EXPLANATION OF DATA TABLES FOR NORTON BASIN ASSESSMENT PROVINCE

RESULTS

LOG-N PARAMS (PORE) — Key mathematic parameters that describe log-normal probability distributions for volume of hydrocarbon-bearing rock, in acre-feet, for each play as reported in the **PORE** module of **GRASP**.

- **mu** — Natural logarithm of F50 value of log-normal distribution for volume of hydrocarbon-bearing rock, or "μ", for the subject play. **mu** = ln F50. [Note: distribution **mean** = $e^{(mu + 0.5[sig.\ sq.])}$.]
- **sig. sq.** — The variance of the log-normal distribution for volume of hydrocarbon-bearing rock, or "σ^2", for the subject play. **sig. sq.** = $\{\ln [0.5((F50/F16)+(F84/F50))]\}^2$.

N (MPRO) — Number of hydrocarbon pools calculated for the plays by the **MPRO** module of **GRASP** from inputs for probability distributions of prospect numbers and geologic chances of success (approximately the product of play and prospect chances of success) . The maximum (**Max**) number of pools for each play was entered into the **MONTE1** module of **GRASP** to fix the number of pools aggregated to calculate play resources.

Reserves — Sums of recoverable oil and gas volumes for pools within the play, including both proven and inferred reserve categories. A "prop" entry indicates that the reserve data are proprietary.

- **BCF** — Billions of cubic feet of gas, recoverable, at standard (surface) conditions (here fixed at a temperature of 60° Fahrenheit or 520° Rankine, and 14.73 psi atmospheric pressure).
- **MMB** — Millions of barrels of oil, recoverable, at standard (surface) conditions.

Undiscovered Potential — Risked, undiscovered, conventionally recoverable oil and gas resources of the play, here reported at **Means** of probability distributions.

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Mean Pool Sizes of Ranks 1 to 3 Unrisked (or conditional) mean volumes of recoverable oil and gas in the three largest pools in the play.

PLAY INPUT DATA

F100.....F00 Fractiles for values within probability distributions entered to **GRASP** for calculations of play resources. Four-point distributions (F100, F50, F02, F00) generally indicate that calculations were conducted using log-normal mathematics. Eight-point distributions generally indicate that calculations were conducted using Monte Carlo mathematics. Choice of mathematic approach was in most cases the option of the assessor.

Prospect Area Maximum area of prospect closure, or area within spill contour, in acres. Probability distributions for prospect areas were generally based on distributions assembled independently for each play from large numbers of prospects mapped with seismic reflection data.

Trap Fill Trap fill fraction, or fraction of prospect area in which the reservoir is predicted to be saturated by hydrocarbons.

Pool Area Areal extent of hydrocarbon-saturated part of prospect, in acres. Calculated using **PRASS**, or **SAMPLER** module of **GRASP**, to integrate input probability distributions for prospect areas and trap fill fractions.

Pay Thickness Thickness of hydrocarbon-productive part of reservoir within pool areas, in feet. Probability distributions for prospect areas, trap fill fractions, and pay thicknesses are integrated in the **PORE** module of **GRASP**, to calculate a probability distribution for volume of hydrocarbon-bearing rock, in feet, within the play as reported above under **LOG-N PARAMS (PORE)** .

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Oil Yield (Recov. B/Acre-Feet) Oil, in barrels at standard (surface) conditions, recoverable from a volume of one acre-foot of oil-saturated reservoir in the subsurface. Oil yield probability distributions were generally calculated in a separate exercise using **PRASS** to integrate input probability distributions for porosities, oil saturations, oil shrinkage factors (or "Formation Volume Factors"), and oil recovery efficiencies.

Gas Yield (MMCF/Ac.-Ft.) Gas, in millions of cubic feet at standard (surface) conditions, recoverable from a volume of one acre-foot of gas-saturated reservoir in the subsurface. Distributions were generally calculated in a separate exercise using **PRASS** to integrate input probability distributions for porosities, gas saturations, reservoir pressures, reservoir temperatures (in degrees Rankine), gas deviation ("Z") factors, combustible fractions (that exclude noncombustibles such as carbon dioxide, nitrogen, etc.), and gas recovery efficiencies.

Solution Gas-Oil Ratio (CF/B) Quantity of gas dissolved in oil in the reservoir that separates from the oil when brought to standard (surface) conditions, in cubic feet recovered per barrel of produced oil.

