



COG Production LLC

Lea County, New Mexico

Sec 30 T24-S R32-E

Windward Federal #8H

Wellbore #1

Plan: Design #1

HOBBS OCD

DEC 27 2016

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QES Well Planning Report

02 May, 2016





QES Directional Drilling, LLC
Well Planning Report



Database:	EDM5002	Local Co-ordinate Reference:	Well Windward Federal #8H
Company:	COG Production LLC	TVD Reference:	WELL @ 3576.0usft (Scandril Freedom)
Project:	Lea County, New Mexico	MD Reference:	WELL @ 3576.0usft (Scandril Freedom)
Site:	Sec 30 T24-S R32-E	North Reference:	Grid
Well:	Windward Federal #8H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Project	Lea County, New Mexico		
Map System:	US State Plane 1927 (Exact solution)	System Datum:	Mean Sea Level
Geo Datum:	NAD 1927 (NADCON CONUS)		
Map Zone:	New Mexico East 3001		

Site	Sec 30 T24-S R32-E		
Site Position:		Northing:	435,185.29 usft
From:	Map	Easting:	692,144.40 usft
Position Uncertainty:	0.0 usft	Slot Radius:	13-3/16 "
		Latitude:	32° 11' 41.697 N
		Longitude:	103° 42' 43.883 W
		Grid Convergence:	0.33 °

Well	Windward Federal #8H		
Well Position	+N/-S	-10.2 usft	Northing:
	+E/-W	-1,286.8 usft	Easting:
Position Uncertainty		0.0 usft	Wellhead Elevation:
			0.0 usft
			Latitude:
			32° 11' 41.670 N
			Longitude:
			103° 42' 58.859 W
			Ground Level:
			3,539.0 usft

Wellbore	Wellbore #1		
Magnetics	Model Name	Sample Date	Declination
			(°)
	IGRF2015	1/13/2016	7.17
			Dip Angle
			(°)
			60.03
			Field Strength
			(nT)
			48,051

Design	Design #1		
Audit Notes:			
Version:	Phase:	PLAN	Tie On Depth:
			0.0
Vertical Section:	Depth From (TVD)	+N/-S	+E/-W
	(usft)	(usft)	(usft)
	0.0	0.0	0.0
			Direction
			(°)
			176.87

Plan Sections										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	TFO (°)	Target
0.0	0.00	0.00	0.0	0.0	0.0	0.00	0.00	0.00	0.00	
1,000.0	0.00	0.00	1,000.0	0.0	0.0	0.00	0.00	0.00	0.00	
1,193.9	3.88	82.75	1,193.8	0.8	6.5	2.00	2.00	0.00	82.75	
8,445.0	3.88	82.75	8,428.2	62.8	493.0	0.00	0.00	0.00	0.00	
8,638.9	0.00	0.01	8,622.0	63.6	499.5	2.00	-2.00	0.00	180.00	VP Windward Federal
9,538.9	90.00	179.65	9,195.0	-509.4	503.0	10.00	10.00	19.96	179.65	
19,329.1	90.00	179.65	9,195.0	-10,299.4	552.8	0.00	0.00	0.00	0.00	PBHL Windward Fede



