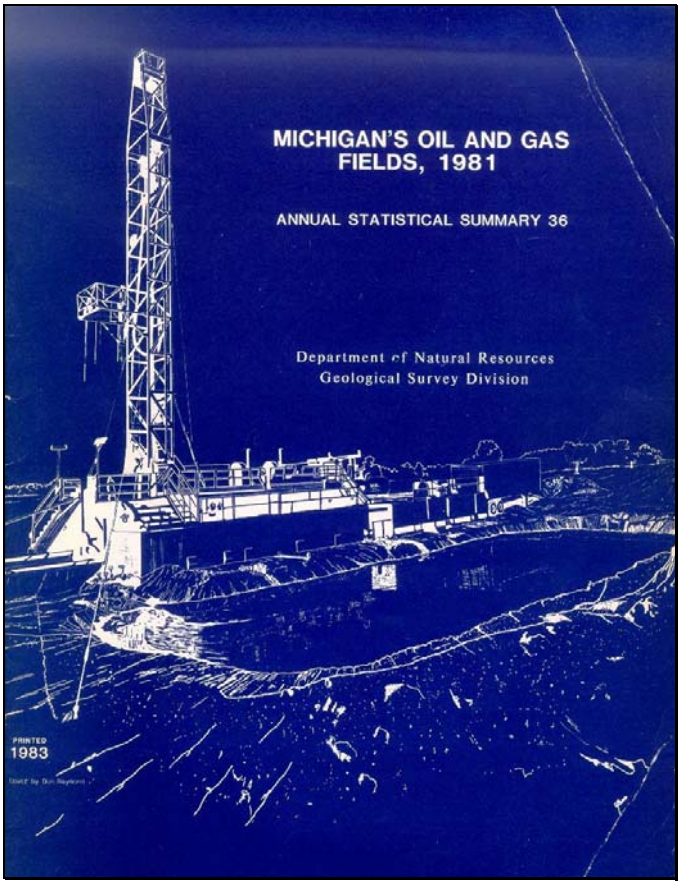

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STATE OF MICHIGAN

DEPARTMENT OF NATURAL RESOURCES

Geological Survey Division

ANNUAL STATISTICAL SUMMARY 36 MICHIGAN'S OIL AND GAS FIELDS, 1981

Drilling Statistics
Production
Exports and Imports

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Beverly L. Champion, Acting Supervisor, Regulatory Control Unit. Contribution: All data in columns under the headings "Number of Oil and Gas Wells" and "Brine Production" on Table 23.

Raymond H. Ellison, Supervisor, Production-Proration Unit. Contribution: All Michigan oil and gas production data, oil and gas valuation figures (Table 15), import and export figures (Tables 16-18), LPG and condensate fiqures (Table 14), secondary recovery projects (Table 25).

D. Michael Bricker, Supervisor, Subsurface and Petroleum Geology Unit. Contribution: All general drilling statistics and well completion data, discovery well and deep test data, cumulative records, and all other summary information not specifically provided by other Unit supervisors or by other agencies. Annual Statistical Summary compilation and manuscript preparation by staff members of the Subsurface and Petroleum Geology Unit.

The compilers also acknowledge the assistance of the Interstate Supply personnel, Office of Utilities Operation, Gas Division, Department of Commerce, in providing figures on natural gas imports via interstate pipelines, and the Lands Division, Department of Natural Resources, in providing figures for state revenue derived from various oil and gas transactions.

Michigan oil and gas production figures maintained by the Production-Proration Unit are compiled by the Unit from records obtained from the Michigan Department of Treasury and from records filed by producers and purchasers. All hydrocarbon production figures cited herein are subject to correction as warranted.

Inquiries concerning information contained in this publication should be directed to the appropriate Unit supervisor as noted earlier.

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Lansing, Michigan
September, 1983

INTRODUCTION

To help foster the development of Michigan's hydrocarbon resources, statistical data have been maintained and published for many years. This issue of the oil and gas field statistical summary brings together information on various facets of Michigan's oil and gas industry activities.

The information contained in this oil and gas summary has been treated as uniformly as possible from year to year so that the data reflect accurately the actual figures and other information that should be credited to this year. The data found herein are mainly derived from records maintained by the Oil and Gas Section, Geological Survey Division, Department of Natural Resources.

This publication is divided into three parts. Part 1 summarizes significant statistics on oil and gas field activities and includes numerous other related records kept by the Oil and Gas Section. Part 2 contains specific information on Michigan's oil and gas fields, gas storage fields, and other related subjects. Part 3 contains cumulative records important to the oil and gas industry.

Certain well completion data are furnished to the American Petroleum Institute (API) and the American Association of Petroleum Geologists (AAPG) on a regular basis. Reports citing preliminary oil and gas statistics and production figures are also prepared for the Interstate Oil Compact Commission (IOCC). API publishes the data in monthly and quarterly reports. Year-end printouts of the data are made available to authors of the AAPG yearly Development Papers and to others. Year-end figures published by API are in general agreement with figures for similar categories published in this summary. Oil and gas production data are supplied by request to the United States Bureau of Mines for publication in their minerals yearbook.

Statistical data on Michigan oil and gas activities, derived from outside sources, are also published by the Oil and Gas News, Mt. Pleasant, Michigan; Petroleum Information, Incorporated, Denver, Colorado; Anerican Petroleum Institute, Washington, D.C.; American Association of Petroleum Geologists, Tulsa, Oklahoma; Interstate Oil Compact Commission, Oklahoma City, Oklahoma; World Oil, Houston, Texas; and Oil and Gas Journal, Tulsa, Oklahoma.

It should be noted that certain figures for the number of exploratory, development, and service wells drilled and completed, the number of new fields and pools

discovered, oil and gas production figures, and other data published in this summary may differ from figures reported by regional or national trade publications or by industry reporting services. The differences in the various statistics are generally minor and are due to methods of gathering and reporting well data, determining cutoff dates for reporting yearly statistics, and the necessity for making projections and estimates for certain types of reports.

Other factors which may result in statistical differences are internal decisions of the Oil and Gas Section regarding final year-end status of completed wells and decisions resulting from public hearings on oil and gas matters. For example, a well originally classified as a development well, and reported as such to one of the above organizations, may later be reclassified as the discovery well for a new pool or field, or a gas well might later be declared an oil well completion on the basis of new evidence. Frequently the changes in well status cannot be readily passed on to these outside organizations so that their records can be updated prior to publications of their final statistics.

PART 1
GENERAL STATISTICAL INFORMATION

OIL AND GAS PERMITS

Michigan's oil and gas permit system began in 1927 with the issuance of permit number 1. Since then, permit numbers have been issued in numerically consecutive order. Permits issued under Act 61, P.A. of 1939, as amended are terminated one year after date of issue if actual drilling operations have not begun.

The distribution of oil and gas drilling permits (including terminated permits) according to districts (oil and gas district map, Illustration 1) through a five year period is seen in Table 2.

Deepening permits were issued for 54 wells during 1981 as compared with 37 the previous year. Deepening permits issued in 1981 began with number 2008 and ended with number 2061.

Directionally Drilled Holes

Environmental and economic considerations have necessitated the drilling of a large number of directional holes since 1972, particularly to help locate Niagaran reefs. During 1981 there were 174 permits issued to drill directional holes. Many of these holes involve using the upper part of a previously drilled hole which, after being initially completed as a dry hole, was plugged back and directionally drilled to a more favorable subsurface location. Only one producing well is allowed per well bore, regardless of the number of holes directionally drilled from the same well bore.

Each new directional hole, even if drilled from the same surface location and using the upper part of a previously drilled well, is treated as a separate test and Is assigned its own unique permit number.

