

# Minimum Radius of Curvature

**API: 34-013-21542**      **Well: Echo S3H**      **Wellhead Location N+/S- : 40.163138**  
**Operator: Ascent Resources**      **Area: DJ**      **E+/W- : -81.021428**  
**Rig: Patterson 581**      **Type: U-Lateral**      **Magnetic Declination: -7.97**  
**TD: 16,441'**      **Plane of Proposal: 330.00**

Measured Depth Ft	Drift Angle Deg	Azimuth Direction Deg	Course Length Ft	TVD Ft	Vertical Section Ft	COORDINATES		CLOSURE		Dog Leg Severity Deg/100'	Build / Drop Deg/100'	Left / Right Deg/100'
						N-S Ft	E-W Ft	Distance FT	Direction Deg			
0.00	0.00	172.72		0.0	0.00	0.00	0.00	0.00	0.00			
25	0.00	172.72	25	25.0	-75.29	0.00	0.00	0.00	#DIV/0!	0.00		
156	0.36	172.72	131	156.0	-75.67	-0.41	0.05	0.41	172.72	0.27	0.27	0.00
250	0.69	173.22	94	250.0	-76.47	-1.26	0.16	1.27	172.94	0.35	0.35	0.53
340	1.22	146.18	90	340.0	-77.92	-2.60	0.75	2.70	163.82	0.76	0.59	-30.04
433	1.00	134.05	93	433.0	-79.69	-3.98	1.89	4.41	154.64	0.34	-0.24	-13.04
527	1.07	82.89	94	527.0	-80.82	-4.45	3.35	5.57	143.01	0.95	0.07	-54.43
621	1.22	1.36	94	620.9	-80.30	-3.34	4.24	5.40	128.18	1.60	0.16	-86.73
715	2.95	324.81	94	714.9	-77.04	-0.36	2.87	2.90	97.13	2.23	1.84	344.10
809	4.74	316.96	94	808.7	-70.85	4.46	-1.17	4.61	345.26	1.98	1.90	-8.35
903	5.16	311.12	94	902.3	-63.06	10.08	-7.01	12.27	325.18	0.70	0.45	-6.21
997	6.56	306.34	94	995.8	-54.15	16.04	-14.52	21.63	317.85	1.58	1.49	-5.09
1091	7.00	293.68	94	1089.2	-44.61	21.52	-24.09	32.30	311.78	1.65	0.47	-13.47
1185	6.57	290.53	94	1182.5	-35.85	25.71	-34.37	42.92	306.79	0.60	-0.46	-3.35
1279	6.40	290.55	94	1275.9	-27.65	29.43	-44.31	53.20	303.59	0.18	-0.18	0.02
1373	6.99	306.20	94	1369.3	-18.37	34.65	-53.83	64.02	302.77	2.03	0.63	16.65
1431	7.01	307.85	58	1426.8	-11.86	38.90	-59.48	71.07	303.19	0.35	0.03	2.84
1480	7.23	308.36	49	1475.5	-6.23	42.65	-64.26	77.12	303.58	0.47	0.45	1.04
1573	8.58	306.07	93	1567.6	5.55	50.37	-74.45	89.89	304.08	1.49	1.45	-2.46
1668	7.52	300.11	95	1661.6	17.42	57.66	-85.56	103.17	303.98	1.42	-1.12	-6.27
1761	7.67	295.78	93	1753.8	27.83	63.41	-96.41	115.40	303.33	0.64	0.16	-4.66
1855	8.66	295.45	94	1846.9	38.85	69.18	-108.45	128.64	302.53	1.05	1.05	-0.35
1948	7.41	291.23	93	1939.0	49.29	74.36	-120.36	141.48	301.71	1.49	-1.34	-4.54
2042	6.86	285.06	94	2032.2	57.99	78.02	-131.43	152.85	300.69	1.00	-0.59	-6.56
2136	6.01	296.08	94	2125.6	66.05	81.64	-141.28	163.17	300.02	1.59	-0.90	11.72
2230	5.65	305.42	94	2219.2	74.34	86.48	-149.47	172.68	300.05	1.08	-0.38	9.94
2324	5.62	309.46	94	2312.7	82.86	92.09	-156.79	181.84	300.43	0.42	-0.03	4.30
