

STATE OF NORTH DAKOTA PROBABLE (2P50) OIL RESERVES PROJECT

By

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This paper presents the second phase of a project by the Oil and Gas Division (OGD) of the Department of Mineral Resources (DMR) that began in August of 2005 to estimate the proved developed producing (1P90) oil reserves and probable (2P50) oil reserves of each producing pool within the State of North Dakota. The first phase of the project, the 1P90 oil reserve estimate, was completed in April 2006.

2P50 reserves are defined as technically and economically recoverable volumes with a probability of recovery greater than fifty (50%) percent. Typically 2P50 reserves require significant capital investment for re-completions, stimulations, drilling, or enhanced oil recovery (EOR) operations such as water-flood improvements, carbon dioxide (CO₂) flooding, or other tertiary recovery methods.

The total 2P50 reserves estimated within North Dakota are over 660 million barrels. These reserve estimates are useful for economic forecasting, infrastructure planning, and estimating possible (3P10) reserves.

The process of estimating 2P50 reserves began while each pool was evaluated for Estimated Ultimate Recovery (EUR) and 1P90 reserves. Pools with a known analog that has benefited from infill drilling, horizontal drilling, and/or EOR processes were identified as having potential for 2P50 reserves and were cataloged for evaluation in this phase of the study.

2P50 reserve potential from re-completions, stimulations, in-fill drilling or water-flood improvement was estimated by using statistical comparison of recovery factors.

2P50 reserve potential for EOR was limited to pools with certain characteristics as follows:

- Madison pools with 5 or more active wells, water saturation less than 45%, and primary EUR of more than 1 million barrels.
- Devonian pools with 3 or more active wells, water saturation less than 45%, and primary EUR of more than 1 million barrels.
- Red River pools with 2 or more active wells, water saturation less than 50%, and primary EUR of more than 1 million barrels.

Reservoir parameters (porosity, thickness, water saturation, and formation volume factor) required to calculate original oil in place (OOIP) were taken from temporary and proper spacing exhibits, entered into spreadsheets, compared statistically, and evaluated based on experience by the authors of this paper. Missing parameters and/or parameters that resulted in unreasonable recovery factors were reviewed and revised or estimated utilizing correlations, reservoir studies on file at the OGD, fractional flow curves, and well log analysis. Parameters estimated in this way are identified as “current” to

distinguish them from those presented by expert witnesses in temporary or proper spacing hearings.

The area parameter for each pool was estimated by multiplying the primary spacing set for the pool times the maximum number of producing wells during the pools producing history.

OOIP was calculated for each pool and the estimated ultimate recovery (EUR) from the 1P90 reserves study was divided by OOIP to calculate an ultimate recovery factor. The pools were grouped by county for statistical comparison of recovery factors. Field-pool combinations with recovery factors below the mean value were checked for potential re-completion, stimulation, in-fill drilling, or water-flood improvements. When potential was confirmed, the difference between mean recovery factor for that pool type in that county and the recovery factor of the specific pool was multiplied by the OOIP to estimate probable reserves.

CO₂ – EOR reserves were taken from previous estimates published by the Energy & Environmental Research Center (EERC) as a part of the Plains Carbon Dioxide Reduction Partnership (PCORP) Phase 1 project. The unitized pools in the PCORP list were evaluated based on experience. CO₂ – EOR reserves in unitized pools, where water-flooding has been effective and reservoir pressure maintained above bubble point, were considered 2P50 reserves. CO₂ – EOR reserves in unitized pools, where water-flooding has not been effective or reservoir pressure is currently below bubble point, will be considered Possible (3P10) reserves, meaning they are technically recoverable, but with a significantly lower probability of recovery.

Table 1 lists the Madison pools in North Dakota with 2P50 reserves.

Table 2 lists the Bakken pools in North Dakota with 2P50 reserves.

Table 3 lists the Devonian pools in North Dakota with 2P50 reserves.

Table 4 lists the Red River pools in North Dakota with 2P50 reserves.

Table 5 lists the Midale-Nesson, Ratcliffe, Birdbear, Silurian, Stonewall, Tyler and Winnipegosis pools in North Dakota with 2P50 reserves.