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Site:	Sec 30 T24-S R32-E	North Reference:	Grid
Well:	Windward Federal #8H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
0.0	0.00	0.00	0.0	0.0	0.0	0.0	0.00	0.00	0.00
100.0	0.00	0.00	100.0	0.0	0.0	0.0	0.00	0.00	0.00
200.0	0.00	0.00	200.0	0.0	0.0	0.0	0.00	0.00	0.00
300.0	0.00	0.00	300.0	0.0	0.0	0.0	0.00	0.00	0.00
400.0	0.00	0.00	400.0	0.0	0.0	0.0	0.00	0.00	0.00
500.0	0.00	0.00	500.0	0.0	0.0	0.0	0.00	0.00	0.00
600.0	0.00	0.00	600.0	0.0	0.0	0.0	0.00	0.00	0.00
RUSTLER									
700.0	0.00	0.00	700.0	0.0	0.0	0.0	0.00	0.00	0.00
800.0	0.00	0.00	800.0	0.0	0.0	0.0	0.00	0.00	0.00
900.0	0.00	0.00	900.0	0.0	0.0	0.0	0.00	0.00	0.00
TOS									
928.0	0.00	0.00	928.0	0.0	0.0	0.0	0.00	0.00	0.00
Build 2°/100'									
1,000.0	0.00	0.00	1,000.0	0.0	0.0	0.0	0.00	0.00	0.00
1,100.0	2.00	82.75	1,100.0	0.2	1.7	-0.1	2.00	2.00	0.00
EOB / 3.88° Inc / 82.75° Azm									
1,193.9	3.88	82.75	1,193.8	0.8	6.5	-0.5	2.00	2.00	0.00
1,200.0	3.88	82.75	1,199.8	0.9	6.9	-0.5	0.00	0.00	0.00
1,300.0	3.88	82.75	1,299.6	1.7	13.6	-1.0	0.00	0.00	0.00
1,400.0	3.88	82.75	1,399.4	2.6	20.3	-1.5	0.00	0.00	0.00
1,500.0	3.88	82.75	1,499.2	3.4	27.0	-2.0	0.00	0.00	0.00
1,600.0	3.88	82.75	1,598.9	4.3	33.8	-2.4	0.00	0.00	0.00
1,700.0	3.88	82.75	1,698.7	5.2	40.5	-2.9	0.00	0.00	0.00
1,800.0	3.88	82.75	1,798.5	6.0	47.2	-3.4	0.00	0.00	0.00
1,900.0	3.88	82.75	1,898.2	6.9	53.9	-3.9	0.00	0.00	0.00
2,000.0	3.88	82.75	1,998.0	7.7	60.6	-4.4	0.00	0.00	0.00
2,100.0	3.88	82.75	2,097.8	8.6	67.3	-4.9	0.00	0.00	0.00
2,200.0	3.88	82.75	2,197.5	9.4	74.0	-5.4	0.00	0.00	0.00
2,300.0	3.88	82.75	2,297.3	10.3	80.7	-5.9	0.00	0.00	0.00
2,400.0	3.88	82.75	2,397.1	11.1	87.4	-6.3	0.00	0.00	0.00
2,500.0	3.88	82.75	2,496.9	12.0	94.1	-6.8	0.00	0.00	0.00
2,600.0	3.88	82.75	2,596.6	12.8	100.8	-7.3	0.00	0.00	0.00
2,700.0	3.88	82.75	2,696.4	13.7	107.6	-7.8	0.00	0.00	0.00
2,800.0	3.88	82.75	2,796.2	14.5	114.3	-8.3	0.00	0.00	0.00
2,900.0	3.88	82.75	2,895.9	15.4	121.0	-8.8	0.00	0.00	0.00
3,000.0	3.88	82.75	2,995.7	16.3	127.7	-9.3	0.00	0.00	0.00
3,100.0	3.88	82.75	3,095.5	17.1	134.4	-9.7	0.00	0.00	0.00
3,200.0	3.88	82.75	3,195.3	18.0	141.1	-10.2	0.00	0.00	0.00
3,300.0	3.88	82.75	3,295.0	18.8	147.8	-10.7	0.00	0.00	0.00
3,400.0	3.88	82.75	3,394.8	19.7	154.5	-11.2	0.00	0.00	0.00
3,500.0	3.88	82.75	3,494.6	20.5	161.2	-11.7	0.00	0.00	0.00
3,600.0	3.88	82.75	3,594.3	21.4	167.9	-12.2	0.00	0.00	0.00
3,700.0	3.88	82.75	3,694.1	22.2	174.6	-12.7	0.00	0.00	0.00
3,800.0	3.88	82.75	3,793.9	23.1	181.4	-13.2	0.00	0.00	0.00
3,900.0	3.88	82.75	3,893.7	23.9	188.1	-13.6	0.00	0.00	0.00
4,000.0	3.88	82.75	3,993.4	24.8	194.8	-14.1	0.00	0.00	0.00
4,100.0	3.88	82.75	4,093.2	25.6	201.5	-14.6	0.00	0.00	0.00
4,200.0	3.88	82.75	4,193.0	26.5	208.2	-15.1	0.00	0.00	0.00
4,300.0	3.88	82.75	4,292.7	27.4	214.9	-15.6	0.00	0.00	0.00
BOS									
4,345.4	3.88	82.75	4,338.0	27.7	217.9	-15.8	0.00	0.00	0.00
4,400.0	3.88	82.75	4,392.5	28.2	221.6	-16.1	0.00	0.00	0.00
4,500.0	3.88	82.75	4,492.3	29.1	228.3	-16.6	0.00	0.00	0.00



