



Precision Drilling Corporation

Survey Report

Company:	US ROCKIES WATTENBERG PLANNING	Local Co-ordinate Reference:	Well Babcock 13E-33HZ
Project:	WELD-NAD83-UTMFT13N	TVD Reference:	4886'GL + 21'KB @ 4907.00usft (PD464)
Site:	3N-67W-33 Babcock 6-4HZ Pad	MD Reference:	4886'GL + 21'KB @ 4907.00usft (PD464)
Well:	Babcock 13E-33HZ	North Reference:	True
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Original Hole	Database:	LocalDatabase

Project	WELD-NAD83-UTMFT13N		
Map System:	Universal Transverse Mercator (US Survey Feet)	System Datum:	Mean Sea Level
Geo Datum:	North American Datum 1983		
Map Zone:	Zone 13N (108 W to 102 W)		

Site	3N-67W-33 Babcock 6-4HZ Pad				
Site Position:		Northing:	14,588,357.65 usft	Latitude:	40.169184°N
From:	Lat/Long	Easting:	1,669,071.31 usft	Longitude:	104.897427°W
Position Uncertainty:	0.00 usft	Slot Radius:	13.20 in	Grid Convergence:	0.07 °

Well		Babcock 13E-33HZ				
Well Position	+N-S	0.00 usft	Northing:	14,588,357.35 usft	Latitude:	40.169183°N
	+E-W	0.00 usft	Easting:	1,669,131.10 usft	Longitude:	104.897213°W
Position Uncertainty		3.28 usft	Wellhead Elevation:	0.00 usft	Ground Level:	4,886.00 usft

Wellbore	Original Hole				
Magnetics	Model Name	Sample Date	Declination (°)	Dip Angle (°)	Field Strength (nT)
	IGRF2010	03/31/16	8.27	66.68	52,491.30606166

Design	Original Hole				
Audit Notes:					
Version:	1.0	Phase:	ACTUAL	Tie On Depth:	0.00
Vertical Section:	Depth From (TVD) (usft)	+N/-S (usft)	+E/-W (usft)	Direction (°)	
	0.00	0.00	0.00	0.34	

Survey Program	Date	06/19/17			
From (usft)	To (usft)	Survey (Wellbore)	Tool Name	Description	
9.00	1,774.00	Survey #1 (Original Hole)	APC_ISCWSA REV 2 MV Fixed:v2:crustal field declination		
1,836.00	12,223.00	Survey #2 (Original Hole)	APC_ISCWSA REV 2 MV Fixed:v2:crustal field declination		
12,279.00	12,279.00	Survey #3 (Original Hole)	APC_BLIND	OWSG BLIND	

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)	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
9.00	0.00	0.00	9.00	0.00	0.00	0.00	0.00	0.00	0.00	
247.00	0.48	232.38	247.00	-0.61	-0.79	-0.61	0.20	0.20	0.00	
336.00	0.68	299.50	335.99	-0.58	-1.54	-0.59	0.74	0.22	75.42	
469.00	1.12	324.92	468.98	0.88	-2.98	0.86	0.44	0.33	19.11	
554.00	1.04	349.54	553.96	2.31	-3.60	2.29	0.55	-0.09	28.96	
640.00	1.01	353.98	639.95	3.84	-3.82	3.81	0.10	-0.03	5.16	
729.00	0.17	270.62	728.94	4.62	-4.03	4.59	1.13	-0.94	-93.66	
816.00	0.56	230.72	815.94	4.35	-4.49	4.32	0.51	0.45	-45.86	

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Well:	Babcock 13E-33HZ	North Reference:	True
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Original Hole	Database:	LocalDatabase

