

Anadarko Petroleum Corp.

Weld County, CO (NAD 83)

Sec. 15-T3N-R66W

Morning Fresh 15N-15HZ

Plan A Rev 0

Plan: Plan A Rev 0 Permit

Sperry Drilling Services

Proposal Report

12 September, 2012

Well Coordinates: 1,328,047.81 N, 3,206,469.23 E (40° 13' 53.49" N, 104° 45' 37.78" W)

Ground Level: 4,884.00 ft

Local Coordinate Origin: Centered on Well Morning Fresh 15N-15HZ

Viewing Datum: RKB=17 @ 4901.00ft (Drilling Rig)

TVDs to System: N

North Reference: True

Unit System: API - US Survey Feet - Custom

Geodetic Scale Factor Applied

Version: 2003.16 Build: 43I

HALLIBURTON

Project: Weld County, CO (NAD 83)
Site: Sec. 15-T3N-R66W
Well: Morning Fresh 15N-15HZ
Wellbore: Plan A Rev 0
Design: Plan A Rev 0 Permit

Anadarko Petroleum Corp.

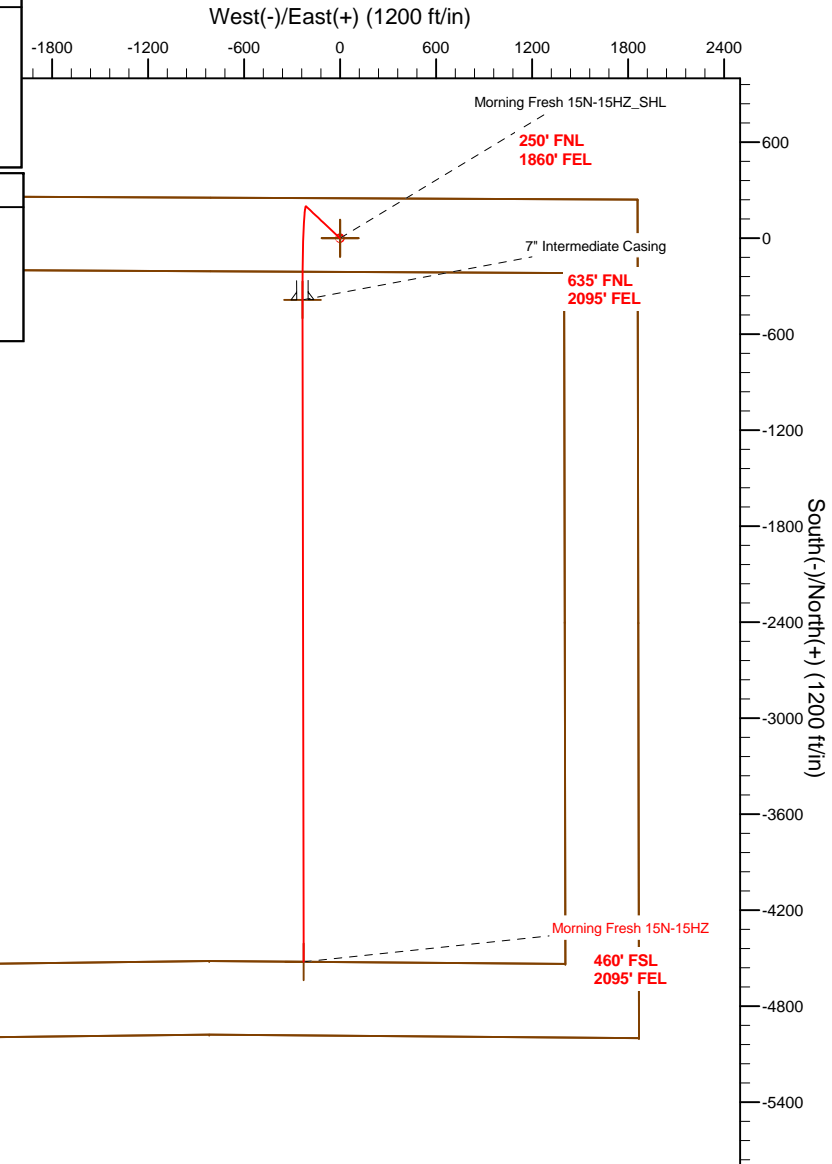
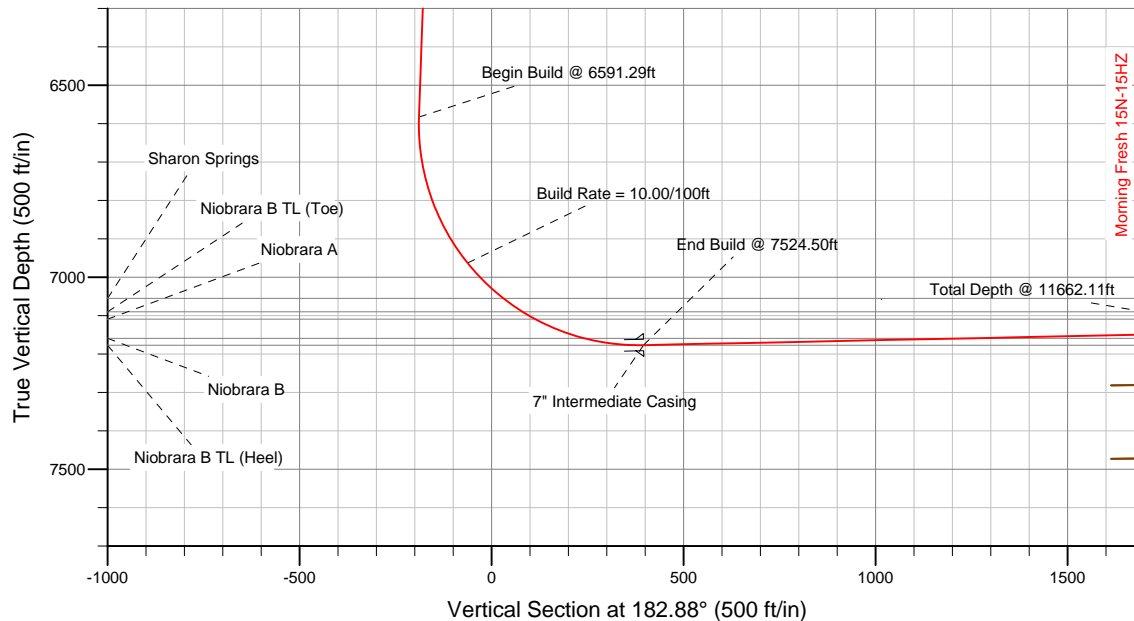