2419	6.01	313.01	95	2407.2	91.97	98.44	-164.02	191.29	300.97	0.56	0.41	3.74
2515	6.11	314.46	96	2502.7	101.70	105.45	-171.34	201.19	301.61	0.19	0.10	1.51
2609	6.43	303.48	94	2596.1	111.23	111.85	-179.30	211.33	301.96	1.32	0.34	-11.68
2703	6.79	302.87	94	2689.5	120.88	117.77	-188.36	222.15	302.02	0.39	0.38	-0.65
2798	7.00	303.50	95	2783.8	131.06	124.02	-197.90	233.55	302.07	0.23	0.22	0.66
2892	6.25	296.53	94	2877.2	140.46	129.46	-207.26	244.37	301.99	1.17	-0.80	-7.41
2985	5.36	297.18	93	2969.7	148.33	133.71	-215.65	253.74	301.80	0.96	-0.96	0.70
3079	5.27	298.99	94	3063.3	155.72	137.81	-223.33	262.43	301.68	0.20	-0.10	1.93
3172	5.57	301.06	93	3155.9	163.33	142.21	-230.94	271.21	301.62	0.38	0.32	2.23
3267	5.58	305.06	95	3250.4	171.55	147.24	-238.67	280.43	301.67	0.41	0.01	4.21
3361	5.22	306.57	94	3344.0	179.62	152.41	-245.84	289.25	301.80	0.41	-0.38	1.61
3455	6.20	310.02	94	3437.5	188.31	158.22	-253.16	298.54	302.00	1.10	1.04	3.67
3549	6.66	310.91	94	3531.0	198.23	165.06	-261.17	308.95	302.29	0.50	0.49	0.95
3643	6.79	310.60	94	3624.3	208.63	172.24	-269.51	319.85	302.58	0.14	0.14	-0.33
3782	6.93	304.17	139	3762.3	223.93	182.30	-282.69	336.37	302.82	0.56	0.10	-4.63
3831	6.95	305.02	49	3811.0	229.27	185.66	-287.56	342.29	302.85	0.21	0.04	1.73
3924	6.85	303.49	93	3903.3	239.34	191.95	-296.79	353.46	302.89	0.22	-0.11	-1.65
4018	6.90	301.87	94	3996.6	249.33	198.02	-306.26	364.71	302.89	0.21	0.05	-1.72
4112	6.95	301.20	94	4089.9	259.30	203.95	-315.92	376.04	302.85	0.10	0.05	-0.71
4238	6.87	298.97	126	4215.0	272.43	211.55	-329.04	391.18	302.74	0.22	-0.06	-1.77
4300	6.79	297.71	62	4276.6	278.71	215.05	-335.52	398.53	302.66	0.27	-0.13	-2.03
4395	6.60	296.38	95	4370.9	288.00	220.09	-345.39	409.55	302.51	0.26	-0.20	-1.40
4489	6.25	295.23	94	4464.3	296.71	224.67	-354.86	420.00	302.34	0.40	-0.37	-1.22
4615	5.96	291.42	126	4589.6	307.45	229.98	-367.15	433.23	302.06	0.40	-0.23	-3.02
4674	6.06	292.19	59	4648.3	312.31	232.28	-372.89	439.31	301.92	0.22	0.17	1.31
4768	5.97	301.14	94	4741.8	320.51	236.68	-381.66	449.09	301.80	1.00	-0.10	9.52
4862	6.21	305.46	94	4835.2	329.42	242.16	-389.99	459.05	301.84	0.55	0.26	4.60
4956	6.37	307.10	94	4928.7	338.84	248.25	-398.29	469.32	301.94	0.26	0.17	1.74
5049	6.43	307.53	93	5021.1	348.41	254.54	-406.53	479.64	302.05	0.08	0.06	0.46
5143	6.24	307.46	94	5114.5	357.99	260.85	-414.76	489.97	302.17	0.20	-0.20	-0.07
5237	6.52	305.57	94	5207.9	367.57	267.06	-423.16	500.39	302.26	0.37	0.30	-2.01

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5330	6.27	308.34	93	5300.4	377.10	273.28	-431.44	510.71	302.35	0.43	-0.27	2.98
5424	6.37	312.20	94	5393.8	386.83	279.97	-439.33	520.95	302.51	0.46	0.11	4.11