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)
904.00	0.58	204.73	903.94	3.67	-5.01	3.64	0.29	0.02	-29.53
947.00	0.62	231.15	946.94	3.33	-5.28	3.30	0.64	0.09	61.44
1,033.00	0.94	218.23	1,032.93	2.48	-6.08	2.45	0.42	0.37	-15.02
1,122.00	2.28	217.38	1,121.89	0.50	-7.61	0.46	1.51	1.51	-0.96
1,211.00	3.29	222.72	1,210.78	-2.78	-10.41	-2.84	1.17	1.13	6.00
1,299.00	4.82	227.48	1,298.56	-7.13	-14.85	-7.22	1.78	1.74	5.41
1,386.00	6.45	227.26	1,385.14	-12.92	-21.14	-13.05	1.87	1.87	-0.25
1,475.00	7.95	230.21	1,473.43	-20.25	-29.54	-20.43	1.74	1.69	3.31
1,561.00	9.49	232.86	1,558.44	-28.34	-39.76	-28.58	1.85	1.79	3.08
1,648.00	10.22	233.28	1,644.15	-37.29	-51.66	-37.59	0.84	0.84	0.48
1,737.00	11.60	231.92	1,731.54	-47.53	-65.04	-47.91	1.58	1.55	-1.53
1,774.00	11.75	233.11	1,767.78	-52.08	-70.98	-52.50	0.77	0.41	3.22
1,836.00	12.15	232.41	1,828.43	-59.85	-81.20	-60.33	0.69	0.65	-1.13
1,925.00	12.00	230.65	1,915.47	-71.43	-95.77	-72.00	0.45	-0.17	-1.98
2,015.00	13.01	233.20	2,003.33	-83.43	-111.12	-84.09	1.28	1.12	2.83
2,105.00	14.70	236.10	2,090.71	-95.87	-128.71	-96.63	2.03	1.88	3.22
2,194.00	15.10	235.49	2,176.72	-108.74	-147.64	-109.61	0.48	0.45	-0.69
2,284.00	15.71	234.17	2,263.48	-122.51	-167.18	-123.50	0.78	0.68	-1.47
2,374.00	16.77	230.83	2,349.89	-137.84	-187.12	-138.95	1.57	1.18	-3.71
2,463.00	19.14	227.58	2,434.55	-155.80	-207.85	-157.03	2.89	2.66	-3.65
2,553.00	20.35	230.65	2,519.26	-175.68	-230.84	-177.04	1.77	1.34	3.41
2,642.00	21.65	232.06	2,602.35	-195.58	-255.76	-197.10	1.57	1.46	1.58
2,732.00	21.03	231.36	2,686.18	-215.87	-281.47	-217.54	0.74	-0.69	-0.78
2,822.00	19.98	230.39	2,770.48	-235.76	-305.93	-237.57	1.23	-1.17	-1.08
2,911.00	20.24	230.30	2,854.05	-255.29	-329.49	-257.24	0.29	0.29	-0.10
3,001.00	21.14	230.39	2,938.25	-275.58	-353.97	-277.68	1.00	1.00	0.10
3,091.00	19.93	229.16	3,022.53	-295.96	-378.08	-298.20	1.43	-1.34	-1.37
3,180.00	20.96	232.50	3,105.92	-315.57	-402.18	-317.95	1.75	1.16	3.75
3,270.00	21.54	234.87	3,189.80	-334.88	-428.47	-337.42	1.15	0.64	2.63
3,360.00	19.23	233.73	3,274.16	-353.16	-453.93	-355.84	2.60	-2.57	-1.27
3,449.00	19.98	234.79	3,358.00	-370.60	-478.17	-373.43	0.93	0.84	1.19
3,539.00	20.81	235.40	3,442.36	-388.54	-503.90	-391.52	0.95	0.92	0.68
3,628.00	19.71	232.76	3,525.85	-406.60	-528.86	-409.73	1.61	-1.24	-2.97
3,718.00	19.65	231.97	3,610.60	-425.11	-552.86	-428.38	0.30	-0.07	-0.88
3,807.00	22.09	233.64	3,693.75	-444.25	-578.13	-447.67	2.82	2.74	1.88
3,897.00	20.06	233.12	3,777.73	-463.55	-604.10	-467.12	2.27	-2.26	-0.58
3,987.00	20.99	233.29	3,862.01	-482.45	-629.37	-486.17	1.04	1.03	0.19
4,076.00	21.56	233.64	3,944.95	-501.67	-655.32	-505.55	0.66	0.64	0.39
4,166.00	21.84	232.41	4,028.57	-521.69	-681.90	-525.72	0.59	0.31	-1.37
4,256.00	22.00	230.30	4,112.06	-542.67	-708.14	-546.86	0.89	0.18	-2.34
4,345.00	20.77	231.01	4,194.93	-563.24	-733.23	-567.59	1.41	-1.38	0.80
4,435.00	19.98	230.65	4,279.30	-583.03	-757.53	-587.52	0.89	-0.88	-0.40
4,551.00	20.50	232.41	4,388.14	-607.99	-788.95	-612.66	0.69	0.45	1.52