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Wellbore:	Wellbore #1		
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Planned Survey									
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
LMAR									
4,571.9	3.88	82.75	4,564.0	29.7	233.1	-16.9	0.00	0.00	0.00
BLCN									
4,598.9	3.88	82.75	4,591.0	29.9	235.0	-17.0	0.00	0.00	0.00
4,600.0	3.88	82.75	4,592.1	29.9	235.0	-17.0	0.00	0.00	0.00
4,700.0	3.88	82.75	4,691.8	30.8	241.7	-17.5	0.00	0.00	0.00
4,800.0	3.88	82.75	4,791.6	31.6	248.4	-18.0	0.00	0.00	0.00
4,900.0	3.88	82.75	4,891.4	32.5	255.2	-18.5	0.00	0.00	0.00
5,000.0	3.88	82.75	4,991.1	33.3	261.9	-19.0	0.00	0.00	0.00
5,100.0	3.88	82.75	5,090.9	34.2	268.6	-19.5	0.00	0.00	0.00
5,200.0	3.88	82.75	5,190.7	35.0	275.3	-20.0	0.00	0.00	0.00
5,300.0	3.88	82.75	5,290.5	35.9	282.0	-20.5	0.00	0.00	0.00
5,400.0	3.88	82.75	5,390.2	36.7	288.7	-20.9	0.00	0.00	0.00
5,500.0	3.88	82.75	5,490.0	37.6	295.4	-21.4	0.00	0.00	0.00
CYCN									
5,507.0	3.88	82.75	5,497.0	37.7	295.9	-21.5	0.00	0.00	0.00
5,600.0	3.88	82.75	5,589.8	38.5	302.1	-21.9	0.00	0.00	0.00
5,700.0	3.88	82.75	5,689.5	39.3	308.8	-22.4	0.00	0.00	0.00
5,800.0	3.88	82.75	5,789.3	40.2	315.5	-22.9	0.00	0.00	0.00
5,900.0	3.88	82.75	5,889.1	41.0	322.2	-23.4	0.00	0.00	0.00
6,000.0	3.88	82.75	5,988.8	41.9	329.0	-23.9	0.00	0.00	0.00
6,100.0	3.88	82.75	6,088.6	42.7	335.7	-24.3	0.00	0.00	0.00
6,200.0	3.88	82.75	6,188.4	43.6	342.4	-24.8	0.00	0.00	0.00
6,300.0	3.88	82.75	6,288.2	44.4	349.1	-25.3	0.00	0.00	0.00
6,400.0	3.88	82.75	6,387.9	45.3	355.8	-25.8	0.00	0.00	0.00
6,500.0	3.88	82.75	6,487.7	46.1	362.5	-26.3	0.00	0.00	0.00
6,600.0	3.88	82.75	6,587.5	47.0	369.2	-26.8	0.00	0.00	0.00
6,700.0	3.88	82.75	6,687.2	47.8	375.9	-27.3	0.00	0.00	0.00
6,800.0	3.88	82.75	6,787.0	48.7	382.6	-27.8	0.00	0.00	0.00
BYCN									
6,894.2	3.88	82.75	6,881.0	49.5	388.9	-28.2	0.00	0.00	0.00
6,900.0	3.88	82.75	6,886.8	49.6	389.3	-28.2	0.00	0.00	0.00
7,000.0	3.88	82.75	6,986.6	50.4	396.0	-28.7	0.00	0.00	0.00
7,100.0	3.88	82.75	7,086.3	51.3	402.8	-29.2	0.00	0.00	0.00
7,200.0	3.88	82.75	7,186.1	52.1	409.5	-29.7	0.00	0.00	0.00
7,300.0	3.88	82.75	7,285.9	53.0	416.2	-30.2	0.00	0.00	0.00
7,400.0	3.88	82.75	7,385.6	53.8	422.9	-30.7	0.00	0.00	0.00
7,500.0	3.88	82.75	7,485.4	54.7	429.6	-31.2	0.00	0.00	0.00
7,600.0	3.88	82.75	7,585.2	55.5	436.3	-31.6	0.00	0.00	0.00
7,700.0	3.88	82.75	7,685.0	56.4	443.0	-32.1	0.00	0.00	0.00
7,800.0	3.88	82.75	7,784.7	57.2	449.7	-32.6	0.00	0.00	0.00
7,900.0	3.88	82.75	7,884.5	58.1	456.4	-33.1	0.00	0.00	0.00
8,000.0	3.88	82.75	7,984.3	59.0	463.1	-33.6	0.00	0.00	0.00
8,100.0	3.88	82.75	8,084.0	59.8	469.8	-34.1	0.00	0.00	0.00
8,200.0	3.88	82.75	8,183.8	60.7	476.6	-34.6	0.00	0.00	0.00
8,300.0	3.88	82.75	8,283.6	61.5	483.3	-35.1	0.00	0.00	0.00
8,400.0	3.88	82.75	8,383.4	62.4	490.0	-35.5	0.00	0.00	0.00
Drop 2°/100'									
8,445.0	3.88	82.75	8,428.2	62.8	493.0	-35.8	0.00	0.00	0.00
8,500.0	2.78	82.75	8,483.2	63.2	496.2	-36.0	2.00	-2.00	0.00
BONE SPRG									
8,536.9	2.04	82.75	8,520.0	63.4	497.7	-36.1	2.00	-2.00	0.00
U AVALON									