5517	5.83	316.85	93	5486.3	396.34	286.88	-446.38	530.62	302.73	0.79	-0.58	5.00
5612	5.47	315.67	95	5580.8	405.43	293.64	-452.84	539.71	302.96	0.40	-0.38	-1.24
5705	7.18	305.26	93	5673.2	415.00	300.17	-460.69	549.85	303.09	2.21	1.84	-11.19
5799	7.74	294.34	94	5766.4	425.48	306.17	-471.25	561.98	303.01	1.62	0.60	-11.62
5893	7.03	286.75	94	5859.7	434.81	310.43	-482.53	573.76	302.76	1.28	-0.76	-8.07
5987	6.04	286.45	94	5953.1	442.59	313.49	-492.78	584.04	302.46	1.05	-1.05	-0.32
6081	6.53	292.65	94	6046.5	450.42	316.95	-502.45	594.07	302.24	0.89	0.52	6.60
6174	6.89	298.14	93	6138.9	459.36	321.62	-512.25	604.85	302.12	0.79	0.39	5.90
6269	6.12	294.97	95	6233.2	468.35	326.44	-521.87	615.56	302.03	0.89	-0.81	-3.34
6363	6.26	300.72	94	6326.7	476.92	331.18	-530.82	625.66	301.96	0.68	0.15	6.12
6457	7.35	305.86	94	6420.0	486.88	337.32	-540.10	636.78	301.99	1.33	1.16	5.47
6553	7.22	305.65	96	6515.3	497.98	344.43	-549.98	648.93	302.06	0.14	-0.14	-0.22
6647	7.11	304.37	94	6608.5	508.61	351.16	-559.58	660.63	302.11	0.21	-0.12	-1.36
6741	7.12	305.39	94	6701.8	519.15	357.82	-569.13	672.26	302.16	0.13	0.01	1.09
6835	7.66	306.49	94	6795.0	530.19	364.92	-578.91	684.33	302.23	0.59	0.57	1.17
6929	8.16	306.63	94	6888.1	542.06	372.62	-589.30	697.23	302.31	0.53	0.53	0.15
7023	8.11	304.68	94	6981.2	554.18	380.37	-600.11	710.50	302.37	0.30	-0.05	-2.07
7117	7.69	300.27	94	7074.3	565.63	387.32	-610.99	723.42	302.37	0.78	-0.45	-4.69
7211	7.02	294.36	94	7167.5	575.76	392.86	-621.66	735.39	302.29	1.07	-0.71	-6.29
7305	6.58	294.60	94	7260.9	584.82	397.47	-631.79	746.42	302.17	0.47	-0.47	0.26
7399	6.43	298.17	94	7354.3	593.68	402.20	-641.33	757.01	302.09	0.46	-0.16	3.80
7493	6.53	302.36	94	7447.7	602.89	407.54	-650.48	767.60	302.07	0.51	0.11	4.46
7587	7.30	302.19	94	7541.0	612.91	413.58	-660.05	778.92	302.07	0.82	0.82	-0.18
7681	7.15	296.29	94	7634.2	623.05	419.36	-670.35	790.71	302.03	0.80	-0.16	-6.28
7774	7.73	290.63	93	7726.4	632.70	424.12	-681.39	802.61	301.90	1.00	0.62	-6.09
7868	7.22	289.18	94	7819.6	642.06	428.29	-692.89	814.57	301.72	0.58	-0.54	-1.54
7898	7.43	287.68	30	7849.4	644.92	429.50	-696.52	818.29	301.66	0.95	0.70	-5.00
8052	7.35	286.69	154	8002.1	659.45	435.35	-715.44	837.49	301.32	0.10	-0.05	-0.64
8147	7.48	301.90	95	8096.3	669.33	440.37	-726.51	849.55	301.22	2.06	0.14	16.01
8241	11.07	334.50	94	8189.1	683.74	451.76	-735.60	863.24	301.56	6.62	3.82	34.68
8336	19.83	335.24	95	8280.6	708.93	474.66	-746.29	884.46	302.46	9.22	9.22	0.78
8430	27.36	335.70	94	8366.7	746.35	508.88	-761.88	916.20	303.74	8.01	8.01	0.49
