# Anschutz Oil Company - Well Prognosis

**CONFIDENTIAL**

ANSCHUTZ EXPLORATION CORPORATION
ANSCHUTZ OIL COMPANY

## GENERAL INFORMATION

| AFE No. | Date |
|---|---|
| | 1/20/2017 |

| Lease/Well Name & Number: | APC Prospect Number |
|---|---|
| **Rio Blanco Fed 0297-33-28-3 NH** | |
| **Prospect Name:** | **API No.** |
| **White River Dome** | |

| | |
|---|---|
| **Field:** | White River Dome |
| **Closest Town:** | Meeker, CO and Rangely, CO |
| **County:** | Rio Blanco |
| **State:** | Colorado |

| | Lat/Longs (NAD27) | | NAD 83 | Legal | | | Sec. | Township | Range |
|---|---|---|---|---|---|---|---|---|---|
| **Surface Hole Location:** | Lat<br>Long | 40.096531<br>-108.284233 | 40.096500<br>-108.284875 | 1905' FSL | & | 2185' FWL | 33 | T2N | R97W |
| **Pilot Hole BH Location:** | N/A | | | | | | | | |
| **Bottom Hole Location:** | Lat<br>Long | 40.118489<br>-108.284958 | 40.118461<br>-108.285603 | 660' FNL | & | 1980' FWL | 28 | T2N | R97W |

| Elevation | GL Elevation | Ground Level to RKB | RKB Elevation |
|---|---|---|---|
| | 6,168.9' | 26.5' | 6,195.4' |

## GEOLOGICAL INFORMATION

| Proposed TD | Vertical | | Lateral Toe | Primary Objective | Secondary Objective |
|---|---|---|---|---|---|
| | N/A | **TVD** | 12,086' | Niobrara (Rangely Bench) | N/A |
| | N/A | **MD** | 19,815' | **Type Production (oil or gas)** | **Type Production (oil or gas)** |
| | | | | Gas/condensate | |

**Anticipated Formation Tops**

Reference Elevation: **6,195.4'** RKB

| Formation Name | Lithology | Top (ss kb) | Top (md) | Top (TVD) | Thickness (ft) | Comment |
|---|---|---|---|---|---|---|
| Green River Fm @ Surface | Sand/Shale | 6,195 | 0' | 0' | 2,229' | |
| Wasatch Fm/Base Aquifer | Sand/Shale | 3,966 | 2,229' | 2,229' | 702' | Potential fresh water aquafer |
| Ohio Crk Conglomerate | Sand/Shale | 3,264 | 2,931' | 2,931' | 284' | Marker |
| Williams Fork (top Mesaverde) | Sandstone | 2,980 | 3,215' | 3,215' | 3,494' | Potential depletion (gas prod in area) |
| Rollins | Sandstone | -514 | 6,710' | 6,709' | 886' | Potential depletion (gas prod in area) |
| Cozzette | Sandstone | -1,400 | 7,596' | 7,595' | 99' | Potential depletion (gas prod in area) |
| Corcoran | Sandstone | -1,499 | 7,695' | 7,694' | 50' | Potential depletion (gas prod in area) |
| Sego | Sand/Shale | -1,549 | 7,745' | 7,744' | 291' | |
| Lloyd SS | Sand/Shale | -1,840 | 8,036' | 8,035' | 391' | |
| Castlegate | Sandstone | -2,231 | 8,427' | 8,426' | 842' | |
| Mancos MFS | Shale | -3,073 | 9,269' | 9,268' | 507' | Potential hydrocarbon (cond, gas) |
| Base Mancos B | Shale | -3,580 | 9,777' | 9,775' | 958' | Potential hydrocarbon (cond, gas) |
| Niobrara | Shale | -4,538 | 10,735' | 10,733' | 1,107' | Potential hydrocarbon; top of overpressure |
| Top Rangely | Shale | -5,645 | 11,872' | 11,840' | 270' | Potential hydrocarbon (cond, gas) |
| **LANDING POINT** | **Shale** | **-5,891** | **12,451'** | **12,086'** | | **LANDING POINT** |
| Base Rangely | Shale | -5,915 | | 12,110' | 265' | Shale |
| Carlile | Shale | -6,180 | | 12,375' | 143' | Shale |
| Frontier | Sand/Shale | -6,323 | | 12,518' | | Potential hydrocarbon; Overpressure |

All shows of fresh water and minerals will be adequately protected and reported.