TABLE 1 INITIAL WELL CLASSIFICATION

INITIAL CLASSIFICATION	1979	1980	1981
Exploratory wells	282	356	561
Development wells	283	456	470
Gas storage facility wells . .	62	25	10
LPG storage facility wells . .	5	0	0
Brine disposal wells	5	5	2
Water injection wells . . .	12	5	5
Total	649	856	1,048

TABLE 2 DRILLING PERMITS BY DISTRICT

	Permits Issued				
DISTRICT	1977	1978	1979	1980	1981
Basin	135	146	161	251	359
Northern	261	284	271	284	296
Southeastern	111	98	63	109	91
Southwestern	67	47	60	104	180
Western	118	115	94	108	122
Totals	692	690	649	856	1,048

TABLE 3 NEW WELL COMPLETIONS BY DISTRICT

Classifications of	Basin		Northern		Western		Southwestern		Southeastern		Totals	
New Well Completions	1980	1981	1980	1981	1980	1981	1980	1981	1980	1981	1980	1981
Exploratory Wells												
Oil	17	14	8	18	8	3	5	15	3	1	41	51
Gas	1	3	13	6	3	2	2	5	2	2	21	18
D&A	45	57	125	127	32	55	26	58	29	33	257	330
Total	63	74	146	151	43	60	33	78	34	36	319	399
Development Wells												
Oil	96	99	23	27	17	21	12	25	19	29	167	201
Gas	0	2	17	13	4	3	5	3	4	4	30	25
D&A	28	18	72	51	26	18	17	24	16	9	159	120
Total	124	119	112	91	47	42	34	52	39	42	356	346
Service												
WI	6	9	3	5	0	0	0	0	0	2	9	16
BDW	2	1	1	3	1	2	1	0	0	0	5	6
GS	20	3	21	9	0	0	0	0	0	0	41	12
LPG	0	0	0	0	0	0	0	0	2	0	2	0
Total	28	13	25	17	1	2	1	0	2	2	57	34
Total Completions	215	206	283	259	91	104	68	130	75	80	732	779

TABLE 4 OIL AND GAS PRODUCTION BY DISTRICT IN 1981

District	Barrels Oil	MCF Gas
Basin	5,259,914	9,519,862
Northern	15,687,543	78,328,018
Southeastern	2,035,188	13,539,285
Southwestern	1,266,836	1,888,420
Western	8,359,683	46,527,464
Totals	32,609,164	149,803,049

[Illustration 1 – Oil and Gas Districts]

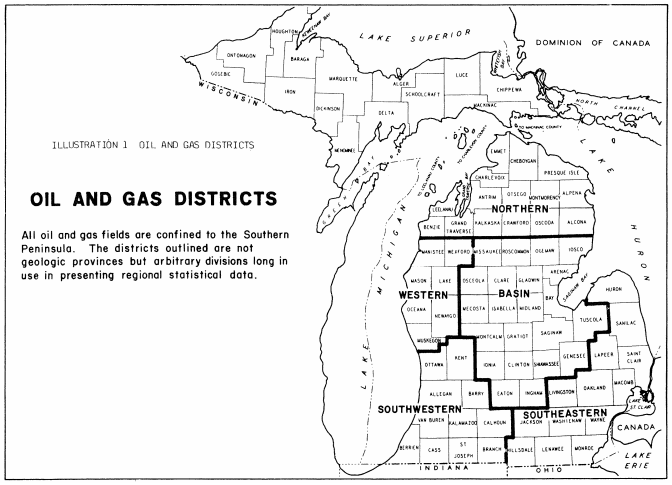

TABLE 5 TERMINATED PERMIT NUMBERS

D.P.1981	33652	33861	34059
33420	33653	33866	34091
33426	33662	33872	34169
33455	33665	33878	34170
33469	33667	33881	34171
33487	33689	33887	34202
33515	33695	33899	34239
33548	33704	33903	34249
33549	33741	33908	34278
33564	33752	33965	34279
33579	33816	33969	34512
33585	33817	33992	35067
33638	33821	34004	35076
33650	33852	34024	
33651	33857	34037	

TABLE 6 PERMITS ISSUED FOR DIRECTIONAL HOLES

Calhoun	20 permits 34351, 34354, 34377, 34421, 34451, 34498, 34624, 34655, 34736, 34783, 34839, 34971, 34978, 35047, 35078, 35107, 35156, 35164, 35177, 35314
Cheboygan	4 permits 34589, 35016, 35057, 35130
Crawford	7 permits 34312, 34520, 34755, 34782, 35055, 35238, 35266
Eaton	5 permits 34349, 34361, 34899, 35152, 35330
Grand Traverse	29 permits 34319, 34396, 34408, 34422, 34463, 34489, 34513, 34515, 34580, 34626, 34654, 34934, 34948, 34968, 35013, 35017, 35026, 35039, 35050, 35066, 35102, 35174, 35181, 35196, 35215, 35219, 35221, 35240, 35333
Hillsdale	1 permit 34950
Ingham	2 permits 34985, 35031
Isabella	1 permit 35061
Kalkaska	13 permits 34320, 34329, 34397, 34651, 34739, 34752, 34887, 34933, 34997, 35005, 35247, 35277, 35323
Livingston	5 permits 34403, 34418, 34656, 35104, 35325
Macomb	3 permits 34333, 34529, 35028
Manistee	32 permits 34317, 34391, 34393, 34424, 34486, 34487, 34535, 34708, 34737, 34743, 34756, 34757, 34789, 34832, 34861, 34863, 34953, 34969, 34982, 35007, 35008, 35011, 35049, 35058, 35105, 35129, 35157, 35170, 35183, 35211, 35239, 35349
Mason	2 permits 34457, 34499
Montmorency	3 permits 34433, 35065, 35315
Newaygo	2 permits 34441, 34608
Oakland	1 permit 35136
Osceola	1 permit 34852
Otsego	26 permits 34406, 34414, 34434, 34455, 34471, 34473, 34476, 34683, 34687, 34702, 34727, 34730, 34780, 34794, 34803, 34822, 34893, 34915, 34940, 34980, 35027, 35045, 35158, 35165, 35179, 35236
Presque Isle	13 permits 34311, 34478, 34573, 34584, 34729, 34999, 35032, 35040, 35063, 35121, 35151, 35167, 35327
St. Clair	1 permit 35348
Wexford	3 permits 34321, 34591, 34620

Rework Applications, Transfers of Ownership

In addition to issuance of permits for various types of wells covered under Act No. 61, P.A. of 1939, as amended, 381 applications were received and approved for rework operations on existing wells. Letters of termination were sent out for 58 previously issued permits. Transfers of ownership were processed for 163 wells. Corrections of location, well name, or other detail involving specific permits were made for 60 wells, and cancel and transfer of permit were made for 28 others. The surface location as well as the projected bottom-hole location is published for each permitted directionally drilled hole. After the well is drilled and the directional survey is filed, the correct bottom-hole location is determined from the survey record and then published as a correction for the initial projected bottom-hole location. Corrections of this type were published for 169 wells.

Oil and Gas Hearings

Oil and Gas Section activities included scheduling and preparation for hearings on oil and gas matters and the issuance of orders resulting from these hearings. These activities are summarized in Table 7.

TABLE 7 SUMMARY OF OIL AND GAS HEARINGS

Advisory Board Hearings held		8
Administrative Hearings held		21
Meetings as provided for in Special Order 1-78		1
Total Orders issued		49
Total Causes heard		49
Includes:	5	amendments to Spacing Orders
	13	Spacing and Proration Orders
	5	exceptions to Spacing Orders
	6	compulsory Pooling Orders
	1	exception to spacing for development wells
	3	amendments to Special Order 3-71
	4	exceptions to Special Order 1-73
	4	supplemental recovery and plan of unitization
	1	amendment to Special Order 1-81
	3	abrogation of spacing orders and Proration Orders
	2	amendment to spacing order denied
	1	commingle oil and gas production thru same string of casing

WELL COMPLETIONS

TABLE 8 EXPLORATORY AND DEVELOPMENT WELL COMPLETIONS

	Exploratory Wells			Development Wells			
Year	Oil	Gas	Dry	Oil	Gas	Dry	Totals
1977	35	36	230	101	34	111	547
1978	29	25	214	117	32	111	528
1979	42	28	187	131	30	103	521
1980	41	21	257	167	30	159	675
1981	51	18	330	201	25	120	745

TABLE 9 SERVICE WELL COMPLETIONS

Year	GS	INJ	LPG	BDW	Totals
1977	43	2	1	4	50
1978	60	11	0	3	74
1979	51	13	0	4	68
1980	41	9	2	5	57
1981	12	16	0	6	34

GS = Gsa Storage; INJ = Injection well; LPG = Liquidified Petroleum Gas well; BDW = Brine Disposal Well

Major and Independent Company Well Completions

Requests are frequently made for statistics on major oil company drilling activities in Michigan. The figures cited for the major companies do not include wells drilled by independents under farmout agreements with a major company or wells drilled by independents but partially supported by dry hole money or some other significant assistance from a major oil company. Independent oil companies, who have drilled most of Michigan's wells,

are too numerous to cite individually. All figures cited for majors and independents were derived from inspection of operator names appearing on completion records. In Table 10, in cases where two or more companies were joint operators in a drilling venture, the well completion was attributed to the company whose name appears first (generally the major interest holder) on the official records.