QES Directional Drilling, LLC
Well Planning Report



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8,581.9	1.14	82.75	8,565.0	63.5	498.9	-36.2	2.00	-2.00	0.00
8,600.0	0.78	82.75	8,583.1	63.5	499.2	-36.2	2.00	-2.00	0.00
EOD @ Vertical / Build 10°/100'									
8,638.9	0.00	0.01	8,622.0	63.6	499.5	-36.2	2.00	-2.00	0.00
8,700.0	6.11	179.65	8,683.0	60.3	499.5	-33.0	10.00	10.00	0.00
8,800.0	16.11	179.65	8,781.0	41.1	499.6	-13.8	10.00	10.00	0.00
8,900.0	26.11	179.65	8,874.2	5.1	499.9	22.2	10.00	10.00	0.00
9,000.0	36.11	179.65	8,959.7	-46.5	500.2	73.7	10.00	10.00	0.00
LAVALON									
9,087.3	44.84	179.65	9,026.0	-103.1	500.5	130.2	10.00	10.00	0.00
9,100.0	46.11	179.65	9,034.9	-112.2	500.6	139.3	10.00	10.00	0.00
9,200.0	56.11	179.65	9,097.6	-189.9	501.0	216.9	10.00	10.00	0.00
9,300.0	66.11	179.65	9,145.9	-277.3	501.6	304.3	10.00	10.00	0.00
9,400.0	76.11	179.65	9,178.2	-371.8	502.2	398.7	10.00	10.00	0.00
9,500.0	86.11	179.65	9,193.6	-470.5	502.8	497.2	10.00	10.00	0.00
EOC / 90° Inc / 179.65° Azm / 9195' TVD									
9,538.9	90.00	179.65	9,195.0	-509.4	503.0	536.1	10.00	10.00	0.00
9,600.0	90.00	179.65	9,195.0	-570.5	503.4	597.1	0.00	0.00	0.00
9,700.0	90.00	179.65	9,195.0	-670.5	504.0	697.0	0.00	0.00	0.00
9,800.0	90.00	179.65	9,195.0	-770.5	504.6	796.8	0.00	0.00	0.00
9,900.0	90.00	179.65	9,195.0	-870.5	505.2	896.7	0.00	0.00	0.00
10,000.0	90.00	179.65	9,195.0	-970.5	505.8	996.6	0.00	0.00	0.00
10,100.0	90.00	179.65	9,195.0	-1,070.5	506.4	1,096.5	0.00	0.00	0.00
10,200.0	90.00	179.65	9,195.0	-1,170.5	507.0	1,196.4	0.00	0.00	0.00
10,300.0	90.00	179.65	9,195.0	-1,270.5	507.6	1,296.3	0.00	0.00	0.00
10,400.0	90.00	179.65	9,195.0	-1,370.5	508.3	1,396.1	0.00	0.00	0.00
10,500.0	90.00	179.65	9,195.0	-1,470.5	508.9	1,496.0	0.00	0.00	0.00
