# PETROLEUM DEVELOPMENT CORP DJ Basin

Well Name: **Hop 18F-102**

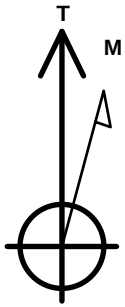
Surface Location: Hop 5N64W18A Pad Sec.18-T5N-R64W
North American Datum 1983 , US State Plane 1983, Colorado Northern Zone
Ground Elevation: 4628.0

| +N/-S | +E/-W | Northing | Easting | Latittude | Longitude | Slot |
|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 1391153.90 | 3251028.18 | 40.403617 | -104.598612 | |

Original Well Elev WELL @ 4641.0ft (Original Well Elev)

## DESIGN TARGET DETAILS

| Name | TVD | +N/-S | +E/-W | Shape |
|---|---|---|---|---|
| SHL 1001'FNL, 893'FWL, SEC.18 | 1.0 | 0.0 | 0.0 | Point |
| BHL 1265'FNL, 500'FEL, SEC.17 | 6552.0 | -197.6 | 9011.7 | Point |



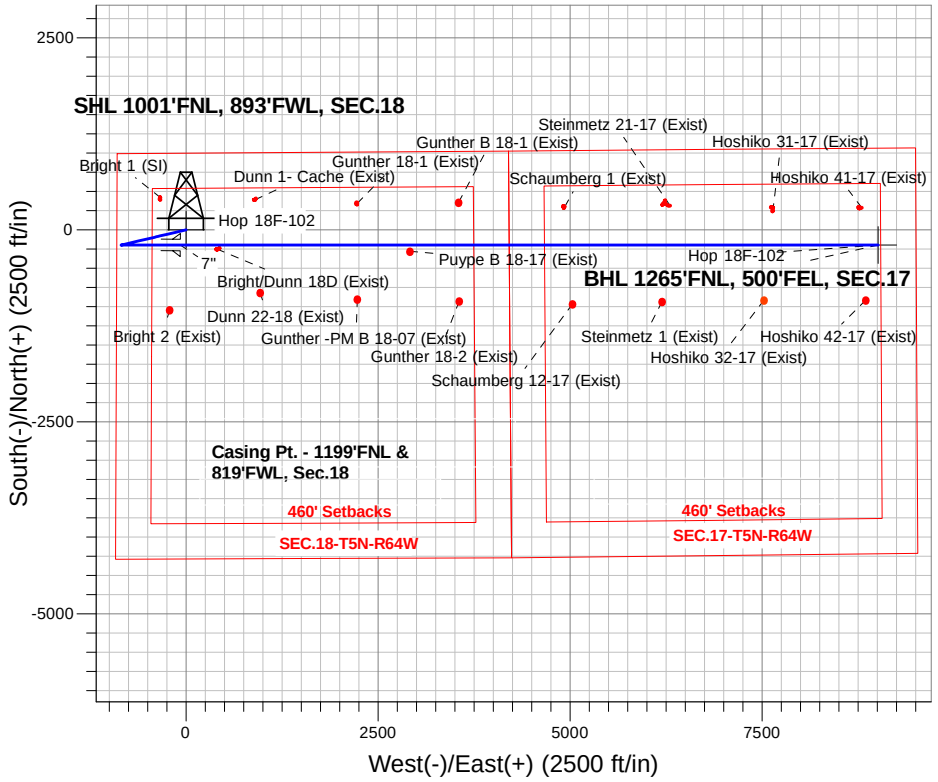

Azimuths to True North
Magnetic North: 8.16°

Magnetic Field
Strength: 52675.9snT
Dip Angle: 66.92°
Date: 12/21/2015
Model: IGRF2010

Hop 5N64W18A Pad Sec.18-T5N-R64W
Hop 18F-102
Plan #1 (12-16-15)
12:17, December 21 2015

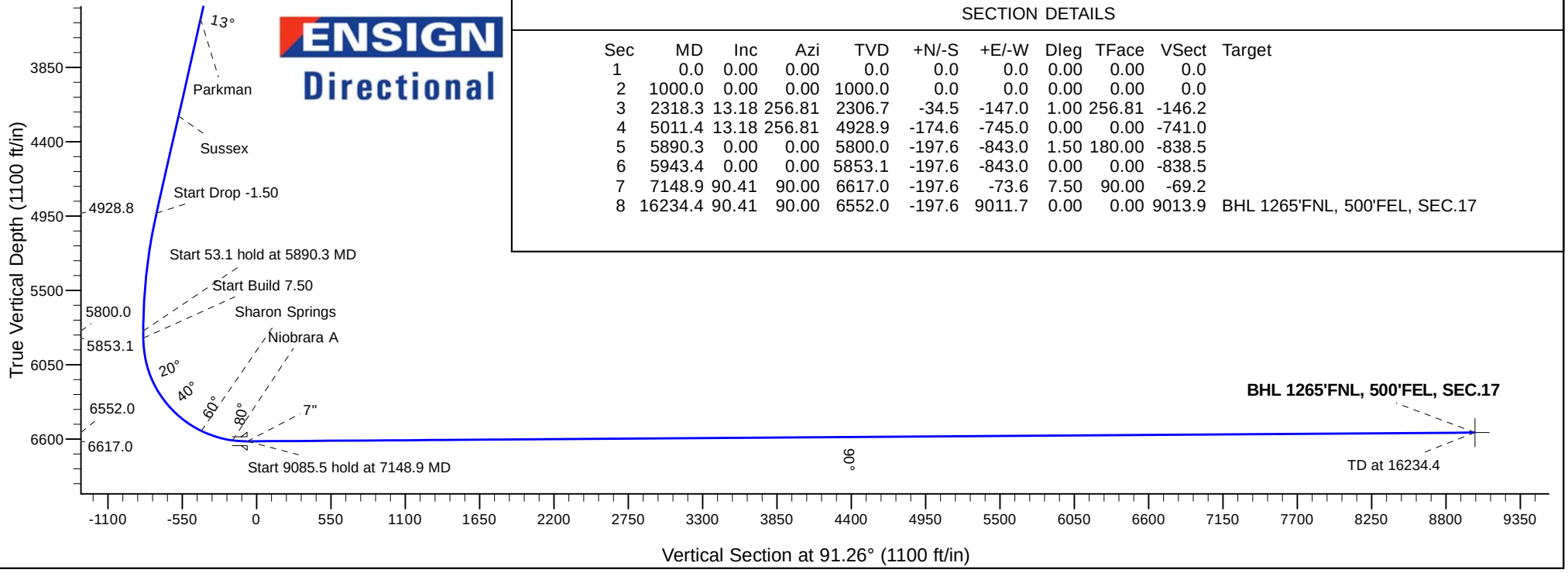
## ANNOTATIONS

| TVD | MD | Annotation |
|---|---|---|
| 1000.0 | 1000.0 | KOP - Start Build 1.00 |
| 4928.9 | 5011.4 | Start Drop -1.50 |
| 5800.0 | 5890.3 | Start 53.1 hold at 5890.3 MD |
| 5853.1 | 5943.4 | Start Build 7.50 |
| 6617.0 | 7148.9 | Start 9085.5 hold at 7148.9 MD |
| 6552.0 | 16234.4 | TD at 16234.4 |




## SECTION DETAILS

| Sec | MD | Inc | Azi | TVD | +N/-S | +E/-W | Dleg | TFace | VSect | Target |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 0.0 | 0.00 | 0.00 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.0 | |
| 2 | 1000.0 | 0.00 | 0.00 | 1000.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.0 | |
| 3 | 2318.3 | 13.18 | 256.81 | 2306.7 | -34.5 | -147.0 | 1.00 | 256.81 | -146.2 | |
| 4 | 5011.4 | 13.18 | 256.81 | 4928.9 | -174.6 | -745.0 | 0.00 | 0.00 | -741.0 | |
| 5 | 5890.3 | 0.00 | 0.00 | 5800.0 | -197.6 | -843.0 | 1.50 | 180.00 | -838.5 | |
| 6 | 5943.4 | 0.00 | 0.00 | 5853.1 | -197.6 | -843.0 | 0.00 | 0.00 | -838.5 | |
| 7 | 7148.9 | 90.41 | 90.00 | 6617.0 | -197.6 | -73.6 | 7.50 | 90.00 | -69.2 | |
| 8 | 16234.4 | 90.41 | 90.00 | 6552.0 | -197.6 | 9011.7 | 0.00 | 0.00 | 9013.9 | BHL 1265'FNL, 500'FEL, SEC.17 |



ENSIGN Directional

# PETROLEUM DEVELOPMENT CORP DJ Basin

**SEC.18-T5N-R64W**
**Hop 5N64W18A Pad Sec.18-T5N-R64W**
**Hop 18F-102**

**Wellbore #1**

**Plan: Plan #1 (12-16-15)**

# Standard Planning Report

**21 December, 2015**

PDC ENERGY
Growing E&P Value

| | | | |
|---|---|---|---|
| **Database:** | US_EDM | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Project:** | SEC.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **North Reference:** | True |
| **Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #1 (12-16-15) | | |

**Project** SEC.18-T5N-R64W, Weld County, Colorado

| | | | |
|---|---|---|---|
| **Map System:** | US State Plane 1983 | **System Datum:** | Mean Sea Level |
| **Geo Datum:** | North American Datum 1983 | | Using Well Reference Point |
| **Map Zone:** | Colorado Northern Zone | | Using geodetic scale factor |

**Site** Hop 5N64W18A Pad Sec.18-T5N-R64W

| | | | | | |
|---|---|---|---|---|---|
| **Site Position:** | | **Northing:** | 1,391,153.68 usft | **Latitude:** | 40.403618 |
| **From:** | Lat/Long | **Easting:** | 3,250,968.30 usft | **Longitude:** | -104.598827 |
| **Position Uncertainty:** | 0.0 ft | **Slot Radius:** | 13-3/16 " | **Grid Convergence:** | 0.58 ° |

**Well** Hop 18F-102

| | | | | | | |
|---|---|---|---|---|---|---|
| **Well Position** | **+N/-S** | -0.4 ft | **Northing:** | 1,391,153.90 usft | **Latitude:** | 40.403617 |
| | **+E/-W** | 59.9 ft | **Easting:** | 3,251,028.18 usft | **Longitude:** | -104.598612 |
| **Position Uncertainty** | | 0.0 ft | **Wellhead Elevation:** | 0.0 ft | **Ground Level:** | 4,628.0 ft |

**Wellbore** Wellbore #1

| Magnetics | Model Name | Sample Date | Declination (°) | Dip Angle (°) | Field Strength (nT) |
|---|---|---|---|---|---|
| | IGRF2010 | 12/21/2015 | 8.17 | 66.92 | 52,676 |

**Design** Plan #1 (12-16-15)

**Audit Notes:**

| | | | | | |
|---|---|---|---|---|---|
| **Version:** | | **Phase:** | PROTOTYPE | **Tie On Depth:** | 0.0 |

| Vertical Section: | Depth From (TVD) (ft) | +N/-S (ft) | +E/-W (ft) | Direction (°) |
|---|---|---|---|---|
| | 0.0 | 0.0 | 0.0 | 91.26 |

**Plan Sections**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | 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 | |
| 2,318.3 | 13.18 | 256.81 | 2,306.7 | -34.5 | -147.0 | 1.00 | 1.00 | 0.00 | 256.81 | |
| 5,011.4 | 13.18 | 256.81 | 4,928.9 | -174.6 | -745.0 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 5,890.3 | 0.00 | 0.00 | 5,800.0 | -197.6 | -843.0 | 1.50 | -1.50 | 0.00 | 180.00 | |
| 5,943.4 | 0.00 | 0.00 | 5,853.1 | -197.6 | -843.0 | 0.00 | 0.00 | 0.00 | 0.00 | |
| 7,148.9 | 90.41 | 90.00 | 6,617.0 | -197.6 | -73.6 | 7.50 | 7.50 | 0.00 | 90.00 | |
| 16,234.4 | 90.41 | 90.00 | 6,552.0 | -197.6 | 9,011.7 | 0.00 | 0.00 | 0.00 | 0.00 | BHL 1265'FNL, 500'F |