Well Casing Used in Well Completion

Periodically, inquiries are made concerning the amount of casing (pipe) used in Michigan wells during a given year. Almost all oil and gas tests drilled in this state utilize rotary drilling techniques and require the setting of surface pipe and an intermediate casing string. A conductor pipe is set on many holes, and all wells completed as producers require a string of production casing. For convenience, casing tallies have been related to a range of casing sizes and are shown in Table 12.

TABLE 10 WELL COMPLETIONS BY MAJORS AND INDEPENDENTS

MAJOR	EXPLORATORY			DEVELOPMENT			SERVICE	
COMPANY	OIL	GAS	DRY	OIL	GAS	DRY	WELLS	TOTALS
AMOCO	2	2	16	3	2	1	0	26
MARATHON	0	0	0	6	0	0	7	13
SHELL	5	4	57	12	4	31	7	120
OTHER	1	0	7	35	1	3	4	51
SUBTOTAL	8	6	80	56	7	35	18	210
INDEPEND.	43	12	250	145	18	85	16	569
TOTALS	51	18	330	201	25	120	34	779

TOTAL WELLS DRILLED BY MAJORS AND INDEPENDENTS

EXPLORATORY WELLS	399
DEVELOPMENT WELLS	346
SERVICE WELLS	34
EXPLORATORY WELLS DRILLED	
PERCENTAGE FOR MAJORS	24%
PERCENTAGE FOR INDEPENDENTS	76%
EXPLORATORY DISCOVERIES	
PERCENTAGE FOR MAJORS	20%
PERCENTAGE FOR INDEPENDENTS	80%
DEVELOPMENT WELLS DRILLED	
PERCENTAGE FOR MAJORS	28%
PERCENTAGE FOR INDEPENDENTS	72%
PRODUCING DEVELOPMENT WELLS DRILLED	
PERCENTAGE FOR MAJORS	28%
PERCENTAGE FOR INDEPENDENTS	72%
DISCOVERY SUCCESS RATIO (DISCOVERY:EXPLORATORY)	
AVERAGE FOR MAJORS	1:7
AVERAGE FOR INDEPENDENTS	1:6

TABLE 11 DRILLED FOOTAGE BY COUNTY

County	Exploratory Wells	Development Wells	Service Wells
Alcona	10,402	- - -	- - -
Allegan	12,120	13,804	- - -
Alpena	- - -	- - -	- - -
Antrim	10,218	- - -	- - -
Arenac	- - -	30,505	- - -
Barry	10,358	- - -	- - -
Bay	15,864	60,178	3,950
Benzie	5,851	5,790	- - -
Berrien	- - -	- - -	- - -
Branch	4,500	- - -	- - -
Calhoun	151,880	63,964	- - -
Cass	23,751	7,822	- - -
Charlevoix	8,902	- - -	- - -
Cheboygan	26,936	- - -	- - -
Chippewa	4,727	- - -	- - -
Clare	30,486	24,317	- - -
Clinton	- - -	- - -	- - -
Crawford	20,458	66,388	7,150
Eaton	95,199	12,056	- - -
Gd. Traverse	307,708	132,949	4,260
Genesee	- - -	6,279	- - -
Gladwin	- - -	35,198	- - -
Gratiot	7,665	- - -	- - -
Hillsdale	7,791	20,306	- - -
Huron	3,850	7,115	- - -
Ingham	50,757	19,570	4,000
Ionia	- - -	- - -	- - -
Iosco	4,432	- - -	- - -
Isabella	3,899	55,490	- - -
Jackson	24,389	- - -	- - -
Kalamazoo	5,859	2,695	- - -
Kalkaska	130,086	75,250	56,906
Kent	- - -	- - -	- - -
Lake	- - -	- - -	- - -
Lapeer	- - -	82,225	6,374
Lenawee	- - -	- - -	- - -
Livingston	27,534	13,579	- - -
Macomb	21,523	10,253	- - -
Manistee	174,184	110,129	3,726
Mason	29,248	6,239	- - -
Mecosta	4,472	3,350	5,103
Midland	11,031	3,493	- - -
Missaukee	75,882	67,964	- - -
Monroe	- - -	- - -	- - -
Montcalm	3,278	3,301	- - -
Montmorency	30,740	6,135	- - -
Muskegon	- - -	3,476	- - -
Newaygo	15,457	7,205	- - -
Oakland	21,960	3,594	- - -
Oceana	14,699	10,615	- - -
Ogemaw	- - -	38,243	19,411
Osceola	31,662	- - -	- - -
Oscoda	15,520	- - -	- - -
Otsego	97,825	115,339	20,376
Ottawa	12,316	2,831	- - -
Presque Isle	106,502	12,897	- - -
Roscommon	12,288	40,994	4,430
Saginaw	3,096	- - -	- - -
Sanilac	- - -	- - -	- - -
Shiawassee	- - -	- - -	- - -
St. Clair	14,537	8,257	- - -
St. Joseph	- - -	- - -	- - -
Tuscola	17,604	36,820	- - -
Van Buren	1,069	14,635	- - -
Washtenaw	11,455	- - -	- - -
Wayne	- - -	- - -	- - -
Wexford	34,623	14,509	- - -
State Total	1,766,593	1,255,759	135,686

TABLE 12 SUMMARY OF CASING INFORMATION

	Conductor Pipe	Surface Pipe	Intermediate Pipe	Production Pipe
Casing Size	--------- DAIMETER IN INCHES --------			
Range Used	13 - 20	10 - 13	6 - 10	4 - 6
Normal Size Used	16"	11-3/4"	8-5/8"	5-1/2"
Average Weight	75#/ft.	53#/ft.	37#/ft.	19#/ft.
No. feet used	40,353	277,360	1,200,296	1,438,031

Total footage for all casing sizes = 2,956,040

OIL AND GAS PRODUCTION

Oil and gas production figures are derived from records submitted to the Production-Proration Unit, Oil and Gas Section, Geological Survey Division, Department of Natural Resources and from tax records from the Michigan Department of Treasury. Treasury Department records are primarily concerned with gross production figures needed to calculate revenues. These data are supported by reports required from producing companies and purchasers by the Geological Survey Division.

Delays in reporting and changes in methods of reporting used by producing companies and purchasers result in a continuous correction and refinement of production figures. Consequently all monthly, yearly, or other production figures are subject to correction as warranted.

In an attempt to obtain national uniformity of data as recommended by the Interstate Oil Compact Commission, all annual and cumulative gas production figures for Michigan were converted to a standard base pressure for volumetric measurement of 14.73 pounds per square inch in 1978. This conversion and subsequent adjustment of gas production figures resulted in slight changes in cumulative production volumes in those fields which had been measured at varying pressure bases in prior years.

A no-flare order, enacted as a conservation measure, prohibits the flaring of oil-well gas and requires Salina-Niagaran oil wells in specified counties to be shut-in until a market connection is achieved for the sale of the gas or an exception to the order is granted. Consequently, Special Order No. 3-71, amended, in effect since late 1971, tends to temporarily curtail production from Salina-Niagaran oil wells until gas gathering pipelines are laid and connections made.

Another order, Special Order No. 1-73, deals with spacing and proration of Salina-Niagaran wells in specific counties. This order established basic 80-acre drilling units (either stand-up or lay-down units) for Salina-Niagaran oil and/or gas wells and state-wide proration for Salina-Niagaran oil reservoirs in the specified counties or parts of counties covered by the order. These prudent and justifiable conservation measures effectively prevent waste of millions of cubic feet of valuable and much needed gas that might have been flared in past years, and these measures should ultimately result in more efficient drainage of reef reservoirs and a greater recovery of the liquid hydrocarbons.