Table 1
North Dakota Madison Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
* BIG STICK	MADISON	BILLINGS			37	52,899,737	10,366,335	63,266,072	166,000,000	0.381	20,000,000	CO ₂
* FRYBURG	MADISON	BILLINGS			29	14,272,034	11,785,533	26,057,567	63,452,611	0.411	9,500,000	CO ₂
* KNUITSON	MADISON	BILLINGS	GOLDEN VALLEY		10	4,430,649	1,403,397	5,834,046	19,100,000	0.305	690,160	Waterflood Improvement
* LITTLE KNIFE	MADISON	BILLINGS	MCKENZIE	DUNN	4	1,226,674	269,470	1,496,144	4,128,000	0.362	**	
* MEDORA	MADISON	BILLINGS			13	7,698,122	3,494,489	11,192,611	50,601,349	0.221	9,591,871	Waterflood Improvement & CO ₂
* NORTH ELKHORN RANCH	MADISON	BILLINGS			21	15,538,320	5,109,803	20,648,123	55,500,000	0.372	7,000,000	CO ₂
* T. R.	MADISON	BILLINGS			18	8,214,960	6,210,400	14,425,360	42,656,906	0.338	145,448	Waterflood Improvement
* ANTLER	MADISON	BOTTINEAU			8	386,444	175,935	562,379	996,292	0.564	**	
* BAUMANN DRAIN	MADISON	BOTTINEAU			2	31,520	10,991	42,511	400,000	0.106	71,442	Waterflood Improvement
* HAAS	MADISON	BOTTINEAU			42	10,050,376	4,077,146	14,127,522	44,572,000	0.317	**	
* KUROKI	MADISON	BOTTINEAU			6	777,045	287,159	1,064,204	3,679,000	0.289	**	
* LANDA	MADISON	BOTTINEAU			7	2,396,172	677,667	3,073,839	8,103,578	0.379	1,000,000	CO ₂
* LANDA	MADISON	BOTTINEAU			7	439,370	118,047	557,417	6,680,000	0.083	1,345,597	Waterflood Improvement
* MOHALL	MADISON	BOTTINEAU	RENVILLE		20	4,611,988	2,009,859	6,621,847	15,285,400	0.433	2,000,000	CO ₂
* NORTH WESTHOPE	MADISON	BOTTINEAU			4	1,302,294	133,835	1,436,129	10,000,000	0.144	1,412,694	Waterflood Improvement
* SCOTIA	MADISON	BOTTINEAU			4	379,639	117,443	497,082	1,500,000	0.331	**	
* SOUTH ANTLER CREEK	MADISON	BOTTINEAU	RENVILLE		5	1,045,040	130,463	1,175,503	5,100,000	0.230	277,397	Waterflood Improvement
* SOUTH LANDA	MADISON	BOTTINEAU			3	277,428	44,716	322,144	976,000	0.330	**	
* SOUTH STARBUCK	MADISON	BOTTINEAU			5	212,588	138,933	351,521	1,771,000	0.198	153,006	Waterflood Improvement
* WILEY	MADISON	BOTTINEAU			52	18,096,549	10,335,233	28,431,782	95,900,000	0.296	12,000,000	CO ₂
* FLAXTON	MADISON	BURKE			6	1,322,603	142,694	1,465,297	13,300,000	0.110	2,483,750	Waterflood Improvement
* NORTHEAST FOOTHILLS	MADISON	BURKE			7	1,216,831	8,789	1,225,620	22,000,000	0.056	5,306,638	Waterflood Improvement
* RIVAL	MADISON	BURKE			22	14,550,206	1,396,403	15,946,609	79,000,000	0.202	16,510,137	Waterflood Improvement & CO ₂
* FLAT LAKE EAST	MADISON	DIVIDE			1	96,371	3,895	100,266	637,949	0.157	89,154	Waterflood Improvement
* ANTELOPE	MADISON	MCKENZIE			5	17,144,759	1,110,575	18,255,334	100,000,000	0.183	13,501,498	Waterflood Improvement
* BLUE BUTTES	MADISON	MCKENZIE			14	34,137,338	946,878	35,084,216	92,700,000	0.378	**	
* CHARLSON	MADISON	MCKENZIE	WILLIAMS		8	23,422,813	919,351	24,342,164	80,000,000	0.304	11,063,301	Waterflood Improvement & CO ₂
* CHARLSON	MADISON	MCKENZIE	WILLIAMS		5	4,094,897	1,125,857	5,220,754	9,600,000	0.544	1,000,000	CO ₂
* CLEAR CREEK	MADISON	MCKENZIE			3	9,633,598	237,050	9,870,648	27,000,000	0.366	3,000,000	CO ₂
* GLASS BLUFF	MADISON	MCKENZIE	WILLIAMS		36	6,465,127	2,070,603	8,535,730	52,069,696	0.164	7,999,956	Waterflood Improvement
* HAWKEYE	MADISON	MCKENZIE			6	14,289,907	607,491	14,897,398	43,600,000	0.342	**	
* RED WING CREEK	MADISON	MCKENZIE			12	15,076,868	3,248,868	18,325,736	62,413,417	0.294	1,494,788	Waterflood Improvement
* ROUGH RIDER	MADISON	MCKENZIE			11	6,893,516	1,076,076	7,969,592	31,000,000	0.257	5,875,026	Waterflood Improvement & CO ₂
* ROUGH RIDER	MADISON	MCKENZIE			11	8,813,572	1,526,218	10,339,790	30,000,000	0.345	**	
* PLAZA	MADISON	MOUNTRAIL			8	2,228,826	986,864	3,215,690	7,690,000	0.418	**	
* WABEK	MADISON	MOUNTRAIL	WARD		13	6,029,853	215,392	6,245,245	29,700,000	0.210	3,087,130	CO ₂
* CHOLA	MADISON	RENVILLE			5	1,211,461	52,734	1,264,195	7,300,000	0.173	921,140	CO ₂
* GLENBURN	MADISON	RENVILLE	BOTTINEAU		13	2,988,470	725,021	3,713,491	11,430,643	0.325	**	
* LAKE DARLING	MADISON	RENVILLE			3	133,749	45,123	178,872	2,842,105	0.063	671,943	Waterflood Improvement
* MACKOBEE COULEE	MADISON	RENVILLE			2	562,391	13,103	575,494	1,510,000	0.381	**	
* MOUSE RIVER PARK	MADISON	RENVILLE			29	2,539,688	468,288	3,007,976	15,810,987	0.190	1,725,216	Waterflood Improvement
* MOUSE RIVER PARK	MADISON	RENVILLE			11	1,368,015	850,164	2,218,179	5,454,761	0.407	**	
* NORTH GRANO	MADISON	RENVILLE			3	517,028	84,079	601,107	3,568,322	0.168	467,109	Waterflood Improvement
* PLEASANT	MADISON	RENVILLE			11	1,760,921	265,326	2,026,247	5,354,000	0.378	**	
* TRURO	MADISON	RENVILLE			9	1,282,866	1,605,094	2,887,960	4,747,325	0.608	**	
* LONE TREE	MADISON	WARD			4	1,851,450	96,222	1,947,672	8,277,700	0.235	510,150	Waterflood Improvement
* BEAVER LODGE	MADISON	WILLIAMS			26	54,676,387	8,589,685	63,266,072	172,000,000	0.368	929,829	Waterflood Improvement
* CAPA	MADISON	WILLIAMS			3	12,270,420	167,102	12,437,522	32,200,000	0.386	**	
* HOFFLUND	MADISON	WILLIAMS			7	2,828,852	1,883,782	4,712,634	10,300,000	0.458	**	
* TIOGA	MADISON	WILLIAMS	MOUNTRAIL	BURKE	24	58,878,723	1,883,415	60,762,138	216,000,000	0.281	19,855,970	Waterflood Improvement

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.

