BOTTOM HOLE LOCATION: Sec. 7 T 2S R 97W
TYPE OF UNIT: FED
FEDERAL EA: Yes
HARDLINE: No

Unspaced

ELEVATION (ft):
PAD (ft): 6621
GROUND (ft): 6620
KELLY BUSHING (ft): 6651

RIG INFORMATION:
RIG NAME: HP 329
KB HEIGHT (ft): 30

ESTIMATE TOPS:

Formation	TVD	MD	Formation Resource Notes
Green River	951	961	Potentially Useable Water
A Groove	1111	1126	Potentially Useable Water
B Groove	1296	1316	Potentially Useable Water
Dissolution Surface	1611	1640	Possible Lost Circ Zone
Orange Marker	2516	2570	Potentially Useable Water
Wasatch	2721	2781	Potentially Useable Water
Top of "G" Sand	5141	5268	Possible Lost Circ Zone
Fort Union	5471	5607	Gas and Limited Use and Quality Water
Ohio Creek	6841	7015	Possible Lost Circ Zone
Mesaverde	6841	7015	Gas and Limited Use and Quality Water
Approx. Top Gas	7931	8119	Gas and Limited Use and Quality Water
Cameo Coals	10281	10469	Gas, Coal, and Limited Use and Quality Water
Rollins SS	10861	11049	Gas and Limited Use and Quality Water
Cozzette	11011	11199	Gas and Limited Use and Quality Water
Corcoran	11231	11419	Gas and Limited Use and Quality Water
Upper Segro	11591	11779	Gas and Limited Use and Quality Water
Lower Segro	11891	12079	Gas and Limited Use and Quality Water
TD	12011	12199	

MUD LOGGING: Type: (Optional) Remote Gas Unit
Interval: Base of surface casing to TD with total gas only

OPEN HOLE LOGS: Specifics: (Optional) Triple-Combo (DIL-GR-SP-Neutron Density)
Interval: GR from TD to surface, DIL-SP and Neutron Density from TD to 100' inside surface casing

CASED HOLE LOGS: Specifics: Pulsed Neutron Log (e.g. RMTE, RPM, or RST)
Processing: Emulation Triple Combo Using OH logs and training well
Cement Evaluation: CBL

CSG & CEMENT PROGRAM: SHOE TEST REQUIRED

	Csg Size (in)	Depth Set (tvd)	Depth Set (md)	Hole Size (in)	Approx. Cmt Tail (ft3)	Tail Yield (ft3/sx)	Approx. Sx Tail	Approx. Cmt Lead (ft3)	Lead Yield (ft3/sx)	Approx. Sx Lead	WOC (hrs)
Conductor:	20	84	84	30	228	199	N/A	N/A	N/A	N/A	N/A
Surface	13.375	1411	1440	17.5	N/A	N/A	N/A	1100	2.34	470	
Intermediate	9.625	3221	3281	12.25	172	2.10	82	172	2.40	72	
Liner or Production:	4.5	12011	12199	8.75/7.875	1446	1.85	784	373	2.00	187	
					Surface (sacks): 470		Intermediate (sacks):	154	Prod. (sacks): 970		

ANTICIPATED PRESSURES (psi)

MASP	Prod Csg Test Pressure	Anticipated BHP	Prod. Csg. Grade
2,943	8,500	5,585	P-110

MUD PROGRAM: (Do not deviate from mud engineer's recommendation without prior consent from Parachute office)

FROM (md)	TO (md)	TYPE MUD	#/GAL	VIS	WL	CHEMICALS
0	3281	WBM	8.33-9.0	45-50	7-15	Bentonite/PHPA
3281	12199	LSND	8.7-10.0	40-80	6-10	PHPA/Barite

(Write mud added to system on tour sheets and report all mud mixed and daily cost in morning report)

LOST CIRCULATION: Report depth and bbls of mud lost on morning report and tour sheet. Any severe lost circulation problems should be reported immediately to well supervisor.

SURVEYS: Run every 100' on surface hole and trips unless otherwise instructed.