8525	35.05	336.38	95	8447.9	795.26	553.84	-781.83	958.12	305.31	8.10	8.09	0.72
8620	43.40	334.15	95	8521.4	855.03	608.30	-807.03	1010.61	307.01	8.91	8.79	-2.35
8703	48.92	331.61	83	8578.9	914.79	661.53	-834.36	1064.79	308.41	7.01	6.65	-3.06
8797	57.44	329.73	94	8635.2	989.96	727.03	-871.25	1134.74	309.84	9.20	9.06	-2.00
8891	60.85	326.88	94	8683.4	1070.59	795.65	-913.66	1211.54	311.05	4.46	3.63	-3.03
8985	68.86	326.96	94	8723.3	1155.49	866.89	-960.07	1293.53	312.08	8.52	8.52	0.09
9080	75.69	327.72	95	8752.2	1245.83	943.04	-1008.86	1380.98	313.07	7.23	7.19	0.80
9174	82.51	326.51	94	8770.0	1337.96	1020.50	-1058.96	1470.65	313.94	7.36	7.26	-1.29
9269	90.34	330.65	95	8775.9	1432.65	1101.34	-1108.32	1562.47	314.82	9.32	8.24	4.36
9363	89.69	329.95	94	8775.9	1526.65	1182.99	-1154.89	1653.25	315.69	1.02	-0.69	-0.74
9457	89.63	329.91	94	8776.4	1620.65	1264.33	-1201.99	1744.51	316.45	0.08	-0.06	-0.04
9551	90.34	330.01	94	8776.5	1714.65	1345.71	-1249.05	1836.04	317.13	0.76	0.76	0.11
9646	90.34	329.67	95	8775.9	1809.65	1427.84	-1296.78	1928.83	317.75	0.36	0.00	-0.36
9740	90.80	329.82	94	8775.0	1903.64	1509.04	-1344.14	2020.87	318.31	0.51	0.49	0.16
9834	90.09	329.48	94	8774.2	1997.63	1590.15	-1391.63	2113.11	318.81	0.84	-0.76	-0.36
9929	90.25	330.14	95	8774.0	2092.63	1672.27	-1439.40	2206.43	319.28	0.71	0.17	0.69
10023	90.25	329.18	94	8773.5	2186.63	1753.39	-1486.88	2298.96	319.70	1.02	0.00	-1.02
10117	90.18	329.87	94	8773.2	2280.62	1834.40	-1534.56	2391.63	320.09	0.74	-0.07	0.73
10212	90.25	329.68	95	8772.8	2375.62	1916.49	-1582.38	2485.33	320.45	0.21	0.07	-0.20
10306	90.25	330.02	94	8772.4	2469.62	1997.77	-1629.59	2578.11	320.80	0.36	0.00	0.36
10401	90.37	330.61	95	8771.9	2564.62	2080.30	-1676.64	2671.85	321.13	0.63	0.13	0.62
10495	90.12	329.98	94	8771.5	2658.62	2161.95	-1723.22	2764.69	321.44	0.72	-0.27	-0.67
10589	90.06	330.09	94	8771.4	2752.62	2243.38	-1770.17	2857.67	321.72	0.13	-0.06	0.12
10683	90.18	329.87	94	8771.2	2846.62	2324.77	-1817.20	2950.72	321.99	0.27	0.13	-0.23

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10778	89.82	329.93	95	8771.2	2941.62	2406.96	-1864.84	3044.85	322.23	0.38	-0.38	0.06
10872	89.41	330.20	94	8771.8	3035.61	2488.42	-1911.75	3137.99	322.47	0.52	-0.44	0.29
10966	89.63	329.68	94	8772.6	3129.61	2569.77	-1958.83	3231.21	322.68	0.60	0.23	-0.55
11061	90.31	329.73	95	8772.6	3224.61	2651.80	-2006.75	3325.52	322.88	0.72	0.72	0.05
11155	90.46	330.14	94	8772.0	3318.60	2733.15	-2053.84	3418.83	323.08	0.46	0.16	0.44
11250	90.46	330.42	95	8771.2	3413.60	2815.65	-2100.94	3513.09	323.27	0.29	0.00	0.29
11344	89.91	330.26	94	8770.9	3507.60	2897.33	-2147.45	3606.40	323.45	0.61	-0.59	-0.17