SECTION DETAILS

Sec	MD	Inc	Azi	TVD	+N/-S	+E/-W	DLeg	TFace	VSec	Target
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
2	1100.00	0.00	0.00	1100.00	0.00	0.00	0.00	0.00	0.00	
3	1254.27	3.09	313.24	1254.19	2.85	-3.03	2.00	313.24	-2.69	
4	6591.29	3.09	313.24	6583.48	199.65	-212.28	0.00	0.00	-188.72	
5	7524.50	91.20	179.90	7177.00	-385.00	-235.00	10.00	-133.26	396.33	Morning Fresh 15N-15HZ_Casing Point
6	11662.11	91.20	179.90	7090.00	-4521.69	-227.60	0.00	0.00	4527.42	Morning Fresh 15N-15HZ_BHL

WELLBORE TARGET DETAILS (LAT/LONG)

Name	TVD	+N/-S	+E/-W	Latitude	Longitude	Shape
Morning Fresh 15N-15HZ_Section Line	0.00	0.00	0.00	40.231526	-104.760495	Polygon
Morning Fresh 15N-15HZ_Setback Line	0.00	0.00	0.00	40.231526	-104.760495	Polygon
Morning Fresh 15N-15HZ_SHL	0.00	0.00	0.00	40.231526	-104.760495	Point
Morning Fresh 15N-15HZ_BHL	7090.00	-4521.69	-227.60	40.219114	-104.761310	Point
Morning Fresh 15N-15HZ_Casing Point	7177.00	-385.00	-235.00	40.230469	-104.761337	Point



WELL DETAILS: Morning Fresh 15N-15HZ

Ground Level: 4884.00
RKB=17 @ 4901.00ft (Drilling Rig)

Plan: Plan A Rev 0 Permit (Morning Fresh 15N-15HZ/Plan A Rev 0)