TEP GEOLOGIST: Office Cell
Stephen Sunnenberg 281-936-0361 303-918-4327 ssunnenberg@terraep.com

(note: if there are questions concerning TD or logging, please call Geologist)

CASING & CEMENTING PLAN

Operator: Terra Energy Partners
 Well Name & Number: RG 344-7-297
 Location: Ryan Gulch

Casing Design Calculations											
Type of Casing	Size of Hole (inches)	Size of Casing (inches)	Weight per Foot (lbs/ft)	Grade	Thread	Interval (ft)	(ft - Length (feet)	Setting Depth (TVD feet)	Collapse (psi)	Burst (psi)	Tension (lbs)
Surface	17.5	13.375	54.5	J-55	BTC	0-1440	1,440	1,411	1130	2735	853,000
Intermediate	12.250	9.625	36.0	J-55	LTC	0-3281	3,281	3,221	2,020	3,520	453,000
Production	8.750	4.500	11.6	P-110	DWC/C	0-12199	12,199	12,011	8,860	12,150	417,000

Surface Casing Shoe	Intermediate Casing Shoe	Production Casing Shoe
Max MW = 9.2 ppg HP = 675 psi	Max MW = 9.2 ppg HP = 1,541 psi	Max MW = 10.0 ppg HP = 6,246 psi

True Vertical Depth = 12,011
 Bottom Hole Pressure = 5,585
 Pore Pressure Gradient = 0.465
 Max. Sur. Pressure = 2,943
 BOP Required = 3M
 5M system will be used as per A

Bottom Hole Temperature = 230 degrees Fahrenheit

Casing Safety Factors			
Surface Casing	Pb = 3.47	Min = 1.100	Pass
	Pc = 1.67	Min = 1.125	Pass
	Sj = 10.87	Min = 1.500	Pass
Intermediate Casing	Pb = 1.20	Min = 1.100	Pass
	Pc = 1.31	Min = 1.125	Pass
	Sj = 3.84	Min = 1.500	Pass
Production Casing	Pb = 4.13	Min = 1.100	Pass
	Pc = 1.42	Min = 1.125	Pass
	Sj = 2.95	Min = 1.500	Pass

Cement Design Calculations

Estimating Cement for Ryan Gulch Wells (Permitting purpose only)

Critical Depths - Permitting Purposes Only	
Casing/Formation	Measured Depth
Surface Casing	1,440 ft
Intermediate Casing	3,281 ft
Top of Mesaverde	7,015 ft
Top of Gas	8,119 ft
Total Depth	12,199 ft

Production Cement Tops (Permitting Purposes Only)	
Cement Slurry	TOC - Measured Depth
Scavenger	3,081 ft
Lead	6,815 ft
Tail	7,919 ft

Surface Cement	Lead
Cement Tops	Surface
Volume, bbls	178
Annular vol w/ excess, ft ³	1100
Volume, sacks	470
Slurry Weight, ppg	12.3
Slurry Yield, ft ³ /sk	2.340
Mixwater, gal/sk	13.40
Annular Capacity (BBJ)	0.1237
Annular Capacity (CF)	0.6947
Excess	0.1
Total Sacks	470
Total Cubic Ft.	1,100

Intermediate Cement	Lead	Tail
Cement Tops	2,281	2,781
Volume, bbls	28	28
Annular vol w/ excess, ft ³	172	172
Volume, sacks	72	82
Slurry Weight, ppg	12.3	12.8
Slurry Yield, ft ³ /sk	2.400	2.100
Mixwater, gal/sk	13.30	11.30
Annular Capacity (BBJ)	0.0558	0.0558
Annular Capacity (CF)	0.3132	0.3132
Excess	0.1	0.1
Total Sacks =	154	
Total Cubic Ft. =	345	