11439	89.72	329.76	95	8771.2	3602.60	2979.61	-2194.94	3700.79	323.62	0.56	-0.20	-0.53
11533	89.57	329.78	94	8771.8	3696.59	3060.83	-2242.27	3794.26	323.77	0.16	-0.16	0.02
11628	89.82	330.27	95	8772.3	3791.59	3143.12	-2289.73	3888.71	323.93	0.58	0.26	0.52
11723	89.88	330.60	95	8772.6	3886.59	3225.75	-2336.60	3983.11	324.08	0.35	0.06	0.35
11817	89.78	329.75	94	8772.9	3980.59	3307.30	-2383.35	4076.59	324.22	0.91	-0.11	-0.90
11911	89.97	329.83	94	8773.1	4074.59	3388.53	-2430.65	4170.16	324.35	0.22	0.20	0.09
12006	89.94	330.26	95	8773.1	4169.59	3470.84	-2478.09	4264.70	324.47	0.45	-0.03	0.45
12100	88.86	330.32	94	8774.1	4263.58	3552.48	-2524.67	4358.22	324.60	1.15	-1.15	0.06
12194	89.08	330.80	94	8775.8	4357.56	3634.33	-2570.86	4451.71	324.73	0.56	0.23	0.51
12289	89.23	329.27	95	8777.2	4452.55	3716.62	-2618.31	4546.29	324.84	1.62	0.16	-1.61
12383	89.17	328.96	94	8778.5	4546.53	3797.28	-2666.56	4640.03	324.92	0.34	-0.06	-0.33
12478	89.11	329.37	95	8779.9	4641.50	3878.84	-2715.24	4734.76	325.01	0.44	-0.06	0.43
12573	89.35	329.87	95	8781.2	4736.49	3960.79	-2763.28	4829.45	325.10	0.58	0.25	0.53
12668	88.89	328.87	95	8782.7	4831.47	4042.52	-2811.68	4924.18	325.18	1.16	-0.48	-1.05
12762	89.63	329.89	94	8783.9	4925.46	4123.41	-2859.55	5017.92	325.26	1.34	0.79	1.09
12857	89.20	329.15	95	8784.9	5020.45	4205.28	-2907.74	5112.66	325.34	0.90	-0.45	-0.78
12952	89.11	328.91	95	8786.3	5115.43	4286.72	-2956.62	5207.45	325.41	0.27	-0.09	-0.25
13046	88.80	329.03	94	8788.0	5209.40	4367.26	-3005.06	5301.26	325.47	0.35	-0.33	0.13
13141	87.94	333.30	95	8790.7	5304.31	4450.42	-3050.85	5395.74	325.57	4.58	-0.91	4.49
13235	87.97	342.68	94	8794.0	5397.24	4537.42	-3086.02	5487.41	325.78	9.97	0.03	9.98
13329	88.86	353.18	94	8796.7	5486.51	4629.18	-3105.64	5574.43	326.14	11.21	0.95	11.17
13424	88.92	1.29	95	8798.5	5570.89	4723.97	-3110.22	5655.91	326.64	8.54	0.06	-370.41
13518	89.38	6.33	94	8799.9	5648.96	4817.72	-3103.97	5731.06	327.21	5.38	0.49	5.36
13612	89.42	11.26	94	8800.9	5722.20	4910.58	-3089.61	5801.68	327.82	5.24	0.04	5.24
13707	89.45	20.98	95	8801.8	5787.97	5001.73	-3063.26	5865.23	328.52	10.23	0.03	10.23
13801	89.17	32.02	94	8803.0	5839.76	5085.72	-3021.39	5915.52	329.29	11.75	-0.30	11.74
13895	89.35	41.26	94	8804.2	5876.99	5161.06	-2965.35	5952.30	330.12	9.83	0.19	9.83
13990	89.11	52.39	95	8805.5	5898.61	5225.95	-2896.19	5974.82	331.01	11.72	-0.25	11.72
14084	89.29	62.38	94	8806.8	5902.89	5276.55	-2817.12	5981.48	331.90	10.63	0.19	10.63
14179	89.14	72.59	95	8808.1	5890.54	5312.88	-2729.49	5973.00	332.81	10.75	-0.16	10.75