**Directional Drilling Information**

| | |
|---|---|
| **Build Rate Curve (°/100')** | 9.0 |
| **Lateral Azimuth (°)** | 1.8 |
| **Inc @ Lnd Pnt (°)** | 90.0 |
| **Landing Point TVD (ft)** | 12,086 |
| **KOP (ft)** | 11,451 |
| **Land Pnt MD (ft)** | 12,451 |
| **Lateral Length (ft)** | 7,364 |
| **Lateral Toe MD (ft)** | 19,815 |
| **Lateral Toe TVD (ft)** | 12,086 |

## Logging Program

| Type Log Suite | Interval Top | Interval Bottom | Comments |
|---|---|---|---|
| GR MWD | KOP | TD | |
| CBL/VDL/CCL/GR | Surface | ~ 11,510' | ~50' below KOP |

COMMENTS: While drilling, a Gamma Ray (GR) log will be run from the top of the build section (Kick-Off Point) to approximately the well TD (Lateral Toe) via the directional company MWD/LWD GR tool. Then later, when running the cement bond log for the intermediate casing, a GR log will be pulled from ~ 50' below KOP all the way to the surface (ground level). These two logging processes will ensure that there is a complete GR log from approximately well TD to ground level.

## Coring Program

| Core No. | Formation | Est. Depth | Core Length (ft) |
|---|---|---|---|
| | | | |
| | | | |

## DrillStem Test Program

| If Needed | Estimated Depth (ft) | Estimated Pressure (psi) | Cushion (ft) | Test Times (min) | | | |
|---|---|---|---|---|---|---|---|
| | | | | Initial Flow | Initial Shut-In | Second Flow | Second Shut-In |
| | | | | | | | |
| | | | | | | | |

## Wellsite Geology

| Service | Description of Services | Start Depth | End Depth |
|---|---|---|---|
| Mudlogger | | | |
| | | | |
| Wellsite Geologist | Wellsite geologist / Geosteering / Mudlogging | Surface | TD |
| | | | |

## Sample Collection

| Depth Interval | | Foot per Sample | Special Instructions |
|---|---|---|---|
| Top | Base | | |
| Surface Casing | TD | 30 | 30 feet per sample as ROP allows. |
| | | | |
| | | | |

## Offset Well Information

| Well Name | Well TD | Year Drilled | Latitude (NAD27) | Longitude (NAD27) | Vert / Hor | Comments |
|---|---|---|---|---|---|---|
| WRD 23-33 R | 15,886 md | 2012 | 40.096583 | -108.284225 | Hor | vert PH to Weber |

## ENGINEERING INFORMATION

### Mud Program

| Interval | Mud Description | Viscosity | MW | pH | Wtr Loss |
|---|---|---|---|---|---|
| Surface | Freshwater with frequent sweeps of Gel and PHPA | 28-32 | 8.4-8.8 | 9.0-10.5 | No Control |
| Intermediate to ~10,000' TVD | Water-Based Mud System | 34-42 | 8.8-10 | 9.0-10.5 | <10 |
| Build & Lateral | Oil Based Mud System | 40-45 | 9.5-11.5 | 2+ lbs excess lime/ Bbl | 10-20 (HTHP) |

Sufficient quantities of mud materials will be maintained or readily accessible for the purpose of assuring well control during the course of drilling operations. We will have enough Barite on location to weight the entire mud system up 0.5 ppg.

Mud Monitoring Equipment: Visual mud monitoring equipment will be in place to detect volume changes indicating loss or gain of circulating fluid volume. If abnormal pressures are anticipated, electronic/mechanical mud monitoring equipment will be used, which will include a pit volume totalizer (PVT), stroke counter, and flow sensor. A mud test will be performed every 24 hours after mudding up to determine, as applicable: density, viscosity, gel strength, filtration, and pH. Gas detecting equipment will be installed in the mud return system beginning after surface casing to TD.