10,600.0	90.00	179.65	9,195.0	-1,570.4	509.5	1,595.9	0.00	0.00	0.00
10,700.0	90.00	179.65	9,195.0	-1,670.4	510.1	1,695.8	0.00	0.00	0.00
10,800.0	90.00	179.65	9,195.0	-1,770.4	510.7	1,795.7	0.00	0.00	0.00
10,900.0	90.00	179.65	9,195.0	-1,870.4	511.3	1,895.6	0.00	0.00	0.00
11,000.0	90.00	179.65	9,195.0	-1,970.4	511.9	1,995.4	0.00	0.00	0.00
11,100.0	90.00	179.65	9,195.0	-2,070.4	512.5	2,095.3	0.00	0.00	0.00
11,200.0	90.00	179.65	9,195.0	-2,170.4	513.1	2,195.2	0.00	0.00	0.00
11,300.0	90.00	179.65	9,195.0	-2,270.4	513.8	2,295.1	0.00	0.00	0.00
11,400.0	90.00	179.65	9,195.0	-2,370.4	514.4	2,395.0	0.00	0.00	0.00
11,500.0	90.00	179.65	9,195.0	-2,470.4	515.0	2,494.9	0.00	0.00	0.00
11,600.0	90.00	179.65	9,195.0	-2,570.4	515.6	2,594.7	0.00	0.00	0.00
11,700.0	90.00	179.65	9,195.0	-2,670.4	516.2	2,694.6	0.00	0.00	0.00
11,800.0	90.00	179.65	9,195.0	-2,770.4	516.8	2,794.5	0.00	0.00	0.00
11,900.0	90.00	179.65	9,195.0	-2,870.4	517.4	2,894.4	0.00	0.00	0.00
12,000.0	90.00	179.65	9,195.0	-2,970.4	518.0	2,994.3	0.00	0.00	0.00
12,100.0	90.00	179.65	9,195.0	-3,070.4	518.6	3,094.1	0.00	0.00	0.00
12,200.0	90.00	179.65	9,195.0	-3,170.4	519.3	3,194.0	0.00	0.00	0.00
12,300.0	90.00	179.65	9,195.0	-3,270.4	519.9	3,293.9	0.00	0.00	0.00
12,400.0	90.00	179.65	9,195.0	-3,370.4	520.5	3,393.8	0.00	0.00	0.00
12,500.0	90.00	179.65	9,195.0	-3,470.4	521.1	3,493.7	0.00	0.00	0.00
12,600.0	90.00	179.65	9,195.0	-3,570.4	521.7	3,593.6	0.00	0.00	0.00
12,700.0	90.00	179.65	9,195.0	-3,670.4	522.3	3,693.4	0.00	0.00	0.00
12,800.0	90.00	179.65	9,195.0	-3,770.4	522.9	3,793.3	0.00	0.00	0.00
12,900.0	90.00	179.65	9,195.0	-3,870.4	523.5	3,893.2	0.00	0.00	0.00
13,000.0	90.00	179.65	9,195.0	-3,970.4	524.1	3,993.1	0.00	0.00	0.00
13,100.0	90.00	179.65	9,195.0	-4,070.4	524.7	4,093.0	0.00	0.00	0.00