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North Dakota Madison Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
BUCKHORN	MADISON	BILLINGS	MCKENZIE		11	4,577,353	350,304	4,927,657	16,183,923	0.304	600,471	Waterflood
DAVIS CREEK	MADISON	BILLINGS			15	1,388,150	936,577	2,324,727	11,191,469	0.208	1,498,071	Waterflood
DEVILS PASS	MADISON	BILLINGS	MCKENZIE		4	1,323,945	236,388	1,560,333	10,235,595	0.152	1,935,956	Waterflood
ELKHORN RANCH	MADISON	BILLINGS			16	12,011,525	1,184,613	13,196,138	59,235,767	0.223	7,037,701	***
FOUR EYES	MADISON	BILLINGS			1	3,849,879	34,703	3,884,582	22,010,377	0.176	911,017	***
FRYBURG	MADISON	BILLINGS			17	1,800,507	1,465,116	3,265,623	73,782,106	0.044	12,809,948	***
HUNGRY MAN BUTTE	MADISON	BILLINGS			2	229,586	81,096	310,682	2,033,064	0.153	132,280	***
KNUTSON	MADISON	BILLINGS	GOLDEN VALLEY		3	1,993,222	738,768	2,731,990	7,797,542	0.350	**	
LITTLE KNIFE	MADISON	BILLINGS	MCKENZIE	DUNN	88	72,748,064	13,430,308	86,178,372	253,276,346	0.340	**	
MORGAN DRAW	MADISON	BILLINGS	GOLDEN VALLEY		1	424,620	125,004	549,624	2,659,886	0.207	29,909	***
ROOSEVELT	MADISON	BILLINGS			3	75,696	170,532	246,228	1,059,915	0.232	**	
TREE TOP	MADISON	BILLINGS			16	12,316,919	1,633,311	13,950,230	67,172,345	0.208	8,994,597	Waterflood
WHISKEY JOE	MADISON	BILLINGS			20	8,141,447	5,439,446	13,580,893	57,987,239	0.234	6,226,472	Waterflood
ANTLER	MADISON	BOTTINEAU			8	382,784	46,548	429,332	13,866,569	0.031	3,521,008	Waterflood
CIMBEL	MADISON	BOTTINEAU			7	821,480	145,601	967,081	3,644,302	0.265	71,116	***
ELMS	MADISON	BOTTINEAU			7	1,630,322	510,167	2,140,489	5,995,382	0.357	**	
HARAM	MADISON	BOTTINEAU			9	1,652,735	718,161	2,370,896	5,908,493	0.401	**	
NORTH HAAS	MADISON	BOTTINEAU			16	1,666,078	211,391	1,877,469	19,875,591	0.094	3,784,735	***
NORTH SOUTHERN	MADISON	BOTTINEAU			7	1,259,230	45,859	1,305,089	3,744,998	0.348	**	
NORTH WESTHOPE	MADISON	BOTTINEAU			5	1,359,979	477,063	1,837,042	3,979,854	0.462	**	
RENNIE LAKE	MADISON	BOTTINEAU			13	401,960	770,341	1,172,301	2,975,010	0.394	**	
SHERMAN	MADISON	BOTTINEAU			12	1,194,694	1,030,717	2,225,411	13,107,917	0.170	844,240	Waterflood
SOUTHWEST LANDA	MADISON	BOTTINEAU			4	351,112	47,430	398,542	2,405,122	0.166	286,635	Waterflood
SOUTHWEST STARBUCK	MADISON	BOTTINEAU			6	549,939	160,947	710,886	5,958,144	0.119	986,484	Waterflood
STARBUCK	MADISON	BOTTINEAU			9	927,338	34,235	961,573	16,528,772	0.058	3,747,181	***
WAYNE	MADISON	BOTTINEAU			43	5,422,293	1,655,784	7,078,077	39,719,408	0.178	2,223,532	***
BLACK SLOUGH	MADISON	BURKE			7	7,098,167	28,949	7,127,116	123,900,242	0.058	16,902,023	***
CARTER	MADISON	BURKE			2	198,856	8,907	207,763	1,817,696	0.114	144,760	***
COLUMBUS	MADISON	BURKE			5	693,560	46,120	739,680	6,153,493	0.120	453,725	***
COTEAU	MADISON	BURKE			2	330,651	66,238	396,889	2,930,235	0.135	171,399	***
DALE	MADISON	BURKE			3	232,615	44,220	276,835	4,069,114	0.068	512,327	***
FLAXTON	MADISON	BURKE			36	4,015,483	602,252	4,617,735	12,316,601	0.375	**	
FOOTHILLS	MADISON	BURKE			6	2,759,328	56,434	2,815,762	88,520,997	0.032	14,351,947	***
LIGNITE	MADISON	BURKE			13	3,077,411	1,955	3,079,366	10,341,636	0.298	**	
NORTH TIOGA	MADISON	BURKE	DIVIDE	WILLIAMS	26	17,278,481	1,177,783	18,456,264	90,000,000	0.205	**	
NORTHEAST FOOTHILLS	MADISON	BURKE			28	4,605,205	603,815	5,209,020	16,633,152	0.313	**	
PORTAL	MADISON	BURKE			42	4,427,368	314,075	4,741,443	53,530,200	0.089	5,640,172	***
RENNIE LAKE	MADISON	BURKE			11	1,952,239	28,259	1,980,498	45,854,952	0.043	6,912,584	***
RIVAL	MADISON	BURKE			15	1,251,262	225,737	1,476,999	45,222,313	0.033	7,293,389	***
SHORT CREEK	MADISON	BURKE			1	244,315	93,581	337,896	4,395,352	0.077	514,536	***
VANVILLE	MADISON	BURKE			3	155,403	150,025	305,428	1,934,769	0.158	69,800	***
WOBURN	MADISON	BURKE			19	1,918,220	84,313	2,002,533	13,989,226	0.143	710,529	***
DOLPHIN	MADISON	DIVIDE			3	498,109	149,026	647,135	4,029,799	0.161	134,402	***
HAMLET	MADISON	DIVIDE			7	2,052,423	691,253	2,743,676	12,890,215	0.213	**	
KIMBERLY	MADISON	DIVIDE			3	417,869	163,899	581,768	8,451,803	0.069	1,057,370	***
NOONAN	MADISON	DIVIDE			1	894,860	97,689	992,549	9,330,454	0.106	816,994	***
SADLER	MADISON	DIVIDE			4	275,233	31,812	307,045	13,460,647	0.023	2,303,505	***
STONEVIEW	MADISON	DIVIDE	BURKE		8	3,147,639	154,691	3,302,330	18,206,686	0.181	228,664	***
WILDROSE	MADISON	DIVIDE			1	158,133	76,003	234,136	1,945,706	0.120	143,213	***
BARTA	MADISON	DUNN	BILLINGS		2	277,230	283,246	560,476	5,748,081	0.098	554,303	***
BEAR CREEK	MADISON	DUNN			3	227,125	130,346	357,471	2,790,583	0.128	183,733	***
CROOKED CREEK	MADISON	DUNN			9	456,279	87,323	543,602	9,039,943	0.060	1,209,599	***