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Survey									
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4,640.00	21.38	234.26	4,471.26	-626.97	-814.46	-631.80	1.24	0.99	2.08
4,730.00	22.44	234.43	4,554.76	-646.55	-841.75	-651.53	1.18	1.18	0.19
4,820.00	20.77	233.73	4,638.44	-665.98	-868.59	-671.13	1.88	-1.86	-0.78
4,909.00	19.21	233.38	4,722.07	-684.05	-893.07	-689.34	1.76	-1.75	-0.39
4,999.00	17.38	231.62	4,807.52	-701.23	-915.49	-706.65	2.12	-2.03	-1.96
5,089.00	15.93	231.53	4,893.74	-717.26	-935.70	-722.80	1.61	-1.61	-0.10
5,178.00	14.48	230.13	4,979.62	-731.99	-953.80	-737.64	1.68	-1.63	-1.57
5,268.00	12.75	228.46	5,067.09	-745.79	-969.87	-751.54	1.97	-1.92	-1.86
5,358.00	11.03	228.81	5,155.16	-758.05	-983.79	-763.88	1.91	-1.91	0.39
5,447.00	9.76	227.75	5,242.69	-768.73	-995.78	-774.63	1.44	-1.43	-1.19
5,537.00	8.99	227.40	5,331.49	-778.62	-1,006.60	-784.58	0.86	-0.86	-0.39
5,626.00	7.45	226.35	5,419.57	-787.31	-1,015.90	-793.32	1.74	-1.73	-1.18
5,716.00	6.55	226.88	5,508.90	-794.85	-1,023.86	-800.91	1.00	-1.00	0.59
5,805.00	5.21	225.47	5,597.43	-801.15	-1,030.45	-807.25	1.51	-1.51	-1.58
5,895.00	4.37	228.72	5,687.12	-806.28	-1,035.94	-812.41	0.98	-0.93	3.61
5,985.00	3.67	229.69	5,776.90	-810.40	-1,040.71	-816.56	0.78	-0.78	1.08
6,074.00	2.94	237.25	5,865.75	-813.48	-1,044.81	-819.67	0.95	-0.82	8.49
6,164.00	1.87	227.05	5,955.67	-815.73	-1,047.82	-821.93	1.28	-1.19	-11.33
6,254.00	1.01	176.60	6,045.64	-817.52	-1,048.85	-823.73	1.61	-0.96	-56.06
6,343.00	1.03	190.66	6,134.63	-819.09	-1,048.95	-825.30	0.28	0.02	15.80
6,433.00	0.90	200.16	6,224.61	-820.55	-1,049.34	-826.76	0.23	-0.14	10.56
6,522.00	0.51	196.99	6,313.61	-821.59	-1,049.70	-827.80	0.44	-0.44	-3.56
6,612.00	0.40	219.67	6,403.61	-822.21	-1,050.02	-828.43	0.23	-0.12	25.20
6,702.00	0.37	237.07	6,493.60	-822.61	-1,050.46	-828.83	0.13	-0.03	19.33
6,791.00	0.31	279.43	6,582.60	-822.73	-1,050.94	-828.95	0.28	-0.07	47.60
KOP									
6,881.00	11.12	356.69	6,672.03	-814.00	-1,051.69	-820.22	12.28	12.01	85.84
6,971.00	18.59	355.20	6,758.96	-791.00	-1,053.39	-797.24	8.31	8.30	-1.66
7,061.00	23.84	357.92	6,842.84	-758.51	-1,055.25	-764.76	5.93	5.83	3.02
7,150.00	28.68	2.05	6,922.64	-719.16	-1,055.14	-725.41	5.81	5.44	4.64
7,240.00	36.50	3.63	6,998.41	-670.79	-1,052.67	-677.03	8.74	8.69	1.76
7,330.00	44.35	4.16	7,066.87	-612.61	-1,048.69	-618.83	8.73	8.72	0.59
7,420.00	51.14	1.61	7,127.36	-546.13	-1,045.42	-552.32	7.83	7.54	-2.83
7,509.00	57.27	357.31	7,179.40	-474.01	-1,046.20	-480.21	7.92	6.89	-4.83
7,599.00	63.49	359.42	7,223.87	-395.84	-1,048.39	-402.06	7.20	6.91	2.34
7,689.00	74.69	1.61	7,255.94	-311.91	-1,047.57	-318.13	12.65	12.44	2.43
7,778.00	82.54	3.98	7,273.50	-224.85	-1,043.30	-231.03	9.20	8.82	2.66
7,804.00	85.01	4.01	7,276.32	-199.06	-1,041.50	-205.24	9.50	9.50	0.10
Land Box Entry									
7,868.00	91.09	4.07	7,278.49	-135.29	-1,036.99	-141.44	9.50	9.50	0.10
Landing Point									
7,957.00	90.49	2.14	7,277.27	-46.43	-1,032.17	-52.56	2.27	-0.67	-2.17
8,047.00	90.41	0.82	7,276.56	43.53	-1,029.85	37.42	1.47	-0.09	-1.47
8,137.00	90.89	1.52	7,275.54	133.51	-1,028.01	127.40	0.94	0.53	0.78