QES Directional Drilling, LLC
Well Planning Report



Database:	EDM5002	Local Co-ordinate Reference:	Well Windward Federal #8H
Company:	COG Production LLC	TVD Reference:	WELL @ 3576.0usft (Scandril Freedom)
Project:	Lea County, New Mexico	MD Reference:	WELL @ 3576.0usft (Scandril Freedom)
Site:	Sec 30 T24-S R32-E	North Reference:	Grid
Well:	Windward Federal #8H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Planned Survey

Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)
13,200.0	90.00	179.65	9,195.0	-4,170.4	525.4	4,192.9	0.00	0.00	0.00
13,300.0	90.00	179.65	9,195.0	-4,270.4	526.0	4,292.7	0.00	0.00	0.00
13,400.0	90.00	179.65	9,195.0	-4,370.4	526.6	4,392.6	0.00	0.00	0.00
13,500.0	90.00	179.65	9,195.0	-4,470.4	527.2	4,492.5	0.00	0.00	0.00
13,600.0	90.00	179.65	9,195.0	-4,570.4	527.8	4,592.4	0.00	0.00	0.00
13,700.0	90.00	179.65	9,195.0	-4,670.4	528.4	4,692.3	0.00	0.00	0.00
13,800.0	90.00	179.65	9,195.0	-4,770.4	529.0	4,792.1	0.00	0.00	0.00
13,900.0	90.00	179.65	9,195.0	-4,870.4	529.6	4,892.0	0.00	0.00	0.00
14,000.0	90.00	179.65	9,195.0	-4,970.4	530.2	4,991.9	0.00	0.00	0.00
14,100.0	90.00	179.65	9,195.0	-5,070.4	530.9	5,091.8	0.00	0.00	0.00
14,200.0	90.00	179.65	9,195.0	-5,170.4	531.5	5,191.7	0.00	0.00	0.00
14,300.0	90.00	179.65	9,195.0	-5,270.4	532.1	5,291.6	0.00	0.00	0.00
14,400.0	90.00	179.65	9,195.0	-5,370.4	532.7	5,391.4	0.00	0.00	0.00
14,500.0	90.00	179.65	9,195.0	-5,470.4	533.3	5,491.3	0.00	0.00	0.00
14,600.0	90.00	179.65	9,195.0	-5,570.4	533.9	5,591.2	0.00	0.00	0.00
14,700.0	90.00	179.65	9,195.0	-5,670.4	534.5	5,691.1	0.00	0.00	0.00
14,800.0	90.00	179.65	9,195.0	-5,770.4	535.1	5,791.0	0.00	0.00	0.00
14,900.0	90.00	179.65	9,195.0	-5,870.4	535.7	5,890.9	0.00	0.00	0.00
15,000.0	90.00	179.65	9,195.0	-5,970.4	536.4	5,990.7	0.00	0.00	0.00
15,100.0	90.00	179.65	9,195.0	-6,070.4	537.0	6,090.6	0.00	0.00	0.00
15,200.0	90.00	179.65	9,195.0	-6,170.4	537.6	6,190.5	0.00	0.00	0.00
15,300.0	90.00	179.65	9,195.0	-6,270.4	538.2	6,290.4	0.00	0.00	0.00
15,400.0	90.00	179.65	9,195.0	-6,370.4	538.8	6,390.3	0.00	0.00	0.00
