

Table 6. Input parameters for the Eastern Transitional Continuous Oil Assessment Unit (50310164), Bakken Total Petroleum System, Williston Basin Province. [bcfg, billion cubic feet of gas; mmcfcg, million cubic feet of gas; cfcg, cubic feet of gas; mmbo, million barrels of oil; bo, barrel of oil; bliq, barrel of liquid; bngl, barrel of natural gas liquids; m, meters; AU, assessment unit; EUR, estimated ultimate recovery]

**INPUT DATA FORM FOR CONTINUOUS ACCUMULATIONS
(version 1.2, July 20, 2012)**

IDENTIFICATION INFORMATION

Assessment Geologist:	<u>S. Gaswirth</u>	Date:	<u>29-Jan-13</u>
Region:	<u>North America</u>	Number:	<u>5</u>
Province:	<u>Williston Basin</u>	Number:	<u>5031</u>
Total Petroleum System:	<u>Bakken</u>	Number:	<u>503101</u>
Assessment Unit:	<u>Eastern Transitional Continuous Oil</u>	Number:	<u>50310164</u>
Based on Data as of:	<u>IHS Energy Group (2012), NRG Associates (2010)</u>		
Notes from Assessor:	<u>Ancillary data from Pollastro (2008)</u>		

CHARACTERISTICS OF ASSESSMENT UNIT

Assessment-unit type: oil (<20,000 cfcg/bo) X gas (>20,000 cfcg/bo) _____
heavy oil (<10 API) _____

Well type: vertical _____ horizontal X

Major reservoir type (Choose one.):
shale _____ low-permeability clastics X
coal _____ low-permeability carbonates _____
diatomite _____

Minimum EUR per well 0.002 (mmbo for oil AU; bcfg for gas AU)

Number of tested wells: 919

Number of tested wells with EUR > minimum: 919

Historic success ratio, tested wells (%) 100

Assessment-Unit Probability:
What is the probability that at least one well within the AU will have production capacity of at least the minimum EUR? 1.0

NUMBER OF UNDRILLED WELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES

- Productive area of accumulation (acres): (triangular)
calculated mean 1,900,000 minimum 1,800,000 mode 1,900,000 maximum 2,000,000
- Uncertainty about average drainage area of wells (acres): (triangular)
calculated mean 440 minimum 320 mode 400 maximum 600
- Percentage of total assessment-unit area that is untested (%): (triangular)
calculated mean 81 minimum 70 mode 79 maximum 93
- Percentage of untested assessment-unit area in sweet spots (%): (triangular)
calculated mean 15 minimum 10 mode 15 maximum 20

ESTIMATED ULTIMATE RECOVERY (EUR) PER WELL

SWEET SPOTS

5a. Future success ratio (%): (triangular)

calculated mean 88 minimum 80 mode 90 maximum 95

5b. Uncertainty about average EUR (mmbo for oil; bcfg for gas): (shifted truncated lognormal)

calculated mean 0.154 minimum 0.075 median 0.15 maximum 0.25

NON-SWEET SPOTS

6a. Future success ratio (%): (triangular)

calculated mean 43 minimum 10 mode 40 maximum 80

6b. Uncertainty about average EUR (mmbo for oil; bcfg for gas): (shifted truncated lognormal)

calculated mean 0.055 minimum 0.005 median 0.05 maximum 0.15

UNCERTAINTY ABOUT AVERAGE COPRODUCT RATIOS FOR UNTESTED WELLS
 (triangular)

<u>Oil assessment unit:</u>	minimum	mode	maximum
Gas/oil ratio (cfg/bo)	<u>350</u>	<u>700</u>	<u>1050</u>
NGL/gas ratio (bnlq/mmcfg)	<u>35</u>	<u>85</u>	<u>115</u>
<u>Gas assessment unit:</u>			
Liquids/gas ratio (bliq/mmcfg)	<u></u>	<u></u>	<u></u>

SELECTED ANCILLARY DATA FOR UNTESTED WELLS
 (no specified distribution type)

<u>Oil assessment unit:</u>	minimum		median		maximum
API gravity of oil (degrees)	34		41		50
Sulfur content of oil (%)	0.01		0.1		1
Depth (m) of water (if applicable)					
Drilling depth (m)	minimum	F75	median	F25	maximum
	2130		2895		3200

<u>Gas assessment unit:</u>	minimum		median		maximum
Inert-gas content (%)					
CO ₂ content (%)					
Hydrogen sulfide content (%)					
Heating value (BTU)					
Depth (m) of water (if applicable)					
Drilling depth (m)	minimum	F75	median	F25	maximum

Completion practices:

1. Typical well-completion practices (conventional, open hole, open cavity, other)	<u>open hole</u>
2. Fraction of wells drilled that are typically stimulated	<u>1</u>
3. Predominant type of stimulation (none, frac, acid, other)	<u>frac</u>
4. Historic fraction of wells drilled that are horizontal	<u>0.88</u>

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS
Surface Allocations (uncertainty of a fixed value)