Created By: Fred Hartmann Date: 02/07/2013
Reviewed: Date:

Plan Report for Morning Fresh 15N-15HZ - Plan A Rev 0 Permit

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	Toolface Azimuth (°)
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Morning Fresh 15N-15HZ_SHL - Morning Fresh 15N-15HZ_Section Line - Morning Fresh 15N-15HZ_Setback Line										
100.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
200.00	0.00	0.00	200.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
300.00	0.00	0.00	300.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
400.00	0.00	0.00	400.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
500.00	0.00	0.00	500.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
600.00	0.00	0.00	600.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hold Angle @ 0.00										
651.00	0.00	0.00	651.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fox Hills										
700.00	0.00	0.00	700.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
800.00	0.00	0.00	800.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
900.00	0.00	0.00	900.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,000.00	0.00	0.00	1,000.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1,100.00	0.00	0.00	1,100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Begin Nudge @ 1100.00ft										
1,200.00	2.00	313.24	1,199.98	1.20	-1.27	-1.13	2.00	2.00	0.00	313.24
1,254.27	3.09	313.24	1,254.20	2.85	-3.03	-2.69	2.00	2.00	0.00	0.00
End Nudge @ 1254.27ft										
1,300.00	3.09	313.24	1,299.86	4.53	-4.82	-4.28	0.00	0.00	0.00	0.00
1,400.00	3.09	313.24	1,399.71	8.22	-8.74	-7.77	0.00	0.00	0.00	0.00
1,500.00	3.09	313.24	1,499.57	11.91	-12.66	-11.25	0.00	0.00	0.00	0.00
1,600.00	3.09	313.24	1,599.42	15.59	-16.58	-14.74	0.00	0.00	0.00	0.00
1,700.00	3.09	313.24	1,699.28	19.28	-20.50	-18.23	0.00	0.00	0.00	0.00
1,800.00	3.09	313.24	1,799.13	22.97	-24.42	-21.71	0.00	0.00	0.00	0.00
1,900.00	3.09	313.24	1,898.99	26.66	-28.34	-25.20	0.00	0.00	0.00	0.00
2,000.00	3.09	313.24	1,998.84	30.34	-32.26	-28.68	0.00	0.00	0.00	0.00
2,100.00	3.09	313.24	2,098.70	34.03	-36.18	-32.17	0.00	0.00	0.00	0.00
2,200.00	3.09	313.24	2,198.55	37.72	-40.11	-35.65	0.00	0.00	0.00	0.00
2,300.00	3.09	313.24	2,298.41	41.41	-44.03	-39.14	0.00	0.00	0.00	0.00
2,400.00	3.09	313.24	2,398.26	45.09	-47.95	-42.63	0.00	0.00	0.00	0.00
2,500.00	3.09	313.24	2,498.12	48.78	-51.87	-46.11	0.00	0.00	0.00	0.00
2,600.00	3.09	313.24	2,597.97	52.47	-55.79	-49.60	0.00	0.00	0.00	0.00
2,700.00	3.09	313.24	2,697.83	56.16	-59.71	-53.08	0.00	0.00	0.00	0.00
2,800.00	3.09	313.24	2,797.68	59.84	-63.63	-56.57	0.00	0.00	0.00	0.00
2,900.00	3.09	313.24	2,897.54	63.53	-67.55	-60.05	0.00	0.00	0.00	0.00
3,000.00	3.09	313.24	2,997.39	67.22	-71.47	-63.54	0.00	0.00	0.00	0.00
3,100.00	3.09	313.24	3,097.25	70.91	-75.39	-67.03	0.00	0.00	0.00	0.00
3,200.00	3.09	313.24	3,197.10	74.59	-79.31	-70.51	0.00	0.00	0.00	0.00
3,300.00	3.09	313.24	3,296.96	78.28	-83.23	-74.00	0.00	0.00	0.00	0.00
3,400.00	3.09	313.24	3,396.82	81.97	-87.16	-77.48	0.00	0.00	0.00	0.00
3,500.00	3.09	313.24	3,496.67	85.66	-91.08	-80.97	0.00	0.00	0.00	0.00
3,600.00	3.09	313.24	3,596.53	89.34	-95.00	-84.45	0.00	0.00	0.00	0.00
3,700.00	3.09	313.24	3,696.38	93.03	-98.92	-87.94	0.00	0.00	0.00	0.00
3,800.00	3.09	313.24	3,796.24	96.72	-102.84	-91.43	0.00	0.00	0.00	0.00
3,900.00	3.09	313.24	3,896.09	100.41	-106.76	-94.91	0.00	0.00	0.00	0.00
4,000.00	3.09	313.24	3,995.95	104.09	-110.68	-98.40	0.00	0.00	0.00	0.00
Hold Angle @ 3.09										
4,000.05	3.09	313.24	3,996.00	104.10	-110.68	-98.40	0.00	0.00	0.00	0.00
Parkman										
4,100.00	3.09	313.24	4,095.80	107.78	-114.60	-101.88	0.00	0.00	0.00	0.00
4,200.00	3.09	313.24	4,195.66	111.47	-118.52	-105.37	0.00	0.00	0.00	0.00
4,300.00	3.09	313.24	4,295.51	115.16	-122.44	-108.85	0.00	0.00	0.00	0.00
4,400.00	3.09	313.24	4,395.37	118.84	-126.36	-112.34	0.00	0.00	0.00	0.00
4,500.00	3.09	313.24	4,495.22	122.53	-130.28	-115.83	0.00	0.00	0.00	0.00
4,510.80	3.09	313.24	4,506.00	122.93	-130.71	-116.20	0.00	0.00	0.00	0.00
Sussex										