### Lost Circulation Prevention

1. While drilling, circulation losses will be treated by one or more of the following:
   a. Reduction of mud weight (where possible) to reduce the hydrostatic pressure across from any weak zone.
   b. For seepage, we will add the finer LCM's (calcium carbonate, mica, micro fibers, fine walnut shells, etc.).
   c. For more aggressive losses, we will add the larger LCM's (cotton seed hulls, cedar fiber, large walnut shells, sawdust, etc.).
   d. For complete losses, more aggressive steps will be taken. These steps include setting of high-concentration broad-spectrum LCM pills, squeezes of high-concentration broad-spectrum LCM pills and the use of water-absorbing polymers to lock up the loss zone.
   e. Ultimately, if needed, cement squeezes will be available to address the most difficult zone.
2. While cementing, circulation losses will be addressed by the use of one or more of the following:
   a. Use of LCM materials in the cement (celoflake, polyflake, gilsonite, etc.).
   b. Use of reactive spacers that will cause the cement to rapidly set in the loss zone.
   c. Light-weight, rheologically-friendly cement slurries that significantly reduce circulating pressures during the cement job.
   d. Two-stage cementing tools strategically placed in the casing string to enhance cement placement.
   e. Use of thixotropic (shear-thinning) cements.
3. It will always be AOC's goal to address losses aggressively during the Drilling Phase to enhance cement placement during the Cementing Phase.

## Casing Program

| Hole Size (in) | Casing Size (in) | Casing Weight & Grade | Thread | Setting Depth (ft) | | | Length (ft) | Notes |
|---|---|---|---|---|---|---|---|---|
| 26 | 20 | 52.78# A53b | Welded | 0' | - | 80' | 80' | Grouted to surface |
| 17 1/2 | 13 3/8 | 61# J-55 | STC | 0' | - | 2,000' | 2,000' | Guide shoe, 2 joint shoe track, float collar and then casing to surface.<br><br>One bowspring (bs) centralizer stop-locked on the first joint. Then one bs centralizer for the next two joints. Then one bs centralizer every third joint to surface.<br><br>Total BS centralizers (approx.): 23<br><br>Top cmt plug used. No bottom plug.<br><br>Top of tail slurry at 2,400' |
| 17 1/2 | 13 3/8 | 68# HCN-80 | STC | 2,000' | - | 3,000' | 1,000' | |
| 12 1/4 | 9 5/8 | 47# P-110 | LTC | 0' | - | 7,000' | 7,000' | Float shoe, 2-jnt shoe track, float collar, casing to surface.<br><br>One BS centralizer on first four joints beginning at the float shoe. Then one BS centralizer every third joint to 100' above TOC.<br><br>Total BS centralizers (approx.): 57<br><br>Estimated TOC @ 2,800'. Estimated top of tail @ 9,402' |
| 12 1/4 | 9 5/8 | 53.5# P-110 | LTC | 7,000' | - | 10,002' | 3,002' | |
| 8 1/2 | 7 | 26# HCP-110 | BTC | 9,802' | - | 12,451' | 2,649' | Float shoe, 3 jnt shoe track, float collar, casing to 200' above 9 5/8" intermediate csg shoe.<br><br>Liner hanger set at 200' above 9 5/8" intermediate csg shoe.<br><br>One rigid centralizer per joint from the float shoe to 150' above KOP. One BS centralizer every fourth joint from 150' above KOP up to liner hanger.<br><br>Total BS centralizers (approx.): 7<br><br>Total rigid centralizers (approx.): 25<br><br>Estimated top of tail @ 11,851'. |
| 6 1/8 | 4 1/2 | 15.1# P-110 | CDC | 11,951' | - | 19,815' | 7,864' | Float shoe, 1 jnt, float collar, 2 jnts, baffle collar, casing to liner hanger, liner hanger<br><br>Liner hanger set at 45 degrees into the build.<br><br>No centralization on the first 3 jnts. Then, one rigid centralizer every other joint up to liner hanger.<br><br>Total rigid centralizers (approx.): 86 |
| Inside of 7" casing | 4 1/2 | 15.1# P-110 | LTC | 0' | - | 11,951' | 11,951' | Tie-back frac string. Will be removed after stimulation. |