15,500.0	90.00	179.65	9,195.0	-6,470.4	539.4	6,490.2	0.00	0.00	0.00
15,600.0	90.00	179.65	9,195.0	-6,570.4	540.0	6,590.0	0.00	0.00	0.00
15,700.0	90.00	179.65	9,195.0	-6,670.4	540.6	6,689.9	0.00	0.00	0.00
15,800.0	90.00	179.65	9,195.0	-6,770.4	541.2	6,789.8	0.00	0.00	0.00
15,900.0	90.00	179.65	9,195.0	-6,870.3	541.9	6,889.7	0.00	0.00	0.00
16,000.0	90.00	179.65	9,195.0	-6,970.3	542.5	6,989.6	0.00	0.00	0.00
16,100.0	90.00	179.65	9,195.0	-7,070.3	543.1	7,089.4	0.00	0.00	0.00
16,200.0	90.00	179.65	9,195.0	-7,170.3	543.7	7,189.3	0.00	0.00	0.00
16,300.0	90.00	179.65	9,195.0	-7,270.3	544.3	7,289.2	0.00	0.00	0.00
16,400.0	90.00	179.65	9,195.0	-7,370.3	544.9	7,389.1	0.00	0.00	0.00
16,500.0	90.00	179.65	9,195.0	-7,470.3	545.5	7,489.0	0.00	0.00	0.00
16,600.0	90.00	179.65	9,195.0	-7,570.3	546.1	7,588.9	0.00	0.00	0.00
16,700.0	90.00	179.65	9,195.0	-7,670.3	546.7	7,688.7	0.00	0.00	0.00
16,800.0	90.00	179.65	9,195.0	-7,770.3	547.4	7,788.6	0.00	0.00	0.00
16,900.0	90.00	179.65	9,195.0	-7,870.3	548.0	7,888.5	0.00	0.00	0.00
17,000.0	90.00	179.65	9,195.0	-7,970.3	548.6	7,988.4	0.00	0.00	0.00
17,100.0	90.00	179.65	9,195.0	-8,070.3	549.2	8,088.3	0.00	0.00	0.00
17,200.0	90.00	179.65	9,195.0	-8,170.3	549.8	8,188.2	0.00	0.00	0.00
17,300.0	90.00	179.65	9,195.0	-8,270.3	550.4	8,288.0	0.00	0.00	0.00
17,400.0	90.00	179.65	9,195.0	-8,370.3	551.0	8,387.9	0.00	0.00	0.00
17,500.0	90.00	179.65	9,195.0	-8,470.3	551.6	8,487.8	0.00	0.00	0.00
17,600.0	90.00	179.65	9,195.0	-8,570.3	552.2	8,587.7	0.00	0.00	0.00
17,700.0	90.00	179.65	9,195.0	-8,670.3	552.8	8,687.6	0.00	0.00	0.00
17,800.0	90.00	179.65	9,195.0	-8,770.3	553.5	8,787.4	0.00	0.00	0.00
17,900.0	90.00	179.65	9,195.0	-8,870.3	554.1	8,887.3	0.00	0.00	0.00
18,000.0	90.00	179.65	9,195.0	-8,970.3	554.7	8,987.2	0.00	0.00	0.00
18,100.0	90.00	179.65	9,195.0	-9,070.3	555.3	9,087.1	0.00	0.00	0.00
18,200.0	90.00	179.65	9,195.0	-9,170.3	555.9	9,187.0	0.00	0.00	0.00
18,300.0	90.00	179.65	9,195.0	-9,270.3	556.5	9,286.9	0.00	0.00	0.00
18,400.0	90.00	179.65	9,195.0	-9,370.3	557.1	9,386.7	0.00	0.00	0.00
18,500.0	90.00	179.65	9,195.0	-9,470.3	557.7	9,486.6	0.00	0.00	0.00