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.

Table 1
North Dakota Madison Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
LAKE ILO	MADISON	DUNN			3	317,861	48,881	366,742	2,043,782	0.179	29,628	***
LONE BUTTE	MADISON	DUNN	MCKENZIE		11	8,224,133	5,949,940	14,174,073	49,227,510	0.288	**	
RUSSIAN CREEK	MADISON	DUNN			2	388,417	116,326	504,743	3,406,072	0.148	155,829	***
WILLMEN	MADISON	DUNN	BILLINGS		3	282,536	394,448	676,984	4,326,997	0.156	162,191	***
BEAVER CREEK	MADISON	GOLDEN VALLEY	BILLINGS		3	57,813	582,005	639,818	1,613,664	0.397	**	
RIDER	MADISON	GOLDEN VALLEY	BILLINGS		1	375,982	246,003	621,985	4,051,538	0.154	175,135	***
SQUARE BUTTE	MADISON	GOLDEN VALLEY			7	2,178,433	1,249,704	3,428,137	85,241,180	0.040	13,342,647	***
ALEXANDER	MADISON	MCKENZIE			3	472,525	52,958	525,483	1,945,706	0.270	**	
ASSINIBOINE	MADISON	MCKENZIE			2	282,215	36,986	319,201	2,606,688	0.122	205,769	***
BAKER	MADISON	MCKENZIE			4	593,181	183,330	776,511	2,924,907	0.265	**	
BEAR DEN	MADISON	MCKENZIE			2	1,252,286	384,400	1,636,686	5,213,376	0.314	**	
BUFFALO WALLOW	MADISON	MCKENZIE			3	1,651,409	553,105	2,204,514	7,807,552	0.282	274,917	***
BULL MOOSE	MADISON	MCKENZIE			2	727,992	41,363	769,355	8,761,976	0.088	995,251	***
CAMEL BUTTE	MADISON	MCKENZIE			7	1,475,818	517,822	1,993,640	17,493,286	0.114	1,529,397	Waterflood
CAMP	MADISON	MCKENZIE			17	2,613,058	1,347,919	3,960,977	30,386,534	0.130	5,688,824	***
CARTWRIGHT	MADISON	MCKENZIE			3	899,138	249,569	1,148,707	3,721,548	0.309	**	
DIMMICK LAKE	MADISON	MCKENZIE			2	2,163,841	19,517	2,183,358	7,862,945	0.278	**	
ELK	MADISON	MCKENZIE			14	3,311,053	629,522	3,940,575	26,575,705	0.148	1,411,603	***
ESTES	MADISON	MCKENZIE			4	498,849	114,794	613,643	2,938,969	0.209	**	
FLAT TOP BUTTE	MADISON	MCKENZIE			4	1,798,815	254,983	2,053,798	12,412,006	0.165	445,901	***
FOREMAN BUTTE	MADISON	MCKENZIE			22	622,110	2,702,806	3,324,916	89,435,098	0.037	14,686,744	***
GRASSY BUTTE	MADISON	MCKENZIE			10	1,533,372	686,110	2,219,482	15,779,772	0.141	958,464	***
HARDING	MADISON	MCKENZIE			13	2,102,949	776,398	2,879,347	9,843,350	0.293	**	
INDIAN HILL	MADISON	MCKENZIE	WILLIAMS		40	9,823,620	2,730,882	12,554,502	80,844,855	0.155	13,119,263	***
KEENE	MADISON	MCKENZIE			9	3,701,829	711,204	4,413,033	14,299,546	0.309	**	
MONDAK	MADISON	MCKENZIE			12	14,432,925	585,083	15,018,008	521,342,565	0.029	89,977,071	***
NAMELESS	MADISON	MCKENZIE			5	899,268	304,747	1,204,015	3,028,723	0.398	**	
PATENT GATE	MADISON	MCKENZIE			2	338,626	45,388	384,014	2,693,978	0.143	158,536	***
PERSHING	MADISON	MCKENZIE			1	1,701,110	71,139	1,772,249	6,093,078	0.291	**	
POE	MADISON	MCKENZIE			7	743,522	882,231	1,625,753	15,831,640	0.103	1,562,639	***
PRONGHORN	MADISON	MCKENZIE			3	614,067	570,760	1,184,827	4,456,020	0.266	**	
RAGGED BUTTE	MADISON	MCKENZIE			7	1,630,796	168,963	1,799,759	9,010,452	0.200	14,889	***
RANDOLPH	MADISON	MCKENZIE			4	383,349	151,618	534,967	10,054,368	0.053	1,489,919	***
RAWSON	MADISON	MCKENZIE			6	976,892	601,449	1,578,341	6,019,587	0.262	**	
RED WING CREEK	MADISON	MCKENZIE			11	1,551,795	4,616,622	6,168,417	27,390,333	0.225	**	
SAKAKAWEA	MADISON	MCKENZIE			2	263,693	40,854	304,547	1,014,303	0.300	**	
SIOUX	MADISON	MCKENZIE			4	278,162	190,275	468,437	3,650,693	0.128	266,789	***
SQUAW GAP	MADISON	MCKENZIE			2	862,562	211,733	1,074,295	14,858,122	0.072	1,918,036	***
TRAILSIDE	MADISON	MCKENZIE			3	1,319,047	727,995	2,047,042	4,845,957	0.422	**	
UNION CENTER	MADISON	MCKENZIE			3	1,050,050	86,384	1,136,434	9,131,849	0.124	702,662	***
LUCKY MOUND	MADISON	MCLEAN			10	1,751,347	99,467	1,850,814	20,539,637	0.090	2,132,631	***
PLAZA	MADISON	MOUNTRAIL			4	1,046,916	192,292	1,239,208	8,400,817	0.148	390,041	Waterflood
STANLEY	MADISON	MOUNTRAIL			14	3,948,498	934,167	4,882,665	21,282,920	0.229	1,804,883	***
WHITE EARTH	MADISON	MOUNTRAIL			3	2,834,339	251,644	3,085,983	20,353,020	0.152	861,269	Waterflood
ELMORE	MADISON	RENVILLE			13	2,629,208	191,224	2,820,432	18,231,921	0.155	2,637,493	Waterflood
GLENBURN	MADISON	RENVILLE	BOTTINEAU		69	20,168,681	5,766,594	25,935,275	120,547,024	0.215	10,151,799	Waterflood
LAKE DARLING	MADISON	RENVILLE			10	4,043,608	418,123	4,461,731	17,887,871	0.249	893,200	***
LITTLE DEEP CREEK	MADISON	RENVILLE			4	439,822	42,210	482,032	8,391,053	0.057	1,316,095	Waterflood
MACKOBEE COULEE	MADISON	RENVILLE			8	1,217,025	387,526	1,604,551	14,694,165	0.109	2,794,308	***
MCKINNEY	MADISON	RENVILLE			13	1,140,827	2,890	1,143,717	2,840,714	0.403	**	
PRATT	MADISON	RENVILLE			13	1,033,887	54,550	1,088,437	8,238,820	0.132	1,377,944	***
SHERWOOD	MADISON	RENVILLE			36	19,572,098	674,536	20,246,634	64,600,398	0.313	**	