TABLE 13 1981 OIL AND GAS PRODUCTION BY COUNTY

County	Barrels Oil	MCF Gas
Allegan	109,728	16,284
Antrim	134,650	436,465
Arenac	171,774	0
Barry	12,378	0
Bay	208,381	0
Benzie	190,450	177,608
Calhoun	983,565	1,785,700
Cass	25,343	0
Cheboygan	287	0
Clare	413,697	688,113
Crawford	1,443,049	2,878,838
Eaton	612,847	4,619,743
Gd. Traverse	3,867,586	32,044,200
Genesee	20,454	0
Gladwin	312,177	0
Gratiot	7,188	0
Hillsdale	1,108,033	5,678,680
Huron	1,497	0
Ingham	895,569	2,421,400
Isabella	181,419	0
Jackson	4,918	0
Kalamazoo	1,136	0
Kalkaska	3,590,124	30,995,309
Kent	93,622	0
Lake	78,413	0
Lapeer	353,632	203,634
Lenawee	379	0
Livingston	804	525,776
Macomb	25,981	4,280,938
Manistee	7,427,645	41,981,643
Mason	210,936	1,583,362
Mecosta	21,609	4,963
Midland	180,901	0
Missaukee	906,299	1,118,173
Monroe	3,193	0
Montcalm	70,808	0
Muskegon	9,224	0
Newaygo	17,094	1,675
Oakland	94,221	1,649,072
Oceana	19,046	0
Ogemaw	579,850	106,405
Osceola	132,028	3,265
Oscoda	742	0
Otsego	6,450,883	11,795,598
Ottawa	8,167	86,436
Presque Isle	9,772	0
Roscommon	411,693	557,800
Saginaw	46,938	0
Shiawassee	12,281	0
St. Clair	430,953	1,201,151
Tuscola	74,001	0
Van Buren	32,897	0
Washtenaw	334	34
Wayne	11,243	0
Wexford	597,325	2,960,784
Totals	32,609,164	149,803,049

NATURAL GAS LIQUIDS

The amount of liquids produced from gas-condensate reservoirs are included in the yearly oil production totals shown in tabulations in this publication. Wells officially determined to be gas wells are assigned to the Public Service Commission for well connection permits and determination and jurisdiction of gas production rates. There is no restriction on the amount of liquids produced along with the gas. Gas plants operated by Shell Oil Company and Amoco Production Company in Kalkaska County strip natural gas liquids from the gas. The liquids are then sold to another company through the Shell pipeline that terminates at Marysville, Michigan.

An attempt has been made to maintain records of condensate production from the northern reef reservoirs discovered since 1969. Production-Proration Unit records are show in Table 14 for condensate liquids.

TABLE 14 CONDENSATE PRODUCTION

Year	Barrels	Cumulative
1969	0	0
1970	18,946	18,946
1971	98,668	117,614
1972	125,768	243,382
1973	335,041	578,423
1974	1,187,498	1,765,921
1975	1,863,338	3,629,259
1976	1,896,870	5,526,129
1977	1,991,330	7,517,459
1978	2,295,263	9,812,722
1979	1,801,928	11,614,650
1980	1,582,638	13,197,288
1981	1,433,198	14,630,486

Gas plant operations are summarized in Table 26. It should be noted that the LPG recovery figures for the Amoco and Shell plants in Kalkaska County include stabilized condensate as well as LPGs.

TABLE 15 OIL AND GAS VALUATION

	Average Wellhead Price*		Gross Value*	
Year	Oil per Bbls.	Gas per MCF	Oil	Gas
1969	$ 3.07	$ .26	$ 37,494,318	$ 9,296,332
1970	3.10	.27	36,246,376	10,476,482
1971	3.27	.26	38,858,706	6,775,629
1972	3.20	.31	41,556,432	10,314,222
1973	4.07	.40	59,412,710	17,494,727
1974	8.55	.51	154,746,373	35,181,955
1975	10.74	.63	262,351,653	65,103,875
1976	10.84	.88	329,636,770	120,252,528
1977	10.95	1.10	360,994,743	145,969,976
1978	12.34	1.11	427,881,248	166,920,524
1979	14.94	1.75	524,257,112	279,121,269
1980	21.55	2.36	728,607,821	372,855,197
1981	30.38	2.86	992,435,836	436,936,911

*Source: Production-Proration Unit records

OIL AND GAS IMPORTS AND EXPORTS

Michigan refineries import some U.S. domestic and foreign crude oil each year. Overseas foreign sources include Libya and Nigeria. Canadian crude oil brought via pipeline from western Canada oil fields constitutes another important source of imports. Imports by month were reported by refineries and are shown in Table 16.

TABLE 16 1981 MONTHLY CRUDE OIL IMPORTS (Bbls.)

	Domestic & Foreign	Canadian	Total
January	1,694,609	0	1,694,609
February	1,112,753	129,647	1,242,400
March	1,273,934	123,899	1,397,833
April	1,085,755	122,937	1,208,692
May	1,453,093	193,776	1,646,870
June	1,288,671	0	1,288,671
July	1,050,863	62,728	1,113,591
August	730,112	183,052	913,162
September	937,297	127,113	1,064,410
October	840,673	126,456	967,129
November	1,032,289	62,623	1,094,912
December	1,041,671	94,353	1,136,024
Totals	13,541,720	1,226,583	14,768,303

Most Michigan produced crude oil goes to Michigan refineries but some is exported. Records provided to the Production-Proration Unit by companies reporting exports of Michigan crude are summarized in Table 17.

TABLE 17 1981 MONTHLY CRUDE OIL EXPORTS (Bbls.)

January	696,453
February	716,480
March	677,655
April	963,089
May	888,464
June	555,335
July	844,230
August	1,277,866
September	1,122,632
October	1,106,890
November	1,070,416
December	901,774
Total	10,821,284

TABLE 18 1981 MONTHLY PIPELINE GAS IMPORTS (Mcf)*

January	74,759,340
February	67,936,319
March	82,820,836
April	87,684,606
May	56,494,419
June	52,565,540
July	54,309,800
August	57,780,315
September	54,901,117
October	51,389,386
November	50,030,203
December	55,412,314
Total	746,084,195

* Compiled by the Federal Pipeline Tariff Analysis Section, Michigan Public Service Commission

NEW FIELD AND POOL DISCOVERIES

All the new discoveries are tentatively classified as Class E pools having possible oil and gas recoveries as defined by the Committee of Statistics of Drilling, American Association of Petroleum Geologists. These classes are used to give some estimate or measure of reserves found by a discovery well.

Class A - Over 50 million barrels oil or 300 BCF gas
Class B - 25-50 million barrels oil or 150-300 BCF gas
Class C - 10-25 million barrels oil or 60-150 BCF gas
Class D - 1-10 million barrels oil or 6-60 BCF gas
Class E - 1 million barrels or less oil, or less than 6 BCF gas
Class F - Abandoned as non-profitable

Michigan wells are initially classified as near as possible according to guidelines established by AAPG and API (AAPG Bulletin, Volume 58/8, August 1974, pages 1501-1503). Classifications such as exploratory, development, and the various types of service wells, are made after inspection of appropriate oil and gas maps and noting the location of the test in reference to established fields, dry holes, etc. Gas storage facility wells, water injection wells and other types of service wells are generally designated as such by the operator. The Lahee classification system for designating exploratory or development wells is particularly adaptable to structural traps but does not adapt to all situations involving small reefs such as are found in Michigan. Because of the apparent small areal extent of most reefs as shown by seismic anomalies and the close proximity of one reef to another, especially in the northern and southern reef belts, it has become

increasingly difficult to classify with certainty all new well locations as exploratory or development.

Reservoir performance may show that a well previously classified as a development well should actually be considered as being in a separate reservoir or pool. Likewise, a so-called discovery well may actually turn out to be a development well to a nearby reef reservoir. Changes in classification may be the result of action by the regulating agency after enough data has been accumulated on the well or wells, or may result from new data presented at public hearings and the decision of the Supervisor of Wells after thorough consideration of the new data.

