

## Dave Kubeczko - DNR

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**From:** Dave Kubeczko - DNR  
**Sent:** Monday, May 09, 2016 10:50 AM  
**To:** Dave Kubeczko  
**Subject:** Drilling and Production Factors Pertinent to BP's Location Variance Request \_ Anderson C2 and C3  
**Attachments:** Bp Drilling Cost\_ APD Anderson C2 and C3.pdf; Log Cross Sections \_ Anderson Well Plan Concept Diagram.pptx; NARRATIVE mew \_ BP Anderson C2 and C3 APD \_ Location Variance Request.docx; Pump Failure vs Deviation.pdf  
**Categories:** Operator Correspondence

Scan No. 2107812      Engineering and Drilling Information      2A#400950178

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**From:** Weems - DNR, Mark [mailto:[mark.weems@state.co.us](mailto:mark.weems@state.co.us)]  
**Sent:** Friday, April 29, 2016 1:56 PM  
**To:** Dave Kubeczko - DNR  
**Cc:** Dave Andrews  
**Subject:** Fwd: Drilling and Production Factors Pertinent to BP's Location Variance Request \_ Anderson C2 and C3

I sent this to Dave Andrews to review, he reviewed it and then told me to send it to you and guess what?!

Mark Weems, P. E.  
Regional Engineer - SW Colorado



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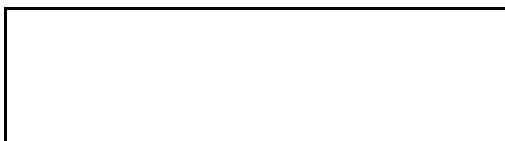
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----- Forwarded message -----

**From:** Weems - DNR, Mark <[mark.weems@state.co.us](mailto:mark.weems@state.co.us)>  
**Date:** Mon, Apr 18, 2016 at 1:23 PM  
**Subject:** Drilling and Production Factors Pertinent to BP's Location Variance Request \_ Anderson C2 and C3  
**To:** Dave Andrews <[david.andrews@state.co.us](mailto:david.andrews@state.co.us)>

See attachments...

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BP has met the objective of the COGCC's well drilling and producing inquiry pertaining to the well location variance request.

Attached are BP's responses for both drilling and production costs associated with various changes in a constant inclination well bore relative to vertical which also means a constant angle and straight line drilled well bore. This data also assumes an average or constant measured total depth (MTD) or length of well bore.

As an exercise in meeting the setback rules, my purpose for the request was for placing prospective wells in various other locations and only within the confines of the existing lay down 320 acre drilling unit. For the protection of corporate proprietary privacy, the data has been presented in a normalized format (zero to 1 fractions or zero to 100 percent) and can be useful or universal for many different well placement and orientation scenarios for future APD's.

Specific to this drilling unit, BP has also provided a geologic explanation for the likely unsuccessful east to west lateral from the C1 location to the east specific to the middle Lemon seam (upper lateral) and has done so via a log-log cross section (see attachment). The geologic factors include the likely presence of a sandstone channel or wedge which creates difficulty in staying on target as well as a toe down lateral making liquid drainage nearly impossible. When drilling the hypothetical lateral you also more than double the MTD or length of the well bore; this in turn also more than doubles the cost to drill the well.

The scope of my inquiry did not include options outside the existing drilling unit; however, the normalized drilling & production costs along with proportional well bore lengths will be useful in those circumstances. Geologic factors for these cases have not been made available or considered.

Mr. Weems,

Here are the normalized drilling costs associated with several recent constant slope wells with varying angles. The cost basis is the costs for the 32 degree inclination well.

Ford H 3

Highest Inclination 41 degrees

1.24 (24% increase)

Southern Ute Tribal AX 4

Highest Inclination 37 degrees

1.11 (11% increase)