1. <u>Federal Lands</u>	is	<u>1.09</u> % of the AREA of the AU
mean VOLUME % in entity		<u>1.09</u>
2. <u>Private Lands</u>	is	<u>62.12</u> % of the AREA of the AU
mean VOLUME % in entity		<u>62.00</u>
3. <u>Tribal Lands</u>	is	<u>27.38</u> % of the AREA of the AU
mean VOLUME % in entity		<u>27.91</u>
4. <u>Other Lands</u>	is	<u>0.37</u> % of the AREA of the AU
mean VOLUME % in entity		<u>1.00</u>
5. <u>MT State Lands</u>	is	<u>8.21</u> % of the AREA of the AU
mean VOLUME % in entity		<u>7.00</u>
6. <u>ND State Lands</u>	is	<u>0.83</u> % of the AREA of the AU
mean VOLUME % in entity		<u>1.00</u>
7. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
8. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
9. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
10. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
Surface Allocations (uncertainty of a fixed value)

- | | | |
|---|----|-------------------------------------|
| 1. <u>Bureau of Land Management (BLM)</u> | is | <u>0.12</u> % of the AREA of the AU |
| mean VOLUME % in entity | | <u>0.12</u> |
| 2. <u>BLM Wilderness Areas (BLMW)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 3. <u>BLM Roadless Areas (BLMR)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 4. <u>National Park Service (NPS)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 5. <u>NPS Wilderness Areas (NPSW)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 6. <u>NPS Protected Withdrawals (NPSP)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 7. <u>US Forest Service (FS)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 8. <u>USFS Wilderness Areas (FSW)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 9. <u>USFS Roadless Areas (FSR)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 10. <u>USFS Protected Withdrawals (FSP)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
(continued)

11. <u>US Fish and Wildlife Service (FWS)</u>	is	<u>0.97</u> % of the AREA of the AU
mean VOLUME % in entity		<u>0.97</u>
12. <u>USFWS Wilderness Areas (FWSW)</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
13. <u>USFWS Protected Withdrawals (FWSP)</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
14. <u>Wilderness Study Areas (WS)</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
15. <u>Department of Energy (DOE)</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
16. <u>Department of Defense (DOD)</u>	is	<u>0.00</u> % of the AREA of the AU
mean VOLUME % in entity		<u>0.00</u>
17. <u>Bureau of Reclamation (BOR)</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
18. <u>Tennessee Valley Authority (TVA)</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
19. <u>Other Federal</u>	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
20. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
Surface Allocations (uncertainty of a fixed value)

1. <u>Northern Glaciated Plains (NGPL)</u>	is	<u>55.85</u> % of the AREA of the AU
mean VOLUME % in entity		<u>55.85</u>
2. <u>Northwestern Glaciated Plains (NWGL)</u>	is	<u>44.15</u> % of the AREA of the AU
mean VOLUME % in entity		<u>44.15</u>
3. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
4. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
5. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
6. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
7. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
8. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
9. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____
10. _____	is	_____ % of the AREA of the AU
mean VOLUME % in entity		_____

Table 8. Input parameters for the Three Forks Continuous Oil Assessment Unit (50310166), Bakken Total Petroleum System, Williston Basin Province. [bcfg, billion cubic feet of gas; mmcfcg, million cubic feet of gas; cfcg, cubic feet of gas; mmbo, million barrels of oil; bo, barrel of oil; bliq, barrel of liquid; bngl, barrel of natural gas liquids; m, meters; AU, assessment unit; EUR, estimated ultimate recovery]

**INPUT DATA FORM FOR CONTINUOUS ACCUMULATIONS
(version 1.2, July 20, 2012)**

IDENTIFICATION INFORMATION

Assessment Geologist:	K. Marra	Date:	29-Jan-13
Region:	North America	Number:	5
Province:	Williston Basin	Number:	5031
Total Petroleum System:	Bakken	Number:	503101
Assessment Unit:	Three Forks Continuous Oil	Number:	50310166
Based on Data as of:	IHS Energy Group (2012), NRG Associates (2010)		
Notes from Assessor:	Ancillary data from Pollastro (2008), Bakken as analog		

CHARACTERISTICS OF ASSESSMENT UNIT

Assessment-unit type: oil (<20,000 cfcg/bo) X gas (>20,000 cfcg/bo)
heavy oil (<10 API)

Well type: vertical horizontal X

Major reservoir type (Choose one.):
shale low-permeability clastics
coal low-permeability carbonates X
diatomite

Minimum EUR per well 0.002 (mmbo for oil AU; bcfg for gas AU)

Number of tested wells: 924
Number of tested wells with EUR > minimum: 914
Historic success ratio, tested wells (%) 99

Assessment-Unit Probability:
What is the probability that at least one well within the AU will have
production capacity of at least the minimum EUR? 1.0