| | | | |
|---|---|---|---|
| **Database:** | US_EDM | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Project:** | SEC.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **North Reference:** | True |
| **Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #1 (12-16-15) | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | 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 |
| 1.0 | 0.00 | 0.00 | 1.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 |
| **SHL 1001'FNL, 893'FWL, SEC.18** | | | | | | | | | |
| 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 |
| 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 |
| 1,000.0 | 0.00 | 0.00 | 1,000.0 | 0.0 | 0.0 | 0.0 | 0.00 | 0.00 | 0.00 |
| **KOP - Start Build 1.00** | | | | | | | | | |
| 1,100.0 | 1.00 | 256.81 | 1,100.0 | -0.2 | -0.8 | -0.8 | 1.00 | 1.00 | 0.00 |
| 1,200.0 | 2.00 | 256.81 | 1,200.0 | -0.8 | -3.4 | -3.4 | 1.00 | 1.00 | 0.00 |
| 1,300.0 | 3.00 | 256.81 | 1,299.9 | -1.8 | -7.6 | -7.6 | 1.00 | 1.00 | 0.00 |
| 1,400.0 | 4.00 | 256.81 | 1,399.7 | -3.2 | -13.6 | -13.5 | 1.00 | 1.00 | 0.00 |
| 1,500.0 | 5.00 | 256.81 | 1,499.4 | -5.0 | -21.2 | -21.1 | 1.00 | 1.00 | 0.00 |
| 1,600.0 | 6.00 | 256.81 | 1,598.9 | -7.2 | -30.6 | -30.4 | 1.00 | 1.00 | 0.00 |
| 1,700.0 | 7.00 | 256.81 | 1,698.3 | -9.7 | -41.6 | -41.4 | 1.00 | 1.00 | 0.00 |
| 1,800.0 | 8.00 | 256.81 | 1,797.4 | -12.7 | -54.3 | -54.0 | 1.00 | 1.00 | 0.00 |
| 1,900.0 | 9.00 | 256.81 | 1,896.3 | -16.1 | -68.7 | -68.3 | 1.00 | 1.00 | 0.00 |
| 2,000.0 | 10.00 | 256.81 | 1,994.9 | -19.9 | -84.7 | -84.3 | 1.00 | 1.00 | 0.00 |
| 2,100.0 | 11.00 | 256.81 | 2,093.3 | -24.0 | -102.5 | -101.9 | 1.00 | 1.00 | 0.00 |
| 2,200.0 | 12.00 | 256.81 | 2,191.2 | -28.6 | -121.9 | -121.2 | 1.00 | 1.00 | 0.00 |
| 2,300.0 | 13.00 | 256.81 | 2,288.9 | -33.5 | -143.0 | -142.2 | 1.00 | 1.00 | 0.00 |
| 2,318.3 | 13.18 | 256.81 | 2,306.7 | -34.5 | -147.0 | -146.2 | 1.00 | 1.00 | 0.00 |
| 2,400.0 | 13.18 | 256.81 | 2,386.2 | -38.7 | -165.1 | -164.3 | 0.00 | 0.00 | 0.00 |
| 2,500.0 | 13.18 | 256.81 | 2,483.6 | -43.9 | -187.4 | -186.3 | 0.00 | 0.00 | 0.00 |
| 2,600.0 | 13.18 | 256.81 | 2,581.0 | -49.1 | -209.6 | -208.4 | 0.00 | 0.00 | 0.00 |
| 2,700.0 | 13.18 | 256.81 | 2,678.3 | -54.3 | -231.8 | -230.5 | 0.00 | 0.00 | 0.00 |
| 2,800.0 | 13.18 | 256.81 | 2,775.7 | -59.5 | -254.0 | -252.6 | 0.00 | 0.00 | 0.00 |
| 2,900.0 | 13.18 | 256.81 | 2,873.1 | -64.7 | -276.2 | -274.7 | 0.00 | 0.00 | 0.00 |
| 3,000.0 | 13.18 | 256.81 | 2,970.4 | -69.9 | -298.4 | -296.8 | 0.00 | 0.00 | 0.00 |
| 3,100.0 | 13.18 | 256.81 | 3,067.8 | -75.1 | -320.6 | -318.9 | 0.00 | 0.00 | 0.00 |
| 3,200.0 | 13.18 | 256.81 | 3,165.2 | -80.4 | -342.8 | -340.9 | 0.00 | 0.00 | 0.00 |
| 3,300.0 | 13.18 | 256.81 | 3,262.5 | -85.6 | -365.0 | -363.0 | 0.00 | 0.00 | 0.00 |
| 3,400.0 | 13.18 | 256.81 | 3,359.9 | -90.8 | -387.2 | -385.1 | 0.00 | 0.00 | 0.00 |
| 3,500.0 | 13.18 | 256.81 | 3,457.3 | -96.0 | -409.4 | -407.2 | 0.00 | 0.00 | 0.00 |
| 3,533.6 | 13.18 | 256.81 | 3,490.0 | -97.7 | -416.9 | -414.6 | 0.00 | 0.00 | 0.00 |
| **Parkman** | | | | | | | | | |
| 3,600.0 | 13.18 | 256.81 | 3,554.6 | -101.2 | -431.6 | -429.3 | 0.00 | 0.00 | 0.00 |
| 3,700.0 | 13.18 | 256.81 | 3,652.0 | -106.4 | -453.8 | -451.4 | 0.00 | 0.00 | 0.00 |
| 3,800.0 | 13.18 | 256.81 | 3,749.4 | -111.6 | -476.0 | -473.4 | 0.00 | 0.00 | 0.00 |
| 3,900.0 | 13.18 | 256.81 | 3,846.7 | -116.8 | -498.2 | -495.5 | 0.00 | 0.00 | 0.00 |
| 4,000.0 | 13.18 | 256.81 | 3,944.1 | -122.0 | -520.4 | -517.6 | 0.00 | 0.00 | 0.00 |
| 4,100.0 | 13.18 | 256.81 | 4,041.4 | -127.2 | -542.6 | -539.7 | 0.00 | 0.00 | 0.00 |
| 4,200.0 | 13.18 | 256.81 | 4,138.8 | -132.4 | -564.8 | -561.8 | 0.00 | 0.00 | 0.00 |
| 4,273.1 | 13.18 | 256.81 | 4,210.0 | -136.2 | -581.1 | -577.9 | 0.00 | 0.00 | 0.00 |
| **Sussex** | | | | | | | | | |
| 4,300.0 | 13.18 | 256.81 | 4,236.2 | -137.6 | -587.0 | -583.9 | 0.00 | 0.00 | 0.00 |
| 4,400.0 | 13.18 | 256.81 | 4,333.5 | -142.8 | -609.2 | -606.0 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | US_EDM | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Project:** | SEC.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **North Reference:** | True |
| **Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #1 (12-16-15) | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100usft) | Build Rate (°/100usft) | Turn Rate (°/100usft) |
|---|---|---|---|---|---|---|---|---|---|
| 4,500.0 | 13.18 | 256.81 | 4,430.9 | -148.0 | -631.4 | -628.0 | 0.00 | 0.00 | 0.00 |
| 4,600.0 | 13.18 | 256.81 | 4,528.3 | -153.2 | -653.6 | -650.1 | 0.00 | 0.00 | 0.00 |
| 4,700.0 | 13.18 | 256.81 | 4,625.6 | -158.4 | -675.8 | -672.2 | 0.00 | 0.00 | 0.00 |
| 4,800.0 | 13.18 | 256.81 | 4,723.0 | -163.6 | -698.0 | -694.3 | 0.00 | 0.00 | 0.00 |
| 4,900.0 | 13.18 | 256.81 | 4,820.4 | -168.8 | -720.3 | -716.4 | 0.00 | 0.00 | 0.00 |
| 5,000.0 | 13.18 | 256.81 | 4,917.7 | -174.0 | -742.5 | -738.5 | 0.00 | 0.00 | 0.00 |
| 5,011.4 | 13.18 | 256.81 | 4,928.8 | -174.6 | -745.0 | -741.0 | 0.00 | 0.00 | 0.00 |
| **Start Drop -1.50** | | | | | | | | | |
| 5,100.0 | 11.85 | 256.81 | 5,015.3 | -179.0 | -763.7 | -759.6 | 1.50 | -1.50 | 0.00 |
| 5,200.0 | 10.35 | 256.81 | 5,113.4 | -183.4 | -782.4 | -778.2 | 1.50 | -1.50 | 0.00 |
| 5,300.0 | 8.85 | 256.81 | 5,212.0 | -187.2 | -798.7 | -794.4 | 1.50 | -1.50 | 0.00 |
| 5,400.0 | 7.35 | 256.81 | 5,311.0 | -190.4 | -812.4 | -808.0 | 1.50 | -1.50 | 0.00 |
| 5,500.0 | 5.85 | 256.81 | 5,410.4 | -193.1 | -823.6 | -819.2 | 1.50 | -1.50 | 0.00 |
| 5,600.0 | 4.35 | 256.81 | 5,510.0 | -195.1 | -832.3 | -827.8 | 1.50 | -1.50 | 0.00 |
| 5,700.0 | 2.85 | 256.81 | 5,609.8 | -196.5 | -838.4 | -833.9 | 1.50 | -1.50 | 0.00 |
| 5,800.0 | 1.35 | 256.81 | 5,709.7 | -197.4 | -842.0 | -837.4 | 1.50 | -1.50 | 0.00 |
| 5,890.3 | 0.00 | 256.81 | 5,800.0 | -197.6 | -843.0 | -838.5 | 1.50 | -1.50 | 0.00 |
| **Start 53.1 hold at 5890.3 MD** | | | | | | | | | |
| 5,900.0 | 0.00 | 0.00 | 5,809.7 | -197.6 | -843.0 | -838.5 | 0.00 | 0.00 | 0.00 |
| 5,943.4 | 0.00 | 0.00 | 5,853.1 | -197.6 | -843.0 | -838.5 | 0.00 | 0.00 | 0.00 |
| **Start Build 7.50** | | | | | | | | | |
| 6,000.0 | 4.25 | 90.00 | 5,909.6 | -197.6 | -840.9 | -836.4 | 7.50 | 7.50 | 0.00 |
| 6,100.0 | 11.75 | 90.00 | 6,008.6 | -197.6 | -827.0 | -822.5 | 7.50 | 7.50 | 0.00 |
| 6,200.0 | 19.25 | 90.00 | 6,104.9 | -197.6 | -800.3 | -795.8 | 7.50 | 7.50 | 0.00 |
| 6,300.0 | 26.75 | 90.00 | 6,196.9 | -197.6 | -761.3 | -756.8 | 7.50 | 7.50 | 0.00 |
| 6,400.0 | 34.25 | 90.00 | 6,283.0 | -197.6 | -710.6 | -706.1 | 7.50 | 7.50 | 0.00 |
| 6,500.0 | 41.75 | 90.00 | 6,361.7 | -197.6 | -649.0 | -644.6 | 7.50 | 7.50 | 0.00 |
| 6,600.0 | 49.25 | 90.00 | 6,431.8 | -197.6 | -577.8 | -573.3 | 7.50 | 7.50 | 0.00 |
| 6,700.0 | 56.75 | 90.00 | 6,491.9 | -197.6 | -498.0 | -493.5 | 7.50 | 7.50 | 0.00 |
| 6,797.4 | 64.05 | 90.00 | 6,540.0 | -197.6 | -413.4 | -408.9 | 7.50 | 7.50 | 0.00 |
| **Sharon Springs** | | | | | | | | | |
| 6,800.0 | 64.25 | 90.00 | 6,541.1 | -197.6 | -411.0 | -406.6 | 7.50 | 7.50 | 0.00 |
| 6,900.0 | 71.75 | 90.00 | 6,578.6 | -197.6 | -318.4 | -313.9 | 7.50 | 7.50 | 0.00 |
| 7,000.0 | 79.25 | 90.00 | 6,603.6 | -197.6 | -221.6 | -217.2 | 7.50 | 7.50 | 0.00 |
| 7,039.7 | 82.22 | 90.00 | 6,610.0 | -197.6 | -182.5 | -178.1 | 7.50 | 7.50 | 0.00 |
| **Niobrara A** | | | | | | | | | |
| 7,100.0 | 86.75 | 90.00 | 6,615.8 | -197.6 | -122.4 | -118.1 | 7.50 | 7.50 | 0.00 |
| 7,148.9 | 90.41 | 90.00 | 6,617.0 | -197.6 | -73.6 | -69.2 | 7.49 | 7.49 | 0.00 |
| **Start 9085.5 hold at 7148.9 MD - 7"** | | | | | | | | | |
| 7,200.0 | 90.41 | 90.00 | 6,616.6 | -197.6 | -22.5 | -18.1 | 0.00 | 0.00 | 0.00 |
| 7,300.0 | 90.41 | 90.00 | 6,615.9 | -197.6 | 77.5 | 81.9 | 0.00 | 0.00 | 0.00 |
| 7,400.0 | 90.41 | 90.00 | 6,615.2 | -197.6 | 177.5 | 181.8 | 0.00 | 0.00 | 0.00 |
| 7,500.0 | 90.41 | 90.00 | 6,614.5 | -197.6 | 277.5 | 281.8 | 0.00 | 0.00 | 0.00 |
| 7,600.0 | 90.41 | 90.00 | 6,613.8 | -197.6 | 377.5 | 381.8 | 0.00 | 0.00 | 0.00 |
| 7,700.0 | 90.41 | 90.00 | 6,613.1 | -197.6 | 477.5 | 481.8 | 0.00 | 0.00 | 0.00 |
| 7,800.0 | 90.41 | 90.00 | 6,612.4 | -197.6 | 577.5 | 581.7 | 0.00 | 0.00 | 0.00 |
| 7,900.0 | 90.41 | 90.00 | 6,611.6 | -197.6 | 677.5 | 681.7 | 0.00 | 0.00 | 0.00 |
| 8,000.0 | 90.41 | 90.00 | 6,610.9 | -197.6 | 777.5 | 781.7 | 0.00 | 0.00 | 0.00 |
| 8,100.0 | 90.41 | 90.00 | 6,610.2 | -197.6 | 877.5 | 881.6 | 0.00 | 0.00 | 0.00 |
| 8,200.0 | 90.41 | 90.00 | 6,609.5 | -197.6 | 977.5 | 981.6 | 0.00 | 0.00 | 0.00 |
| 8,300.0 | 90.41 | 90.00 | 6,608.8 | -197.6 | 1,077.5 | 1,081.6 | 0.00 | 0.00 | 0.00 |
| 8,400.0 | 90.41 | 90.00 | 6,608.1 | -197.6 | 1,177.5 | 1,181.6 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | US_EDM | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Project:** | SEC.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **North Reference:** | True |
| **Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #1 (12-16-15) | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100usft) | Build Rate (°/100usft) | Turn Rate (°/100usft) |
|---|---|---|---|---|---|---|---|---|---|
| 8,500.0 | 90.41 | 90.00 | 6,607.3 | -197.6 | 1,277.5 | 1,281.5 | 0.00 | 0.00 | 0.00 |
| 8,600.0 | 90.41 | 90.00 | 6,606.6 | -197.6 | 1,377.5 | 1,381.5 | 0.00 | 0.00 | 0.00 |
| 8,700.0 | 90.41 | 90.00 | 6,605.9 | -197.6 | 1,477.5 | 1,481.5 | 0.00 | 0.00 | 0.00 |
| 8,800.0 | 90.41 | 90.00 | 6,605.2 | -197.6 | 1,577.5 | 1,581.5 | 0.00 | 0.00 | 0.00 |
| 8,900.0 | 90.41 | 90.00 | 6,604.5 | -197.6 | 1,677.5 | 1,681.4 | 0.00 | 0.00 | 0.00 |
| 9,000.0 | 90.41 | 90.00 | 6,603.8 | -197.6 | 1,777.5 | 1,781.4 | 0.00 | 0.00 | 0.00 |
| 9,100.0 | 90.41 | 90.00 | 6,603.1 | -197.6 | 1,877.5 | 1,881.4 | 0.00 | 0.00 | 0.00 |
| 9,200.0 | 90.41 | 90.00 | 6,602.3 | -197.6 | 1,977.5 | 1,981.4 | 0.00 | 0.00 | 0.00 |
| 9,300.0 | 90.41 | 90.00 | 6,601.6 | -197.6 | 2,077.5 | 2,081.3 | 0.00 | 0.00 | 0.00 |
| 9,400.0 | 90.41 | 90.00 | 6,600.9 | -197.6 | 2,177.5 | 2,181.3 | 0.00 | 0.00 | 0.00 |
| 9,500.0 | 90.41 | 90.00 | 6,600.2 | -197.6 | 2,277.5 | 2,281.3 | 0.00 | 0.00 | 0.00 |
| 9,600.0 | 90.41 | 90.00 | 6,599.5 | -197.6 | 2,377.5 | 2,381.2 | 0.00 | 0.00 | 0.00 |
| 9,700.0 | 90.41 | 90.00 | 6,598.8 | -197.6 | 2,477.5 | 2,481.2 | 0.00 | 0.00 | 0.00 |
| 9,800.0 | 90.41 | 90.00 | 6,598.0 | -197.6 | 2,577.5 | 2,581.2 | 0.00 | 0.00 | 0.00 |
| 9,900.0 | 90.41 | 90.00 | 6,597.3 | -197.6 | 2,677.5 | 2,681.2 | 0.00 | 0.00 | 0.00 |
| 10,000.0 | 90.41 | 90.00 | 6,596.6 | -197.6 | 2,777.5 | 2,781.1 | 0.00 | 0.00 | 0.00 |
| 10,100.0 | 90.41 | 90.00 | 6,595.9 | -197.6 | 2,877.5 | 2,881.1 | 0.00 | 0.00 | 0.00 |
| 10,200.0 | 90.41 | 90.00 | 6,595.2 | -197.6 | 2,977.5 | 2,981.1 | 0.00 | 0.00 | 0.00 |
| 10,300.0 | 90.41 | 90.00 | 6,594.5 | -197.6 | 3,077.5 | 3,081.1 | 0.00 | 0.00 | 0.00 |
| 10,400.0 | 90.41 | 90.00 | 6,593.7 | -197.6 | 3,177.5 | 3,181.0 | 0.00 | 0.00 | 0.00 |
| 10,500.0 | 90.41 | 90.00 | 6,593.0 | -197.6 | 3,277.5 | 3,281.0 | 0.00 | 0.00 | 0.00 |
| 10,600.0 | 90.41 | 90.00 | 6,592.3 | -197.6 | 3,377.5 | 3,381.0 | 0.00 | 0.00 | 0.00 |
| 10,700.0 | 90.41 | 90.00 | 6,591.6 | -197.6 | 3,477.5 | 3,481.0 | 0.00 | 0.00 | 0.00 |
| 10,800.0 | 90.41 | 90.00 | 6,590.9 | -197.6 | 3,577.5 | 3,580.9 | 0.00 | 0.00 | 0.00 |
| 10,900.0 | 90.41 | 90.00 | 6,590.2 | -197.6 | 3,677.5 | 3,680.9 | 0.00 | 0.00 | 0.00 |
| 11,000.0 | 90.41 | 90.00 | 6,589.5 | -197.6 | 3,777.4 | 3,780.9 | 0.00 | 0.00 | 0.00 |
| 11,100.0 | 90.41 | 90.00 | 6,588.7 | -197.6 | 3,877.4 | 3,880.8 | 0.00 | 0.00 | 0.00 |
| 11,200.0 | 90.41 | 90.00 | 6,588.0 | -197.6 | 3,977.4 | 3,980.8 | 0.00 | 0.00 | 0.00 |
| 11,300.0 | 90.41 | 90.00 | 6,587.3 | -197.6 | 4,077.4 | 4,080.8 | 0.00 | 0.00 | 0.00 |
| 11,400.0 | 90.41 | 90.00 | 6,586.6 | -197.6 | 4,177.4 | 4,180.8 | 0.00 | 0.00 | 0.00 |
| 11,500.0 | 90.41 | 90.00 | 6,585.9 | -197.6 | 4,277.4 | 4,280.7 | 0.00 | 0.00 | 0.00 |
| 11,600.0 | 90.41 | 90.00 | 6,585.2 | -197.6 | 4,377.4 | 4,380.7 | 0.00 | 0.00 | 0.00 |
| 11,700.0 | 90.41 | 90.00 | 6,584.4 | -197.6 | 4,477.4 | 4,480.7 | 0.00 | 0.00 | 0.00 |
| 11,800.0 | 90.41 | 90.00 | 6,583.7 | -197.6 | 4,577.4 | 4,580.7 | 0.00 | 0.00 | 0.00 |
| 11,900.0 | 90.41 | 90.00 | 6,583.0 | -197.6 | 4,677.4 | 4,680.6 | 0.00 | 0.00 | 0.00 |
| 12,000.0 | 90.41 | 90.00 | 6,582.3 | -197.6 | 4,777.4 | 4,780.6 | 0.00 | 0.00 | 0.00 |
| 12,100.0 | 90.41 | 90.00 | 6,581.6 | -197.6 | 4,877.4 | 4,880.6 | 0.00 | 0.00 | 0.00 |
| 12,200.0 | 90.41 | 90.00 | 6,580.9 | -197.6 | 4,977.4 | 4,980.6 | 0.00 | 0.00 | 0.00 |
| 12,300.0 | 90.41 | 90.00 | 6,580.2 | -197.6 | 5,077.4 | 5,080.5 | 0.00 | 0.00 | 0.00 |
| 12,400.0 | 90.41 | 90.00 | 6,579.4 | -197.6 | 5,177.4 | 5,180.5 | 0.00 | 0.00 | 0.00 |
| 12,500.0 | 90.41 | 90.00 | 6,578.7 | -197.6 | 5,277.4 | 5,280.5 | 0.00 | 0.00 | 0.00 |
| 12,600.0 | 90.41 | 90.00 | 6,578.0 | -197.6 | 5,377.4 | 5,380.4 | 0.00 | 0.00 | 0.00 |
| 12,700.0 | 90.41 | 90.00 | 6,577.3 | -197.6 | 5,477.4 | 5,480.4 | 0.00 | 0.00 | 0.00 |
| 12,800.0 | 90.41 | 90.00 | 6,576.6 | -197.6 | 5,577.4 | 5,580.4 | 0.00 | 0.00 | 0.00 |
| 12,900.0 | 90.41 | 90.00 | 6,575.9 | -197.6 | 5,677.4 | 5,680.4 | 0.00 | 0.00 | 0.00 |
| 13,000.0 | 90.41 | 90.00 | 6,575.1 | -197.6 | 5,777.4 | 5,780.3 | 0.00 | 0.00 | 0.00 |
| 13,100.0 | 90.41 | 90.00 | 6,574.4 | -197.6 | 5,877.4 | 5,880.3 | 0.00 | 0.00 | 0.00 |
| 13,200.0 | 90.41 | 90.00 | 6,573.7 | -197.6 | 5,977.4 | 5,980.3 | 0.00 | 0.00 | 0.00 |
| 13,300.0 | 90.41 | 90.00 | 6,573.0 | -197.6 | 6,077.4 | 6,080.3 | 0.00 | 0.00 | 0.00 |
| 13,400.0 | 90.41 | 90.00 | 6,572.3 | -197.6 | 6,177.4 | 6,180.2 | 0.00 | 0.00 | 0.00 |
| 13,500.0 | 90.41 | 90.00 | 6,571.6 | -197.6 | 6,277.4 | 6,280.2 | 0.00 | 0.00 | 0.00 |
| 13,600.0 | 90.41 | 90.00 | 6,570.9 | -197.6 | 6,377.4 | 6,380.2 | 0.00 | 0.00 | 0.00 |
| 13,700.0 | 90.41 | 90.00 | 6,570.1 | -197.6 | 6,477.4 | 6,480.2 | 0.00 | 0.00 | 0.00 |

| | | | |
|---|---|---|---|
| **Database:** | US_EDM | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Project:** | SEC.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **North Reference:** | True |
| **Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #1 (12-16-15) | | |

