



Directional Survey

Well Name: THISTLE UNIT 60H

Sub-Division DELAWARE BASIN EAST		Region BASIN EAST		Field Name JOHNSON RANCH		County LEA		State/Province NM					
Surface Legal Location SEC 28-23S-33E		API/UWI 3002541797		Latitude (") 32° 16' 56.648" N		Longitude (") 103° 34' 19.755" W		Orig KB Elevation (ft) 3,724.30		Ground Elev MSL (ft) 3,701.30		KB - GL (ft) 23.00	
Wellbores													
Wellbore Name OH		Parent Wellbore OH				SAP Well ID 38792				Vertical Section Direction (")			
Kick Offs & Key Depths													
Date 9/4/2015				Type CURVE				Top Depth (ftKB) 10,652.0					
Actual Deviation Survey MWD, Proposed? No				Definitive? No		Proposed? No		Proposed Deviation Survey					

Deviation Survey													
Date 8/24/2015		Description MWD											
MD Tie In (ftKB) 0.00		TVD Tie In (ftKB) 0.00		Inclination Tie In (") 0.00		Azimuth Tie In (") 0.00		NSTie In (ft) 0.00		EWTie In (ft) 0.00			

Survey Data										
Date	MD (ftKB)	Incl (")	Azm (")	TVD (ftKB)	VS (ft)	N/S (ft)	E/W (ft)	DLS ("/100ft)	Survey Tool	Survey Company
8/24/2015	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	MWD	EXTREME
8/24/2015	265.00	0.79	203.05	264.99	-1.73	-1.68	-0.72	0.30	MWD	EXTREME
8/24/2015	355.00	0.88	216.71	354.98	-2.89	-2.81	-1.37	0.24	MWD	EXTREME
8/24/2015	447.00	0.79	227.52	446.97	-3.95	-3.80	-2.26	0.20	MWD	EXTREME
8/24/2015	537.00	1.01	243.33	536.96	-4.80	-4.58	-3.43	0.37	MWD	EXTREME
8/24/2015	630.00	0.79	243.33	629.95	-5.54	-5.23	-4.73	0.24	MWD	EXTREME
8/24/2015	724.00	0.40	232.32	723.94	-6.09	-5.72	-5.57	0.43	MWD	EXTREME
8/24/2015	819.00	0.09	225.33	818.94	-6.37	-5.98	-5.89	0.33	MWD	EXTREME
8/24/2015	914.00	0.09	179.45	913.94	-6.50	-6.11	-5.94	0.07	MWD	EXTREME
8/24/2015	1,004.50	0.27	212.92	1,004.44	-6.76	-6.36	-6.06	0.22	MWD	VES
8/24/2015	1,099.00	0.30	248.14	1,098.94	-7.06	-6.63	-6.41	0.18	MWD	VES
8/24/2015	1,193.50	0.66	244.98	1,193.44	-7.43	-6.96	-7.13	0.38	MWD	VES
8/24/2015	1,288.00	0.96	254.33	1,287.93	-7.96	-7.40	-8.38	0.35	MWD	VES
8/24/2015	1,361.00	1.13	261.41	1,360.92	-8.32	-7.67	-9.68	0.29	MWD	VES
8/24/2015	1,527.00	0.79	281.07	1,526.89	-8.53	-7.70	-12.43	0.28	MWD	VES
8/24/2015	1,716.00	0.97	288.98	1,715.87	-7.96	-6.93	-15.22	0.11	MWD	VES
8/24/2015	1,906.00	0.88	283.71	1,905.85	-7.29	-6.06	-18.16	0.07	MWD	VES
8/24/2015	2,095.00	0.44	263.31	2,094.83	-7.18	-5.80	-20.29	0.26	MWD	VES
8/24/2015	2,284.00	0.09	252.59	2,283.83	-7.37	-5.93	-21.15	0.19	MWD	VES