NUMBER OF UNDRILLED WELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES

- Productive area of accumulation (acres): (triangular)
calculated mean 13,333,333 minimum 5,000,000 mode 10,000,000 maximum 25,000,000
- Uncertainty about average drainage area of wells (acres): (triangular)
calculated mean 407 minimum 220 mode 400 maximum 600
- Percentage of total assessment-unit area that is untested (%): (triangular)
calculated mean 95 minimum 89 mode 96.5 maximum 99.2
- Percentage of untested assessment-unit area in sweet spots (%): (triangular)
calculated mean 50 minimum 10 mode 50 maximum 90

ESTIMATED ULTIMATE RECOVERY (EUR) PER WELL

SWEET SPOTS

5a. Future success ratio (%): (triangular)

calculated mean 88 minimum 80 mode 90 maximum 95

5b. Uncertainty about average EUR (mmbo for oil; bcfg for gas): (shifted truncated lognormal)

calculated mean 0.222 minimum 0.18 median 0.22 maximum 0.275

NON-SWEET SPOTS

6a. Future success ratio (%): (triangular)

calculated mean 43 minimum 10 mode 40 maximum 80

6b. Uncertainty about average EUR (mmbo for oil; bcfg for gas): (shifted truncated lognormal)

calculated mean 0.085 minimum 0.01 median 0.08 maximum 0.2

UNCERTAINTY ABOUT AVERAGE COPRODUCT RATIOS FOR UNTESTED WELLS
(triangular)

<u>Oil assessment unit:</u>	minimum	mode	maximum
Gas/oil ratio (cfg/bo)	<u>760</u>	<u>960</u>	<u>1160</u>
NGL/gas ratio (bnlg/mmcf)	<u>35</u>	<u>85</u>	<u>115</u>
<u>Gas assessment unit:</u>			
Liquids/gas ratio (bliq/mmcf)	<u> </u>	<u> </u>	<u> </u>

SELECTED ANCILLARY DATA FOR UNTESTED WELLS
 (no specified distribution type)

<u>Oil assessment unit:</u>	minimum		median		maximum
API gravity of oil (degrees)	34		41		50
Sulfur content of oil (%)	0.01		0.1		1
Depth (m) of water (if applicable)					
Drilling depth (m)	minimum	F75	median	F25	maximum
	2200		3250		3400

<u>Gas assessment unit:</u>	minimum		median		maximum
Inert-gas content (%)					
CO ₂ content (%)					
Hydrogen sulfide content (%)					
Heating value (BTU)					
Depth (m) of water (if applicable)					
Drilling depth (m)	minimum	F75	median	F25	maximum

Completion practices:

1. Typical well-completion practices (conventional, open hole, open cavity, other)	open hole
2. Fraction of wells drilled that are typically stimulated	1
3. Predominant type of stimulation (none, frac, acid, other)	frac
4. Historic fraction of wells drilled that are horizontal	1

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES
Surface Allocations (uncertainty of a fixed value)

1.	<u>Montana</u>	is	<u>25.18</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>25.00</u>
2.	<u>North Dakota</u>	is	<u>74.82</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>75.00</u>
3.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
4.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
5.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
6.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
7.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
8.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
9.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
10.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
Surface Allocations (uncertainty of a fixed value)

- | | | |
|---|----|-------------------------------------|
| 1. <u>Bureau of Land Management (BLM)</u> | is | <u>0.46</u> % of the AREA of the AU |
| mean VOLUME % in entity | | <u>0.50</u> |
| 2. <u>BLM Wilderness Areas (BLMW)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 3. <u>BLM Roadless Areas (BLMR)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 4. <u>National Park Service (NPS)</u> | is | <u>0.28</u> % of the AREA of the AU |
| mean VOLUME % in entity | | <u>0.30</u> |
| 5. <u>NPS Wilderness Areas (NPSW)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 6. <u>NPS Protected Withdrawals (NPSP)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 7. <u>US Forest Service (FS)</u> | is | <u>3.14</u> % of the AREA of the AU |
| mean VOLUME % in entity | | <u>3.20</u> |
| 8. <u>USFS Wilderness Areas (FSW)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 9. <u>USFS Roadless Areas (FSR)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |
| 10. <u>USFS Protected Withdrawals (FSP)</u> | is | _____ % of the AREA of the AU |
| mean VOLUME % in entity | | _____ |

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
Surface Allocations (uncertainty of a fixed value)

1.	<u>Northeastern Glaciated Plains (NEGP)</u>	is	<u>25.16</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>25.16</u>
2.	<u>Northern Glaciated Plains (NGPL)</u>	is	<u>41.50</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>41.50</u>
3.	<u>Northwestern Glaciated Plains (NWGL)</u>	is	<u>8.62</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>8.62</u>
4.	<u>Northwestern Great Plains (NWGP)</u>	is	<u>24.66</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>24.66</u>
5.	<u>Powder River Basin (PRBA)</u>	is	<u>0.07</u> % of the AREA of the AU
	mean VOLUME % in entity		<u>0.06</u>
6.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
7.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
8.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
9.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____
10.	_____	is	_____ % of the AREA of the AU
	mean VOLUME % in entity		_____