## Casing Design Assumptions and Minimum Safety Factors (Bureau of Land Management - See Attached)

| Casing String | Min Burst SF | Min Collapse SF | Minimum Tension | Assumptions |
|---|---|---|---|---|
| Surface | 1.2 | 1.1 | 1.6 and/or 100 klbs overpull | **BURST** - FG = 0.8 psi/ft + 1 ppg injection pressure SF at shoe, casing evacuated to gas (gradient 0.115 psi/ft), back-up freshwater gradient = 0.433 psi/ft<br>**COLLAPSE** - Max collapse with cement on backside that never set up with zero back-up inside csg |
| Intermediate | 1.2 | 1.1 | 1.6 and/or 100 klbs overpull | **BURST -** Fixed end point casing design with csg shoe set at injection pressure and surface set at rated working pressure of surface equipment and/or Limited Kick Design assuming 100 bbl kick; FG = 0.9 psi/ft + 1 ppg injection pressure SF, 0.115 psi/ft gas gradient, back-up freshwater gradient = 0.433 psi/ft<br>**COLLAPSE** - Well pumped down dry inside during production with heaviest fluids (mud & cement) on backside |
| Production | 1.2 | 1.1 | 1.6 and/or 100 klbs overpull | **BURST -** Max Surface Treating Pressure during completion + hydrostatic of heaviest frac fluid & highest prop concentration, freshwater back-up gradient<br>**COLLAPSE** - Heaviest mud weight casing is run in on outside with zero back-up inside casing |

AOC casing design generated using standards found in ANSI/API TECHNICAL REPORT 5C3, FIRST EDITION, DECEMBER 2008.

## Cementing Program

| String | Cement Depth (ft) | | | Type and Amount |
|---|---|---|---|---|
| 20" Conductor | 0' | - | 80' | Run trimmie pipe and grout to surface |
| Surface | 0' | - | 3,000' | Lead Slurry - 12.0 ppg ALTCem S100-12 (TM). Slurry to contain 2 lb/sk ACL-10 (Accelerator), 5% ACL-20 (Accelerator), 0.03 gal/sk ADF-20 (Defoamer), 0.13 lb/sk ALC-10 (Lost Circ), 2 lb/sk AXE-30 (Extender). Slurry yield - 2.52 cuft/sx. Water requirements - 14.8 gal/sx.<br>**TOTAL (Lead): 1325 sxs 594.7 Bbls Excess: 100%**<br>Tail Slurry - 12.5 ppg ALTCem S100-12 (TM). Slurry to contain 2 lb/sk ACL-10 (Accelerator), 5% ACL-20 (Accelerator), 0.03 gal/sk ADF-20 (Defoamer), 0.13 lb/sk ALC-10 (Lost Circ), 2 lb/sk AXE-30 (Extender). Slurry yield - 2.22 cuft/sx. Water requirements - 12.5 gal/sx.<br>**TOTAL (Tail): 410 sxs 162.1 Bbls Excess: 100%** |
| Intermediate | 2,800' | - | 10,002' | Lead Slurry - 12.7 ppg ALTCem I100-X1 (TM). Slurry to contain 0.3% ABX-30 (Bond Enhancer), 0.03 gal/sk ADF-20 (Defoamer), 0.1% ADS-10 (Dispersant), 0.5% AFL-50 (Fluid Loss), 0.5% AR-10 (Retarder), 0.1% AVS-10 (Viscosifier). Slurry yield - 1.97 cuft/sx. Water requirements - 11.0 gal/sx.<br>**TOTAL (Lead): 1315 sxs 461.4 Bbls Excess: 25%**<br>Tail Slurry - 13.5 ppg ALTCem ACG-10 (TM) with AFA-10 & AXE-20 Extender. Slurry to contain 0.2% ABX-30 (Bond Enhancer), 0.4% AFL-10 (Fluid Loss), 0.3% AR-10 (Retarder), 25% ASR-20 (Strength Retrogression), 6% AVS-50 (Viscosifier). Slurry yield - 1.90 cuft/sx. Water requirements - 9.5 gal/sx.<br>**TOTAL (Tail): 145 sxs 49.1 Bbls Excess: 25%** |
| Intermediate Liner & Build Section | 9,802' | - | 12,451' | Lead Slurry - 12.7 ppg ALTCem I100-X1 (TM). Slurry to contain 0.3% ABX-30 (Bond Enhancer), 0.03 gal/sk ADF-20 (Defoamer), 0.1% ADS-10 (Dispersant), 0.5% AFL-50 (Fluid Loss), 0.5% AR-10 (Retarder), 0.1% AVS-10 (Viscosifier). Slurry yield - 1.97 cuft/sx. Water requirements - 11.0 gal/sx.<br>**TOTAL (Lead): 165 sxs 57.9 Bbls Excess: 25%**<br>Tail Slurry - 13.5 ppg ALTCem ACG-10 (TM) with AFA-10 & AXE-20 Extender. Slurry to contain 0.2% ABX-30 (Bond Enhancer), 0.4% AFL-10 (Fluid Loss), 0.3% AR-10 (Retarder), 25% ASR-20 (Strength Retrogression), 6% AVS-50 (Viscosifier). Slurry yield - 1.90 cuft/sx. Water requirements - 9.5 gal/sx.<br>**TOTAL (Tail): 70 sxs 23.7 Bbls Excess: 25%** |
| Lateral | 11,951' | - | 19,815' | Tail Slurry (only) - 13.5 ppg ALTCem P50-31 ™ with AFA-10 Extender. Slurry to contain 3% ABX-20 (Bond Enhancer), 0.03 gal/sk ADF-20 (Defoamer), 0.70% AFL-10 (Fluid Loss), 0.60% AR-20 (Retarder), 20% ASR-20 (Strength Retrogression), 0.15% AVS-10 (Viscosifier), 5 lb/sk AXE-20 (Extender). Slurry yield - 1.85 cuft/sx. Water requirements - 9.1 gal/sx.<br>**Total (Tail): 490 sxs 161.5 Bbls Excess: 20%** |
| **WATER SOURCE for Cementing Program** | Anschutz is proposing two options for drilling water and cement mix:<br>a. Option 1: Anschutz plans on obtaining fresh water for drilling and cement from a non-municipal source. If this option is chosen, a water quality analysis will be performed before use.<br>b. Option 2: Anschutz will obtain water for drilling and cement from the City of Meeker, CO or City of Rangely, CO municipal water source. | | | |