**Planned Survey**

| Measured Depth (ft) | Inclination (°) | Azimuth (°) | Vertical Depth (ft) | +N/-S (ft) | +E/-W (ft) | Vertical Section (ft) | Dogleg Rate (°/100usft) | Build Rate (°/100usft) | Turn Rate (°/100usft) |
|---|---|---|---|---|---|---|---|---|---|
| 13,800.0 | 90.41 | 90.00 | 6,569.4 | -197.6 | 6,577.4 | 6,580.1 | 0.00 | 0.00 | 0.00 |
| 13,900.0 | 90.41 | 90.00 | 6,568.7 | -197.6 | 6,677.4 | 6,680.1 | 0.00 | 0.00 | 0.00 |
| 14,000.0 | 90.41 | 90.00 | 6,568.0 | -197.6 | 6,777.4 | 6,780.1 | 0.00 | 0.00 | 0.00 |
| 14,100.0 | 90.41 | 90.00 | 6,567.3 | -197.6 | 6,877.4 | 6,880.0 | 0.00 | 0.00 | 0.00 |
| 14,200.0 | 90.41 | 90.00 | 6,566.6 | -197.6 | 6,977.4 | 6,980.0 | 0.00 | 0.00 | 0.00 |
| 14,300.0 | 90.41 | 90.00 | 6,565.8 | -197.6 | 7,077.4 | 7,080.0 | 0.00 | 0.00 | 0.00 |
| 14,400.0 | 90.41 | 90.00 | 6,565.1 | -197.6 | 7,177.4 | 7,180.0 | 0.00 | 0.00 | 0.00 |
| 14,500.0 | 90.41 | 90.00 | 6,564.4 | -197.6 | 7,277.4 | 7,279.9 | 0.00 | 0.00 | 0.00 |
| 14,600.0 | 90.41 | 90.00 | 6,563.7 | -197.6 | 7,377.4 | 7,379.9 | 0.00 | 0.00 | 0.00 |
| 14,700.0 | 90.41 | 90.00 | 6,563.0 | -197.6 | 7,477.4 | 7,479.9 | 0.00 | 0.00 | 0.00 |
| 14,800.0 | 90.41 | 90.00 | 6,562.3 | -197.6 | 7,577.4 | 7,579.9 | 0.00 | 0.00 | 0.00 |
| 14,900.0 | 90.41 | 90.00 | 6,561.5 | -197.6 | 7,677.3 | 7,679.8 | 0.00 | 0.00 | 0.00 |
| 15,000.0 | 90.41 | 90.00 | 6,560.8 | -197.6 | 7,777.3 | 7,779.8 | 0.00 | 0.00 | 0.00 |
| 15,100.0 | 90.41 | 90.00 | 6,560.1 | -197.6 | 7,877.3 | 7,879.8 | 0.00 | 0.00 | 0.00 |
| 15,200.0 | 90.41 | 90.00 | 6,559.4 | -197.6 | 7,977.3 | 7,979.8 | 0.00 | 0.00 | 0.00 |
| 15,300.0 | 90.41 | 90.00 | 6,558.7 | -197.6 | 8,077.3 | 8,079.7 | 0.00 | 0.00 | 0.00 |
| 15,400.0 | 90.41 | 90.00 | 6,558.0 | -197.6 | 8,177.3 | 8,179.7 | 0.00 | 0.00 | 0.00 |
| 15,500.0 | 90.41 | 90.00 | 6,557.3 | -197.6 | 8,277.3 | 8,279.7 | 0.00 | 0.00 | 0.00 |
| 15,600.0 | 90.41 | 90.00 | 6,556.5 | -197.6 | 8,377.3 | 8,379.6 | 0.00 | 0.00 | 0.00 |
| 15,700.0 | 90.41 | 90.00 | 6,555.8 | -197.6 | 8,477.3 | 8,479.6 | 0.00 | 0.00 | 0.00 |
| 15,800.0 | 90.41 | 90.00 | 6,555.1 | -197.6 | 8,577.3 | 8,579.6 | 0.00 | 0.00 | 0.00 |
| 15,900.0 | 90.41 | 90.00 | 6,554.4 | -197.6 | 8,677.3 | 8,679.6 | 0.00 | 0.00 | 0.00 |
| 16,000.0 | 90.41 | 90.00 | 6,553.7 | -197.6 | 8,777.3 | 8,779.5 | 0.00 | 0.00 | 0.00 |
| 16,100.0 | 90.41 | 90.00 | 6,553.0 | -197.6 | 8,877.3 | 8,879.5 | 0.00 | 0.00 | 0.00 |
| 16,200.0 | 90.41 | 90.00 | 6,552.2 | -197.6 | 8,977.3 | 8,979.5 | 0.00 | 0.00 | 0.00 |
| 16,234.4 | 90.41 | 90.00 | 6,552.0 | -197.6 | 9,011.7 | 9,013.9 | 0.00 | 0.00 | 0.00 |

**TD at 16234.4 - BHL 1265'FNL, 500'FEL, SEC.17**

**Design Targets**

| Target Name - hit/miss target - Shape | Dip Angle (°) | Dip Dir. (°) | TVD (ft) | +N/-S (ft) | +E/-W (ft) | Northing (usft) | Easting (usft) | Latitude | Longitude |
|---|---|---|---|---|---|---|---|---|---|
| SHL 1001'FNL, 893'FWL<br>- plan hits target center<br>- Point | 0.00 | 0.00 | 1.0 | 0.0 | 0.0 | 1,391,153.93 | 3,251,028.18 | 40.403617 | -104.598612 |
| BHL 1265'FNL, 500'FEL<br>- plan hits target center<br>- Point | 0.00 | 0.00 | 6,552.0 | -197.6 | 9,011.7 | 1,391,047.91 | 3,260,041.07 | 40.403070 | -104.566255 |

**Casing Points**

| Measured Depth (ft) | Vertical Depth (ft) | Name | Casing Diameter (") | Hole Diameter (") |
|---|---|---|---|---|
| 7,148.9 | 6,617.0 | 7" | 7 | 8-3/4 |

| | | | |
|---|---|---|---|
| **Database:** | US_EDM | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Project:** | SEC.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **North Reference:** | True |
| **Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Wellbore:** | Wellbore #1 | | |
| **Design:** | Plan #1 (12-16-15) | | |

**Formations**

| Measured Depth (ft) | Vertical Depth (ft) | Name | Lithology | Dip (°) | Dip Direction (°) |
|---|---|---|---|---|---|
| 3,533.6 | 3,490.0 | Parkman | | 0.00 | |
| 4,273.1 | 4,210.0 | Sussex | | 0.00 | |
| 6,797.4 | 6,540.0 | Sharon Springs | | 0.00 | |
| 7,039.7 | 6,610.0 | Niobrara A | | 0.00 | |

**Plan Annotations**

| Measured Depth (ft) | Vertical Depth (ft) | Local Coordinates +N/-S (ft) | Local Coordinates +E/-W (ft) | Comment |
|---|---|---|---|---|
| 1,000.0 | 1,000.0 | 0.0 | 0.0 | KOP - Start Build 1.00 |
| 5,011.4 | 4,928.9 | -34.5 | -147.0 | Start Drop -1.50 |
| 5,890.3 | 5,800.0 | -174.6 | -745.0 | Start 53.1 hold at 5890.3 MD |
| 5,943.4 | 5,853.1 | -197.6 | -843.0 | Start Build 7.50 |
| 7,148.9 | 6,617.0 | -197.6 | -843.0 | Start 9085.5 hold at 7148.9 MD |
| 16,234.4 | 6,552.0 | -197.6 | -73.6 | TD at 16234.4 |

ENSIGN Directional

# PETROLEUM DEVELOPMENT CORP DJ Basin

**SEC.18-T5N-R64W**
**Hop 5N64W18A Pad Sec.18-T5N-R64W**
**Hop 18F-102**

**Wellbore #1**
**Plan #1 (12-16-15)**

# Anticollision Report

**21 December, 2015**

PDC ENERGY
Growing E&P Value

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Reference** Plan #1 (12-16-15)

| | | | |
|---|---|---|---|
| **Filter type:** | NO GLOBAL FILTER: Using user defined selection & filtering criteria | | |
| **Interpolation Method:** | Stations | **Error Model:** | ISCWSA |
| **Depth Range:** | Unlimited | **Scan Method:** | Closest Approach 3D |
| **Results Limited by:** | Maximum center-center distance of 500.0 ft | **Error Surface:** | Elliptical Conic |
| **Warning Levels Evaluated at:** | 2.00 **Sigma** | **Casing Method:** | Not applied |

**Survey Tool Program** **Date** 12/21/2015

| From (ft) | To (ft) | Survey (Wellbore) | Tool Name | Description |
|---|---|---|---|---|
| 0.0 | 16,234.4 | Plan #1 (12-16-15) (Wellbore #1) | MWD | MWD - Standard |

**Summary**

| Site Name / Offset Well - Wellbore - Design | Reference Measured Depth (ft) | Offset Measured Depth (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|
| Existing Wells - Sec.17 & 18-T5N-R64W | | | | | | |
| Bright 1 (SI) - Wellbore #1 - Wellbore #1 | 2,849.0 | 2,814.9 | 470.3 | 457.1 | 35.509 | CC |
| Bright 1 (SI) - Wellbore #1 - Wellbore #1 | 2,900.0 | 2,864.3 | 470.5 | 457.0 | 34.762 | ES |
| Bright 1 (SI) - Wellbore #1 - Wellbore #1 | 3,500.0 | 3,442.3 | 498.1 | 481.2 | 29.550 | SF |
| Bright 2 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Bright/Dunn 18D (Exist) - Wellbore #1 - Wellbore #1 | 7,626.0 | 6,599.6 | 50.4 | 6.1 | 1.138 | Level 2, CC, ES, SF |
| Dunn 1- Cache (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Dunn 22-18 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Gunther 18-1 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Gunther 18-2 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Gunther B 18-1 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Gunther -PM B 18-07 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Hoshiko 31-17 (Exist) - Wellbore #1 - Wellbore #1 | 14,858.0 | 6,547.8 | 441.9 | 200.4 | 1.830 | CC, ES |
| Hoshiko 31-17 (Exist) - Wellbore #1 - Wellbore #1 | 14,900.0 | 6,547.8 | 443.9 | 201.2 | 1.829 | SF |
| Hoshiko 32-17 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Hoshiko 41-17 (Exist) - Wellbore #1 - Wellbore #1 | 15,998.0 | 6,524.2 | 484.4 | 211.1 | 1.772 | CC |
| Hoshiko 41-17 (Exist) - Wellbore #1 - Wellbore #1 | 16,000.0 | 6,524.2 | 484.4 | 211.0 | 1.772 | ES, SF |
| Hoshiko 42-17 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Puype B 18-17 (Exist) - Wellbore #1 - Wellbore #1 | 10,137.4 | 6,576.6 | 83.1 | -146.9 | 0.361 | Level 1, CC, ES, SF |
| Schaumberg 1 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Schaumberg 12-17 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Steinmetz 1 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Steinmetz 21-17 (Exist) - Wellbore #1 - Wellbore #1 | | | | | | Out of range |
| Hop 5N64W18A Pad Sec.18-T5N-R64W | | | | | | |
| Hop 18E-232 - Wellbore #1 - Plan #1 (12-16-15) | 400.0 | 400.0 | 45.1 | 43.5 | 28.677 | CC, ES |
| Hop 18E-232 - Wellbore #1 - Plan #1 (12-16-15) | 900.0 | 895.8 | 63.2 | 59.3 | 16.485 | SF |
| Hop 18E-332 - Wellbore #1 - Plan #1 (12-16-15) | 600.0 | 600.0 | 30.1 | 27.6 | 12.166 | CC, ES |
| Hop 18E-332 - Wellbore #1 - Plan #1 (12-16-15) | 900.0 | 898.4 | 37.1 | 33.3 | 9.765 | SF |
| Hop 18E-402 - Wellbore #1 - Plan #1 (12-16-15) | 200.0 | 200.0 | 59.9 | 59.2 | 88.804 | CC, ES |
| Hop 18E-402 - Wellbore #1 - Plan #1 (12-16-15) | 1,000.0 | 989.4 | 105.0 | 100.5 | 23.571 | SF |
| Hop 18F-212 - Wellbore #1 - Plan #1 (12-16-15) | 800.0 | 800.0 | 15.0 | 11.7 | 4.461 | CC |
| Hop 18F-212 - Wellbore #1 - Plan #1 (12-16-15) | 16,234.4 | 16,346.6 | 259.5 | -230.3 | 0.530 | Level 1, ES, SF |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Existing Wells - Sec.17 & 18-T5N-R64W - Bright 1 (SI) - Wellbore #1 - Wellbore #1

**Offset Site Error:** 0.0 ft

**Survey Program:** 100-NS-GYRO-MS

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,100.0 | 2,093.3 | 2,081.8 | 2,081.6 | 4.9 | 4.7 | 74.80 | 411.8 | -341.6 | 497.2 | 487.6 | 9.53 | 52.182 | |
| 2,200.0 | 2,191.2 | 2,180.5 | 2,180.3 | 5.3 | 4.7 | 76.99 | 410.6 | -341.9 | 491.2 | 481.3 | 9.93 | 49.452 | |
| 2,300.0 | 2,288.9 | 2,278.6 | 2,278.3 | 5.7 | 4.7 | 79.44 | 409.5 | -341.8 | 485.6 | 475.2 | 10.37 | 46.824 | |
| 2,318.3 | 2,306.7 | 2,296.4 | 2,296.2 | 5.7 | 4.7 | 79.92 | 409.3 | -341.7 | 484.6 | 474.2 | 10.45 | 46.357 | |
| 2,400.0 | 2,386.2 | 2,376.3 | 2,376.1 | 6.1 | 4.8 | 82.03 | 408.4 | -341.6 | 480.7 | 469.8 | 10.84 | 44.326 | |
| 2,500.0 | 2,483.6 | 2,473.9 | 2,473.6 | 6.5 | 4.8 | 84.65 | 407.1 | -341.4 | 476.7 | 465.3 | 11.34 | 42.020 | |
| 2,600.0 | 2,581.0 | 2,572.0 | 2,571.7 | 7.0 | 4.9 | 87.29 | 405.8 | -341.5 | 473.7 | 461.8 | 11.87 | 39.904 | |
| 2,700.0 | 2,678.3 | 2,669.8 | 2,669.5 | 7.4 | 5.0 | 89.93 | 404.2 | -341.6 | 471.6 | 459.2 | 12.41 | 37.984 | |
| 2,800.0 | 2,775.7 | 2,767.3 | 2,767.0 | 7.9 | 5.1 | 92.58 | 402.6 | -341.7 | 470.5 | 457.5 | 12.97 | 36.273 | |
| 2,849.0 | 2,823.4 | 2,814.9 | 2,814.6 | 8.1 | 5.2 | 93.88 | 401.9 | -341.8 | 470.3 | 457.1 | 13.25 | 35.509 | CC |
| 2,900.0 | 2,873.1 | 2,864.3 | 2,864.0 | 8.3 | 5.2 | 95.22 | 401.1 | -341.9 | 470.5 | 457.0 | 13.54 | 34.762 | ES |
| 3,000.0 | 2,970.4 | 2,960.3 | 2,960.0 | 8.8 | 5.4 | 97.80 | 399.8 | -342.3 | 471.8 | 457.7 | 14.11 | 33.428 | |
| 3,100.0 | 3,067.8 | 3,055.6 | 3,055.3 | 9.3 | 5.5 | 100.32 | 398.8 | -342.9 | 474.5 | 459.8 | 14.70 | 32.272 | |
| 3,200.0 | 3,165.2 | 3,151.4 | 3,151.1 | 9.7 | 5.7 | 102.86 | 398.3 | -343.2 | 478.6 | 463.3 | 15.28 | 31.315 | |
| 3,300.0 | 3,262.5 | 3,248.0 | 3,247.7 | 10.2 | 5.8 | 105.40 | 397.9 | -343.3 | 484.0 | 468.2 | 15.84 | 30.560 | |
| 3,400.0 | 3,359.9 | 3,344.9 | 3,344.6 | 10.7 | 6.0 | 107.92 | 397.8 | -343.1 | 490.5 | 474.2 | 16.36 | 29.992 | |
| 3,500.0 | 3,457.3 | 3,442.3 | 3,442.0 | 11.2 | 6.1 | 110.39 | 397.6 | -342.8 | 498.1 | 481.2 | 16.85 | 29.550 | SF |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Existing Wells - Sec.17 & 18-T5N-R64W - Bright/Dunn 18D (Exist) - Wellbore #1 - Wellbore #1