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.

Table 1
North Dakota Madison Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
SMITH	MADISON	RENVILLE			15	3,386,122	366,367	3,752,489	17,031,744	0.220	1,346,150	***
TOLLEY	MADISON	RENVILLE			3	1,052,134	99,448	1,151,582	6,077,307	0.189	150,730	***
WEST GREENE	MADISON	RENVILLE			5	598,055	74,025	672,080	2,144,932	0.313	**	
ROCKY HILL	MADISON	STARK	BILLINGS		4	301,351	140,970	442,321	5,825,741	0.076	687,520	***
GREENBUSH	MADISON	WARD			3	810,293	354,422	1,164,715	4,386,684	0.266	**	
SOUTH LONE TREE	MADISON	WARD			2	1,455,547	1,028	1,456,575	6,417,418	0.227	**	
SOUTHWEST AURELIA	MADISON	WARD	MOUNTRAIL		1	84,888	155	85,043	8,465,530	0.010	1,556,757	***
TORNING	MADISON	WARD			2	394,403	142,861	537,264	2,076,993	0.259	**	
AVOCA	MADISON	WILLIAMS			4	311,532	8,985	320,517	1,362,925	0.235	**	
BUFORD	MADISON	WILLIAMS			8	1,476,786	336,054	1,812,840	18,023,386	0.101	4,914,064	Waterflood
CATWALK	MADISON	WILLIAMS			12	2,079,948	220,323	2,300,271	7,131,898	0.323	361,582	***
COW CREEK	MADISON	WILLIAMS			3	482,143	162,522	644,665	1,655,457	0.389	**	
CRAZY MAN CREEK	MADISON	WILLIAMS			2	308,769	6,818	315,587	1,650,902	0.191	46,116	***
DUBLIN	MADISON	WILLIAMS			4	889,384	275,904	1,165,288	2,464,046	0.473	**	
EAST FORK	MADISON	WILLIAMS			28	4,957,912	262,341	5,220,253	29,790,720	0.175	5,898,596	Waterflood
EIGHTMILE	MADISON	WILLIAMS	MCKENZIE		7	1,338,605	240,680	1,579,285	10,724,831	0.147	2,423,565	***
FT. BUFORD	MADISON	WILLIAMS			3	1,158,294	563,654	1,721,948	12,066,960	0.143	921,850	Waterflood
HARDSCRABBLE	MADISON	WILLIAMS	MCKENZIE		5	750,616	82,524	833,140	2,644,482	0.315	153,865	Waterflood
LAST CHANCE	MADISON	WILLIAMS			8	1,516,121	116,861	1,632,982	16,895,245	0.097	4,672,864	Waterflood
LINDAHL	MADISON	WILLIAMS			12	1,891,161	481,553	2,372,714	9,210,959	0.258	1,065,110	Waterflood
MCGREGOR	MADISON	WILLIAMS			9	2,653,298	647,725	3,301,023	20,679,725	0.160	4,417,312	Waterflood
MISSOURI RIDGE	MADISON	WILLIAMS			2	408,769	144,846	553,615	1,211,489	0.457	**	
NORTHWEST MCGREGOR	MADISON	WILLIAMS			5	1,167,640	335,668	1,503,308	15,414,910	0.098	4,250,029	***
ROSEBUD	MADISON	WILLIAMS			4	943,367	682,907	1,626,274	10,810,034	0.150	742,139	Waterflood
STOCKYARD CREEK	MADISON	WILLIAMS			8	1,863,888	964,454	2,828,342	11,561,491	0.245	1,486,776	***
STONY CREEK	MADISON	WILLIAMS			3	532,091	145,892	677,983	2,878,674	0.236	**	
TEMPLE	MADISON	WILLIAMS			3	412,311	488	412,799	13,592,910	0.030	2,565,325	***
TIOGA	MADISON	WILLIAMS	MOUNTRAIL	BURKE	8	1,692,143	439,818	2,131,961	9,723,939	0.219	**	
TODD	MADISON	WILLIAMS			3	512,519	142,785	655,304	2,972,575	0.220	**	
WEST TIOGA	MADISON	WILLIAMS			9	1,181,415	1,004,691	2,186,106	12,868,970	0.170	2,617,005	***
WILLISTON	MADISON	WILLIAMS			3	288,683	20,257	308,940	1,997,570	0.155	128,716	***
WILLOW CREEK	MADISON	WILLIAMS			2	366,889	191,586	558,475	2,048,112	0.273	**	