TABLE 19 DISCOVERY WELLS BY GEOLOGIC SYSTEM

SYSTEM	FORMATION OR PAY	NO. OF DISCOVERIES 1979	1980	1981
PENNSYLVANIAN		-	-	-
MISSISSIPPIAN	"MICHIGAN STRAY SS."	-	1	-
	"BEREA SS."	2	2	3
DEVONIAN	ANTRIM SHALE	1	2	-
	"TRAVERSE LIME"	2	5	3
	DUNDEE	4	1	-
	DETROIT RIVER "SOUR ZONE"	2	2	3
	RICHFIELD	1	3	1
SILURIAN	SALINA-NIAGARAN	56	46	58
ORDOVICIAN	TRENTON-BLACK RIVER	2	-	-
	PRAIRIE DU CHIEN	-	-	1

TABLE 20 DRILLING OBJECTIVES BY GEOLOGIC SYSTEM

SYSTEM	FORMATION OR PAY	PERCENTAGE 1979	1980	1981
PENNSYLVANIAN		-	-	-
MISSISSIPPIAN	"MICHIGAN STRAY SS."	4.8	2.9	1.1
	"BEREA SS."	0.8	2.6	3.8
DEVONIAN	ANTRIM SHALE	1.0	1.4	1.2
	"TRAVERSE LIME"	3.4	4.5	6.9
	DUNDEE	7.1	7.7	6.4
	DETROIT RIVER "SOUR ZONE" & RICHFIELD	11.0	12.7	15.2
SILURIAN	SALINA-NIAGARAN	69.1	64.1	58.5
ORDOVICIAN	TRENTON-BLACK RIVER	2.6	3.6	1.5
	PRAIRIE DU CHIEN	0.2	0.1	3.9
CAMBRIAN		-	-	1.2
PRECAMBRIAN		-	.4	.3

WELL RECORDS & OIL AND GAS MAPS

Descriptive geological logs and driller's logs are available for over 35,000 tests, including exploratory, development, facility and other types of wells. Individual well records may be purchased at a nominal cost from the Geological Survey Division. Drillers logs are available on 16 mm reel microfilm. For details please contact the Information and Technical Services Unit, Box 30028, Lansing, Michigan 48909, telephone (1-517) 373 1256. Electric or radiation logs of any type are not available for distribution or sale.

Blueprint copies of oil and gas field maps are available for every county in the Southern Peninsula. The maps show locations of oil and gas tests but do not show geological data or structural contour lines. County map scales are 1 inch equals 1 mile. Blueprint field maps are available for many oil and gas fields. These maps show well locations, well permit numbers, operators and lease names. They do not show geological data or structural contour lines. Field map scales are mainly 4 inches equals 1 mile. All manuscript maps or tracings from which blueprint copies are made are posted on a regular basis. An oil and gas field maps list may be obtained from the Geological Survey Division upon request.

TABLE 21 1981 DISCOVERY WELLS

COUNTY TOWNSHIP-T,R,SEC	FIELD NAME	OPERATOR & LEASE	PERMIT NUMBER	TOTAL DEPTH	DEPTH TO PAY	INITIAL PRODUCTION OIL WELLS	GAS WELLS	PRODUCING FORMATION	AAPG POOL CLASS
ALLEGAN CASCO-01N,16W,07	CASCO SEC. 07	OMNI PET. CORP. BRYANT 1-7	34556	1168	1163	20 BOPD		TRAVERSE	E
BAY HAMPTON-14N,06E,21	ESSEXVILLE	WOLVERINE GAS & OIL CO. HUGO 1-21	33753	3915	3451	48 BOPD		DETROIT RIVER	E
BENZIE COLFAX-29N,13W,25	COLFAX 25-29N-13W	SHELL OIL CO. ST-COLFAX 2-25	34084	5851	5688	335 BOPD +236 MCF		NIAGARAN	E
CALHOUN CLARENCE-01S,04W,27	CLARENCE 27-01S-04W P/A	REEF PET. CORP. QUISBERT 3-27	34704	3302	3169	264 BOPD +243 MCF		NIAGARAN	E
CALHOUN CLARENCE-01S,04W,33	CLARENCE 33-01S-04W	REEF PET. CORP. LAKE 2-33	34753	3312	3152		3170 MCF +10 BWPD	NIAGARAN	E
CALHOUN CLARENCE-01S,04W,34	CLARENCE 34-01S-04W	REEF PET. CORP. KECK-BUNDE 1-34	34658	3328	3183	261 BOPD +118 MCF		NIAGARAN	E
CALHOUN CLARENCE-01S,04W,35	CLARENCE 35-01S-04W	REEF PET. CORP. SCHMIDT 1-35	34652	3335	3089	265 BOPD +160 MCF		NIAGARAN	E
CALHOUN CONVIS-01S,06W,09	CONVIS 09-01S-06W	SMITH PET. CO. BARNES 1-9	34182	3150	3026	80 BOPD +80 BWPD		NIAGARAN	E
CALHOUN CONVIS-01S,06W,16	CONVIS 16-01S-06W	MICH. PET. EXPL. INC. RUDD-AUDUBON 1-16A	34421	3111	3025	145 BOPD +30 MCF		NIAGARAN	E
CALHOUN CONVIS-01S,06W,16	CONVIS 16-01S-06W P/A	MICH. PET. EXPL. INC. BUEHMER 1-16	34759	3226	3108	132 BOPD +35 MCF		NIAGARAN	E
CALHOUN CONVIS-01S,06W,20	CONVIS 20-01S-06W	R. KLABZUBA HOUK UNIT 1-20A	34351	3038	2853	35 BOPD +17.3 MCF		NIAGARAN	E
CALHOUN CONVIS-01S,06W,20	CONVIS 20-01S-06W P/A	R. KLABZUBA COATS UNIT 1-20A	34377	3000	2874	50 BOPD +11.2 MCF		NIAGARAN	E
CALHOUN CONVIS-01S,06W,21	CONVIS 21-01S-06W P/A	R. KLABZUBA HUGGETT 1-21A	35107	3010	2924	50 BOPD		NIAGARAN	E
CALHOUN CONVIS-01S,06W,22	CONVIS 22-01S-06W	R. KLABZUBA FAIRCHILD UNIT 1-22	34429	3024	2976	240 BOPD		SALINA-NIAGARAN	E
CALHOUN CONVIS-01S,06W,30	CONVIS 30-01S-06W P/A	PATRICK PET. CORP. L. W. SMITH FARM 1-30	34243	3115	2839	65 BOPD		NIAGARAN	E
CALHOUN LEE-01S-05W,01	LEE 01-01S-05W	HOBSON PET. CO. MARTIN-ROSS 1A-1	34360	3476	3198		SMALL GAS WELL	SALINA-NIAGARAN	E
CALHOUN LEE-01S,05W,10	LEE 10-01S-05W P/D	HARRIS-CRANNIE PERSONS 1-10	34541	3473	3324		2000 MCF	SALINA-NIAGARAN	E
CALHOUN LEE-01S,05W,13	LEE 13-01S-05W P/B	TROLZ & ASSOC. MIDLAM 3-A	33838	3361	3220		SIGW	NIAGARAN	E
CALHOUN LEE-01S,05W,20	LEE 20-01S-05W	COLLINS BROS. OBERLAIN-WILLIAMS 1-20	34416	3220	3019	2 BOPD +282 MCF		NIAGARAN	E
CALHOUN LEE-01S,05W,24	LEE 24-01S-05W P/A	MGU DEV. CO. MICH. GAS UTILITIES 1-24	34685	3307	3100		50 MCF	NIAGARAN	E
CALHOUN LEE-01S,05W,24	LEE 24-01S-05W P/B	R. VAN BELOIS USA/LYNN/DEBRUYN 1-24	35009	3272	3148	100 BOPD +50 MCF		NIAGARAN	E
CASS CALVIN-07S,14W,29	CALVIN SEC. 29	FAYETTE DRILLING SMITH 1	34630	734	734	40 BOPD		TRAVERSE	E
CRAWFORD FREDERIC-28N,04W,13	FREDERIC 13-28N-04W P/A	SHELL OIL CO. SALLING-HANSON 2-13B	34782	7395	7240	430 BOPD +476 MCF		NIAGARAN	E
CRAWFORD FREDERIC-28N,04W,20	FREDERIC 20-28N-04W	SHELL OIL CO. ST-FREDERIC 4-20A	34312	7431	7346	96 BOPD +36 MCF		NIAGARAN	E
CRAWFORD S. BRANCH-29N,02W,25	HICKEYS CREEK	DART OIL & GAS CORP. MEAD 1-25	34305	4530	4298	183 BOPD +63 MCF +63BWPD		RICHFIELD	E
EATON EATON-02N,04W,25	EATON 25-02N-04W	REEF PET. CORP. HARRIS 1-25	34402	4070	3881	238 BOPD +133 MCF		NIAGARAN	E
EATON EATON RAPIDS-02N,03W,28	EATON RAPIDS 28-02N-03W P/B	TOTAL PET. INC. WOODS 1-28	34837	4065	3871		1210 MCF	SALINA-NIAGARAN	E
EATON EATON RAPIDS-02N,03W,33	EATON RAPIDS 33-02N-03W P/A	CONS. POWER CO. ACKLEY 2-33	34361	3897	3764	352 BOPD +85 MCF		NIAGARAN	E
EATON HAMLIN-01N,03W,11	HAMLIN 11-01N-03W	DART OIL & GAS CORP. ROGERS 1-11	34404	3930	3646	70 BOPD +31 MCF		NIAGARAN	E
EATON HAMLIN-01N,03W,11	HAMLIN 11-01N-03W P/A	DART OIL & GAS CORP. ROGERS 2-11	34398	3928	3650	64 BOPD +56 MCF		NIAGARAN	E
EATON HAMLIN-01N,03W,14	HAMLIN 14-01N-03W	G. K. MOORE HOLMES-PHILLIPS 1	30110	3790	3636	SMALL OIL WELL		NIAGARAN	E
EATON HAMLIN-01N,03W,16	HAMLIN 09-01N-03W P/A	PATRICK PET. CORP. SMITH-ABBEY 1-16	34899	3807	3690		990 MCF	NIAGARAN	E
GD. TRAVERSE BLAIR-26N,11W,21	BLAIR 21-26N-11W P/A	R. RAFFAELE, INC. STATE-BLAIR 5-21	34713	5636	5441	23 BOPD +192 BWPD		NIAGARAN	E
GD. TRAVERSE BLAIR-26N,11W,29	BLAIR 29-26N-11W	MID-AMERICAN OIL & GAS RASHO-LEMCOOL 1-29	34145	5830	5587	35 BOPD +10 BWPD		NIAGARAN	E
GD. TRAVERSE BLAIR-26N,11W,34	BLAIR 34-26N-11W P/B	DELTA & GT. LKS. NIAG. FRANKLIN UNIT 1-34	33218	6124	5907	50 BOPD +200 MCF		NIAGARAN	E