**Offset Site Error:** 0.0 ft

**Survey Program:** 100-NS-GYRO-MS

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 3.0 | 3.0 | 0.0 | 0.0 | 118.88 | -237.5 | 430.6 | 492.1 | | | | |
| 100.0 | 100.0 | 80.7 | 80.7 | 0.1 | 0.1 | 118.90 | -237.9 | 430.8 | 492.1 | 491.9 | 0.22 | 2,282.447 | |
| 200.0 | 200.0 | 182.1 | 182.1 | 0.3 | 0.3 | 118.98 | -238.8 | 431.3 | 493.0 | 492.3 | 0.68 | 723.114 | |
| 300.0 | 300.0 | 283.1 | 283.1 | 0.6 | 0.6 | 119.04 | -239.5 | 431.4 | 493.4 | 492.3 | 1.17 | 421.321 | |
| 400.0 | 400.0 | 384.7 | 384.7 | 0.8 | 0.9 | 119.10 | -240.1 | 431.4 | 493.7 | 492.0 | 1.65 | 299.516 | |
| 500.0 | 500.0 | 485.7 | 485.7 | 1.0 | 1.1 | 119.14 | -240.3 | 431.2 | 493.6 | 491.5 | 2.08 | 236.754 | |
| 600.0 | 600.0 | 586.2 | 586.1 | 1.2 | 1.2 | 119.14 | -240.3 | 431.0 | 493.4 | 491.0 | 2.43 | 203.442 | |
| 700.0 | 700.0 | 686.0 | 685.9 | 1.5 | 1.2 | 119.10 | -239.9 | 430.9 | 493.2 | 490.5 | 2.71 | 182.099 | |
| 800.0 | 800.0 | 785.2 | 785.2 | 1.7 | 1.3 | 119.06 | -239.5 | 431.0 | 493.1 | 490.1 | 3.02 | 163.111 | |
| 814.9 | 814.9 | 800.0 | 800.0 | 1.7 | 1.4 | 119.05 | -239.4 | 431.1 | 493.1 | 490.0 | 3.07 | 160.572 | |
| 900.0 | 900.0 | 883.1 | 883.1 | 1.9 | 1.5 | 119.00 | -239.1 | 431.4 | 493.3 | 489.9 | 3.38 | 145.872 | |
| 1,000.0 | 1,000.0 | 981.8 | 981.8 | 2.1 | 1.6 | 118.94 | -238.9 | 432.1 | 493.8 | 490.0 | 3.78 | 130.666 | |
| 1,100.0 | 1,100.0 | 1,082.1 | 1,082.0 | 2.3 | 1.8 | -138.00 | -238.7 | 433.0 | 495.1 | 490.9 | 4.19 | 118.291 | |
| 1,200.0 | 1,200.0 | 1,182.0 | 1,182.0 | 2.5 | 2.1 | -138.24 | -238.6 | 433.7 | 497.6 | 493.0 | 4.59 | 108.315 | |
| 7,148.9 | 6,617.0 | 6,606.4 | 6,605.6 | 23.8 | 11.6 | 97.92 | -248.0 | 403.5 | 479.8 | 444.9 | 34.90 | 13.745 | |
| 7,200.0 | 6,616.6 | 6,605.6 | 6,604.9 | 24.6 | 11.6 | 97.11 | -248.0 | 403.5 | 429.0 | 393.2 | 35.75 | 12.000 | |
| 7,300.0 | 6,615.9 | 6,604.2 | 6,603.5 | 26.2 | 11.5 | 95.51 | -248.0 | 403.5 | 329.9 | 292.3 | 37.54 | 8.786 | |
| 7,400.0 | 6,615.2 | 6,602.8 | 6,602.0 | 28.1 | 11.5 | 93.90 | -248.0 | 403.5 | 231.6 | 192.1 | 39.50 | 5.862 | |
| 7,500.0 | 6,614.5 | 6,601.4 | 6,600.6 | 30.1 | 11.5 | 92.28 | -248.0 | 403.5 | 135.7 | 94.1 | 41.58 | 3.264 | |
| 7,600.0 | 6,613.8 | 6,599.9 | 6,599.2 | 32.2 | 11.5 | 90.65 | -248.0 | 403.6 | 56.8 | 13.0 | 43.76 | 1.297 | Level 3 |
| 7,626.0 | 6,613.6 | 6,599.6 | 6,598.8 | 32.8 | 11.5 | 90.22 | -248.1 | 403.6 | 50.4 | 6.1 | 44.34 | 1.138 | Level 2, CC, ES, SF |
| 7,700.0 | 6,613.1 | 6,598.5 | 6,597.7 | 34.5 | 11.5 | 89.02 | -248.1 | 403.6 | 89.5 | 43.5 | 45.99 | 1.947 | |
| 7,800.0 | 6,612.4 | 6,597.1 | 6,596.3 | 36.8 | 11.5 | 87.39 | -248.1 | 403.6 | 181.1 | 132.9 | 48.27 | 3.752 | |
| 7,900.0 | 6,611.6 | 6,595.6 | 6,594.9 | 39.1 | 11.5 | 85.78 | -248.1 | 403.6 | 278.6 | 228.0 | 50.58 | 5.507 | |
| 8,000.0 | 6,610.9 | 6,594.2 | 6,593.4 | 41.6 | 11.5 | 84.17 | -248.1 | 403.6 | 377.3 | 324.4 | 52.89 | 7.134 | |
| 8,100.0 | 6,610.2 | 6,592.8 | 6,592.0 | 44.0 | 11.5 | 82.57 | -248.1 | 403.6 | 476.6 | 421.4 | 55.20 | 8.635 | |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Existing Wells - Sec.17 & 18-T5N-R64W - Hoshiko 31-17 (Exist) - Wellbore #1 - Wellbore #1

**Offset Site Error:** 0.0 ft

**Survey Program:** 100-NS-GYRO-MS

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14,700.0 | 6,563.0 | 6,547.6 | 6,546.1 | 225.5 | 11.6 | -89.90 | 244.3 | 7,635.4 | 469.3 | 232.2 | 237.05 | 1.980 | |
| 14,800.0 | 6,562.3 | 6,547.7 | 6,546.2 | 228.3 | 11.6 | -89.91 | 244.3 | 7,635.4 | 445.7 | 205.8 | 239.84 | 1.858 | |
| 14,858.0 | 6,561.8 | 6,547.8 | 6,546.3 | 229.9 | 11.6 | -89.92 | 244.3 | 7,635.4 | 441.9 | 200.4 | 241.47 | 1.830 | CC, ES |
| 14,900.0 | 6,561.5 | 6,547.8 | 6,546.3 | 231.1 | 11.6 | -89.93 | 244.3 | 7,635.4 | 443.9 | 201.2 | 242.64 | 1.829 | SF |
| 15,000.0 | 6,560.8 | 6,547.9 | 6,546.4 | 233.9 | 11.6 | -89.95 | 244.3 | 7,635.4 | 464.1 | 218.7 | 245.44 | 1.891 | |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Existing Wells - Sec.17 & 18-T5N-R64W - Hoshiko 41-17 (Exist) - Wellbore #1 - Wellbore #1

**Offset Site Error:** 0.0 ft

**Survey Program:** 100-NS-GYRO-MS

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 15,900.0 | 6,554.4 | 6,522.0 | 6,521.2 | 259.1 | 11.5 | -89.47 | 286.8 | 8,775.2 | 494.2 | 223.6 | 270.62 | 1.826 | |
| 15,998.0 | 6,553.7 | 6,524.2 | 6,523.4 | 261.9 | 11.5 | -89.73 | 286.8 | 8,775.3 | 484.4 | 211.1 | 273.37 | 1.772 | CC |
| 16,000.0 | 6,553.7 | 6,524.2 | 6,523.4 | 261.9 | 11.5 | -89.73 | 286.8 | 8,775.3 | 484.4 | 211.0 | 273.43 | 1.772 | ES, SF |
| 16,100.0 | 6,553.0 | 6,526.4 | 6,525.6 | 264.7 | 11.5 | -89.99 | 286.8 | 8,775.4 | 495.0 | 218.8 | 276.24 | 1.792 | |

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Existing Wells - Sec.17 & 18-T5N-R64W - Puype B 18-17 (Exist) - Wellbore #1 - Wellbore #1

**Offset Site Error:** 0.0 ft

**Survey Program:** 7055-UNKNOWN

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9,700.0 | 6,598.8 | 6,579.8 | 6,579.8 | 86.5 | 131.6 | 92.16 | -280.7 | 2,914.9 | 445.2 | 227.3 | 217.92 | 2.043 | |
| 9,800.0 | 6,598.0 | 6,579.0 | 6,579.0 | 89.2 | 131.6 | 91.66 | -280.7 | 2,914.9 | 347.5 | 126.8 | 220.71 | 1.574 | |
| 9,900.0 | 6,597.3 | 6,578.3 | 6,578.3 | 92.0 | 131.6 | 91.17 | -280.7 | 2,914.9 | 251.5 | 28.1 | 223.48 | 1.126 | Level 2 |
| 10,000.0 | 6,596.6 | 6,577.6 | 6,577.6 | 94.7 | 131.6 | 90.68 | -280.7 | 2,914.9 | 160.6 | -65.7 | 226.24 | 0.710 | Level 1 |
| 10,100.0 | 6,595.9 | 6,576.9 | 6,576.9 | 97.5 | 131.5 | 90.18 | -280.7 | 2,914.9 | 91.1 | -137.9 | 228.99 | 0.398 | Level 1 |
| 10,137.4 | 6,595.6 | 6,576.6 | 6,576.6 | 98.5 | 131.5 | 90.00 | -280.7 | 2,914.9 | 83.1 | -146.9 | 230.01 | 0.361 | Level 1, CC, ES, SF |
| 10,200.0 | 6,595.2 | 6,576.2 | 6,576.2 | 100.2 | 131.5 | 89.69 | -280.7 | 2,914.9 | 104.0 | -127.7 | 231.72 | 0.449 | Level 1 |
| 10,300.0 | 6,594.5 | 6,575.5 | 6,575.5 | 103.0 | 131.5 | 89.20 | -280.7 | 2,914.9 | 182.6 | -51.9 | 234.45 | 0.779 | Level 1 |
| 10,400.0 | 6,593.7 | 6,574.7 | 6,574.7 | 105.7 | 131.5 | 88.70 | -280.7 | 2,914.9 | 275.4 | 38.3 | 237.15 | 1.161 | Level 2 |
| 10,500.0 | 6,593.0 | 6,574.0 | 6,574.0 | 108.5 | 131.5 | 88.21 | -280.7 | 2,914.9 | 372.0 | 132.1 | 239.85 | 1.551 | |
| 10,600.0 | 6,592.3 | 6,573.3 | 6,573.3 | 111.2 | 131.5 | 87.72 | -280.7 | 2,914.9 | 470.0 | 227.5 | 242.52 | 1.938 | |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18E-232 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -89.52 | 0.4 | -45.1 | 45.1 | | | | |
| 100.0 | 100.0 | 100.0 | 100.0 | 0.1 | 0.1 | -89.52 | 0.4 | -45.1 | 45.1 | 44.9 | 0.22 | 200.741 | |
| 200.0 | 200.0 | 200.0 | 200.0 | 0.3 | 0.3 | -89.52 | 0.4 | -45.1 | 45.1 | 44.4 | 0.67 | 66.914 | |
| 300.0 | 300.0 | 300.0 | 300.0 | 0.6 | 0.6 | -89.52 | 0.4 | -45.1 | 45.1 | 44.0 | 1.12 | 40.148 | |
| 400.0 | 400.0 | 400.0 | 400.0 | 0.8 | 0.8 | -89.52 | 0.4 | -45.1 | 45.1 | 43.5 | 1.57 | 28.677 | CC, ES |
| 500.0 | 500.0 | 499.4 | 499.4 | 1.0 | 1.0 | -88.82 | 0.9 | -45.8 | 45.8 | 43.8 | 2.02 | 22.693 | |
| 600.0 | 600.0 | 598.7 | 598.7 | 1.2 | 1.2 | -86.84 | 2.6 | -47.7 | 47.8 | 45.4 | 2.46 | 19.426 | |
| 700.0 | 700.0 | 697.9 | 697.8 | 1.5 | 1.4 | -83.90 | 5.5 | -51.0 | 51.3 | 48.4 | 2.91 | 17.630 | |
| 800.0 | 800.0 | 797.0 | 796.7 | 1.7 | 1.7 | -80.40 | 9.4 | -55.5 | 56.4 | 53.0 | 3.37 | 16.752 | |
| 900.0 | 900.0 | 895.8 | 895.2 | 1.9 | 1.9 | -76.76 | 14.4 | -61.3 | 63.2 | 59.3 | 3.83 | 16.485 | SF |
| 1,000.0 | 1,000.0 | 994.3 | 993.2 | 2.1 | 2.2 | -73.27 | 20.6 | -68.4 | 71.7 | 67.4 | 4.31 | 16.640 | |
| 1,100.0 | 1,100.0 | 1,092.5 | 1,090.8 | 2.3 | 2.4 | 33.37 | 27.8 | -76.7 | 81.4 | 76.7 | 4.69 | 17.339 | |
| 1,200.0 | 1,200.0 | 1,190.4 | 1,187.9 | 2.5 | 2.7 | 37.02 | 36.0 | -86.2 | 91.5 | 86.3 | 5.12 | 17.879 | |
| 1,300.0 | 1,299.9 | 1,288.0 | 1,284.5 | 2.7 | 3.0 | 40.76 | 45.4 | -97.0 | 102.2 | 96.7 | 5.55 | 18.427 | |
| 1,400.0 | 1,399.7 | 1,385.3 | 1,380.5 | 3.0 | 3.4 | 44.49 | 55.7 | -109.0 | 113.7 | 107.8 | 5.99 | 19.002 | |
| 1,500.0 | 1,499.4 | 1,482.2 | 1,475.8 | 3.2 | 3.7 | 48.15 | 67.1 | -122.1 | 126.2 | 119.8 | 6.44 | 19.606 | |
| 1,600.0 | 1,598.9 | 1,578.7 | 1,570.4 | 3.4 | 4.1 | 51.69 | 79.5 | -136.4 | 139.7 | 132.8 | 6.91 | 20.236 | |
| 1,700.0 | 1,698.3 | 1,674.7 | 1,664.2 | 3.7 | 4.5 | 55.05 | 92.9 | -151.8 | 154.4 | 147.0 | 7.40 | 20.875 | |
| 1,800.0 | 1,797.4 | 1,770.3 | 1,757.2 | 3.9 | 4.9 | 58.23 | 107.2 | -168.3 | 170.3 | 162.4 | 7.92 | 21.512 | |
| 1,900.0 | 1,896.3 | 1,868.0 | 1,852.2 | 4.2 | 5.4 | 61.33 | 122.5 | -186.0 | 186.9 | 178.4 | 8.48 | 22.042 | |
| 2,000.0 | 1,994.9 | 1,966.1 | 1,947.4 | 4.5 | 5.8 | 64.34 | 137.9 | -203.7 | 203.2 | 194.1 | 9.08 | 22.380 | |
| 2,100.0 | 2,093.3 | 2,064.1 | 2,042.6 | 4.9 | 6.3 | 67.29 | 153.2 | -221.4 | 219.3 | 209.6 | 9.73 | 22.548 | |
| 2,200.0 | 2,191.2 | 2,162.1 | 2,137.7 | 5.3 | 6.8 | 70.21 | 168.5 | -239.0 | 235.5 | 225.0 | 10.43 | 22.578 | |
| 2,300.0 | 2,288.9 | 2,259.9 | 2,232.7 | 5.7 | 7.2 | 73.10 | 183.9 | -256.7 | 251.7 | 240.5 | 11.19 | 22.498 | |
| 2,318.3 | 2,306.7 | 2,277.8 | 2,250.0 | 5.7 | 7.3 | 73.63 | 186.7 | -259.9 | 254.7 | 243.3 | 11.33 | 22.474 | |
| 2,400.0 | 2,386.2 | 2,357.6 | 2,327.6 | 6.1 | 7.7 | 75.99 | 199.2 | -274.3 | 268.2 | 256.2 | 12.00 | 22.360 | |
| 2,500.0 | 2,483.6 | 2,455.4 | 2,422.5 | 6.5 | 8.2 | 78.57 | 214.5 | -292.0 | 285.4 | 272.6 | 12.83 | 22.241 | |
| 2,600.0 | 2,581.0 | 2,553.1 | 2,517.4 | 7.0 | 8.7 | 80.85 | 229.8 | -309.6 | 303.0 | 289.4 | 13.69 | 22.140 | |
| 2,700.0 | 2,678.3 | 2,650.8 | 2,612.3 | 7.4 | 9.2 | 82.89 | 245.1 | -327.3 | 321.1 | 306.6 | 14.56 | 22.058 | |
| 2,800.0 | 2,775.7 | 2,748.6 | 2,707.2 | 7.9 | 9.7 | 84.71 | 260.4 | -344.9 | 339.6 | 324.1 | 15.44 | 21.991 | |
| 2,900.0 | 2,873.1 | 2,846.3 | 2,802.1 | 8.3 | 10.1 | 86.34 | 275.7 | -362.6 | 358.3 | 342.0 | 16.33 | 21.937 | |
| 3,000.0 | 2,970.4 | 2,944.1 | 2,897.0 | 8.8 | 10.6 | 87.82 | 291.0 | -380.2 | 377.3 | 360.1 | 17.23 | 21.896 | |
| 3,100.0 | 3,067.8 | 3,041.8 | 2,991.9 | 9.3 | 11.1 | 89.15 | 306.3 | -397.9 | 396.5 | 378.4 | 18.14 | 21.863 | |
| 3,200.0 | 3,165.2 | 3,139.5 | 3,086.8 | 9.7 | 11.6 | 90.35 | 321.6 | -415.5 | 415.9 | 396.9 | 19.04 | 21.839 | |
| 3,300.0 | 3,262.5 | 3,237.3 | 3,181.7 | 10.2 | 12.1 | 91.45 | 336.9 | -433.1 | 435.5 | 415.5 | 19.95 | 21.822 | |
| 3,400.0 | 3,359.9 | 3,335.0 | 3,276.7 | 10.7 | 12.6 | 92.46 | 352.2 | -450.8 | 455.2 | 434.3 | 20.87 | 21.811 | |
| 3,500.0 | 3,457.3 | 3,432.7 | 3,371.6 | 11.2 | 13.1 | 93.38 | 367.5 | -468.4 | 475.0 | 453.2 | 21.78 | 21.804 | |
| 3,600.0 | 3,554.6 | 3,530.5 | 3,466.5 | 11.7 | 13.6 | 94.23 | 382.8 | -486.1 | 494.9 | 472.2 | 22.70 | 21.801 | |