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Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Original Hole	Database:	LocalDatabase

Survey										
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8,226.00	91.88	1.09	7,273.39	222.46	-1,025.99	216.36	1.21	1.11	-0.48	
8,316.00	91.18	359.33	7,270.98	312.42	-1,025.66	306.33	2.10	-0.78	-1.96	
8,406.00	91.18	358.36	7,269.13	402.38	-1,027.47	396.28	1.08	0.00	-1.08	
8,495.00	90.60	358.45	7,267.75	491.34	-1,029.95	485.21	0.66	-0.65	0.10	
8,585.00	90.32	357.92	7,267.02	581.29	-1,032.80	575.15	0.67	-0.31	-0.59	
8,674.00	89.48	359.59	7,267.18	670.26	-1,034.73	664.11	2.10	-0.94	1.88	
8,764.00	89.15	358.98	7,268.26	760.25	-1,035.85	754.09	0.77	-0.37	-0.68	
8,854.00	89.22	0.29	7,269.54	850.23	-1,036.43	844.07	1.46	0.08	1.46	
8,943.00	90.76	0.29	7,269.55	939.23	-1,035.98	933.07	1.73	1.73	0.00	
9,033.00	89.70	359.42	7,269.19	1,029.23	-1,036.20	1,023.06	1.52	-1.18	-0.97	
9,058.00	89.90	359.74	7,269.28	1,054.23	-1,036.39	1,048.06	1.49	0.79	1.27	
460' Heel Exit										
9,123.00	90.41	0.56	7,269.10	1,119.23	-1,036.22	1,113.06	1.49	0.79	1.27	
9,213.00	89.07	359.68	7,269.51	1,209.22	-1,036.03	1,203.05	1.78	-1.49	-0.98	
9,302.00	89.57	359.94	7,270.57	1,298.21	-1,036.33	1,292.04	0.63	0.56	0.29	
9,392.00	91.51	0.21	7,269.72	1,388.21	-1,036.21	1,382.03	2.18	2.16	0.30	
9,482.00	90.91	359.68	7,267.82	1,478.19	-1,036.30	1,472.01	0.89	-0.67	-0.59	
9,571.00	90.67	359.15	7,266.59	1,567.17	-1,037.20	1,560.99	0.65	-0.27	-0.60	
9,661.00	89.88	358.80	7,266.16	1,657.16	-1,038.81	1,650.96	0.96	-0.88	-0.39	
9,750.00	88.78	359.06	7,267.20	1,746.13	-1,040.48	1,739.93	1.27	-1.24	0.29	
9,840.00	90.36	0.29	7,267.88	1,836.12	-1,040.99	1,829.91	2.22	1.76	1.37	
9,930.00	91.09	1.70	7,266.74	1,926.10	-1,039.42	1,919.90	1.76	0.81	1.57	
10,019.00	90.78	1.00	7,265.29	2,015.06	-1,037.33	2,008.87	0.86	-0.35	-0.79	
10,109.00	90.36	0.38	7,264.39	2,105.05	-1,036.24	2,098.87	0.83	-0.47	-0.69	