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.

Table 2
North Dakota Bakken Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
ASH COULEE	BAKKEN	BILLINGS			8	1,697,143	18,473	1,715,616	14,216,104	0.121	740,967	***
BUCKHORN	BAKKEN	BILLINGS	MCKENZIE		11	3,195,523	76,540	3,272,063	17,957,184	0.182	**	
DEMORES	BAKKEN	BILLINGS			4	1,348,156	47,864	1,396,020	8,978,592	0.155	155,506	***
DEVILS PASS	BAKKEN	BILLINGS	MCKENZIE		4	1,356,132	16,931	1,373,063	11,971,456	0.115	695,638	***
ELKHORN RANCH	BAKKEN	BILLINGS			17	5,503,744	147,959	5,651,703	38,159,016	0.148	942,282	***
MORGAN DRAW	BAKKEN	BILLINGS	GOLDEN VALLEY		8	1,220,702	653,278	1,873,980	6,275,360	0.299	**	
ROOSEVELT	BAKKEN	BILLINGS			9	3,269,282	991,318	4,260,600	22,446,480	0.190	**	
BICENTENNIAL	BAKKEN	GOLDEN VALLEY	MCKENZIE		20	3,568,485	482,338	4,050,823	19,453,616	0.208	**	
CHARLSON	BAKKEN	MCKENZIE	WILLIAMS		9	254,124	80,093	334,217	9,654,400	0.035	1,186,277	***
CINNAMON CREEK	BAKKEN	MCKENZIE			6	906,573	602,134	1,508,707	6,902,896	0.219	**	
FLAT TOP BUTTE	BAKKEN	MCKENZIE			15	1,906,583	54,746	1,961,329	14,433,328	0.136	311,810	***
MONDAK	BAKKEN	MCKENZIE			2	35,855	278,913	314,768	7,530,432	0.042	871,217	***
PIERRE CREEK	BAKKEN	MCKENZIE			10	2,007,415	1,144,199	3,151,614	10,668,112	0.295	**	
SQUAW GAP	BAKKEN	MCKENZIE			3	735,574	165,059	900,633	4,392,752	0.205	**	
MCGREGOR	BAKKEN	WILLIAMS			2	108,319	158,339	266,658	1,834,336	0.145	**	
WEST TIOGA	BAKKEN	WILLIAMS			7	258,617	66,747	325,364	12,840,352	0.025	1,696,893	***

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.

Table 3
North Dakota Devonian Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
* ANTELOPE	DEVONIAN	MCKENZIE			3	6,025,328	846,583	6,871,911	16,300,000	0.42	2,540,081	Waterflood Improvement & CO ₂
* BEAVER LODGE	DEVONIAN	WILLIAMS			38	67,565,933	27,251,542	94,817,475	172,000,000	0.55	17,000,000	CO ₂
* BEAR CREEK	DUPEROW	DUNN			6	5,125,388	196,513	5,321,901	13,600,000	0.39	2,862,338	Waterflood Improvement & CO ₂
LITTLE KNIFE	DUPEROW	BILLINGS	MCKENZIE	DUNN	4	832,146	477,755	1,309,901	2,592,175	0.51	**	
ROOSEVELT	DUPEROW	BILLINGS			1	942,737	36,951	979,688	13,079,171	0.07	2,350,249	***
TREE TOP	DUPEROW	BILLINGS			1	695,522	181,145	876,667	4,775,861	0.18	339,260	***
AMBROSE	DUPEROW	DIVIDE			6	1,386,465	47,153	1,433,618	4,005,197	0.36	**	
GOOSENECK	DUPEROW	DIVIDE			4	1,138,141	20,318	1,158,459	3,096,292	0.37	**	
WEST AMBROSE	DUPEROW	DIVIDE			2	134,583	128,317	262,900	1,583,082	0.17	211,049	***
JIM CREEK	DUPEROW	DUNN			1	1,946,197	91,974	2,038,171	10,175,738	0.20	**	
LAKE ILO	DUPEROW	DUNN			1	512,766	131,420	644,186	4,290,434	0.15	107,588	***
BLUE BUTTES	DUPEROW	MCKENZIE			2	908,081	244,530	1,152,611	5,291,773	0.22	160,666	***
BOXCAR BUTTE	DUPEROW	MCKENZIE			4	761,414	406,945	1,168,359	16,437,160	0.07	2,910,906	***
BULL MOOSE	DUPEROW	MCKENZIE			3	1,080,755	162,576	1,243,331	2,051,091	0.61	**	
CHERRY CREEK	DUPEROW	MCKENZIE			1	876,904	89,756	966,660	7,443,986	0.13	880,739	***
INDIAN HILL	DUPEROW	MCKENZIE	WILLIAMS		7	2,226,848	95,502	2,322,350	18,448,179	0.13	6,066,469	Waterflood
NORTH BRANCH	DUPEROW	MCKENZIE			5	1,411,711	288,719	1,700,430	4,623,520	0.37	401,993	Waterflood
PIERRE CREEK	DUPEROW	MCKENZIE			3	822,633	33,220	855,853	2,452,769	0.35	**	
ROUGH RIDER	DUPEROW	MCKENZIE			4	2,096,260	345,558	2,441,818	14,685,922	0.17	4,236,215	Waterflood
SIOUX	DUPEROW	MCKENZIE			2	230,843	261,662	492,505	2,465,439	0.20	119,351	***
HARDSCRABBLE	DUPEROW	WILLIAMS	MCKENZIE		3	1,402,949	3,826	1,406,775	5,406,464	0.26	**	
NORTHWEST MCGREGOR	DUPEROW	WILLIAMS			1	1,072,452	347	1,072,799	6,627,598	0.16	197,395	***
TEMPLE	DUPEROW	WILLIAMS			3	624,071	162,212	786,283	25,279,554	0.03	4,058,599	***
TRENTON	DUPEROW	WILLIAMS			3	928,681	267,514	1,196,195	3,816,412	0.31	**	