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18E-332 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -89.97 | 0.0 | -30.1 | 30.1 | | | | |
| 100.0 | 100.0 | 100.0 | 100.0 | 0.1 | 0.1 | -89.97 | 0.0 | -30.1 | 30.1 | 29.9 | 0.22 | 133.823 | |
| 200.0 | 200.0 | 200.0 | 200.0 | 0.3 | 0.3 | -89.97 | 0.0 | -30.1 | 30.1 | 29.4 | 0.67 | 44.608 | |
| 300.0 | 300.0 | 300.0 | 300.0 | 0.6 | 0.6 | -89.97 | 0.0 | -30.1 | 30.1 | 29.0 | 1.12 | 26.765 | |
| 400.0 | 400.0 | 400.0 | 400.0 | 0.8 | 0.8 | -89.97 | 0.0 | -30.1 | 30.1 | 28.5 | 1.57 | 19.118 | |
| 500.0 | 500.0 | 500.0 | 500.0 | 1.0 | 1.0 | -89.97 | 0.0 | -30.1 | 30.1 | 28.1 | 2.02 | 14.869 | |
| 600.0 | 600.0 | 600.0 | 600.0 | 1.2 | 1.2 | -89.97 | 0.0 | -30.1 | 30.1 | 27.6 | 2.47 | 12.166 | CC, ES |
| 700.0 | 700.0 | 699.5 | 699.5 | 1.5 | 1.5 | -89.18 | 0.4 | -30.8 | 30.8 | 27.9 | 2.91 | 10.582 | |
| 800.0 | 800.0 | 799.0 | 799.0 | 1.7 | 1.7 | -87.05 | 1.7 | -33.1 | 33.2 | 29.8 | 3.35 | 9.885 | |
| 900.0 | 900.0 | 898.4 | 898.2 | 1.9 | 1.9 | -84.09 | 3.8 | -36.9 | 37.1 | 33.3 | 3.80 | 9.765 | SF |
| 1,000.0 | 1,000.0 | 997.5 | 997.2 | 2.1 | 2.1 | -80.88 | 6.8 | -42.1 | 42.7 | 38.5 | 4.25 | 10.054 | |
| 1,100.0 | 1,100.0 | 1,096.5 | 1,095.9 | 2.3 | 2.4 | 25.76 | 10.5 | -48.8 | 49.3 | 44.7 | 4.66 | 10.579 | |
| 1,200.0 | 1,200.0 | 1,195.3 | 1,194.3 | 2.5 | 2.6 | 29.64 | 15.1 | -57.0 | 56.2 | 51.2 | 5.08 | 11.071 | |
| 1,300.0 | 1,299.9 | 1,294.0 | 1,292.3 | 2.7 | 2.9 | 33.74 | 20.5 | -66.7 | 63.6 | 58.1 | 5.50 | 11.553 | |
| 1,400.0 | 1,399.7 | 1,392.4 | 1,389.8 | 3.0 | 3.1 | 37.92 | 26.8 | -77.8 | 71.5 | 65.6 | 5.94 | 12.048 | |
| 1,500.0 | 1,499.4 | 1,490.5 | 1,487.0 | 3.2 | 3.4 | 42.06 | 33.8 | -90.3 | 80.2 | 73.8 | 6.38 | 12.565 | |
| 1,600.0 | 1,598.9 | 1,588.4 | 1,583.5 | 3.4 | 3.8 | 46.08 | 41.6 | -104.3 | 89.7 | 82.9 | 6.85 | 13.103 | |
| 1,700.0 | 1,698.3 | 1,686.1 | 1,679.6 | 3.7 | 4.1 | 49.91 | 50.2 | -119.6 | 100.1 | 92.8 | 7.33 | 13.655 | |
| 1,800.0 | 1,797.4 | 1,783.4 | 1,775.0 | 3.9 | 4.5 | 53.52 | 59.5 | -136.3 | 111.6 | 103.7 | 7.85 | 14.212 | |
| 1,900.0 | 1,896.3 | 1,881.4 | 1,870.8 | 4.2 | 4.9 | 56.95 | 69.7 | -154.4 | 123.9 | 115.5 | 8.41 | 14.731 | |
| 2,000.0 | 1,994.9 | 1,980.4 | 1,967.5 | 4.5 | 5.3 | 60.37 | 80.0 | -172.8 | 135.9 | 126.9 | 9.02 | 15.076 | |
| 2,100.0 | 2,093.3 | 2,079.3 | 2,064.2 | 4.9 | 5.7 | 63.81 | 90.3 | -191.2 | 147.6 | 137.9 | 9.67 | 15.258 | |
| 2,200.0 | 2,191.2 | 2,178.2 | 2,160.8 | 5.3 | 6.1 | 67.29 | 100.6 | -209.6 | 159.1 | 148.7 | 10.39 | 15.313 | |
| 2,300.0 | 2,288.9 | 2,277.0 | 2,257.3 | 5.7 | 6.6 | 70.83 | 110.9 | -228.0 | 170.5 | 159.4 | 11.17 | 15.271 | |
| 2,318.3 | 2,306.7 | 2,295.0 | 2,274.9 | 5.7 | 6.6 | 71.49 | 112.8 | -231.3 | 172.6 | 161.3 | 11.32 | 15.256 | |
| 2,400.0 | 2,386.2 | 2,375.7 | 2,353.7 | 6.1 | 7.0 | 74.34 | 121.2 | -246.3 | 182.3 | 170.3 | 12.00 | 15.190 | |
| 2,500.0 | 2,483.6 | 2,474.4 | 2,450.2 | 6.5 | 7.4 | 77.45 | 131.5 | -264.7 | 194.6 | 181.7 | 12.86 | 15.136 | |
| 2,600.0 | 2,581.0 | 2,573.1 | 2,546.6 | 7.0 | 7.9 | 80.18 | 141.8 | -283.0 | 207.4 | 193.7 | 13.73 | 15.105 | |
| 2,700.0 | 2,678.3 | 2,671.8 | 2,643.1 | 7.4 | 8.3 | 82.59 | 152.1 | -301.4 | 220.7 | 206.0 | 14.62 | 15.094 | |
| 2,800.0 | 2,775.7 | 2,770.6 | 2,739.5 | 7.9 | 8.8 | 84.73 | 162.4 | -319.8 | 234.3 | 218.7 | 15.52 | 15.097 | |
| 2,900.0 | 2,873.1 | 2,869.3 | 2,835.9 | 8.3 | 9.2 | 86.63 | 172.6 | -338.1 | 248.1 | 231.7 | 16.42 | 15.111 | |
| 3,000.0 | 2,970.4 | 2,968.0 | 2,932.4 | 8.8 | 9.7 | 88.33 | 182.9 | -356.5 | 262.2 | 244.9 | 17.33 | 15.134 | |
| 3,100.0 | 3,067.8 | 3,066.7 | 3,028.8 | 9.3 | 10.1 | 89.85 | 193.2 | -374.9 | 276.6 | 258.3 | 18.24 | 15.163 | |
| 3,200.0 | 3,165.2 | 3,165.4 | 3,125.3 | 9.7 | 10.6 | 91.23 | 203.5 | -393.2 | 291.1 | 271.9 | 19.15 | 15.196 | |
| 3,300.0 | 3,262.5 | 3,264.1 | 3,221.7 | 10.2 | 11.0 | 92.47 | 213.8 | -411.6 | 305.7 | 285.6 | 20.07 | 15.233 | |
| 3,400.0 | 3,359.9 | 3,362.8 | 3,318.2 | 10.7 | 11.5 | 93.60 | 224.1 | -429.9 | 320.5 | 299.5 | 20.98 | 15.272 | |
| 3,500.0 | 3,457.3 | 3,461.6 | 3,414.6 | 11.2 | 11.9 | 94.63 | 234.4 | -448.3 | 335.4 | 313.5 | 21.90 | 15.313 | |
| 3,600.0 | 3,554.6 | 3,560.3 | 3,511.0 | 11.7 | 12.4 | 95.58 | 244.7 | -466.7 | 350.3 | 327.5 | 22.82 | 15.354 | |
| 3,700.0 | 3,652.0 | 3,659.0 | 3,607.5 | 12.1 | 12.8 | 96.44 | 255.0 | -485.0 | 365.4 | 341.7 | 23.74 | 15.395 | |
| 3,800.0 | 3,749.4 | 3,757.7 | 3,703.9 | 12.6 | 13.3 | 97.24 | 265.3 | -503.4 | 380.6 | 355.9 | 24.65 | 15.437 | |
| 3,900.0 | 3,846.7 | 3,856.4 | 3,800.4 | 13.1 | 13.7 | 97.98 | 275.5 | -521.8 | 395.8 | 370.2 | 25.57 | 15.478 | |
| 4,000.0 | 3,944.1 | 3,955.1 | 3,896.8 | 13.6 | 14.2 | 98.66 | 285.8 | -540.1 | 411.0 | 384.5 | 26.49 | 15.518 | |
| 4,100.0 | 4,041.4 | 4,053.8 | 3,993.3 | 14.1 | 14.6 | 99.29 | 296.1 | -558.5 | 426.4 | 398.9 | 27.40 | 15.558 | |
| 4,200.0 | 4,138.8 | 4,152.5 | 4,089.7 | 14.6 | 15.1 | 99.88 | 306.4 | -576.8 | 441.7 | 413.4 | 28.32 | 15.597 | |
| 4,300.0 | 4,236.2 | 4,251.3 | 4,186.1 | 15.1 | 15.6 | 100.43 | 316.7 | -595.2 | 457.1 | 427.9 | 29.24 | 15.635 | |
| 4,400.0 | 4,333.5 | 4,350.0 | 4,282.6 | 15.6 | 16.0 | 100.95 | 327.0 | -613.6 | 472.6 | 442.4 | 30.16 | 15.672 | |
| 4,500.0 | 4,430.9 | 4,448.7 | 4,379.0 | 16.1 | 16.5 | 101.43 | 337.3 | -631.9 | 488.1 | 457.0 | 31.07 | 15.708 | |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18E-402 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference | | Offset | | Semi Major Axis | | | Offset Wellbore Centre | | Distance | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured Depth (ft) | Vertical Depth (ft) | Measured Depth (ft) | Vertical Depth (ft) | Reference (ft) | Offset (ft) | Highside Toolface (°) | +N/-S (ft) | +E/-W (ft) | Between Centres (ft) | Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -89.63 | 0.4 | -59.9 | 59.9 | | | | |
| 100.0 | 100.0 | 100.0 | 100.0 | 0.1 | 0.1 | -89.63 | 0.4 | -59.9 | 59.9 | 59.7 | 0.22 | 266.412 | |
| 200.0 | 200.0 | 200.0 | 200.0 | 0.3 | 0.3 | -89.63 | 0.4 | -59.9 | 59.9 | 59.2 | 0.67 | 88.804 | CC, ES |
| 300.0 | 300.0 | 299.3 | 299.3 | 0.6 | 0.6 | -89.02 | 1.0 | -60.4 | 60.5 | 59.3 | 1.12 | 53.985 | |
| 400.0 | 400.0 | 398.5 | 398.5 | 0.8 | 0.8 | -87.26 | 3.0 | -62.1 | 62.2 | 60.7 | 1.57 | 39.709 | |
| 500.0 | 500.0 | 497.7 | 497.5 | 1.0 | 1.0 | -84.55 | 6.2 | -65.0 | 65.3 | 63.3 | 2.02 | 32.337 | |
| 600.0 | 600.0 | 596.6 | 596.3 | 1.2 | 1.2 | -81.18 | 10.7 | -68.9 | 69.9 | 67.4 | 2.48 | 28.168 | |
| 700.0 | 700.0 | 695.3 | 694.7 | 1.5 | 1.5 | -77.45 | 16.5 | -74.0 | 76.0 | 73.0 | 2.95 | 25.756 | |
| 800.0 | 800.0 | 793.7 | 792.7 | 1.7 | 1.8 | -73.67 | 23.5 | -80.2 | 83.8 | 80.4 | 3.43 | 24.412 | |
| 900.0 | 900.0 | 891.8 | 890.1 | 1.9 | 2.0 | -70.04 | 31.7 | -87.4 | 93.5 | 89.6 | 3.94 | 23.760 | |
| 1,000.0 | 1,000.0 | 989.4 | 987.0 | 2.1 | 2.3 | -66.71 | 41.2 | -95.7 | 105.0 | 100.5 | 4.45 | 23.571 | SF |
| 1,100.0 | 1,100.0 | 1,086.7 | 1,083.2 | 2.3 | 2.6 | 39.65 | 51.8 | -105.1 | 117.7 | 112.9 | 4.75 | 24.774 | |
| 1,200.0 | 1,200.0 | 1,183.6 | 1,178.7 | 2.5 | 3.0 | 42.91 | 63.7 | -115.4 | 131.0 | 125.8 | 5.18 | 25.281 | |
| 1,300.0 | 1,299.9 | 1,280.0 | 1,273.6 | 2.7 | 3.3 | 46.19 | 76.7 | -126.8 | 145.1 | 139.5 | 5.62 | 25.821 | |
| 1,400.0 | 1,399.7 | 1,376.0 | 1,367.7 | 3.0 | 3.7 | 49.43 | 90.8 | -139.2 | 160.1 | 154.0 | 6.06 | 26.401 | |
| 1,500.0 | 1,499.4 | 1,471.4 | 1,461.0 | 3.2 | 4.1 | 52.60 | 106.0 | -152.6 | 176.1 | 169.6 | 6.52 | 27.021 | |
| 1,600.0 | 1,598.9 | 1,566.3 | 1,553.4 | 3.4 | 4.5 | 55.66 | 122.2 | -166.8 | 193.4 | 186.4 | 6.99 | 27.660 | |
| 1,700.0 | 1,698.3 | 1,661.0 | 1,645.2 | 3.7 | 5.0 | 58.58 | 139.6 | -182.1 | 211.8 | 204.3 | 7.48 | 28.304 | |
| 1,800.0 | 1,797.4 | 1,758.5 | 1,739.6 | 3.9 | 5.5 | 61.47 | 158.0 | -198.2 | 230.6 | 222.6 | 8.01 | 28.800 | |
| 1,900.0 | 1,896.3 | 1,856.0 | 1,834.0 | 4.2 | 6.0 | 64.25 | 176.3 | -214.3 | 249.3 | 240.7 | 8.56 | 29.104 | |
| 2,000.0 | 1,994.9 | 1,953.4 | 1,928.3 | 4.5 | 6.5 | 66.95 | 194.7 | -230.4 | 267.8 | 258.6 | 9.16 | 29.236 | |
| 2,100.0 | 2,093.3 | 2,050.7 | 2,022.5 | 4.9 | 7.0 | 69.60 | 213.0 | -246.5 | 286.3 | 276.5 | 9.80 | 29.217 | |
| 2,200.0 | 2,191.2 | 2,148.0 | 2,116.6 | 5.3 | 7.5 | 72.21 | 231.4 | -262.6 | 304.9 | 294.4 | 10.49 | 29.073 | |
| 2,300.0 | 2,288.9 | 2,245.0 | 2,210.6 | 5.7 | 8.0 | 74.79 | 249.6 | -278.7 | 323.6 | 312.4 | 11.23 | 28.828 | |
| 2,318.3 | 2,306.7 | 2,262.7 | 2,227.8 | 5.7 | 8.1 | 75.26 | 253.0 | -281.6 | 327.1 | 315.7 | 11.37 | 28.774 | |
| 2,400.0 | 2,386.2 | 2,342.0 | 2,304.4 | 6.1 | 8.5 | 77.40 | 267.9 | -294.7 | 342.8 | 330.8 | 12.01 | 28.531 | |
| 2,500.0 | 2,483.6 | 2,438.9 | 2,398.3 | 6.5 | 9.0 | 79.77 | 286.2 | -310.7 | 362.6 | 349.7 | 12.83 | 28.261 | |
| 2,600.0 | 2,581.0 | 2,535.9 | 2,492.1 | 7.0 | 9.5 | 81.90 | 304.4 | -326.8 | 382.9 | 369.3 | 13.67 | 28.020 | |
| 2,700.0 | 2,678.3 | 2,632.8 | 2,586.0 | 7.4 | 10.0 | 83.81 | 322.7 | -342.8 | 403.7 | 389.2 | 14.52 | 27.808 | |
| 2,800.0 | 2,775.7 | 2,729.8 | 2,679.8 | 7.9 | 10.5 | 85.54 | 341.0 | -358.8 | 425.0 | 409.6 | 15.38 | 27.621 | |
| 2,900.0 | 2,873.1 | 2,826.7 | 2,773.7 | 8.3 | 11.0 | 87.11 | 359.2 | -374.9 | 446.5 | 430.2 | 16.26 | 27.459 | |
| 3,000.0 | 2,970.4 | 2,923.6 | 2,867.6 | 8.8 | 11.5 | 88.53 | 377.5 | -390.9 | 468.3 | 451.2 | 17.14 | 27.318 | |
| 3,100.0 | 3,067.8 | 3,020.6 | 2,961.4 | 9.3 | 12.0 | 89.82 | 395.8 | -406.9 | 490.4 | 472.4 | 18.03 | 27.195 | |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18F-212 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -89.97 | 0.0 | -15.0 | 15.0 | 15.0 | 0.00 | N/A | |
| 100.0 | 100.0 | 100.0 | 100.0 | 0.1 | 0.1 | -89.97 | 0.0 | -15.0 | 15.0 | 14.8 | 0.22 | 66.911 | |
| 200.0 | 200.0 | 200.0 | 200.0 | 0.3 | 0.3 | -89.97 | 0.0 | -15.0 | 15.0 | 14.4 | 0.67 | 22.304 | |
| 300.0 | 300.0 | 300.0 | 300.0 | 0.6 | 0.6 | -89.97 | 0.0 | -15.0 | 15.0 | 13.9 | 1.12 | 13.382 | |
| 400.0 | 400.0 | 400.0 | 400.0 | 0.8 | 0.8 | -89.97 | 0.0 | -15.0 | 15.0 | 13.5 | 1.57 | 9.559 | |
| 500.0 | 500.0 | 500.0 | 500.0 | 1.0 | 1.0 | -89.97 | 0.0 | -15.0 | 15.0 | 13.0 | 2.02 | 7.435 | |
| 600.0 | 600.0 | 600.0 | 600.0 | 1.2 | 1.2 | -89.97 | 0.0 | -15.0 | 15.0 | 12.6 | 2.47 | 6.083 | |
| 700.0 | 700.0 | 700.0 | 700.0 | 1.5 | 1.5 | -89.97 | 0.0 | -15.0 | 15.0 | 12.1 | 2.92 | 5.147 | |
| 800.0 | 800.0 | 800.0 | 800.0 | 1.7 | 1.7 | -89.97 | 0.0 | -15.0 | 15.0 | 11.7 | 3.37 | 4.461 | CC |
| 900.0 | 900.0 | 899.7 | 899.7 | 1.9 | 1.9 | -89.83 | 0.0 | -15.9 | 15.9 | 12.1 | 3.81 | 4.178 | |
| 1,000.0 | 1,000.0 | 999.4 | 999.4 | 2.1 | 2.1 | -89.49 | 0.2 | -18.5 | 18.5 | 14.3 | 4.24 | 4.371 | |
| 1,100.0 | 1,100.0 | 1,099.0 | 1,098.8 | 2.3 | 2.3 | 14.64 | 0.4 | -22.8 | 22.0 | 17.4 | 4.65 | 4.737 | |
| 1,200.0 | 1,200.0 | 1,198.5 | 1,198.2 | 2.5 | 2.5 | 16.37 | 0.6 | -28.9 | 25.6 | 20.5 | 5.05 | 5.064 | |
| 1,300.0 | 1,299.9 | 1,298.0 | 1,297.3 | 2.7 | 2.8 | 18.60 | 1.0 | -36.6 | 29.2 | 23.8 | 5.46 | 5.352 | |
| 1,400.0 | 1,399.7 | 1,397.3 | 1,396.3 | 3.0 | 3.0 | 21.13 | 1.4 | -46.1 | 33.0 | 27.1 | 5.88 | 5.614 | |
| 1,500.0 | 1,499.4 | 1,496.6 | 1,494.9 | 3.2 | 3.3 | 23.85 | 1.9 | -57.3 | 37.0 | 30.7 | 6.31 | 5.859 | |
| 1,600.0 | 1,598.9 | 1,595.9 | 1,593.3 | 3.4 | 3.5 | 26.65 | 2.5 | -70.2 | 41.2 | 34.4 | 6.75 | 6.093 | |
| 1,700.0 | 1,698.3 | 1,695.0 | 1,691.4 | 3.7 | 3.8 | 29.49 | 3.2 | -84.7 | 45.6 | 38.3 | 7.21 | 6.316 | |
| 1,800.0 | 1,797.4 | 1,794.1 | 1,789.1 | 3.9 | 4.2 | 32.32 | 3.9 | -101.0 | 50.2 | 42.5 | 7.69 | 6.530 | |
| 1,900.0 | 1,896.3 | 1,893.1 | 1,886.4 | 4.2 | 4.5 | 35.09 | 4.7 | -118.9 | 55.2 | 47.0 | 8.20 | 6.732 | |
| 2,000.0 | 1,994.9 | 1,992.2 | 1,983.7 | 4.5 | 4.9 | 37.81 | 5.6 | -138.4 | 60.5 | 51.7 | 8.75 | 6.911 | |
| 2,100.0 | 2,093.3 | 2,092.1 | 2,081.4 | 4.9 | 5.3 | 40.94 | 6.5 | -158.5 | 64.9 | 55.6 | 9.35 | 6.944 | |
| 2,200.0 | 2,191.2 | 2,191.9 | 2,179.2 | 5.3 | 5.7 | 44.68 | 7.4 | -178.6 | 68.2 | 58.2 | 10.01 | 6.819 | |
| 2,300.0 | 2,288.9 | 2,291.7 | 2,277.0 | 5.7 | 6.1 | 49.11 | 8.3 | -198.7 | 70.7 | 59.9 | 10.76 | 6.573 | |
| 2,318.3 | 2,306.7 | 2,310.0 | 2,294.9 | 5.7 | 6.1 | 50.00 | 8.5 | -202.4 | 71.1 | 60.2 | 10.90 | 6.518 | |
| 2,400.0 | 2,386.2 | 2,391.5 | 2,374.8 | 6.1 | 6.5 | 53.96 | 9.2 | -218.8 | 72.9 | 61.3 | 11.60 | 6.283 | |
| 2,500.0 | 2,483.6 | 2,491.3 | 2,472.5 | 6.5 | 6.9 | 58.52 | 10.1 | -238.9 | 75.5 | 63.0 | 12.49 | 6.045 | |
| 2,600.0 | 2,581.0 | 2,591.1 | 2,570.2 | 7.0 | 7.3 | 62.75 | 11.0 | -259.0 | 78.6 | 65.2 | 13.42 | 5.856 | |
| 2,700.0 | 2,678.3 | 2,690.9 | 2,668.0 | 7.4 | 7.7 | 66.64 | 11.9 | -279.1 | 82.1 | 67.7 | 14.38 | 5.709 | |
| 2,800.0 | 2,775.7 | 2,790.7 | 2,765.7 | 7.9 | 8.2 | 70.20 | 12.8 | -299.2 | 85.9 | 70.6 | 15.35 | 5.597 | |
| 2,900.0 | 2,873.1 | 2,890.5 | 2,863.5 | 8.3 | 8.6 | 73.44 | 13.7 | -319.3 | 90.1 | 73.7 | 16.33 | 5.515 | |
| 3,000.0 | 2,970.4 | 2,990.3 | 2,961.2 | 8.8 | 9.0 | 76.40 | 14.6 | -339.4 | 94.5 | 77.2 | 17.31 | 5.456 | |
| 3,100.0 | 3,067.8 | 3,090.1 | 3,059.0 | 9.3 | 9.5 | 79.08 | 15.6 | -359.5 | 99.1 | 80.8 | 18.29 | 5.417 | |
| 3,200.0 | 3,165.2 | 3,189.8 | 3,156.7 | 9.7 | 9.9 | 81.52 | 16.5 | -379.6 | 103.9 | 84.7 | 19.27 | 5.393 | |
| 3,300.0 | 3,262.5 | 3,289.6 | 3,254.4 | 10.2 | 10.3 | 83.74 | 17.4 | -399.7 | 108.9 | 88.7 | 20.24 | 5.381 | |
| 3,400.0 | 3,359.9 | 3,389.4 | 3,352.2 | 10.7 | 10.8 | 85.76 | 18.3 | -419.8 | 114.1 | 92.9 | 21.21 | 5.379 | |
| 3,500.0 | 3,457.3 | 3,489.2 | 3,449.9 | 11.2 | 11.2 | 87.61 | 19.2 | -439.9 | 119.3 | 97.2 | 22.17 | 5.384 | |
| 3,600.0 | 3,554.6 | 3,589.0 | 3,547.7 | 11.7 | 11.7 | 89.30 | 20.1 | -460.0 | 124.7 | 101.6 | 23.12 | 5.395 | |
| 3,700.0 | 3,652.0 | 3,688.8 | 3,645.4 | 12.1 | 12.1 | 90.84 | 21.0 | -480.1 | 130.2 | 106.1 | 24.07 | 5.410 | |
| 3,800.0 | 3,749.4 | 3,788.6 | 3,743.1 | 12.6 | 12.5 | 92.26 | 21.9 | -500.2 | 135.8 | 110.8 | 25.01 | 5.429 | |
| 3,900.0 | 3,846.7 | 3,888.4 | 3,840.9 | 13.1 | 13.0 | 93.57 | 22.8 | -520.2 | 141.4 | 115.5 | 25.95 | 5.451 | |
| 4,000.0 | 3,944.1 | 3,988.2 | 3,938.6 | 13.6 | 13.4 | 94.78 | 23.7 | -540.3 | 147.2 | 120.3 | 26.88 | 5.474 | |
| 4,100.0 | 4,041.4 | 4,088.0 | 4,036.4 | 14.1 | 13.9 | 95.90 | 24.6 | -560.4 | 152.9 | 125.1 | 27.81 | 5.499 | |
| 4,200.0 | 4,138.8 | 4,187.7 | 4,134.1 | 14.6 | 14.3 | 96.93 | 25.5 | -580.5 | 158.8 | 130.0 | 28.74 | 5.525 | |
| 4,300.0 | 4,236.2 | 4,287.5 | 4,231.9 | 15.1 | 14.8 | 97.90 | 26.4 | -600.6 | 164.7 | 135.0 | 29.66 | 5.552 | |
| 4,400.0 | 4,333.5 | 4,387.3 | 4,329.6 | 15.6 | 15.2 | 98.79 | 27.3 | -620.7 | 170.6 | 140.0 | 30.58 | 5.579 | |
| 4,500.0 | 4,430.9 | 4,487.1 | 4,427.3 | 16.1 | 15.6 | 99.63 | 28.2 | -640.8 | 176.6 | 145.1 | 31.50 | 5.606 | |
| 4,600.0 | 4,528.3 | 4,586.9 | 4,525.1 | 16.6 | 16.1 | 100.41 | 29.2 | -660.9 | 182.6 | 150.1 | 32.41 | 5.633 | |
| 4,700.0 | 4,625.6 | 4,686.7 | 4,622.8 | 17.0 | 16.5 | 101.14 | 30.1 | -681.0 | 188.6 | 155.3 | 33.32 | 5.660 | |
| 4,800.0 | 4,723.0 | 4,786.5 | 4,720.6 | 17.5 | 17.0 | 101.82 | 31.0 | -701.1 | 194.6 | 160.4 | 34.23 | 5.686 | |
| 4,900.0 | 4,820.4 | 4,886.3 | 4,818.3 | 18.0 | 17.4 | 102.47 | 31.9 | -721.2 | 200.7 | 165.6 | 35.14 | 5.713 | |