8/24/2015	2,473.00	0.09	355.07	2,472.83	-7.28	-5.82	-21.30	0.07	MWD	VES
8/24/2015	2,662.00	0.09	195.11	2,661.83	-7.27	-5.82	-21.35	0.09	MWD	VES
8/24/2015	2,851.00	0.09	261.38	2,850.83	-7.45	-5.99	-21.54	0.05	MWD	VES
8/24/2015	3,039.00	0.09	302.51	3,038.83	-7.41	-5.93	-21.81	0.03	MWD	VES
8/24/2015	3,228.00	0.26	197.57	3,227.83	-7.76	-6.26	-22.07	0.16	MWD	VES
8/24/2015	3,416.00	0.18	247.85	3,415.83	-8.30	-6.78	-22.47	0.11	MWD	VES
8/24/2015	3,605.00	0.09	207.06	3,604.83	-8.57	-7.02	-22.81	0.07	MWD	VES
8/24/2015	3,795.00	0.35	200.03	3,794.83	-9.27	-7.70	-23.08	0.14	MWD	VES
8/24/2015	3,984.00	0.18	76.46	3,983.83	-9.73	-8.17	-22.99	0.25	MWD	VES
8/24/2015	4,174.00	0.18	243.28	4,173.83	-9.79	-8.23	-22.96	0.19	MWD	VES
8/24/2015	4,363.00	0.62	133.24	4,362.82	-10.59	-9.07	-22.48	0.37	MWD	VES
8/24/2015	4,553.00	1.32	122.16	4,552.79	-12.28	-10.94	-19.88	0.38	MWD	VES
8/24/2015	4,742.00	1.49	76.11	4,741.74	-12.56	-11.51	-15.65	0.59	MWD	VES
8/24/2015	4,836.00	1.93	90.70	4,835.70	-12.09	-11.23	-12.88	0.65	MWD	VES
8/24/2015	4,931.00	1.93	81.38	4,930.65	-11.65	-11.01	-9.70	0.33	MWD	VES
8/24/2015	5,025.00	1.76	33.04	5,024.60	-10.05	-9.57	-7.35	1.62	MWD	VES
8/24/2015	5,120.00	1.58	24.60	5,119.56	-7.55	-7.15	-6.01	0.32	MWD	VES
8/24/2015	5,188.00	1.23	37.79	5,187.54	-6.06	-5.72	-5.17	0.70	MWD	VES
8/24/2015	5,303.00	1.32	52.20	5,302.52	-4.16	-3.93	-3.37	0.29	MWD	VES
8/24/2015	5,398.00	1.85	56.77	5,397.48	-2.50	-2.42	-1.22	0.57	MWD	VES
8/24/2015	5,492.00	3.69	56.07	5,491.36	0.27	0.10	2.56	1.96	MWD	VES
8/24/2015	5,586.00	5.19	56.07	5,585.08	4.74	4.16	8.60	1.60	MWD	VES
8/24/2015	5,680.00	5.19	55.72	5,678.69	9.98	8.93	15.64	0.03	MWD	VES
8/24/2015	5,869.00	5.72	59.06	5,866.84	20.65	18.58	30.78	0.33	MWD	VES
8/24/2015	6,058.00	5.72	63.10	6,054.90	30.87	27.69	47.26	0.21	MWD	VES
8/24/2015	6,247.00	5.36	63.28	6,243.01	40.20	35.92	63.54	0.19	MWD	VES
8/24/2015	6,435.00	5.10	62.57	6,430.23	49.03	43.71	78.80	0.14	MWD	VES
8/24/2015	6,624.00	5.19	62.40	6,618.47	57.87	51.54	93.83	0.05	MWD	VES
8/24/2015	6,813.00	5.01	58.88	6,806.72	67.09	59.77	108.47	0.19	MWD	VES
8/24/2015	7,002.00	4.57	60.64	6,995.06	75.96	67.73	122.10	0.25	MWD	VES
8/24/2015	7,190.00	4.48	61.17	7,182.48	84.05	74.94	135.06	0.05	MWD	VES
8/24/2015	7,379.00	4.48	60.64	7,370.90	92.10	82.12	147.96	0.02	MWD	VES
8/24/2015	7,567.00	4.22	61.87	7,558.36	99.80	88.98	160.46	0.15	MWD	VES
8/24/2015	7,662.00	3.87	74.70	7,653.12	102.71	91.47	166.63	1.02	MWD	VES