Gas Cond. (B/MMCF) Quantity of liquids or condensate dissolved in gas in the reservoir that separates from the gas when brought to standard (surface) conditions, in barrels recovered per million cubic feet of produced gas.

Number of Prospects..... Probability distributions for numbers of prospects in plays, generally ranging from minimum values (F99) representing the numbers of mapped prospects, to maximum values (F00) that include speculative estimates for the numbers of additional prospects that remain unidentified (generally stratigraphic prospects, geophysically indefinite prospects, or prospects expected in areas with no seismic coverage).

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Probabilities for Oil, Gas, or Mixed Pools

Oil (OPROB) Fraction of hydrocarbon pools that consist entirely of oil, with no free gas present. Typically, an undersaturated oil pool.

Gas (GPROB) Fraction of hydrocarbon pools consisting entirely of gas, with no free oil present.

Mixed (MXPROB) Fraction of hydrocarbon pools that contain both oil and gas as free phases, the gas usually present as a gas cap overlying the oil.

Fraction of Net Pay to Oil (OFRAC) When a hydrocarbon pool is modeled as a mixed case, with both oil and gas present, the fraction of pool volume that is saturated by oil in the subsurface.

Play Chance Success Probability that the play contains at least one pool of technically-recoverable hydrocarbons (that would flow into a conventional wellbore in a flow test or during production).

Prospect Chance Success The fraction of prospects within the play that are predicted to contain hydrocarbon pools, given the condition that at least one pool of technically-recoverable hydrocarbons occurs within the play.

Play Type (E-F-C) Play classification scheme.

E **Established** play, in which significant numbers of fields have been discovered, providing the assessor with data for pool size distributions and reservoirs sufficient to allow the assessor to model the play with confidence.

F **Frontier** play, where exploration activities are at an early stage. Some wells have already been drilled to test the play concept but no commercial fields have been established.

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C	**Conceptual** play, hypothesized by analysts based on the subsurface geologic knowledge of the area. Such plays remain hypothetical and the play concept has not been tested.

NORTON BASIN

Play				Log-N Params. PORE		N (MPRO) No. Pools		Reserves		Undiscovered Potentia	
				Ac/Ft	Ac/Ft			Gas	Oil	Gas	Oil
No.	Area	UAI Code	Name	mu	sig. sq.	Mean	Max	(BCF)	(MMB)	(BCF)	(MMB)
1	Norton	UANO0101	Upper Tertiary Basin Fill	11.987	1.7811	3	23	0	0	745.14	13.67
2	Norton	UANO0201	Mid Tertiary East Subbasin Fill	12.101	1.6755	1	16	0	0	305.50	5.32
3	Norton	UANO0301	Mid Tertiary West Subbasin Fill	11.924	2.2642	6	32	0	0	1617.47	27.74
4	Norton	UANO0401	Lower Tertiary Subbasin Fill	11.813	1.5671	0	9	0	0	39.65	0.72
5	Norton		Basement	Not Quantified							

PLAY		MEAN POOL SIZES OF RANKS 1 TO 3 Pool #1 Gas	Pool #1 Oil	Pool #2 Gas	Pool #2 Oil	Pool #3 Gas	Pool #3 Oil	INPUT DATA Prospect Area (Acres)					
No.	Name	(BCF)	(MMB)	(BCF)	(MMB)	(BCF)	(MMB)	F100	F95	F75	F50	F25	F05
1	Upper Tertiary Basin Fill	890.84	16.20	362.70	6.67	212.36	3.88	30	550	1800	4050	9300	31000
2	Mid Tertiary East Subbasin Fill	619.43	11.27	227.86	4.19	127.92	2.34	35	515	1600	3500	7950	24000
3	Mid Tertiary West Subbasin Fill	1681.00	30.58	675.48	12.42	404.59	7.39	40	290	1100	2700	6800	25000
4	Lower Tertiary Subbasin Fill	153.62	2.79	57.20	1.05	34.71	0.63	25	370	1250	2750	5000	19000
5	Basement	Not Quantified											

PLAY		INPUT DATA Prospect Area (Acres)			Trap Fill (Dec. Frac.)								
No.	Name	F02	F01	F00	F100	F95	F75	F50	F25	F05	F02	F01	F00
1	Upper Tertiary Basin Fill		72000	185000	0.1	0.2	0.26	0.32	0.39	0.51		0.62	1.00
2	Mid Tertiary East Subbasin Fill		5100	130000	0.1	0.2	0.26	0.32	0.39	0.51		0.62	1.00
3	Mid Tertiary West Subbasin Fill		65000	185000	0.1	0.2	0.26	0.32	0.39	0.51		0.62	1.00
4	Lower Tertiary Subbasin Fill		41000	130000	0.1	0.2	0.26	0.32	0.39	0.51		0.62	1.00
5	Basement	Not Quantified											