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18F-212 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5,000.0 | 4,917.7 | 4,986.1 | 4,916.1 | 18.5 | 17.9 | 103.07 | 32.8 | -741.3 | 206.8 | 170.8 | 36.04 | 5.739 | |
| 5,011.4 | 4,928.9 | 4,997.5 | 4,927.2 | 18.6 | 17.9 | 103.14 | 32.9 | -743.6 | 207.5 | 171.4 | 36.15 | 5.742 | |
| 5,100.0 | 5,015.3 | 5,085.9 | 5,013.8 | 19.0 | 18.3 | 103.45 | 33.7 | -761.4 | 212.7 | 175.8 | 36.90 | 5.765 | |
| 5,200.0 | 5,113.4 | 5,185.9 | 5,112.0 | 19.3 | 18.7 | 103.39 | 34.6 | -780.6 | 218.0 | 180.4 | 37.62 | 5.794 | |
| 5,300.0 | 5,212.0 | 5,286.0 | 5,210.7 | 19.6 | 19.0 | 103.33 | 35.3 | -797.4 | 222.5 | 184.3 | 38.23 | 5.821 | |
| 5,400.0 | 5,311.0 | 5,386.2 | 5,309.8 | 19.9 | 19.3 | 103.28 | 36.0 | -811.5 | 226.4 | 187.6 | 38.77 | 5.839 | |
| 5,500.0 | 5,410.4 | 5,486.4 | 5,409.4 | 20.1 | 19.5 | 103.24 | 36.5 | -823.0 | 229.5 | 190.3 | 39.25 | 5.848 | |
| 5,600.0 | 5,510.0 | 5,586.6 | 5,509.2 | 20.3 | 19.7 | 103.22 | 36.9 | -832.0 | 232.0 | 192.3 | 39.68 | 5.847 | |
| 5,700.0 | 5,609.8 | 5,686.9 | 5,609.3 | 20.5 | 19.9 | 103.20 | 37.2 | -838.3 | 233.7 | 193.7 | 40.04 | 5.836 | |
| 5,800.0 | 5,709.7 | 5,787.2 | 5,709.5 | 20.6 | 20.1 | 103.19 | 37.3 | -842.0 | 234.7 | 194.3 | 40.35 | 5.817 | |
| 5,890.3 | 5,800.0 | 5,877.7 | 5,800.0 | 20.7 | 20.2 | -0.01 | 37.4 | -843.0 | 235.0 | 207.1 | 27.85 | 8.438 | |
| 5,900.0 | 5,809.7 | 5,887.4 | 5,809.7 | 20.8 | 20.2 | -0.01 | 37.4 | -843.0 | 235.0 | 207.1 | 27.88 | 8.428 | |
| 5,943.4 | 5,853.1 | 5,930.8 | 5,853.1 | 20.8 | 20.2 | -0.01 | 37.4 | -843.0 | 235.0 | 206.9 | 28.04 | 8.380 | |
| 5,950.0 | 5,859.7 | 5,937.4 | 5,859.7 | 20.8 | 20.3 | -90.02 | 37.4 | -843.0 | 235.0 | 194.3 | 40.73 | 5.769 | |
| 5,954.9 | 5,864.6 | 5,942.3 | 5,864.6 | 20.8 | 20.3 | -90.03 | 37.4 | -843.0 | 235.0 | 194.2 | 40.74 | 5.768 | |
| 6,000.0 | 5,909.6 | 5,987.4 | 5,909.6 | 20.9 | 20.3 | -90.52 | 37.4 | -843.0 | 235.0 | 194.1 | 40.85 | 5.752 | |
| 6,050.0 | 5,959.3 | 6,037.1 | 5,959.3 | 20.9 | 20.4 | -91.80 | 37.4 | -843.0 | 235.1 | 194.1 | 40.97 | 5.739 | |
| 6,100.0 | 6,008.6 | 6,086.9 | 6,009.2 | 20.8 | 20.4 | -93.71 | 37.4 | -842.4 | 235.5 | 194.5 | 41.04 | 5.739 | |
| 6,150.0 | 6,057.2 | 6,137.6 | 6,059.7 | 20.8 | 20.5 | -95.67 | 37.4 | -838.8 | 236.2 | 195.2 | 41.01 | 5.759 | |
| 6,200.0 | 6,104.9 | 6,188.7 | 6,110.4 | 20.7 | 20.5 | -97.61 | 37.4 | -831.6 | 237.1 | 196.2 | 40.89 | 5.799 | |
| 6,250.0 | 6,151.5 | 6,240.5 | 6,161.0 | 20.6 | 20.4 | -99.51 | 37.4 | -821.0 | 238.3 | 197.7 | 40.69 | 5.858 | |
| 6,300.0 | 6,196.9 | 6,292.9 | 6,211.4 | 20.5 | 20.3 | -101.36 | 37.4 | -806.8 | 239.8 | 199.4 | 40.40 | 5.936 | |
| 6,350.0 | 6,240.8 | 6,345.9 | 6,261.3 | 20.4 | 20.3 | -103.15 | 37.4 | -788.9 | 241.5 | 201.4 | 40.04 | 6.031 | |
| 6,400.0 | 6,283.0 | 6,399.5 | 6,310.4 | 20.3 | 20.1 | -104.87 | 37.4 | -767.4 | 243.3 | 203.7 | 39.62 | 6.141 | |
| 6,450.0 | 6,323.4 | 6,453.7 | 6,358.3 | 20.1 | 20.0 | -106.51 | 37.4 | -742.2 | 245.3 | 206.1 | 39.16 | 6.264 | |
| 6,500.0 | 6,361.7 | 6,508.5 | 6,404.9 | 20.1 | 19.9 | -108.06 | 37.4 | -713.3 | 247.4 | 208.7 | 38.68 | 6.396 | |
| 6,550.0 | 6,397.9 | 6,563.9 | 6,449.7 | 20.0 | 19.8 | -109.52 | 37.4 | -680.7 | 249.6 | 211.4 | 38.20 | 6.532 | |
| 6,600.0 | 6,431.8 | 6,619.9 | 6,492.5 | 19.9 | 19.7 | -110.88 | 37.4 | -644.6 | 251.8 | 214.0 | 37.76 | 6.668 | |
| 6,650.0 | 6,463.2 | 6,676.4 | 6,532.9 | 20.0 | 19.6 | -112.14 | 37.4 | -605.1 | 253.9 | 216.6 | 37.37 | 6.795 | |
| 6,700.0 | 6,491.9 | 6,733.6 | 6,570.7 | 20.0 | 19.6 | -113.28 | 37.4 | -562.3 | 256.0 | 219.0 | 37.07 | 6.906 | |
| 6,750.0 | 6,518.0 | 6,791.2 | 6,605.4 | 20.1 | 19.7 | -114.31 | 37.4 | -516.3 | 258.0 | 221.1 | 36.90 | 6.993 | |
| 6,800.0 | 6,541.1 | 6,849.2 | 6,636.8 | 20.3 | 19.9 | -115.22 | 37.4 | -467.5 | 259.9 | 223.0 | 36.88 | 7.048 | |
| 6,850.0 | 6,561.4 | 6,907.7 | 6,664.6 | 20.6 | 20.1 | -116.01 | 37.4 | -416.0 | 261.6 | 224.6 | 37.04 | 7.062 | |
| 6,900.0 | 6,578.6 | 6,966.6 | 6,688.5 | 21.0 | 20.5 | -116.68 | 37.4 | -362.2 | 263.1 | 225.7 | 37.41 | 7.033 | |
| 6,950.0 | 6,592.7 | 7,025.8 | 6,708.3 | 21.4 | 20.9 | -117.23 | 37.4 | -306.4 | 264.3 | 226.4 | 37.99 | 6.958 | |
| 7,000.0 | 6,603.6 | 7,085.3 | 6,723.7 | 21.9 | 21.5 | -117.65 | 37.4 | -249.0 | 265.3 | 226.5 | 38.78 | 6.841 | |
| 7,050.0 | 6,611.3 | 7,145.0 | 6,734.7 | 22.5 | 22.2 | -117.95 | 37.4 | -190.4 | 266.0 | 226.3 | 39.79 | 6.687 | |
| 7,100.0 | 6,615.8 | 7,204.8 | 6,741.1 | 23.1 | 22.9 | -118.12 | 37.4 | -131.0 | 266.4 | 225.5 | 40.99 | 6.500 | |
| 7,148.9 | 6,617.0 | 7,263.2 | 6,742.9 | 23.8 | 23.8 | -118.17 | 37.4 | -72.5 | 266.6 | 224.2 | 42.35 | 6.294 | |
| 7,200.0 | 6,616.6 | 7,314.4 | 6,742.4 | 24.6 | 24.6 | -118.15 | 37.4 | -21.3 | 266.5 | 222.7 | 43.78 | 6.088 | |
| 7,300.0 | 6,615.9 | 7,414.4 | 6,741.5 | 26.2 | 26.3 | -118.12 | 37.4 | 78.7 | 266.4 | 219.6 | 46.83 | 5.689 | |
| 7,400.0 | 6,615.2 | 7,514.4 | 6,740.6 | 28.1 | 28.1 | -118.09 | 37.4 | 178.7 | 266.4 | 216.2 | 50.20 | 5.306 | |
| 7,500.0 | 6,614.5 | 7,614.4 | 6,739.7 | 30.1 | 30.1 | -118.05 | 37.4 | 278.7 | 266.3 | 212.4 | 53.83 | 4.947 | |
| 7,600.0 | 6,613.8 | 7,714.4 | 6,738.8 | 32.2 | 32.3 | -118.02 | 37.4 | 378.6 | 266.2 | 208.5 | 57.67 | 4.616 | |
| 7,700.0 | 6,613.1 | 7,814.4 | 6,737.9 | 34.5 | 34.5 | -117.99 | 37.4 | 478.6 | 266.1 | 204.4 | 61.67 | 4.315 | |
| 7,800.0 | 6,612.4 | 7,914.4 | 6,737.1 | 36.8 | 36.8 | -117.95 | 37.4 | 578.6 | 266.0 | 200.2 | 65.82 | 4.041 | |
| 7,900.0 | 6,611.6 | 8,014.4 | 6,736.2 | 39.1 | 39.2 | -117.92 | 37.4 | 678.6 | 265.9 | 195.9 | 70.09 | 3.794 | |
| 8,000.0 | 6,610.9 | 8,114.4 | 6,735.3 | 41.6 | 41.6 | -117.89 | 37.4 | 778.6 | 265.9 | 191.4 | 74.45 | 3.571 | |
| 8,100.0 | 6,610.2 | 8,214.4 | 6,734.4 | 44.0 | 44.1 | -117.85 | 37.4 | 878.6 | 265.8 | 186.9 | 78.90 | 3.369 | |
| 8,200.0 | 6,609.5 | 8,314.4 | 6,733.5 | 46.6 | 46.6 | -117.82 | 37.4 | 978.6 | 265.7 | 182.3 | 83.41 | 3.185 | |
| 8,300.0 | 6,608.8 | 8,414.4 | 6,732.6 | 49.1 | 49.1 | -117.79 | 37.4 | 1,078.6 | 265.6 | 177.6 | 87.98 | 3.019 | |