8/24/2015	7,757.00	3.25	83.14	7,747.94	104.27	92.64	172.40	0.85	MWD	VES
8/24/2015	7,851.00	2.73	89.29	7,841.81	104.95	92.99	177.28	0.65	MWD	VES
8/24/2015	7,946.00	2.02	98.26	7,936.73	105.01	92.78	181.20	0.84	MWD	VES
8/24/2015	8,040.00	1.32	103.71	8,030.69	104.70	92.28	183.89	0.76	MWD	VES
8/24/2015	8,135.00	0.79	122.16	8,125.67	104.21	91.67	185.51	0.66	MWD	VES
8/24/2015	8,325.00	1.06	130.95	8,315.65	102.53	89.82	187.95	0.16	MWD	VES
8/24/2015	8,514.00	0.97	137.81	8,504.62	100.37	87.49	190.34	0.08	MWD	VES
8/24/2015	8,703.00	1.14	150.81	8,693.59	97.69	84.67	192.33	0.15	MWD	VES
8/24/2015	8,892.00	1.23	162.59	8,882.55	94.22	81.09	193.86	0.14	MWD	VES
8/24/2015	9,082.00	1.06	152.05	9,072.51	90.83	77.59	195.29	0.14	MWD	VES
8/24/2015	9,271.00	0.79	166.11	9,261.48	88.11	74.78	196.42	0.19	MWD	VES
8/24/2015	9,461.00	0.70	204.25	9,451.47	85.77	72.45	196.26	0.26	MWD	VES
8/24/2015	9,650.00	0.97	213.57	9,640.45	83.30	70.07	194.90	0.16	MWD	VES



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Sub-Division		Region		Field Name				County		State/Province		
DELAWARE BASIN EAST		BASIN EAST		JOHNSON RANCH				LEA		NM		
Surface Legal Location		API/UWI		Latitude (°)		Longitude (°)		Orig KB Elevation (ft)		Ground Elev MSL (ft)		KB - GL (ft)
SEC 28-23S-33E		3002541797		32° 16' 56.648" N		103° 34' 19.755" W		3,724.30		3,701.30		23.00
Survey Data												
Date	MD (ftKB)	Incl (°)	Azm (°)	TVD (ftKB)	VS (ft)	N/S (ft)	E/W (ft)	DLS (°/100ft)	Survey Tool	Survey Company		
8/24/2015	9,840.00	1.67	208.82	9,830.40	79.39	66.30	192.68	0.37	MWD	VES		
8/24/2015	10,029.00	1.58	217.96	10,019.32	74.73	61.83	189.75	0.14	MWD	VES		
8/24/2015	10,218.00	1.41	220.07	10,208.26	70.69	58.00	186.65	0.09	MWD	VES		
8/24/2015	10,409.00	1.67	233.61	10,399.19	66.99	54.55	182.90	0.23	MWD	VES		
8/24/2015	10,504.00	1.49	233.43	10,494.15	65.29	52.99	180.79	0.19	MWD	VES		
8/24/2015	10,599.00	1.49	243.63	10,589.12	63.87	51.71	178.69	0.28	MWD	VES		
8/24/2015	10,690.00	4.66	354.02	10,680.02	66.91	54.86	177.25	5.89	MWD	VES		
8/24/2015	10,737.00	10.55	357.18	10,726.59	73.07	61.06	176.83	12.56	MWD	VES		
8/24/2015	10,785.00	14.86	359.12	10,773.40	83.58	71.61	176.52	9.02	MWD	VES		
8/24/2015	10,832.00	21.19	358.06	10,818.07	98.05	86.14	176.14	13.49	MWD	VES		
8/24/2015	10,880.00	25.50	356.30	10,862.13	116.92	105.13	175.18	9.10	MWD	VES		
8/24/2015	10,927.00	30.34	354.90	10,903.65	138.69	127.06	173.47	10.39	MWD	VES		