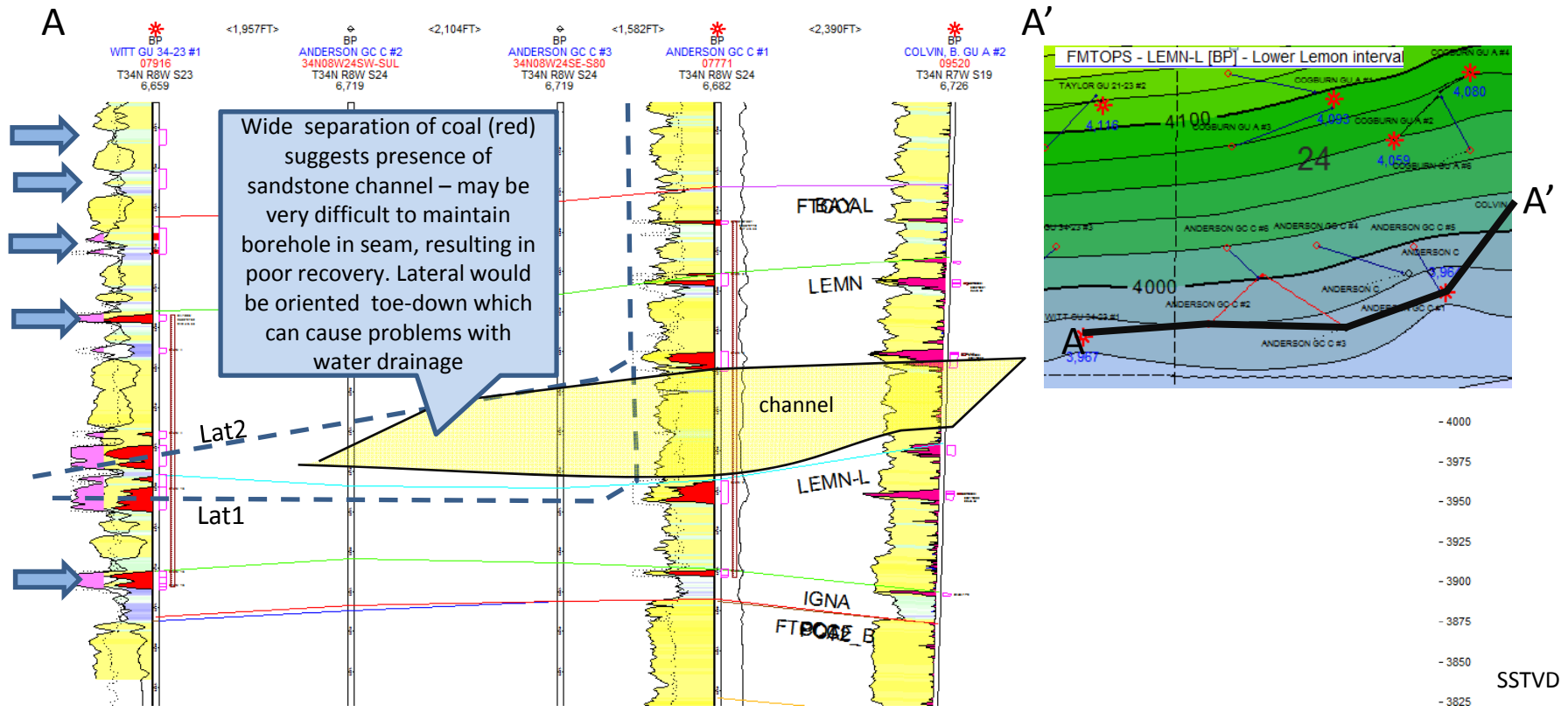
Southern Ute Tribal BK 4

Highest Inclination 32 degrees

1.0 (base case)

Also, regarding your question about horizontal wells, the drilling cost of a pilot well plus a single horizontal would result in a cost 2.57 times (257%) that of the base case 32 degree well. The pilot is necessary for placement of the pump. The preferred inclination in a lateral wellbore would equal 90 degrees. However, the coal reservoir is never perfectly flat and has various faults. The inclination ranges from 88 to 94 degrees while geo-steering. We would like to keep the Dog Leg Severity under 5 degrees per 100 feet.

[Quoted text hidden]



Horizontal wells are not favored for this location. If drilled from Anderson GC C#1 location, wells would be drilled along structural strike. This would probably work for a lateral in the lower LEMN-L seam (proposed Lat1) but would result in toe-down for proposed Lat2. In addition, the degree of vertical coal separation and regional correlations suggest that the two seams are separated by a channel/overbank complex with variable thickness. Therefore Lat2 would have a very low probability of success of staying 100% in target. Directional wells are favored for these reasons, and also because they will access a significant thickness of coal which would be otherwise missed (blue arrows) in a horizontal completion.

## Max. Inclination v. Average of Pump Failures/Year