TABLE 21 1981 DISCOVERY WELLS - Continued

COUNTY TOWNSHIP-T,R,SEC	FIELD NAME	OPERATOR & LEASE	PERMIT NUMBER	TOTAL DEPTH	DEPTH TO PAY	INITIAL PRODUCTION OIL WELLS	GAS WELLS	PRODUCING FORMATION	AAPG POOL CLASS
GD. TRAVERSE MAYFIELD-29N,11W,33	MAYFIELD 33-29N-11W P/B	REEF PET. CORP. ST-MAYFIELD 1-33	35050	6768	6654	125 BOPD +1229 MCF		NIAGARAN	E
GD. TRAVERSE PARADISE-29N,10W,03	PARADISE 03-29N-10W P/A	EASON OIL CO. HART 1-3	34864	6904	6745		1800 MCF +90 BCPD	NIAGARAN	E
GD. TRAVERSE UNION-26N,09W,03	UNION 03-26N-09W P/A	TRAVERSE OIL CO. ELHART 2-3	34849	6681	6557	475 BOPD +665 MCF		NIAGARAN	E
GD. TRAVERSE UNION-26N,09W,04	UNION 04-26N-09W	ROBINSON ENERGY CORP. FIBBING 1-4	34580	6601	6170	4 BOPD +140 BWPD		NIAGARAN	E
GD. TRAVERSE UNION-26N,09W,29	UNION 29-26N-09W P/A	AMOCO PROD. CO. ST-UNION "U" 3A-29	34654	7095	6840		2000 MCF +200 BCPD	SALINA-NIAGARAN	E
INGHAM ONONDAGA-01N,02W,19	ONONDAGA 19-01N-02W	KULKA & SCHMIDT, INC. GALLAGHER-CLONE 1-19	34332	3678	3600	40 BOPD		NIAGARAN	E
INGHAM WHITE OAK-02N,02E,04	WHITE OAK 04-02N-02E	CONS. POWER CO. TUTHILL 1-4	34129	4617	4479	223 BOPD		NIAGARAN	E
INGHAM WHITE OAK-02N,02E,11	WHITE OAK 11-02N-02E	AMOCO PROD. CO. OESTERLE UNIT 1-11	33977	4728	4252	15 BOPD		SALINA-NIAGARAN	E
INGHAM WHITE OAK-02N,02E,15	WHITE OAK 15-02N-02E P/A	NORTHERN MICH. EXPL. CO. COLLAR 1-15B	35031	4469	4197	400 BOPD		NIAGARAN	E
KALKASKA BLUE LAKE-28N,05W,05	BLUE LAKE 05-28N-05W P/A	AMOCO PROD. CO. ST-BLUE LAKE UNIT "N" 1-5	34785	6877	6538	355 BOPD +500 MCF		NIAGARAN	E
KALKASKA BOARDMAN-26N,08W,04	BOARDMAN 04-26N-08W P/B	SHELL OIL CO. ST-BOARDMAN 3-4	34989	6990	6770		1998 MCF +214 BCPD	NIAGARAN	E
KALKASKA COLD SPRINGS-28N,06W,20	COLD SPRINGS 20-28N-06W P/A	AMOCO PROD. CO. WILBUR 3-20	34062	7074	6836		2030 MCF +72 BCPD	NIAGARAN	E
KALKASKA KALKASKA-27N,07W,33	KALKASKA 33-27N-07W	FINDERS OIL & GAS CO. RUBY 3-33	34521	7328	7181	27 BOPD		NIAGARAN	E
KALKASKA KALKASKA-27N,08W,20	KALKASKA 20-27N-08W P/A	NORTHERN MICH. EXPL. CO. USA-ST-AKALKASKA 3-20	34823	6635	6443	275 BOPD +107 MCF		NIAGARAN	E
LIVINGSTON HAMBURG-01N,05E,16	HAMBURG 16-01N-05E	DART OIL & MICH OIL CO. BACALIS 1-16A	34418	3926	3701	96 BOPD +264 BWPD		NIAGARAN	E .
MACOMB ARMADA-05N,13E,07	ARMADA 07-05N-13E	ENERGY ACQ. CORP. HILLMAN 1-7	34175	3894	3700			NIAGARAN	E
MANISTEE MANISTEE-22N,16N,12	MANISTEE 12-22N-16W P/A	DON YOHE ENTERPRISE THIEMAN-PEARSON 1-12	34230	4766	4670	16 BOPD		NIAGARAN	E
MASON VICTORY-19N,17W,05	VICTORY 05-19N-17W P/A	MILLER BROS. DIESING 5-5	34328	4601	4470		400 MCF	NIAGARAN	E
MIDLAND EDENVILLE-16N,01W,05	EDENVILLE SEC. 05	LAKELAND OIL CORP. BOWEN-ELWOOD 1	34575	4280	4268	130 BOPD +75 MCF		DETROIT RIVER	E
MIDLAND EDENVILLE-16N,01W,15	EDENVILLE SEC. 15	BURGESS, HALL & STINSON TRAVERSO 1	34787	3901	2473	10 BOPD +3 BWPD		BEREA	E
MIDLAND PORTER-13N,01W,10	PORTER	UNION OIL OF CALIF. NARMORE 46	32513	3477	2301	31 BOPD +34 BWPD		BEREA	E
MISSAUKEE REEDER-22N,07W,36	FALMOUTH	JEM PET. CORP. EDWARDS 7-36	33963	10,810	10,450		12.3MMCF	PRAIRIE DU CHIEN	E
NEWAYGO BARTON-16N,14W,27	BARTON SEC. 33	R. RAFFAELE INC. DEVRIES 1-27	34441	3000	2954	35 BOPD		TRAVERSE	E
NEWAYGO DENVER-14N,14W,05	HUBER	JENNINGS PET. CORP. VANDERLEY 1-5	34234	2064	1630	2 BOPD		BEREA	E
OTSEGO BAGLEY-30N,03W,21	BAGLEY 21-30N-03W P/A	MICH. PET. EXPL. INC. JOHNSON & JOHNSON 1-21	34482	6136	5929	100 BOPD +35 MCF		NIAGARAN	E
OTSEGO CHARLTON-31N,01W,10	CHARLTON 10-31N-01W	SHELL OIL CO. ST-N. CHARLTON 1-10	31793	5366	5176	240 BOPD +300 MCF		NIAGARAN	E
OTSEGO CHARLTON-31N,01W,11	CHARLTON 11-31N-01W	SHELL OIL CO. ST-N. CHARLTON 1-11	31794	5419	5082		3000 MCF +192 BCPD	NIAGARAN	E
OTSEGO DOVER-31N,02W,33	DOVER 33-31N-02W P/A	FINDERS OIL & GAS CO. HOUSE 1-33	34215	5605	5400	5 BOPD +5 MCF		NIAGARAN	E
PRESQUE ISLE BISMARCK-34N,04E,14	BISMARCK 14-34N-04E	SHELL OIL CO. ST-BISMARCK 1-14A	34729	3284	3109	456 BOPD +240 MCF		NIAGARAN	E
PRESQUE ISLE BISMARCK-34N,04E,34	BISMARCK 34-34N-04E	SHELL OIL CO. UPLAND 1-34	34507	3675	3303		361 MCF +24 BWPD	NIAGARAN	E
PRESQUE ISLE CASE-33N,03E,03	CASE 03-33N-03E	TRENDWELL OIL CORP. SHIRELY 1-3	33960	3790	3659	200 BOPD +156 MCF		NIAGARAN	E
ST. CLAIR COTTRELLVILLE-03N,16E,05	COTTRELLVILLE 05-03N-16E	MICH. OIL & KEP RES. KRATZ 1-5	34126	2455	2266		SIGW	NIAGARAN	E
TUSCOLA WATERTOWN-10N,09E,14	FOSTORIA	DON YOHE ENTERPRISE BROWN 1-14	33947	3355	3103	15 BOPD		DETROIT RIVER	E
WEXFORD WEXFORD-24N,12W,17	WEXFORD 17-24N-12W	SHELL OIL CO. BYARD 2-17B	34620	6270	6128		1480 MCF +5 BOPD	NIAGARAN	E