## Cuttings Management

| Approximate Cuttings Volume (cuft) | Approximate Drying Agent Volume (cuft) | Approximate Volume of Cuttings & Drying Agent (cuft) |
|---|---|---|
| 16,062 | 19,275 | 35,337 |
| **Pit Depth (ft)** | **Pit Width (ft)** | **Pit Length (ft)** |
| 10 | 16 | 320 |

Cuttings will be disposed of according to all applicable rules and regulations.
We will maintain 2' of freeboard in the cuttings pit. When we reclaim the pit we will have 4' of cover over the cuttings. Cuttings pit will be located in cut section of pad.

## Completion Program

AOC plans to hydraulically fracture this lateral with current and appropriate technologies that will maximize the hydrocarbon producing potential. Geology, wellbore mechanics, in house experience and current industry standards will drive these designs. Each well will be extensively thought out. The completion methodology (cemented plug and perf/sliding sleeves), proppant type and mesh size, as well as the use of Acid, clay stabilizers and other frac chemicals, will be carefully considered.

## Pressure and Pressure Control

| Max Anticipated BHP (psi) | 6,648 | Max Hydrostatic BH Mud Weight Pressure | 7,228 | Max Anticipated BH Temp ($^{o}$F) | 233 |
|---|---|---|---|---|---|

Max Anticipated Bottom-Hole Pressure is listed above. This BHP was derived using offset pressure information (DST's, frac's, pressure surveys, etc). Additionally, the Maximum Mud Weight is listed in the Mud Program above.

The Max Hydrostatic BH Mud Weight Pressure calculated by using the Maximum Mud Weight is significantly greater that the Maximum Anticipated BHP. These two bottom-hole pressure numbers are not in conflict with each other. Rather, the significantly higher Max Hydrostatic BH Pressure calculated by using mud weight is a cushion above the Maximum Anticipated BHP. This 'cushion' is safety margin that will allow tripping, running casing and other well activities to be completed in a safe manner.

In determining what BOPE to use, max surface pressure was calculated by subtracting a hydrostatic mud column assuming 50% evacuation with a gas gradient of 0.12 psi/ft from the max anticipated BHP. The result was safely below 5,000 psi, hence our selection of 5,000 psi BOPE.

See attached "AOC Piceance Well Control Plan".

## Other Potential Risks/Hazards

**No H2S is anticipated in this well.**

## Special Instructions:

## Prepared By:

| Department | Name & Title | Date |
|---|---|---|
| **Geology** | Flemming Mengel, Senior Geologist | 1/5/2017 |
| **Seismic** | | |
| **Completions** | | |
| **Drilling** | Ryan Calhoun, Senior Drilling Engineer | |
| **Drilling** | | |
| **Permitting** | Robyn Amundson, Engineer - Permitting | 1/10/2017 |
| **Land** | | |