8/24/2015	10,975.00	35.88	356.30	10,943.84	164.62	153.20	171.49	11.65	MWD	VES		
8/24/2015	11,021.00	41.86	357.89	10,979.64	193.27	182.01	170.05	13.18	MWD	VES		
8/24/2015	11,068.00	48.54	0.52	11,012.74	226.49	215.34	169.63	14.75	MWD	VES		
8/24/2015	11,115.00	54.87	2.63	11,041.86	263.32	252.19	170.67	13.92	MWD	VES		
8/24/2015	11,163.00	59.71	3.51	11,067.79	303.69	292.50	172.85	10.20	MWD	VES		
8/24/2015	11,210.00	65.42	2.63	11,089.43	345.38	334.14	175.07	12.26	MWD	VES		
8/24/2015	11,258.00	70.26	2.10	11,107.53	389.81	378.54	176.90	10.14	MWD	VES		
8/24/2015	11,305.00	74.83	1.75	11,121.63	434.60	423.34	178.40	9.75	MWD	VES		
8/24/2015	11,353.00	78.08	2.10	11,132.87	481.23	469.97	179.97	6.81	MWD	VES		
8/24/2015	11,400.00	80.90	2.81	11,141.44	527.42	516.14	181.95	6.18	MWD	VES		
8/24/2015	11,448.00	84.06	3.16	11,147.72	575.00	563.65	184.43	6.62	MWD	VES		
8/24/2015	11,566.00	88.72	2.81	11,155.15	692.72	681.23	190.56	3.96	MWD	VES		
8/24/2015	11,660.00	90.04	2.46	11,156.17	786.68	775.12	194.88	1.45	MWD	VES		
8/24/2015	11,755.00	90.57	2.46	11,155.66	881.65	870.03	198.96	0.56	MWD	VES		
8/24/2015	11,849.00	91.45	2.46	11,154.00	975.60	963.93	202.99	0.94	MWD	VES		
8/24/2015	11,943.00	92.15	2.63	11,151.05	1,069.53	1,057.79	207.17	0.77	MWD	VES		
8/24/2015	12,038.00	92.86	2.46	11,146.90	1,164.41	1,152.61	211.38	0.77	MWD	VES		
8/24/2015	12,133.00	91.54	2.63	11,143.25	1,259.31	1,247.44	215.60	1.40	MWD	VES		
8/24/2015	12,226.00	91.36	2.10	11,140.90	1,352.24	1,340.33	219.43	0.60	MWD	VES		
8/24/2015	12,321.00	90.75	1.40	11,139.15	1,447.16	1,435.27	222.33	0.98	MWD	VES		
8/24/2015	12,415.00	91.28	0.87	11,137.48	1,541.03	1,529.23	224.19	0.80	MWD	VES		
8/24/2015	12,509.00	90.84	1.05	11,135.75	1,634.88	1,623.21	225.77	0.51	MWD	VES		
8/24/2015	12,604.00	89.78	1.40	11,135.23	1,729.77	1,718.18	227.80	1.18	MWD	VES		
8/24/2015	12,698.00	90.48	1.40	11,135.02	1,823.68	1,812.15	230.10	0.74	MWD	VES		
8/24/2015	12,793.00	90.75	1.93	11,134.00	1,918.60	1,907.11	232.86	0.63	MWD	VES		
8/24/2015	12,887.00	91.54	2.10	11,132.12	2,012.53	2,001.03	236.16	0.86	MWD	VES		
8/24/2015	12,982.00	90.92	2.28	11,130.08	2,107.46	2,095.94	239.79	0.68	MWD	VES		
8/24/2015	13,076.00	89.25	2.28	11,129.94	2,201.42	2,189.86	243.53	1.78	MWD	VES		
8/24/2015	13,171.00	90.40	1.75	11,130.23	2,296.36	2,284.80	246.87	1.33	MWD	VES		
8/24/2015	13,266.00	91.10	1.40	11,128.99	2,391.27	2,379.75	249.48	0.82	MWD	VES		