TABLE 22 DRILLING PERMITS, WELL COMPLETIONS, DRILLED FOOTAGE BY COUNTY, 1981

		Classification of New Hole Completions Does not include reworked wells or old wells drilled deeper											
	OIL/GAS PERMITS	OIL & GAS TESTS Completed		RESULTS			SERVICE WELLS Completed		TOTAL WELLS	TOTAL FOOTAGE DRILLED			Average Well
COUNTY	ISSUED	Explor.	Devel.	Oil Wells	Gas Wells	Dry Holes	G.S.	B.D.W.	DRILLED	Explor.	Devel.	Fac.	Depth
Alcona	1	1	0	0	0	1	0	0	1	10,402	0	0	10,402
Allegan	21	7	7	6	0	8	0	0	14	12,120	13,804	0	1,852
Antrim	1	2	0	0	0	2	0	0	2	10,218	0	0	5,109
Arenac	8	0	7	5	0	2	0	0	7	0	30,505	0	4,358
Barry	3	3	0	0	0	3	0	0	3	10,358	0	0	3,453
Bay	50	5	21	22	0	4	0	1	27	19,865	56,177	3,950	2,963
Benzie	1	1	1	1	0	1	0	0	2	5,851	5,790	0	5,821
Berrien	2	0	0	0	0	0	0	0	0	0	0	0	0
Branch	1	1	0	0	0	1	0	0	1	4,500	0	0	4,500
Calhoun	89	51	20	15	8	48	0	0	71	151,880	63,964	0	3,040
Cass	29	11	10	8	0	13	0	0	21	23,751	7,822	0	1,503
Charlevoix	1	1	0	0	0	1	0	0	1	8,902	0	0	8,902
Cheboygan	11	7	0	0	0	7	0	0	7	26,936	0	0	3,848
Chippewa	5	4	0	0	0	4	0	0	4	4,727	0	0	1,182
Clare	19	3	5	3	1	4	0	0	8	30,486	24,317	0	6,850
Clinton	1	0	0	0	0	0	0	0	0	0	0	0	0
Crawford	29	5	14	12	0	7	0	2	21	20,458	66,388	7,150	4,476
Eaton	30	23	3	7	2	17	0	0	26	95,199	12,056	0	4,125
Gd. Traverse	93	52	27	12	5	62	0	1	80	307,708	132,949	4,260	5,561
Genesee	2	0	2	1	1	0	0	0	2	0	6,279	0	3,140
Gladwin	26	0	9	8	0	1	0	0	9	0	35,198	0	3,911
Gratiot	1	3	0	0	0	3	0	0	3	7,665	0	0	2,555
Hillsdale	10	2	5	2	0	5	0	0	7	7,791	20,306	0	4,014
Huron	3	1	2	1	0	2	0	0	3	3,850	7,115	0	3,655
Ingham	20	14	5	6	0	13	0	1	20	50,757	19,570	4,000	3,716
Iosco	2	1	0	0	0	1	0	0	1	4,432	0	0	4,432
Isabella	41	1	15	11	0	5	0	0	16	3,899	55,490	0	3,712
Jackson	6	6	0	0	0	6	0	0	6	24,389	0	0	4,065
Kalamazoo	4	2	1	0	0	3	0	0	3	5,859	2,695	0	2,851
Kalkaska	42	18	15	8	6	19	9	0	42	130,086	75,250	56,906	6,244
Lapeer	28	0	25	24	0	1	0	2	27	0	82,225	6,374	3,281
Lenawee	2	0	0	0	0	0	0	0	0	0	0	0	0
Livingston	12	7	3	2	0	8	0	0	10	27,534	13,579	0	4,111
Macomb	12	6	3	0	3	6	0	0	9	21,523	10,253	0	3,531
Manistee	72	37	28	15	2	48	0	2	67	174,184	110,129	3,726	4,299
Mason	12	8	2	1	1	8	0	0	10	29,248	6,239	0	3,549
Mecosta	10	1	1	1	0	1	3	0	5	4,472	3,350	5,103	2,585
Midland	11	3	1	4	0	0	0	0	4	11,031	3,493	0	3,631
Missaukee	39	7	15	15	1	6	0	0	22	75,882	67,964	0	6,538
Montcalm	5	1	1	1	0	1	0	0	2	3,278	3,301	0	3,290
Montmorency	8	7	1	0	0	8	0	0	8	30,740	6,135	0	4,609
Muskegon	5	0	2	2	0	0	0	0	2	0	3,476	0	1,738
Newaygo	12	5	4	6	0	3	0	0	9	15,457	7,205	0	2,518
Oakland	8	6	1	0	0	7	0	0	7	21,960	3,594	0	3,651
Oceana	9	4	3	0	0	7	0	0	7	14,699	10,615	0	3,616
Ogemaw	30	0	11	10	0	1	0	7	18	0	38,243	19,411	3,203
Osceola	8	4	0	0	0	4	0	0	4	31,662	0	0	7,916
Oscoda	7	2	0	0	0	2	0	0	2	15,520	0	0	7,760
Otsego	61	19	29	9	7	32	0	5	53	97,825	115,339	20,376	4,406
Ottawa	4	2	1	0	0	3	0	0	3	12,316	2,831	0	5,049
Presque Isle	36	33	4	3	1	33	0	0	37	106,502	12,897	0	3,227
Roscommon	27	1	10	9	0	2	0	1	12	12,288	40,994	4,430	4,809
Saginaw	10	1	4	4	0	1	0	0	5	3,096	10,795	0	2,778
St. Clair	9	6	3	1	3	5	0	0	9	14,537	8,257	0	2,533
Tuscola	19	5	9	6	0	8	0	0	14	17,604	36,820	0	3,887
Van Buren	25	1	13	11	0	3	0	0	14	1,069	14,635	0	1,122
Washtenaw	1	2	0	0	0	2	0	0	2	11,455	0	0	5,728
Wexford	12	6	3	0	2	7	0	0	9	34,623	14,509	0	5,459
Total	1,048	399	346	252	43	450	12	22	779	1,766,593	1,255,759	135,686	

PART 2

EXPLANATION

Part 2 brings together general information on Michigan's oil and gas fields, gas storage reservoirs, LPG storage facilities, gas plant operations, refinery facilities and other items.