10,199.00	91.07	2.32	7,263.27	2,195.01	-1,034.12	2,188.84	2.30	0.79	2.16	
10,288.00	91.00	1.96	7,261.66	2,283.94	-1,030.80	2,277.78	0.41	-0.08	-0.40	
10,378.00	90.87	1.52	7,260.19	2,373.88	-1,028.07	2,367.74	0.51	-0.14	-0.49	
10,468.00	90.69	1.79	7,258.97	2,463.84	-1,025.47	2,457.71	0.36	-0.20	0.30	
10,557.00	90.32	0.82	7,258.18	2,552.81	-1,023.44	2,546.69	1.17	-0.42	-1.09	
10,647.00	90.82	0.82	7,257.29	2,642.80	-1,022.15	2,636.68	0.56	0.56	0.00	
10,737.00	90.65	1.44	7,256.13	2,732.77	-1,020.38	2,726.67	0.71	-0.19	0.69	
10,826.00	89.73	1.09	7,255.84	2,821.75	-1,018.41	2,815.65	1.11	-1.03	-0.39	
10,916.00	92.08	1.96	7,254.42	2,911.70	-1,016.02	2,905.62	2.78	2.61	0.97	
11,005.00	91.70	1.44	7,251.48	3,000.61	-1,013.38	2,994.54	0.72	-0.43	-0.58	
11,095.00	91.29	1.35	7,249.13	3,090.55	-1,011.19	3,084.50	0.47	-0.46	-0.10	
11,136.00	91.30	1.31	7,248.21	3,131.53	-1,010.24	3,125.48	0.10	0.02	-0.10	
460' Toe Entry										
11,185.00	91.31	1.26	7,247.09	3,180.51	-1,009.14	3,174.46	0.10	0.02	-0.10	
11,275.00	90.85	0.91	7,245.39	3,270.47	-1,007.44	3,264.44	0.64	-0.51	-0.39	
11,364.00	90.12	0.56	7,244.64	3,359.46	-1,006.30	3,353.43	0.91	-0.82	-0.39	
11,454.00	90.21	1.88	7,244.38	3,449.44	-1,004.38	3,443.42	1.47	0.10	1.47	
11,544.00	92.49	1.17	7,242.26	3,539.38	-1,001.99	3,533.37	2.65	2.53	-0.79	
11,633.00	92.12	1.00	7,238.68	3,628.29	-1,000.30	3,622.29	0.46	-0.42	-0.19	
11,723.00	91.62	0.29	7,235.74	3,718.23	-999.29	3,712.24	0.96	-0.56	-0.79	

Precision Drilling Corporation

Survey Report

Company:	US ROCKIES WATTENBERG PLANNING	Local Co-ordinate Reference:	Well Babcock 13E-33HZ
Project:	WELD-NAD83-UTMFT13N	TVD Reference:	4886'GL + 21'KB @ 4907.00usft (PD464)
Site:	3N-67W-33 Babcock 6-4HZ Pad	MD Reference:	4886'GL + 21'KB @ 4907.00usft (PD464)
Well:	Babcock 13E-33HZ	North Reference:	True
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Original Hole	Database:	LocalDatabase