NORTON BASIN

INPUT DATA

PLAY		Pool Area (Acres)									Pay Thickness (Feet)				
No.	Name	F100	F95	F75	F50	F25	F05	F02	F01	F00	F100	F95	F75	F50	F25
1	Upper Tertiary Basin Fill	5	179	617	1460	3453	11915	20080		80270	20	58	85	110	143
2	Mid Tertiary East Subbasin Fill	10	149	509	1200	2827	9696	16300		62000	40	100	127	150	177
3	Mid Tertiary West Subbasin Fill	12	79	328	887	2395	10002	18265		72000	40	102	138	170	209
4	Lower Tertiary Subbasin Fill	10	123	397	900	2039	6610	10850		68122	50	90	121	150	185
5	Basement	Not Quantified													

INPUT DATA

PLAY		Pay Thickness (Feet)				Oil Yield (Recov. B/Acre-Foot)								Gas Yield (MMCF/Ac.-Ft)			
No.	Name	F05	F02	F01	F00	F100	F95	F75	F50	F25	F05	F01	F00	F100	F95	F75	F50
1	Upper Tertiary Basin Fill	209	245		380	na	na	na	na	na	na	na	na	0.182	0.337	0.449	0.549
2	Mid Tertiary East Subbasin Fill	226	250		350	na	na	na	na	na	na	na	na	0.203	0.362	0.475	0.573
3	Mid Tertiary West Subbasin Fill	282	320		490	na	na	na	na	na	na	na	na	0.193	0.349	0.459	0.556
4	Lower Tertiary Subbasin Fill	251	285		400	na	na	na	na	na	na	na	na	0.099	0.197	0.272	0.340
5	Basement	Not Quantified															

INPUT DATA

PLAY		Gas Yield (MMCF/Ac.-Ft)				Solution Gas Oil Ratio (CF/B)								Gas Cond. (B/MMCF)			
No.	Name	F25	F05	F01	F00	F100	F95	F75	F50	F25	F05	F01	F00	F100	F95	F75	F50
1	Upper Tertiary Basin Fill	0.669	0.892		1.650	na	na	na	na	na	na	na	na	7.5	13	16	18
2	Mid Tertiary East Subbasin Fill	0.691	0.905		1.610	na	na	na	na	na	na	na	na	7.5	13	16	18
3	Mid Tertiary West Subbasin Fill	0.674	0.887		1.590	na	na	na	na	na	na	na	na	7.5	13	16	18
4	Lower Tertiary Subbasin Fill	0.425	0.567		1.170	na	na	na	na	na	na	na	na	7.5	13	16	18
5	Basement	Not Quantified															

NORTON BASIN

		INPUT DATA											
PLAY		Gas Cond. (B/MMCF)				Number of Prospects in Play							
No.	Name	F25	F05	F01	F00	F99	F95	F75	F50	F25	F05	F01	F00
1	Upper Tertiary Basin Fill	20	25		33	52	54	60	63	68	80		82
2	Mid Tertiary East Subbasin Fill	20	25		33	25	27	34	36	40	53		55
3	Mid Tertiary West Subbasin Fill	20	25		33	96	99	109	113	116	118		136
4	Lower Tertiary Subbasin Fill	20	25		33	5	6	8	10	12	19		20
5	Basement	Not Quantified											

		INPUT DATA						
		Probabilities for Oil, Gas, or Mixed Pools			Fraction of Net	Play	Prospect	
PLAY		Oil	Gas	Mixed	Pay to Oil	Chance	Chance	Play Type
No.	Name	(OPROB)	(GPROB)	(MXPROB)	(OFRAC)	Success	Success	E - F - C
1	Upper Tertiary Basin Fill	0	1	0	0	0.40	0.12	C
2	Mid Tertiary East Subbasin Fill	0	1	0	0	0.30	0.10	C
3	Mid Tertiary West Subbasin Fill	0	1	0	0	0.42	0.12	C
4	Lower Tertiary Subbasin Fill	0	1	0	0	0.30	0.10	C
5	Basement	Not Quantified				0.09		C