Plan Report for Morning Fresh 15N-15HZ - Plan A Rev 0 Permit

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N-S (ft)	+E-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	Toolface Azimuth (°)
4,600.00	3.09	313.24	4,595.08	126.22	-134.20	-119.31	0.00	0.00	0.00	0.00
4,700.00	3.09	313.24	4,694.93	129.91	-138.13	-122.80	0.00	0.00	0.00	0.00
4,800.00	3.09	313.24	4,794.79	133.59	-142.05	-126.28	0.00	0.00	0.00	0.00
4,900.00	3.09	313.24	4,894.64	137.28	-145.97	-129.77	0.00	0.00	0.00	0.00
5,000.00	3.09	313.24	4,994.50	140.97	-149.89	-133.25	0.00	0.00	0.00	0.00
5,100.00	3.09	313.24	5,094.35	144.66	-153.81	-136.74	0.00	0.00	0.00	0.00
5,200.00	3.09	313.24	5,194.21	148.34	-157.73	-140.23	0.00	0.00	0.00	0.00
5,300.00	3.09	313.24	5,294.06	152.03	-161.65	-143.71	0.00	0.00	0.00	0.00
5,400.00	3.09	313.24	5,393.92	155.72	-165.57	-147.20	0.00	0.00	0.00	0.00
5,500.00	3.09	313.24	5,493.77	159.41	-169.49	-150.68	0.00	0.00	0.00	0.00
5,600.00	3.09	313.24	5,593.63	163.09	-173.41	-154.17	0.00	0.00	0.00	0.00
5,700.00	3.09	313.24	5,693.48	166.78	-177.33	-157.65	0.00	0.00	0.00	0.00
5,800.00	3.09	313.24	5,793.34	170.47	-181.25	-161.14	0.00	0.00	0.00	0.00
5,900.00	3.09	313.24	5,893.19	174.16	-185.18	-164.63	0.00	0.00	0.00	0.00
6,000.00	3.09	313.24	5,993.05	177.84	-189.10	-168.11	0.00	0.00	0.00	0.00
6,100.00	3.09	313.24	6,092.90	181.53	-193.02	-171.60	0.00	0.00	0.00	0.00
6,200.00	3.09	313.24	6,192.76	185.22	-196.94	-175.08	0.00	0.00	0.00	0.00
6,300.00	3.09	313.24	6,292.61	188.90	-200.86	-178.57	0.00	0.00	0.00	0.00
6,400.00	3.09	313.24	6,392.47	192.59	-204.78	-182.05	0.00	0.00	0.00	0.00
6,500.00	3.09	313.24	6,492.32	196.28	-208.70	-185.54	0.00	0.00	0.00	0.00
6,591.29	3.09	313.24	6,583.48	199.65	-212.28	-188.72	0.00	0.00	0.00	0.00
Begin Build @ 6591.29ft										
6,600.00	2.57	298.93	6,592.18	199.90	-212.62	-188.96	10.00	-5.94	-164.30	-133.26
6,700.00	9.04	194.22	6,691.76	193.36	-216.52	-182.23	10.00	6.47	-104.71	-118.96
6,800.00	18.89	186.53	6,788.69	169.60	-220.30	-158.31	10.00	9.85	-7.69	-14.45
6,900.00	28.84	184.03	6,880.04	129.37	-223.85	-117.95	10.00	9.95	-2.50	-6.96
7,000.00	38.81	182.74	6,963.01	73.87	-227.05	-62.36	10.00	9.97	-1.29	-4.66
Build Rate = 10.00/100ft										