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18F-212 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference Measured Depth (ft) | Reference Vertical Depth (ft) | Offset Measured Depth (ft) | Offset Vertical Depth (ft) | Semi Major Axis Reference (ft) | Semi Major Axis Offset (ft) | Highside Toolface (°) | Offset Wellbore Centre +N/-S (ft) | Offset Wellbore Centre +E/-W (ft) | Distance Between Centres (ft) | Distance Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8,400.0 | 6,608.1 | 8,514.4 | 6,731.7 | 51.7 | 51.7 | -117.76 | 37.4 | 1,178.6 | 265.5 | 172.9 | 92.61 | 2.867 | |
| 8,500.0 | 6,607.3 | 8,614.4 | 6,730.8 | 54.3 | 54.3 | -117.72 | 37.4 | 1,278.6 | 265.5 | 168.2 | 97.27 | 2.729 | |
| 8,600.0 | 6,606.6 | 8,714.4 | 6,729.9 | 56.9 | 56.9 | -117.69 | 37.4 | 1,378.6 | 265.4 | 163.4 | 101.98 | 2.602 | |
| 8,700.0 | 6,605.9 | 8,814.4 | 6,729.0 | 59.5 | 59.6 | -117.65 | 37.4 | 1,478.6 | 265.3 | 158.6 | 106.71 | 2.486 | |
| 8,800.0 | 6,605.2 | 8,914.4 | 6,728.2 | 62.2 | 62.2 | -117.62 | 37.4 | 1,578.6 | 265.2 | 153.7 | 111.48 | 2.379 | |
| 8,900.0 | 6,604.5 | 9,014.4 | 6,727.3 | 64.8 | 64.9 | -117.59 | 37.4 | 1,678.6 | 265.1 | 148.9 | 116.28 | 2.280 | |
| 9,000.0 | 6,603.8 | 9,114.4 | 6,726.4 | 67.5 | 67.6 | -117.55 | 37.4 | 1,778.6 | 265.1 | 144.0 | 121.09 | 2.189 | |
| 9,100.0 | 6,603.1 | 9,214.4 | 6,725.5 | 70.2 | 70.2 | -117.52 | 37.4 | 1,878.6 | 265.0 | 139.0 | 125.93 | 2.104 | |
| 9,200.0 | 6,602.3 | 9,314.4 | 6,724.6 | 72.9 | 72.9 | -117.49 | 37.4 | 1,978.6 | 264.9 | 134.1 | 130.79 | 2.025 | |
| 9,300.0 | 6,601.6 | 9,414.4 | 6,723.7 | 75.6 | 75.6 | -117.45 | 37.4 | 2,078.6 | 264.8 | 129.1 | 135.67 | 1.952 | |
| 9,400.0 | 6,600.9 | 9,514.4 | 6,722.8 | 78.3 | 78.3 | -117.42 | 37.4 | 2,178.6 | 264.7 | 124.2 | 140.56 | 1.883 | |
| 9,500.0 | 6,600.2 | 9,614.4 | 6,721.9 | 81.0 | 81.1 | -117.39 | 37.4 | 2,278.6 | 264.6 | 119.2 | 145.46 | 1.819 | |
| 9,600.0 | 6,599.5 | 9,714.4 | 6,721.0 | 83.8 | 83.8 | -117.35 | 37.4 | 2,378.6 | 264.6 | 114.2 | 150.38 | 1.759 | |
| 9,700.0 | 6,598.8 | 9,814.4 | 6,720.1 | 86.5 | 86.5 | -117.32 | 37.4 | 2,478.6 | 264.5 | 109.2 | 155.31 | 1.703 | |
| 9,800.0 | 6,598.0 | 9,914.4 | 6,719.3 | 89.2 | 89.3 | -117.29 | 37.4 | 2,578.6 | 264.4 | 104.2 | 160.26 | 1.650 | |
| 9,900.0 | 6,597.3 | 10,014.4 | 6,718.4 | 92.0 | 92.0 | -117.25 | 37.4 | 2,678.6 | 264.3 | 99.1 | 165.21 | 1.600 | |
| 10,000.0 | 6,596.6 | 10,114.4 | 6,717.5 | 94.7 | 94.7 | -117.22 | 37.4 | 2,778.6 | 264.2 | 94.1 | 170.17 | 1.553 | |
| 10,100.0 | 6,595.9 | 10,214.4 | 6,716.6 | 97.5 | 97.5 | -117.19 | 37.4 | 2,878.5 | 264.2 | 89.0 | 175.15 | 1.508 | |
| 10,200.0 | 6,595.2 | 10,314.4 | 6,715.7 | 100.2 | 100.2 | -117.15 | 37.4 | 2,978.5 | 264.1 | 84.0 | 180.13 | 1.466 | Level 3 |
| 10,300.0 | 6,594.5 | 10,414.4 | 6,714.8 | 103.0 | 103.0 | -117.12 | 37.4 | 3,078.5 | 264.0 | 78.9 | 185.12 | 1.426 | Level 3 |
| 10,400.0 | 6,593.7 | 10,514.4 | 6,713.9 | 105.7 | 105.7 | -117.08 | 37.4 | 3,178.5 | 263.9 | 73.8 | 190.12 | 1.388 | Level 3 |
| 10,500.0 | 6,593.0 | 10,614.4 | 6,713.0 | 108.5 | 108.5 | -117.05 | 37.4 | 3,278.5 | 263.8 | 68.7 | 195.13 | 1.352 | Level 3 |
| 10,600.0 | 6,592.3 | 10,714.4 | 6,712.1 | 111.2 | 111.3 | -117.02 | 37.4 | 3,378.5 | 263.8 | 63.6 | 200.14 | 1.318 | Level 3 |
| 10,700.0 | 6,591.6 | 10,814.4 | 6,711.2 | 114.0 | 114.0 | -116.98 | 37.4 | 3,478.5 | 263.7 | 58.5 | 205.16 | 1.285 | Level 3 |
| 10,800.0 | 6,590.9 | 10,914.4 | 6,710.4 | 116.8 | 116.8 | -116.95 | 37.4 | 3,578.5 | 263.6 | 53.4 | 210.19 | 1.254 | Level 3 |
| 10,900.0 | 6,590.2 | 11,014.4 | 6,709.5 | 119.5 | 119.6 | -116.92 | 37.4 | 3,678.5 | 263.5 | 48.3 | 215.22 | 1.224 | Level 2 |
| 11,000.0 | 6,589.5 | 11,114.4 | 6,708.6 | 122.3 | 122.3 | -116.88 | 37.4 | 3,778.5 | 263.5 | 43.2 | 220.26 | 1.196 | Level 2 |
| 11,100.0 | 6,588.7 | 11,214.4 | 6,707.7 | 125.1 | 125.1 | -116.85 | 37.4 | 3,878.5 | 263.4 | 38.1 | 225.30 | 1.169 | Level 2 |
| 11,200.0 | 6,588.0 | 11,314.4 | 6,706.8 | 127.9 | 127.9 | -116.81 | 37.4 | 3,978.5 | 263.3 | 32.9 | 230.36 | 1.143 | Level 2 |
| 11,300.0 | 6,587.3 | 11,414.4 | 6,705.9 | 130.6 | 130.7 | -116.78 | 37.4 | 4,078.5 | 263.2 | 27.8 | 235.41 | 1.118 | Level 2 |
| 11,400.0 | 6,586.6 | 11,514.4 | 6,705.0 | 133.4 | 133.4 | -116.75 | 37.4 | 4,178.5 | 263.1 | 22.7 | 240.47 | 1.094 | Level 2 |
| 11,500.0 | 6,585.9 | 11,614.4 | 6,704.1 | 136.2 | 136.2 | -116.71 | 37.4 | 4,278.5 | 263.1 | 17.5 | 245.54 | 1.071 | Level 2 |
| 11,600.0 | 6,585.2 | 11,714.4 | 6,703.2 | 139.0 | 139.0 | -116.68 | 37.4 | 4,378.5 | 263.0 | 12.4 | 250.61 | 1.049 | Level 2 |
| 11,700.0 | 6,584.4 | 11,814.4 | 6,702.3 | 141.7 | 141.8 | -116.64 | 37.4 | 4,478.5 | 262.9 | 7.2 | 255.69 | 1.028 | Level 2 |
| 11,800.0 | 6,583.7 | 11,914.4 | 6,701.5 | 144.5 | 144.5 | -116.61 | 37.4 | 4,578.5 | 262.8 | 2.1 | 260.77 | 1.008 | Level 2 |
| 11,900.0 | 6,583.0 | 12,014.4 | 6,700.6 | 147.3 | 147.3 | -116.58 | 37.4 | 4,678.5 | 262.7 | -3.1 | 265.86 | 0.988 | Level 1 |
| 12,000.0 | 6,582.3 | 12,114.4 | 6,699.7 | 150.1 | 150.1 | -116.54 | 37.4 | 4,778.5 | 262.7 | -8.3 | 270.95 | 0.969 | Level 1 |
| 12,100.0 | 6,581.6 | 12,214.4 | 6,698.8 | 152.9 | 152.9 | -116.51 | 37.4 | 4,878.5 | 262.6 | -13.5 | 276.04 | 0.951 | Level 1 |
| 12,200.0 | 6,580.9 | 12,314.4 | 6,697.9 | 155.7 | 155.7 | -116.47 | 37.4 | 4,978.5 | 262.5 | -18.6 | 281.14 | 0.934 | Level 1 |
| 12,300.0 | 6,580.2 | 12,414.4 | 6,697.0 | 158.5 | 158.5 | -116.44 | 37.4 | 5,078.5 | 262.4 | -23.8 | 286.24 | 0.917 | Level 1 |
| 12,400.0 | 6,579.4 | 12,514.4 | 6,696.1 | 161.2 | 161.3 | -116.41 | 37.4 | 5,178.5 | 262.4 | -29.0 | 291.35 | 0.900 | Level 1 |
| 12,500.0 | 6,578.7 | 12,614.4 | 6,695.2 | 164.0 | 164.0 | -116.37 | 37.4 | 5,278.4 | 262.3 | -34.2 | 296.46 | 0.885 | Level 1 |
| 12,600.0 | 6,578.0 | 12,714.4 | 6,694.3 | 166.8 | 166.8 | -116.34 | 37.4 | 5,378.4 | 262.2 | -39.4 | 301.58 | 0.869 | Level 1 |
| 12,700.0 | 6,577.3 | 12,814.4 | 6,693.4 | 169.6 | 169.6 | -116.30 | 37.4 | 5,478.4 | 262.1 | -44.6 | 306.70 | 0.855 | Level 1 |
| 12,800.0 | 6,576.6 | 12,914.4 | 6,692.6 | 172.4 | 172.4 | -116.27 | 37.4 | 5,578.4 | 262.0 | -49.8 | 311.82 | 0.840 | Level 1 |
| 12,900.0 | 6,575.9 | 13,014.4 | 6,691.7 | 175.2 | 175.2 | -116.24 | 37.4 | 5,678.4 | 262.0 | -55.0 | 316.95 | 0.827 | Level 1 |
| 13,000.0 | 6,575.1 | 13,114.4 | 6,690.8 | 178.0 | 178.0 | -116.20 | 37.4 | 5,778.4 | 261.9 | -60.2 | 322.08 | 0.813 | Level 1 |
| 13,100.0 | 6,574.4 | 13,214.4 | 6,689.9 | 180.8 | 180.8 | -116.17 | 37.4 | 5,878.4 | 261.8 | -65.4 | 327.21 | 0.800 | Level 1 |
| 13,200.0 | 6,573.7 | 13,314.4 | 6,689.0 | 183.6 | 183.6 | -116.13 | 37.4 | 5,978.4 | 261.7 | -70.6 | 332.35 | 0.788 | Level 1 |
| 13,300.0 | 6,573.0 | 13,414.4 | 6,688.1 | 186.4 | 186.4 | -116.10 | 37.4 | 6,078.4 | 261.7 | -75.8 | 337.50 | 0.775 | Level 1 |
| 13,400.0 | 6,572.3 | 13,514.4 | 6,687.2 | 189.1 | 189.2 | -116.06 | 37.4 | 6,178.4 | 261.6 | -81.1 | 342.64 | 0.763 | Level 1 |