14273	89.48	81.80	94	8809.2	5862.78	5333.68	-2637.93	5950.37	333.68	9.80	0.36	9.80
14367	89.23	88.86	94	8810.3	5822.59	5341.33	-2544.31	5916.36	334.53	7.51	-0.27	7.51
14461	89.32	96.58	94	8811.5	5771.82	5336.88	-2450.49	5872.58	335.34	8.21	0.10	8.21
14555	89.42	103.84	94	8812.5	5711.18	5320.23	-2358.05	5819.38	336.10	7.72	0.11	7.72
14650	89.38	110.35	95	8813.5	5641.64	5292.32	-2267.30	5757.54	336.81	6.85	-0.04	6.85
14744	89.32	117.35	94	8814.6	5565.79	5254.33	-2181.38	5689.15	337.45	7.45	-0.06	7.45
14838	89.20	124.07	94	8815.8	5483.86	5206.36	-2100.62	5614.16	338.03	7.15	-0.13	7.15
14932	89.32	132.66	94	8817.0	5396.57	5148.08	-2026.99	5532.76	338.51	9.14	0.13	9.14
15027	89.38	141.32	95	8818.1	5304.10	5078.68	-1962.26	5444.58	338.87	9.12	0.06	9.12
15121	89.51	149.82	94	8819.0	5210.47	5001.22	-1909.16	5353.23	339.11	9.04	0.14	9.04
15215	89.72	150.35	94	8819.6	5116.47	4919.75	-1862.28	5260.42	339.27	0.61	0.22	0.56
15310	89.60	149.94	95	8820.2	5021.48	4837.36	-1814.99	5166.65	339.43	0.45	-0.13	-0.43
15404	89.35	150.19	94	8821.0	4927.48	4755.90	-1768.09	5073.93	339.61	0.38	-0.27	0.27
15499	90.31	149.22	95	8821.3	4832.49	4673.88	-1720.16	4980.37	339.79	1.44	1.01	-1.02
15593	89.54	150.72	94	8821.4	4738.49	4592.50	-1673.12	4887.78	339.98	1.79	-0.82	1.60
15688	90.43	150.56	95	8821.5	4643.50	4509.70	-1626.54	4794.06	340.17	0.95	0.94	-0.17
15782	89.48	149.20	94	8821.5	4549.50	4428.40	-1579.38	4701.61	340.37	1.76	-1.01	-1.45
15877	88.52	149.34	95	8823.2	4454.52	4346.75	-1530.84	4608.44	340.60	1.02	-1.01	0.15
15971	90.18	149.36	94	8824.3	4360.54	4265.89	-1482.92	4516.29	340.83	1.77	1.77	0.02
16066	89.69	150.22	95	8824.4	4265.54	4183.79	-1435.12	4423.09	341.07	1.04	-0.52	0.91
16160	90.65	150.15	94	8824.1	4171.54	4102.24	-1388.39	4330.82	341.30	1.02	1.02	-0.07

## Minimum Radius of Curvature

**API: 34-013-21542**      **Well: Echo S3H**      **Wellhead Location N+/S- : 40.163138**  
**Operator: Ascent Resources**      **Area: DJ**      **E+/W- : -81.021428**  
**Rig: Patterson 581**      **Type: U-Lateral**      **Magnetic Declination: -7.97**  
**TD: 16,441'**      **Plane of Proposal: 330.00**

Measured Depth Ft	Drift Angle Deg	Azimuth Direction Deg	Course Length Ft	TVD Ft	Vertical Section Ft	COORDINATES		CLOSURE		Dog Leg Severity Deg/100'	Build / Drop Deg/100'	Left / Right Deg/100'
						N-S Ft	E-W Ft	Distance FT	Direction Deg			
16254	90.59	150.07	94	8823.1	4077.55	4020.74	-1341.55	4238.65	341.55	0.11	-0.06	-0.09
16348	89.57	150.19	94	8822.9	3983.55	3939.23	-1294.73	4146.55	341.81	1.09	-1.09	0.13
16441	89.57	150.19	93	8823.6	3890.55	3858.54	-1248.50	4055.50	342.07	0.00	0.00	0.00