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)
11,813.00	91.33	359.42	7,233.43	3,808.20	-999.52	3,802.20	1.02	-0.32	-0.97
11,902.00	91.26	358.36	7,231.42	3,897.16	-1,001.24	3,891.15	1.19	-0.08	-1.19
11,992.00	91.59	358.54	7,229.18	3,987.10	-1,003.67	3,981.07	0.42	0.37	0.20
12,081.00	91.20	358.27	7,227.01	4,076.04	-1,006.15	4,070.00	0.53	-0.44	-0.30
12,171.00	91.18	357.48	7,225.14	4,165.96	-1,009.49	4,159.89	0.88	-0.02	-0.88
12,223.00	91.22	357.39	7,224.05	4,217.89	-1,011.81	4,211.82	0.19	0.08	-0.17
12,279.00	91.22	357.39	7,222.86	4,273.82	-1,014.36	4,267.73	0.00	0.00	0.00

Design Targets

Target Name - hit/miss target - Shape	Dip Angle (°)	Dip Dir. (°)	TVD (usft)	+N/-S (usft)	+E/-W (usft)	Northing (usft)	Easting (usft)	Latitude	Longitude
Surface 13E-33HZ - actual wellpath hits target center - Point	0.00	0.00	0.00	0.00	0.00	14,588,357.35	1,669,131.10	40.169183°N	104.897213°W
KOP 13E-33HZ - actual wellpath hits target center - Point	0.00	0.00	6,582.60	-822.73	-1,050.94	14,587,533.41	1,668,081.11	40.166924°N	104.900975°W
BHL 13E-33HZ - actual wellpath hits target center - Point	0.00	0.00	7,222.86	4,273.82	-1,014.36	14,592,630.00	1,668,111.79	40.180919°N	104.900845°W
PBHL 13E-33HZ - actual wellpath misses target center by 39.38usft at 12279.00usft MD (7222.86 TVD, 4273.82 N, -1014.36 E) - Point	0.00	0.00	7,235.00	4,311.20	-1,016.85	14,592,667.37	1,668,109.26	40.181022°N	104.900854°W
460' Toe Entry 13E-33 - actual wellpath hits target center - Point	0.00	0.00	7,248.21	3,131.53	-1,010.24	14,591,487.71	1,668,117.23	40.177783°N	104.900830°W
460' Heel Exit 13E-33 - actual wellpath hits target center - Point	0.00	0.00	7,269.28	1,054.23	-1,036.39	14,589,410.38	1,668,093.49	40.172078°N	104.900923°W
Land Box Entry 13E-33 - actual wellpath hits target center - Point	0.00	0.00	7,276.32	-199.06	-1,041.50	14,588,157.09	1,668,089.83	40.168636°N	104.900941°W
Landing Point 13E-33 - actual wellpath hits target center - Point	0.00	0.00	7,278.49	-135.29	-1,036.99	14,588,220.86	1,668,094.26	40.168812°N	104.900925°W

Precision Drilling Corporation

Survey Report

Company:	US ROCKIES WATTENBERG PLANNING	Local Co-ordinate Reference:	Well Babcock 13E-33HZ
Project:	WELD-NAD83-UTMFT13N	TVD Reference:	4886'GL + 21'KB @ 4907.00usft (PD464)
Site:	3N-67W-33 Babcock 6-4HZ Pad	MD Reference:	4886'GL + 21'KB @ 4907.00usft (PD464)
Well:	Babcock 13E-33HZ	North Reference:	True
Wellbore:	Original Hole	Survey Calculation Method:	Minimum Curvature
Design:	Original Hole	Database:	LocalDatabase

Design Annotations

Measured Depth (usft)	Vertical Depth (usft)	Local Coordinates		Comment
		+N/-S (usft)	+E/-W (usft)	
6,791.00	6,582.60	-822.73	-1,050.94	KOP
7,804.00	7,276.32	-199.06	-1,041.50	Land Box Entry
7,868.00	7,278.49	-135.29	-1,036.99	Landing Point
9,058.00	7,269.28	1,054.23	-1,036.39	460' Heel Exit
11,136.00	7,248.21	3,131.53	-1,010.24	460' Toe Entry