Production Cement	Scavenger	Lead
Cement Tops	3,081	6815
Volume, bbls	204	60
Annular vol w/excess, ft ³	1,262	373
Volume, sacks	410	187
Slurry Weight, ppg	11.0	12.7
Slurry Yield, ft ³ /sk	3.074	1.999
Mixwater, gal/sk	18.830	11.000
Annular Capacity (BBJ)	0.0547	0.0547
Annular Capacity (CF)	0.3072	0.3072
Excess	0.1	0.1
Total Sacks =		
Total Cubic Ft. =		

NOTES:

Surface Casing 17-1/2" hole to TD - Cement to surface.
 54.5# 13-3/8" J-55, BTC surface casing will be ran.
 10% excess is included in calculations.
 Normal Surface excess is 40% over gauge hole
 Normal Intermediate excess is 50% over gauge hole
 Normal Production excess is 45% over gauge hole.

Casing Design Calculations

Surface Casing - 54.5#	Intermediate Casing - 36#	Production Casing
<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 3221 * 0.465 = 1497.765 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 1497.765 - (0.22 * 3221) = 789.145 psi</p> <p>Pb = Casing Burst Rating / Pburst = 2735 / 789.145 = 3.47</p> <p>Pb ≥ 1.1 3.47 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 1411 * 0.052 ≥ 0.465 * 1411 675.0224 ≥ 656.115</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 675.0224 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 656.115 psi Pcollapse = 675.0224 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 1130 / 675.0224 = 1.67</p> <p>Pc ≥ 1.125 1.67 ≥ 1.125</p> <p>Tensile</p> <p>Tension = (Weight1 * Length1) = (54.5 * 1440) = 78480 lbs</p> <p>Sj = Casing Tension Rating / Tension = 853000 / 78480 = 10.87</p> <p>Sj ≥ 1.5 10.87 ≥ 1.5</p>	<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 12011 * 0.465 = 5585.1 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5585.115 - (0.22 * 12011) = 2942.7 psi</p> <p>Pb = Casing Burst Rating / Pburst = 3520 / 2942.695 = 1.20</p> <p>Pb ≥ 1.1 1.20 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 9.2 * 3221 * 0.052 ≥ 0.465 * 3221 1540.9 ≥ 1497.765</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 1540.9 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 1497.8 psi Pcollapse = 1540.9 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 2020 / 1540.9264 = 1.31</p> <p>Pc ≥ 1.125 1.31 ≥ 1.125</p> <p>Tensile</p> <p>Tension = (Weight1 * Length1) = (36 * 3281) = 118116 lbs</p> <p>Sj = Casing Tension Rating / Tension = 453000 / 118116 = 3.84</p> <p>Sj ≥ 1.5 3.84 ≥ 1.5</p>	<p>Burst</p> <p>Bottom Hole Pressure = TVD * Pore Pressure Gradient = 12011 * 0.465 = 5585.1 psi</p> <p>Pburst = Bottom Hole Pressure - (0.22 * TVD) = 5585.115 - (0.22 * 12011) = 2942.7 psi</p> <p>Pb = Casing Burst Rating / Pburst = 12150 / 2942.695 = 4.13</p> <p>Pb ≥ 1.1 4.13 ≥ 1.1</p> <p>Collapse</p> <p>If: Max MW * Setting TVD * 0.052 ≥ Pore Pressure Gradient * Setting TVD 10 * 12011 * 0.052 ≥ 0.465 * 12011 6245.7 ≥ 5585.115</p> <p>Pcollapse = Max MW * Setting TVD * 0.052 = 6245.7 psi</p> <p>Else: Pcollapse = Pore Pressure Gradient * Setting TVD = 5585.1 psi Pcollapse = 6245.7 psi</p> <p>Pc = Casing Collapse Rating / Pcollapse = 8860 / 6245.72 = 1.42</p> <p>Pc ≥ 1.125 1.42 ≥ 1.125</p> <p>Tensile</p> <p>Tension = Weight * Length = 11.6 * 12199 = 141508 lbs</p> <p>Sj = Casing Tension Rating / Tension = 417000 / 141508.4 = 2.95</p> <p>Sj ≥ 1.5 2.95 ≥ 1.5</p>
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