7,100.00	48.79	181.91	7,035.09	4.80	-229.81	6.76	10.00	9.98	-0.83	-3.59
7,131.21	51.91	181.71	7,055.00	-19.22	-230.57	30.79	10.00	9.99	-0.66	-2.99
Sharon Springs										
7,200.00	58.78	181.31	7,094.09	-75.76	-232.05	87.32	10.00	9.99	-0.58	-2.85
7,230.08	61.79	181.15	7,109.00	-101.87	-232.61	113.44	10.00	9.99	-0.52	-2.63
Niobrara A										
7,300.00	68.77	180.82	7,138.22	-165.34	-233.69	176.87	10.00	9.99	-0.48	-2.55
7,367.88	75.56	180.52	7,159.00	-229.91	-234.44	241.40	10.00	9.99	-0.43	-2.41
Niobrara B										
7,400.00	78.76	180.39	7,166.14	-261.22	-234.69	272.69	10.00	9.99	-0.41	-2.32
7,500.00	88.76	179.99	7,176.99	-360.50	-235.02	371.86	10.00	9.99	-0.40	-2.29
7,524.50	91.20	179.90	7,177.00	-385.00	-235.00	396.33	10.00	9.99	-0.39	-2.25
End Build @ 7524.50ft - Niobrara B TL (Heel) - 7" Intermediate Casing - Morning Fresh 15N-15HZ_Casing Point										
7,600.00	91.20	179.90	7,175.41	-460.48	-234.86	471.71	0.00	0.00	0.00	-2.25
7,700.00	91.20	179.90	7,173.31	-560.46	-234.69	571.55	0.00	0.00	0.00	0.00
7,800.00	91.20	179.90	7,171.21	-660.44	-234.51	671.39	0.00	0.00	0.00	0.00
7,900.00	91.20	179.90	7,169.10	-760.42	-234.33	771.24	0.00	0.00	0.00	0.00
8,000.00	91.20	179.90	7,167.00	-860.40	-234.15	871.08	0.00	0.00	0.00	0.00
8,100.00	91.20	179.90	7,164.90	-960.37	-233.97	970.92	0.00	0.00	0.00	0.00
8,200.00	91.20	179.90	7,162.80	-1,060.35	-233.79	1,070.76	0.00	0.00	0.00	0.00
8,300.00	91.20	179.90	7,160.69	-1,160.33	-233.61	1,170.61	0.00	0.00	0.00	0.00
8,400.00	91.20	179.90	7,158.59	-1,260.31	-233.43	1,270.45	0.00	0.00	0.00	0.00
8,500.00	91.20	179.90	7,156.49	-1,360.28	-233.26	1,370.29	0.00	0.00	0.00	0.00
8,600.00	91.20	179.90	7,154.39	-1,460.26	-233.08	1,470.13	0.00	0.00	0.00	0.00
8,700.00	91.20	179.90	7,152.28	-1,560.24	-232.90	1,569.97	0.00	0.00	0.00	0.00
8,800.00	91.20	179.90	7,150.18	-1,660.22	-232.72	1,669.82	0.00	0.00	0.00	0.00
8,900.00	91.20	179.90	7,148.08	-1,760.19	-232.54	1,769.66	0.00	0.00	0.00	0.00
9,000.00	91.20	179.90	7,145.98	-1,860.17	-232.36	1,869.50	0.00	0.00	0.00	0.00
9,100.00	91.20	179.90	7,143.87	-1,960.15	-232.18	1,969.34	0.00	0.00	0.00	0.00
9,200.00	91.20	179.90	7,141.77	-2,060.13	-232.00	2,069.19	0.00	0.00	0.00	0.00
9,300.00	91.20	179.90	7,139.67	-2,160.11	-231.83	2,169.03	0.00	0.00	0.00	0.00