QES Directional Drilling, LLC
Well Planning Report



Database:	EDM5002	Local Co-ordinate Reference:	Well Windward Federal #8H
Company:	COG Production LLC	TVD Reference:	WELL @ 3576.0usft (Scandril Freedom)
Project:	Lea County, New Mexico	MD Reference:	WELL @ 3576.0usft (Scandril Freedom)
Site:	Sec 30 T24-S R32-E	North Reference:	Grid
Well:	Windward Federal #8H	Survey Calculation Method:	Minimum Curvature
Wellbore:	Wellbore #1		
Design:	Design #1		

Planned Survey										
Measured Depth (usft)	Inclination (°)	Azimuth (°)	Vertical Depth (usft)	+N/-S (usft)	+E/-W (usft)	Vertical Section (usft)	Dogleg Rate (°/100usft)	Build Rate (°/100usft)	Turn Rate (°/100usft)	
18,600.0	90.00	179.65	9,195.0	-9,570.3	558.3	9,586.5	0.00	0.00	0.00	
18,700.0	90.00	179.65	9,195.0	-9,670.3	559.0	9,686.4	0.00	0.00	0.00	
18,800.0	90.00	179.65	9,195.0	-9,770.3	559.6	9,786.3	0.00	0.00	0.00	
18,900.0	90.00	179.65	9,195.0	-9,870.3	560.2	9,886.2	0.00	0.00	0.00	
19,000.0	90.00	179.65	9,195.0	-9,970.3	560.8	9,986.0	0.00	0.00	0.00	
19,100.0	90.00	179.65	9,195.0	-10,070.3	561.4	10,085.9	0.00	0.00	0.00	
19,200.0	90.00	179.65	9,195.0	-10,170.3	562.0	10,185.8	0.00	0.00	0.00	
19,300.0	90.00	179.65	9,195.0	-10,270.3	562.6	10,285.7	0.00	0.00	0.00	
TD @ 19329' MD / 9195' TVD										
19,329.1	90.00	179.65	9,195.0	-10,299.4	562.8	10,314.8	0.00	0.00	0.00	

Design Targets										
Target Name	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude	
- hit/miss target										
- Shape										
VP Windward Federal #8	0.00	0.00	8,622.0	63.6	499.5	435,238.68	691,357.09	32° 11' 42.271 N	103° 42' 53.042 W	
- plan hits target center										
- Point										
PBHL Windward Federal	90.00	179.65	9,195.0	-10,299.4	562.8	424,875.70	691,420.40	32° 9' 59.716 N	103° 42' 52.998 W	
- plan hits target center										
- Rectangle (sides W100.0 H0.0 D9,790.2)										

Formations						
Measured Depth (usft)	Vertical Depth (usft)	Name	Lithology	Dip (°)	Dip Direction (°)	
700.0	693.0	RUSTLER		0.00	179.65	
928.0	921.0	TOS		0.00	179.65	
4,345.4	4,331.0	BOS		0.00	179.65	
4,571.9	4,557.0	LMAR		0.00	179.65	
4,598.9	4,584.0	BLCN		0.00	179.65	
5,507.0	5,490.0	CYCN		0.00	179.65	
6,894.2	6,874.0	BYCN		0.00	179.65	
8,536.9	8,513.0	BONE SPRG		0.00	179.65	
8,581.9	8,558.0	U AVALON		0.00	179.65	
9,087.3	9,019.0	LAVALON		0.00	179.65	

Plan Annotations					
Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates			
		+N/-S (usft)	+E/-W (usft)	Comment	
1,000.0	1,000.0	0.0	0.0	Build 2°/100'	
1,193.9	1,193.8	0.8	6.5	EOB / 3.88° Inc / 82.75° Azm	
8,445.0	8,428.2	62.8	493.0	Drop 2°/100'	
8,638.9	8,622.0	63.6	499.5	EOD @ Vertical / Build 10°/100'	
9,538.9	9,195.0	-509.4	503.0	EOC / 90° Inc / 179.65° Azm / 9195' TVD	
19,329.1	9,195.0	-10,299.4	562.8	TD @ 19329' MD / 9195' TVD	