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill drilling.

Table 4
North Dakota Red River Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
* AMOR NORTH	RED RIVER	BOWMAN			1	1,151,241	573,018	1,724,259	4,102,700	0.42	**	
* AMOR SOUTH	RED RIVER	BOWMAN			6	1,995,862	2,851,012	4,846,874	11,800,000	0.41	**	
* COYOTE CREEK	RED RIVER	BOWMAN			1	375,522	25,371	400,893	1,232,810	0.33	**	
* GRAND RIVER	RED RIVER	BOWMAN			1	452,571	26,989	479,560	3,620,000	0.13	553,289	EOR Improvement
* HORSE CREEK	RED RIVER	BOWMAN			10	4,847,893	1,067,587	5,915,480	45,740,260	0.13	7,135,008	EOR Improvement
* LITTLE MISSOURI	RED RIVER	BOWMAN			4	766,140	457,200	1,223,340	5,647,961	0.22	388,121	EOR Improvement
* MEDICINE POLE HILLS	RED RIVER	BOWMAN			14	8,866,596	1,983,288	10,849,884	40,000,000	0.27	562,808	EOR Improvement
* STATE LINE	RED RIVER	BOWMAN			1	981,713	518,176	1,499,889	2,840,000	0.53	**	
* CEDAR HILLS NORTH	RED RIVER B	BOWMAN	SLOPE		78	15,722,007	45,733,408	61,455,415	278,000,000	0.22	17,862,797	EOR Improvement
* CEDAR HILLS SOUTH	RED RIVER B	BOWMAN	SLOPE		115	31,433,525	176,531,492	207,965,017	360,000,000	0.58	43,000,000	EOR Improvement & CO ₂
* GRAND RIVER	RED RIVER B	BOWMAN			4	761,137	662,220	1,423,357	9,906,000	0.14	1,402,996	EOR Improvement
* MEDICINE POLE HILLS	RED RIVER B	BOWMAN			9	1,049,869	794,646	1,844,515	38,924,342	0.05	9,261,274	EOR Improvement
WANNAGAN	RED RIVER	BILLINGS			1	540,231	179,388	719,619	3,009,164	0.239	**	
COLD TURKEY CREEK	RED RIVER	BOWMAN			7	3,453,969	1,723,637	5,177,606	23,256,145	0.223	1,457,775	EOR
COYOTE CREEK	RED RIVER	BOWMAN			5	3,267,771	365,148	3,632,919	8,646,184	0.420	**	
HALEY	RED RIVER	BOWMAN			1	259,077	164,738	423,815	2,980,055	0.142	95,359	***
MEDICINE POLE HILLS	RED RIVER	BOWMAN			4	1,065,525	260,521	1,326,046	21,449,318	0.062	4,793,816	EOR
SOUTH HORSE CREEK	RED RIVER	BOWMAN			3	2,939,884	1,123,155	4,063,039	29,536,006	0.138	4,364,095	EOR
STATE LINE	RED RIVER	BOWMAN			7	1,444,142	113,857	1,557,999	25,589,160	0.061	5,743,031	EOR
BIG DIPPER	RED RIVER	DIVIDE			2	863,867	399,448	1,263,315	5,362,330	0.236	266,650	EOR
FORTUNA	RED RIVER	DIVIDE			1	938,566	282,670	1,221,236	6,837,791	0.179	**	
SKJERMO	RED RIVER	DIVIDE			2	558,376	80,438	638,814	9,253,987	0.069	851,765	***
BEAVER CREEK	RED RIVER	GOLDEN VALLEY	BILLINGS		5	3,277,152	2,454,938	5,732,090	16,348,569	0.351	**	
BICENTENNIAL	RED RIVER	GOLDEN VALLEY	MCKENZIE		6	4,832,404	1,414,312	6,246,716	20,171,026	0.310	412,797	***
BAKER	RED RIVER	MCKENZIE			2	813,861	48,741	862,602	6,021,743	0.143	**	
ELK	RED RIVER	MCKENZIE			3	1,532,537	273,778	1,806,315	47,613,301	0.038	2,067,237	***
INDIAN HILL	RED RIVER	MCKENZIE	WILLIAMS		10	3,108,961	290,167	3,399,128	92,061,102	0.037	4,090,448	***
LONESOME	RED RIVER	MCKENZIE			1	1,341,614	309,222	1,650,836	12,907,443	0.128	**	
MONDAK	RED RIVER	MCKENZIE			4	1,546,889	174,987	1,721,876	29,391,737	0.059	669,271	***
NORTH BRANCH	RED RIVER	MCKENZIE			3	660,665	95,267	755,932	7,977,922	0.095	**	
PIERRE CREEK	RED RIVER	MCKENZIE			8	1,961,838	1,196,641	3,158,479	56,121,535	0.056	1,407,255	***
SIOUX	RED RIVER	MCKENZIE			1	2,038,694	7,829	2,046,523	21,494,004	0.095	**	
HARDSCRABBLE	RED RIVER	WILLIAMS	MCKENZIE		1	871,131	274,455	1,145,586	2,961,474	0.387	**	
MISSOURI RIDGE	RED RIVER	WILLIAMS			1	1,247,662	15,936	1,263,598	7,611,529	0.166	**	

* Unitized prior to 1/1/06.