Plan Report for Morning Fresh 15N-15HZ - Plan A Rev 0 Permit

Measured Depth (ft)	Inclination (°)	Azimuth (°)	Vertical Depth (ft)	+N/-S (ft)	+E/-W (ft)	Vertical Section (ft)	Dogleg Rate (°/100ft)	Build Rate (°/100ft)	Turn Rate (°/100ft)	Toolface Azimuth (°)
9,400.00	91.20	179.90	7,137.56	-2,260.08	-231.65	2,268.87	0.00	0.00	0.00	0.00
9,500.00	91.20	179.90	7,135.46	-2,360.06	-231.47	2,368.71	0.00	0.00	0.00	0.00
9,600.00	91.20	179.90	7,133.36	-2,460.04	-231.29	2,468.56	0.00	0.00	0.00	0.00
9,700.00	91.20	179.90	7,131.26	-2,560.02	-231.11	2,568.40	0.00	0.00	0.00	0.00
9,800.00	91.20	179.90	7,129.15	-2,659.99	-230.93	2,668.24	0.00	0.00	0.00	0.00
9,900.00	91.20	179.90	7,127.05	-2,759.97	-230.75	2,768.08	0.00	0.00	0.00	0.00
10,000.00	91.20	179.90	7,124.95	-2,859.95	-230.57	2,867.93	0.00	0.00	0.00	0.00
Hold Angle @ 91.20										
10,100.00	91.20	179.90	7,122.85	-2,959.93	-230.39	2,967.77	0.00	0.00	0.00	0.00
10,200.00	91.20	179.90	7,120.74	-3,059.91	-230.22	3,067.61	0.00	0.00	0.00	0.00
10,300.00	91.20	179.90	7,118.64	-3,159.88	-230.04	3,167.45	0.00	0.00	0.00	0.00
10,400.00	91.20	179.90	7,116.54	-3,259.86	-229.86	3,267.29	0.00	0.00	0.00	0.00
10,500.00	91.20	179.90	7,114.44	-3,359.84	-229.68	3,367.14	0.00	0.00	0.00	0.00
10,600.00	91.20	179.90	7,112.33	-3,459.82	-229.50	3,466.98	0.00	0.00	0.00	0.00
10,700.00	91.20	179.90	7,110.23	-3,559.79	-229.32	3,566.82	0.00	0.00	0.00	0.00
10,800.00	91.20	179.90	7,108.13	-3,659.77	-229.14	3,666.66	0.00	0.00	0.00	0.00
10,900.00	91.20	179.90	7,106.02	-3,759.75	-228.96	3,766.51	0.00	0.00	0.00	0.00
11,000.00	91.20	179.90	7,103.92	-3,859.73	-228.79	3,866.35	0.00	0.00	0.00	0.00
11,100.00	91.20	179.90	7,101.82	-3,959.70	-228.61	3,966.19	0.00	0.00	0.00	0.00
11,200.00	91.20	179.90	7,099.72	-4,059.68	-228.43	4,066.03	0.00	0.00	0.00	0.00
11,300.00	91.20	179.90	7,097.61	-4,159.66	-228.25	4,165.88	0.00	0.00	0.00	0.00
11,400.00	91.20	179.90	7,095.51	-4,259.64	-228.07	4,265.72	0.00	0.00	0.00	0.00
11,500.00	91.20	179.90	7,093.41	-4,359.62	-227.89	4,365.56	0.00	0.00	0.00	0.00
11,600.00	91.20	179.90	7,091.31	-4,459.59	-227.71	4,465.40	0.00	0.00	0.00	0.00
11,662.10	91.20	179.90	7,090.00	-4,521.68	-227.60	4,527.40	0.00	0.00	0.00	0.00
Niobrara B TL (Toe)										
11,662.11	91.20	179.90	7,090.00	-4,521.69	-227.60	4,527.41	0.00	0.00	0.00	0.00
Total Depth @ 11662.11ft - Morning Fresh 15N-15HZ_BHL										