8/24/2015	13,360.00	90.22	1.58	11,127.91	2,485.18	2,473.71	251.93	0.96	MWD	VES		
8/24/2015	13,455.00	89.69	1.23	11,127.98	2,580.09	2,568.68	254.25	0.67	MWD	VES		
8/24/2015	13,550.00	90.13	1.23	11,128.13	2,674.98	2,663.66	256.29	0.46	MWD	VES		
8/24/2015	13,644.00	90.92	1.93	11,127.27	2,768.89	2,757.62	258.89	1.12	MWD	VES		
8/24/2015	13,739.00	91.63	2.46	11,125.15	2,863.83	2,852.53	262.52	0.93	MWD	VES		
8/24/2015	13,834.00	91.28	2.10	11,122.74	2,958.75	2,947.42	266.30	0.53	MWD	VES		
8/24/2015	13,928.00	91.36	2.46	11,120.58	3,052.69	3,041.32	270.04	0.39	MWD	VES		
8/24/2015	14,022.00	89.87	2.63	11,119.57	3,146.65	3,135.22	274.21	1.60	MWD	VES		
8/24/2015	14,117.00	90.57	3.33	11,119.20	3,241.64	3,230.09	279.15	1.04	MWD	VES		
8/24/2015	14,212.00	91.54	3.51	11,117.45	3,336.62	3,324.90	284.82	1.04	MWD	VES		
8/24/2015	14,307.00	92.33	4.04	11,114.25	3,431.56	3,419.64	291.07	1.00	MWD	VES		
8/24/2015	14,402.00	91.36	3.69	11,111.19	3,526.51	3,514.38	297.47	1.09	MWD	VES		
8/24/2015	14,497.00	90.75	2.81	11,109.44	3,621.49	3,609.21	302.85	1.13	MWD	VES		
8/24/2015	14,591.00	90.40	1.40	11,108.49	3,715.43	3,703.14	306.31	1.55	MWD	VES		
8/24/2015	14,685.00	90.84	1.40	11,107.48	3,809.33	3,797.10	308.60	0.47	MWD	VES		
8/24/2015	14,780.00	91.80	1.75	11,105.29	3,904.23	3,892.04	311.21	1.08	MWD	VES		
8/24/2015	14,875.00	91.01	1.23	11,102.96	3,999.11	3,986.98	313.68	1.00	MWD	VES		
8/24/2015	14,970.00	90.75	0.87	11,101.50	4,093.98	4,081.95	315.42	0.47	MWD	VES		
8/24/2015	15,064.00	90.22	1.93	11,100.70	4,187.88	4,175.92	317.72	1.26	MWD	VES		
8/24/2015	15,158.00	91.10	2.10	11,099.62	4,281.82	4,269.85	321.02	0.95	MWD	VES		
8/24/2015	15,253.00	90.04	1.58	11,098.68	4,376.75	4,364.80	324.07	1.24	MWD	VES		
8/24/2015	15,348.00	89.96	1.23	11,098.68	4,471.66	4,459.77	326.40	0.38	MWD	VES		
8/24/2015	15,443.00	90.40	1.23	11,098.38	4,566.55	4,554.74	328.44	0.46	MWD	VES		
8/24/2015	15,538.00	90.57	1.40	11,097.57	4,661.44	4,649.72	330.62	0.25	MWD	VES		
8/24/2015	15,633.00	91.19	1.93	11,096.12	4,756.36	4,744.66	333.38	0.86	MWD	VES		
8/24/2015	15,729.00	91.71	2.63	11,093.69	4,852.29	4,840.56	337.20	0.91	MWD	VES		
8/24/2015	15,823.00	91.45	3.16	11,091.09	4,946.23	4,934.40	341.95	0.63	MWD	VES		
8/24/2015	15,918.00	92.07	3.51	11,088.18	5,041.18	5,029.19	347.47	0.75	MWD	VES		
8/24/2015	15,993.00	92.51	3.51	11,085.18	5,116.12	5,103.99	352.06	0.59	MWD	VES		
8/24/2015	16,045.00	92.51	3.51	11,082.90	5,168.07	5,155.85	355.24	0.00	BIT	VES		