** No probable reserves indicated at this time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.

Table 5
North Dakota "Other" Pools
Probable (2P50) Oil Reserves

Field Name	Pool	County	County	County	Active Oil Wells	Cumulative Oil	Remaining Oil	Estimated Ultimate Oil Recovery	OOIP	Estimated Ultimate Recovery Factor	Future P2 Reserves	Basis
CARTER	MIDALE/NESSON	BURKE			6	351,270	150,340	501,610	3,872,794	0.130	753,175	Waterflood
CUSTOMS	MIDALE/NESSON	BURKE			9	541,118	154,039	695,157	4,468,608	0.156	752,672	Waterflood
LAKESIDE	MIDALE/NESSON	BURKE			4	375,820	101,008	476,828	4,985,665	0.096	1,138,528	Waterflood
HELLE SLOUGH	RATCLIFFE	WILLIAMS			2	103,349	209,888	313,237	5,177,172	0.061	357,318	***
BEAVER CREEK	BIRDBEAR	GOLDEN VALLEY	BILLINGS		8	3,116,978	448,097	3,565,075	7,208,619	0.495	**	
BICENTENNIAL	BIRDBEAR	GOLDEN VALLEY	MCKENZIE		7	1,447,158	1,797,938	3,245,096	8,387,233	0.387	**	
BOXCAR BUTTE	BIRDBEAR	MCKENZIE			13	671,252	1,109,332	1,780,584	8,629,036	0.206	879,154	***
COOKS PEAK	BIRDBEAR	GOLDEN VALLEY			7	247,863	727,397	975,260	2,979,072	0.327	**	
COVERED BRIDGE	BIRDBEAR	MCKENZIE			1	481,148	95,812	576,960	3,447,779	0.167	485,753	***
HAY DRAW	BIRDBEAR	MCKENZIE			4	775,360	101,900	877,260	2,810,600	0.312	**	
MISSOURI RIDGE	BIRDBEAR	WILLIAMS			3	1,160,522	296,428	1,456,950	6,553,958	0.222	563,184	***
NORTH BRANCH	BIRDBEAR	MCKENZIE			7	1,571,042	153,995	1,725,037	5,059,617	0.341	**	
PIERRE CREEK	BIRDBEAR	MCKENZIE			5	1,260,206	210,527	1,470,733	4,651,498	0.316	**	
ROOSEVELT	BIRDBEAR	BILLINGS			12	744,210	6,428,275	7,172,485	29,740,701	0.241	1,994,526	***
ANTELOPE	SILURIAN	MCKENZIE			1	4,434,205	315,384	4,749,589	23,408,886	0.203	**	
BLUE BUTTES	SILURIAN	MCKENZIE			13	11,321,711	1,752,049	13,073,760	74,228,544	0.176	1,020,066	***
CAPA	SILURIAN	WILLIAMS			6	3,203,638	657,750	3,861,388	31,718,180	0.122	2,160,965	***
CHARLSON	SILURIAN	MCKENZIE	WILLIAMS		15	17,699,182	2,071,078	19,770,260	105,920,668	0.187	340,972	***
DOBSON BUTTE	SILURIAN	STARK			2	781,725	390,783	1,172,508	3,329,834	0.352	**	
KEENE	SILURIAN	MCKENZIE			1	3,934,779	534,011	4,468,790	17,823,652	0.251	**	
TIOGA	SILURIAN	WILLIAMS	L	BURKE	4	3,660,025	79,466	3,739,491	20,853,504	0.179	219,979	***
WEST CAPA	SILURIAN	WILLIAMS			2	846,887	49,575	896,462	18,153,720	0.049	2,550,398	***
BLUE BUTTES	STONEWALL	MCKENZIE			3	1,855,441	1,491,340	3,346,781	13,448,723	0.249	**	
ELK	STONEWALL	MCKENZIE			4	969,495	166,299	1,135,794	10,783,310	0.105	905,632	***
INDIAN HILL	STONEWALL	MCKENZIE	WILLIAMS		6	2,449,805	1,534,598	3,984,403	gas		**	
MISSOURI RIDGE	STONEWALL	WILLIAMS			2	663,178	141,129	804,307	3,087,402	0.261	**	
NORTH TIOGA	STONEWALL	BURKE	DIVIDE	WILLIAMS	2	655,652	162,675	818,327	5,740,319	0.143	268,393	***
BELL	TYLER	STARK			4	2,845,525	854,828	3,700,353	13,559,179	0.273	**	
DICKINSON	TYLER	STARK			2	359,407	59,594	419,001	2,329,093	0.180	108,309	***
MCGREGOR	WINNIPEGOSIS	WILLIAMS			3	817,036	898,050	1,715,086	5,177,422	0.331	**	
MORAIN	WINNIPEGOSIS	DIVIDE			1	700,440	119,899	820,339	2,845,181	0.288	**	
STONEVIEW	WINNIPEGOSIS	DIVIDE	BURKE		3	455,698	272,151	727,849	3,798,317	0.192	299,232	***

* Unitized prior to 1/1/06.

** No probable reserves indicated a thtis time.

*** No specific mechanism identified. Candidate for recompletions, stimulations, or infill - horizontal drilling.