Plan Annotations

Measured Depth (ft)	Vertical Depth (ft)	Local Coordinates		Comment
		+N/-S (ft)	+E/-W (ft)	
600.00	600.00	0.00	0.00	Hold Angle @ 0.00
1,100.00	1,100.00	0.00	0.00	Begin Nudge @ 1100.00ft
1,254.27	1,254.20	2.85	-3.03	End Nudge @ 1254.27ft
4,000.00	3,995.95	104.09	-110.68	Hold Angle @ 3.09
6,591.29	6,583.48	199.65	-212.28	Begin Build @ 6591.29ft
7,000.00	6,963.01	73.87	-227.05	Build Rate = 10.00/100ft
7,524.50	7,177.00	-385.00	-235.00	End Build @ 7524.50ft
10,000.00	7,124.95	-2,859.95	-230.57	Hold Angle @ 91.20
11,662.11	7,090.00	-4,521.69	-227.60	Total Depth @ 11662.11ft

Vertical Section Information

Angle Type	Target	Azimuth (°)	Origin Type	Origin		Start TVD (ft)
				+N/-S (ft)	+E/-W (ft)	
Target	Morning Fresh 15N-15HZ_BHL	182.88	Slot	0.00	0.00	7,090.00

Survey tool program

From (ft)	To (ft)	Survey/Plan	Survey Tool
0.00	11,662.11	Plan A Rev 0 Permit	MWD

Plan Report for Morning Fresh 15N-15HZ - Plan A Rev 0 Permit

Casing Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Casing Diameter (")	Hole Diameter (")
7,524.50	7,177.00	7" Intermediate Casing	7	8-3/4

Formation Details

Measured Depth (ft)	Vertical Depth (ft)	Name	Lithology	Dip (°)	Dip Direction (°)
651.00	651.00	Fox Hills		0.00	
4,000.05	3,996.00	Parkman		0.00	
4,510.80	4,506.00	Sussex		0.00	
7,131.21	7,055.00	Sharon Springs		0.00	
7,230.08	7,109.00	Niobrara A		0.00	
7,367.88	7,159.00	Niobrara B		0.00	
7,524.50	7,177.00	Niobrara B TL (Heel)		0.00	
11,662.10	7,090.00	Niobrara B TL (Toe)		0.00	

Targets associated with this wellbore

Target Name	TVD (ft)	+N/-S (ft)	+E/-W (ft)	Shape
Morning Fresh 15N-15HZ_Section Line	0.00	0.00	0.00	Polygon
Morning Fresh 15N-15HZ_Casing Point	7,177.00	-385.00	-235.00	Point
Morning Fresh 15N-15HZ_BHL	7,090.00	-4,521.69	-227.60	Point
Morning Fresh 15N-15HZ_Setback Line	0.00	0.00	0.00	Polygon
Morning Fresh 15N-15HZ_SHL	0.00	0.00	0.00	Point

North Reference Sheet for Sec. 15-T3N-R66W - Morning Fresh 15N-15HZ - Plan A Rev 0

All data is in US Feet unless otherwise stated. Directions and Coordinates are relative to True North Reference.
Vertical Depths are relative to RKB=17 @ 4901.00ft (Drilling Rig). Northing and Easting are relative to Morning Fresh 15N-15HZ
Coordinate System is US State Plane 1983, Colorado Northern Zone using datum North American Datum 1983, ellipsoid GRS 1980

Projection method is Lambert Conformal Conic (2 parallel)
Central Meridian is -105.50°, Longitude Origin:0.000000°, Latitude Origin:40.783333°
False Easting: 3,000,000.00ft, False Northing: 1,000,000.00ft, Scale Reduction: 0.99995690

Grid Coordinates of Well: 1,328,047.81 ft N, 3,206,469.23 ft E
Geographical Coordinates of Well: 40° 13' 53.49" N, 104° 45' 37.78" W
Grid Convergence at Surface is: 0.48°

Based upon Minimum Curvature type calculations, at a Measured Depth of 11,662.11ft
the Bottom Hole Displacement is 4,527.41ft in the Direction of 182.88° (True).

Magnetic Convergence at surface is: -8.20° (12 September 2012, , BGGM2011)