CC - Min centre to center distance or covergent point, SF - min separation factor, ES - min ellipse separation

| | | | |
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

**Offset Design** Hop 5N64W18A Pad Sec.18-T5N-R64W - Hop 18F-212 - Wellbore #1 - Plan #1 (12-16-15)

**Offset Site Error:** 0.0 ft

**Survey Program:** 0-MWD

**Offset Well Error:** 0.0 ft

| Reference | | Offset | | Semi Major Axis | | | Offset Wellbore Centre | | Distance | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Measured Depth (ft) | Vertical Depth (ft) | Measured Depth (ft) | Vertical Depth (ft) | Reference (ft) | Offset (ft) | Highside Toolface (°) | +N/-S (ft) | +E/-W (ft) | Between Centres (ft) | Between Ellipses (ft) | Minimum Separation (ft) | Separation Factor | Warning |
| 13,500.0 | 6,571.6 | 13,614.4 | 6,686.3 | 191.9 | 192.0 | -116.03 | 37.4 | 6,278.4 | 261.5 | -86.3 | 347.79 | 0.752 | Level 1 |
| 13,600.0 | 6,570.9 | 13,714.4 | 6,685.4 | 194.7 | 194.8 | -115.99 | 37.4 | 6,378.4 | 261.4 | -91.5 | 352.94 | 0.741 | Level 1 |
| 13,700.0 | 6,570.1 | 13,814.4 | 6,684.5 | 197.5 | 197.6 | -115.96 | 37.4 | 6,478.4 | 261.4 | -96.7 | 358.10 | 0.730 | Level 1 |
| 13,800.0 | 6,569.4 | 13,914.4 | 6,683.6 | 200.3 | 200.3 | -115.93 | 37.4 | 6,578.4 | 261.3 | -102.0 | 363.26 | 0.719 | Level 1 |
| 13,900.0 | 6,568.7 | 14,014.4 | 6,682.8 | 203.1 | 203.1 | -115.89 | 37.4 | 6,678.4 | 261.2 | -107.2 | 368.42 | 0.709 | Level 1 |
| 14,000.0 | 6,568.0 | 14,114.4 | 6,681.9 | 205.9 | 205.9 | -115.86 | 37.4 | 6,778.4 | 261.1 | -112.5 | 373.59 | 0.699 | Level 1 |
| 14,100.0 | 6,567.3 | 14,214.4 | 6,681.0 | 208.7 | 208.7 | -115.82 | 37.4 | 6,878.4 | 261.0 | -117.7 | 378.76 | 0.689 | Level 1 |
| 14,200.0 | 6,566.6 | 14,314.4 | 6,680.1 | 211.5 | 211.5 | -115.79 | 37.4 | 6,978.4 | 261.0 | -123.0 | 383.93 | 0.680 | Level 1 |
| 14,300.0 | 6,565.8 | 14,414.4 | 6,679.2 | 214.3 | 214.3 | -115.75 | 37.4 | 7,078.4 | 260.9 | -128.2 | 389.11 | 0.671 | Level 1 |
| 14,400.0 | 6,565.1 | 14,514.4 | 6,678.3 | 217.1 | 217.1 | -115.72 | 37.4 | 7,178.4 | 260.8 | -133.5 | 394.29 | 0.662 | Level 1 |
| 14,500.0 | 6,564.4 | 14,614.4 | 6,677.4 | 219.9 | 219.9 | -115.68 | 37.4 | 7,278.4 | 260.7 | -138.7 | 399.47 | 0.653 | Level 1 |
| 14,600.0 | 6,563.7 | 14,714.4 | 6,676.5 | 222.7 | 222.7 | -115.65 | 37.4 | 7,378.4 | 260.7 | -144.0 | 404.65 | 0.644 | Level 1 |
| 14,700.0 | 6,563.0 | 14,814.4 | 6,675.6 | 225.5 | 225.5 | -115.62 | 37.4 | 7,478.4 | 260.6 | -149.2 | 409.84 | 0.636 | Level 1 |
| 14,800.0 | 6,562.3 | 14,914.4 | 6,674.7 | 228.3 | 228.3 | -115.58 | 37.4 | 7,578.4 | 260.5 | -154.5 | 415.03 | 0.628 | Level 1 |
| 14,900.0 | 6,561.5 | 15,014.4 | 6,673.9 | 231.1 | 231.1 | -115.55 | 37.4 | 7,678.3 | 260.4 | -159.8 | 420.23 | 0.620 | Level 1 |
| 15,000.0 | 6,560.8 | 15,114.4 | 6,673.0 | 233.9 | 233.9 | -115.51 | 37.4 | 7,778.3 | 260.4 | -165.1 | 425.43 | 0.612 | Level 1 |
| 15,100.0 | 6,560.1 | 15,214.4 | 6,672.1 | 236.7 | 236.7 | -115.48 | 37.4 | 7,878.3 | 260.3 | -170.3 | 430.63 | 0.604 | Level 1 |
| 15,200.0 | 6,559.4 | 15,314.4 | 6,671.2 | 239.5 | 239.5 | -115.44 | 37.4 | 7,978.3 | 260.2 | -175.6 | 435.83 | 0.597 | Level 1 |
| 15,300.0 | 6,558.7 | 15,414.4 | 6,670.3 | 242.3 | 242.3 | -115.41 | 37.4 | 8,078.3 | 260.1 | -180.9 | 441.04 | 0.590 | Level 1 |
| 15,400.0 | 6,558.0 | 15,514.4 | 6,669.4 | 245.1 | 245.1 | -115.37 | 37.4 | 8,178.3 | 260.1 | -186.2 | 446.25 | 0.583 | Level 1 |
| 15,500.0 | 6,557.3 | 15,614.4 | 6,668.5 | 247.9 | 247.9 | -115.34 | 37.4 | 8,278.3 | 260.0 | -191.5 | 451.47 | 0.576 | Level 1 |
| 15,600.0 | 6,556.5 | 15,714.4 | 6,667.6 | 250.7 | 250.7 | -115.30 | 37.4 | 8,378.3 | 259.9 | -196.8 | 456.68 | 0.569 | Level 1 |
| 15,700.0 | 6,555.8 | 15,814.4 | 6,666.7 | 253.5 | 253.5 | -115.27 | 37.4 | 8,478.3 | 259.8 | -202.1 | 461.90 | 0.563 | Level 1 |
| 15,800.0 | 6,555.1 | 15,914.4 | 6,665.8 | 256.3 | 256.3 | -115.23 | 37.4 | 8,578.3 | 259.8 | -207.4 | 467.13 | 0.556 | Level 1 |
| 15,900.0 | 6,554.4 | 16,014.4 | 6,665.0 | 259.1 | 259.1 | -115.20 | 37.4 | 8,678.3 | 259.7 | -212.7 | 472.35 | 0.550 | Level 1 |
| 16,000.0 | 6,553.7 | 16,114.4 | 6,664.1 | 261.9 | 261.9 | -115.16 | 37.4 | 8,778.3 | 259.6 | -218.0 | 477.58 | 0.544 | Level 1 |
| 16,100.0 | 6,553.0 | 16,214.4 | 6,663.2 | 264.7 | 264.7 | -115.13 | 37.4 | 8,878.3 | 259.5 | -223.3 | 482.81 | 0.538 | Level 1 |
| 16,200.0 | 6,552.2 | 16,314.4 | 6,662.3 | 267.5 | 267.5 | -115.09 | 37.4 | 8,978.3 | 259.5 | -228.6 | 488.04 | 0.532 | Level 1 |
| 16,228.8 | 6,552.0 | 16,343.2 | 6,662.0 | 268.3 | 268.3 | -115.08 | 37.4 | 9,007.1 | 259.5 | -230.1 | 489.55 | 0.530 | Level 1 |
| 16,234.4 | 6,552.0 | 16,346.6 | 6,662.0 | 268.5 | 268.4 | -115.08 | 37.4 | 9,010.5 | 259.5 | -230.3 | 489.79 | 0.530 | Level 1, ES, SF |

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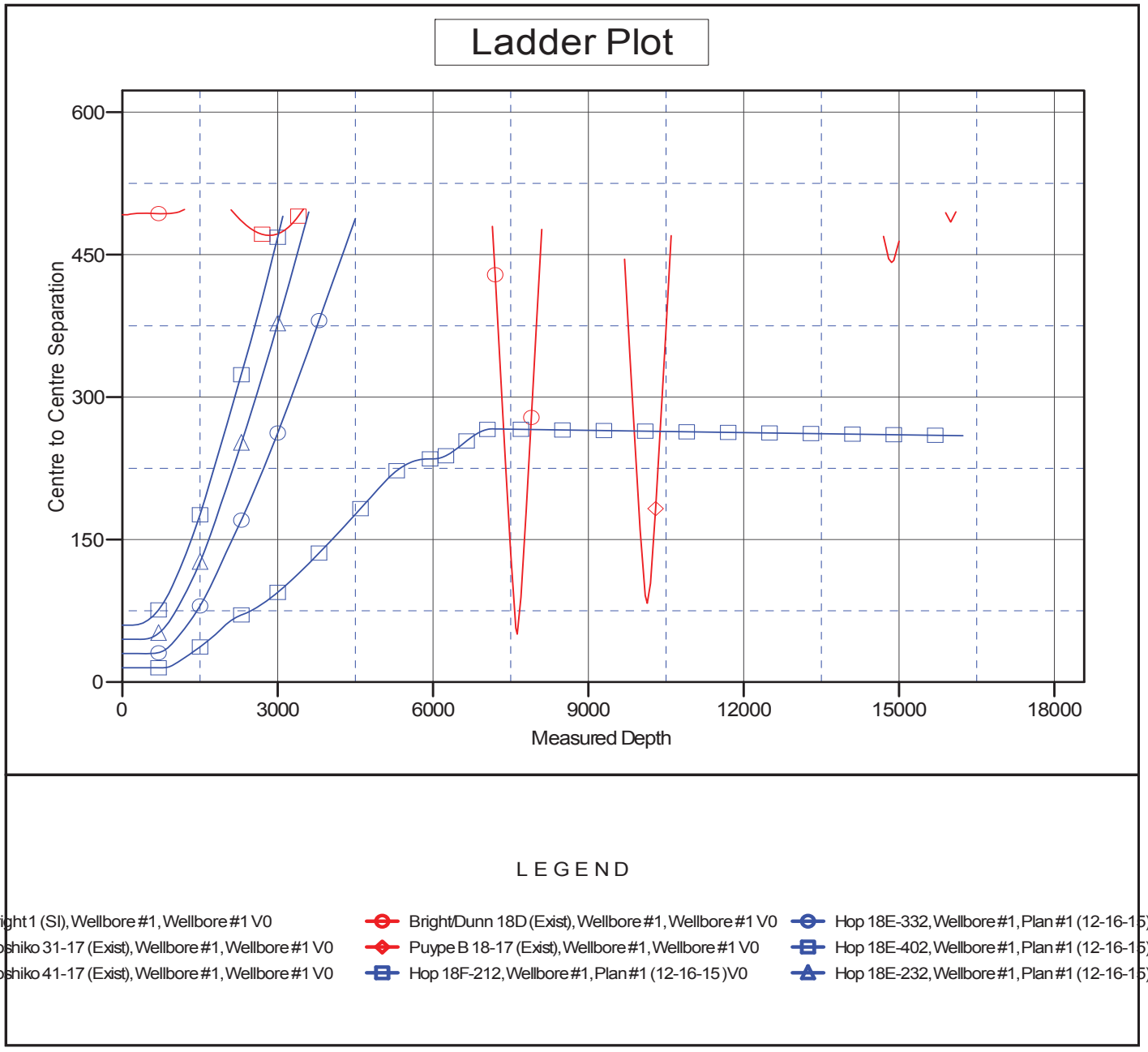
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

Reference Depths are relative to WELL @ 4641.0ft (Original Well Elev)
Offset Depths are relative to Offset Datum
Central Meridian is -105.500000

Coordinates are relative to: Hop 18F-102
Coordinate System is US State Plane 1983, Colorado Northern Zone
Grid Convergence at Surface is: 0.58°



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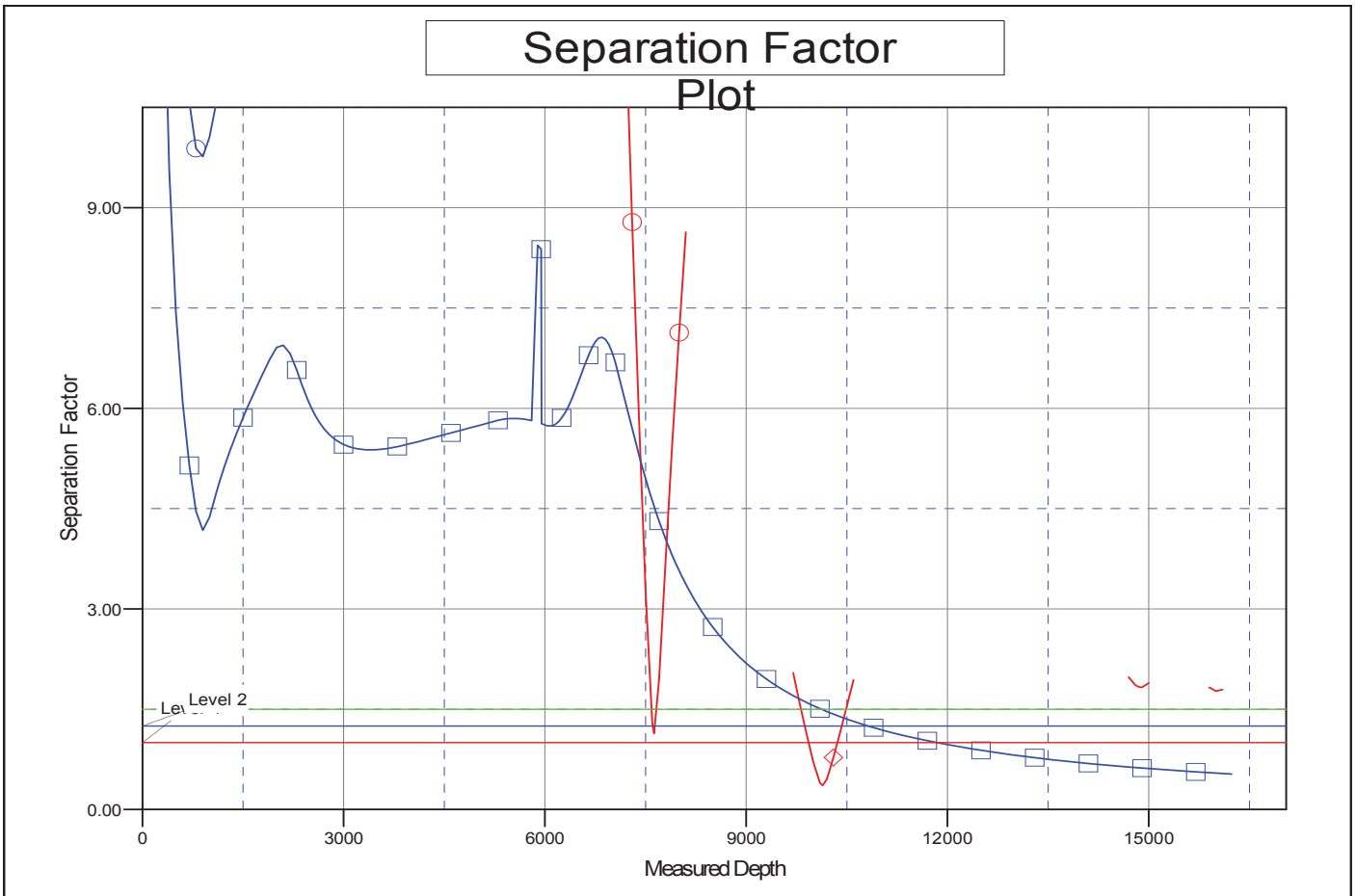
|---|---|---|---|
| **Company:** | PETROLEUM DEVELOPMENT CORP DJ Basin | **Local Co-ordinate Reference:** | Well Hop 18F-102 |
| **Project:** | SEC.18-T5N-R64W | **TVD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Reference Site:** | Hop 5N64W18A Pad Sec.18-T5N-R64W | **MD Reference:** | WELL @ 4641.0ft (Original Well Elev) |
| **Site Error:** | 0.0 ft | **North Reference:** | True |
| **Reference Well:** | Hop 18F-102 | **Survey Calculation Method:** | Minimum Curvature |
| **Well Error:** | 0.0 ft | **Output errors are at** | 2.00 sigma |
| **Reference Wellbore** | Wellbore #1 | **Database:** | US_EDM |
| **Reference Design:** | Plan #1 (12-16-15) | **Offset TVD Reference:** | Offset Datum |

Reference Depths are relative to WELL @ 4641.0ft (Original Well Elev)
Offset Depths are relative to Offset Datum
Central Meridian is -105.500000

Coordinates are relative to: Hop 18F-102
Coordinate System is US State Plane 1983, Colorado Northern Zone
Grid Convergence at Surface is: 0.58°




LEGEND

| | | |
|---|---|---|
| Bright 1 (SI), Wellbore #1, Wellbore #1 V0 | Bright/Dunn 18D (Exist), Wellbore #1, Wellbore #1 V0 | Hop 18E-332, Wellbore #1, Plan #1 (12-16-15)' |
| Hoshiko 31-17 (Exist), Wellbore #1, Wellbore #1 V0 | Puype B 18-17 (Exist), Wellbore #1, Wellbore #1 V0 | Hop 18E-402, Wellbore #1, Plan #1 (12-16-15)' |
| Hoshiko 41-17 (Exist), Wellbore #1, Wellbore #1 V0 | Hop 18F-212, Wellbore #1, Plan #1 (12-16-15) V0 | Hop 18E-232, Wellbore #1, Plan #1 (12-16-15)' |