Table 23 list Michigan's oil and gas fields and gas storage reservoirs. The symbol on the left margin of the table indicates the official classification of fields and pools at the end of the year. Classifications may be changed as warranted. Official field names are listed alphabetically in the first column and the producing pool, or pools, are shown under the heading Producing Formation or Pool. Most fields consist of one pool with oil or gas production coming from a single reservoir within a formation. Some fields have two or more separate pools, each producing from a different formation or stratigraphic interval and at a different depth. Most multi-pool fields are associated with a common structural feature. Salina-Niagaran reef oil or gas accumulations are mostly single-pool fields. Some, however, have several separate reef reservoirs designated as Pool A, Pool B and so on. Most have been so designated by administrative action following public hearings. Also, a few of the listed fields actually consist of two or more hydrocarbon accumulations which for administrative purposes have been consolidated under one field name.

Location of fields. The geographic location of fields and pools can be found by township and range on the oil and gas field map, Illustration 5. Due to space and scale limitations, all field names are not shown on the map.

The Pay Zone part of the table generally refers to data for the discovery well for the field or pool. The indicated pay thickness relates to the amount of pay opened or perforated in the discovery well and does not necessarily indicate total net or gross pay for the reservoir.

The Deepest Formation or Pool Tested column indicates the stratigraphically oldest formation penetrated and the deepest total depth reached beneath the field area. Data in these columns are updated periodically.

The Number of Wells column indicates the number of successful field wells drilled in the field to the end of the specified year, the number completed as producing wells during the specified year, the number abandoned during the year and the number of active wells at the end of the specified year.

The Drilled Acres column indicates the total number of acres assigned to the field or pool according to individual well drilling units assigned to each producing well completed in the field or pool. Except as provided by special orders covering drilling units, rules promulgated under Act No. 61, P.A. of 1939, as amended, call for a minimum 40-acre unit consisting of a governmental quarter-quarter section of land. Special Order No. 1-73 calls for basic 80-acre drilling units for Salina— Niagaran or deeper tests in specified areas of the state. These 80-acre units are formed by two governmental quarter-quarter sections of land having a common boundary of approximately 1320 feet. In past years drilling units have been 10, 20 or 40 acres for oil wells. A field may have had a 10 or 20-acre drilling unit for one pool and a 40-acre unit for a deeper formation pool. During the development of a field or pool the drilling unit size may change. Subsequent wells are assigned acreage values in accordance with the new unit size. Gas well units, especially for Michigan Stray Sandstone reservoirs, have generally been 160-acre units. Other sizes currently in use for gas wells are 40, 80, 320 and 640-acre units, or a unit size based on seismic and reservoir data. Reef reservoirs, especially in the northern reef trend, have been assigned 80, 160, 640, or a unit based on seismic data. Changes in drilling units, off-pattern wells, etc., complicate the maintenance of accurate figures during the lifetime of a given field or pool.

Recovery Per Acre Drilled figures for oil pools are derived by dividing the cumulative production figure by the drilled acres figure.

Gas Fields, Gas-Condensate Fields. Some fields are listed as "shut-in" and show no production figures. In the case of Niagaran reef fields classified as gas-condensate reservoirs, virtually all those listed as shut-in at the end of the year were waiting pipeline construction

or gas-handling facilities. Others, mainly small dry-gas reservoirs in shallower formations, are listed as shut-in because of slow field development, small reserves or lack of marketing facilities. Other fields, not considered to have commercial-size gas accumulations, produce small quantities of unmetered gas which is used for domestic purposes and in some cases, lease fuel.

GAS STORAGE RESERVOIRS

Most gas storage reservoirs were originally classified as gas fields or pools. Upon depletion or near depletion of native gas they were converted to storage reservoirs.

LPG STORAGE

Surface and underground storage facilities for liquified petroleum gas.

OIL WELL GAS

This is casinghead gas produced incidental to the production of oil from pools or fields generally classified as oil accumulations.

NATURAL GAS LIQUIDS (CONDENSATE)

Natural gas liquids are those portions of reservoir gas which are liquified at the surface in lease separators, field facilities, or gas processing plants. These liquids include but are not limited to: ethane, propane, butanes, pentanes, natural gasoline and condensate. On Table 26 of this report, condensates from Michigan gas-condensate fields are shown under the oil production column.

WELL SAMPLE SETS

Well cuttings for over 9,000 wells are available for inspection at the Geological Survey Division, Michigan Department of Natural Resources, Lansing. Samples are contained in either glass vials or in envelopes and are arranged in open trays. In addition, several thousand shallow geological test samples are also available for inspection. The Division does not maintain a core collection. Other sample and core repositories, not connected with the Division, are located at:

[1] Subsurface Laboratory, Department of Geology, The University of Michigan, Ann Arbor, Michigan.

[2] Department of Geology, Wayne State University, Detroit, Michigan.

[3] Department of Geology, Western Michigan University, Kalamazoo, Michigan.

[4] Department of Geology, Michigan State University, East Lansing, Michigan.

[5] Department of Geology, Central Michigan University, Mt. Pleasant, Michigan.

PART 3
CUMULATIVE RECORDS

EXPLANATION

Part 3 contains cumulative statistics principally of oil and gas production, well completions, and oil field brine production and disposal from 1925 through the most recent year-end compilations.

OIL AND GAS PRODUCTION TABLES

Oil and gas production figures for individual years prior to 1960 can be found in issues of “Summary of Operations, Oil and Gas Fields” for 1962 and prior years, and in “Michigan’s Oil and Gas Fields” 1963 to present. The tables show the year of the first recorded production from a particular formation, and the yearly and cumulative production totals from 1925 through the most recent year-end compilations. Cumulative oil and gas production by county is shown on a separate table. Refer to Part 1 for county production figures for the past year, and prior issues for previous years.

CUMULATIVE WELL COMPLETIONS

These tables show the cumulative number of yearly completions in a county. Well density figures include field development wells, exploratory wells, and service wells of all types.

DRILLING PERMITS, WELL COMPLETIONS, FIELDS DISCOVERED

These tables show the number of drilling permits issued by year from 1927 through the most recent year-end compilations. Initial classification of well completions by year, the number of new fields or pools discovered, and the number of producible oil or gas wells on a yearly basis are all shown on the same table.

BRINE PRODUCTION AND DISPOSAL

Oil field brine production records other than for individual fields were discontinued in 1968. These tables listed the reported amount of produced brine and the method of disposal from 1937 up to 1967. Most of field brine is still returned to subsurface formations. Small quantities are used for dust control or ice and snow removal on county roads in local areas.

SERVICE WELLS

Service wells as listed in this publication are those wells which were drilled to serve some purpose other than the initial production of oil or gas. Oil or gas wells are sometimes converted to salt water disposal, observation, or facility wells in gas storage or pressure maintenance projects. There are several types of service wells:

LPG Wells. These are wells drilled for underground storage of liquified petroleum gas. In Michigan, these storage reservoirs are in manmade cavities in salt beds.

The cavities have been made by dissolving the salt with water and then pumping out the brine.

Gas Storage Wells. These are wells drilled in gas storage reservoirs. They are frequently referred to as facility wells, and are generally used to inject gas into or extract gas from the reservoir. Certain facility wells may sometime in the history of the field be used as salt water disposal wells or observation wells.

Observation Wells. Most observation wells are related to gas storage projects. They are used to observe underground movement of gas, brines and other fluids, or to observe pressures.

Brine Disposal Wells. These wells are used in the disposal of oil and gas field brines back into some suitable subsurface formation.

Injection and Pressure Maintenance Wells. These are wells used in secondary recovery, or pressure maintenance projects. They may be new wells drilled specifically for injection or pressure maintenance, or they may be converted oil or gas wells; their status can change from time to time.

Oil or gas wells are sometimes converted to salt water disposal, observation, facility wells in gas storage reservoirs, or water injection wells used in secondary recovery or pressure maintenance projects. The types of service wells listed under "Classification of Well Completions" do not include oil or gas wells converted to service wells.

[CROSS-REFERENCE LISTS]

CROSS-REFERENCE LIST by COUNTY

ALLEGAN
Allegan; Casco; Cheshire; Crooked Lake; Diamond Springs; Dorr; Dunningville; Hawkhead; Heath; Milliards; Hopkins; Hopkins, South; Hopkins, West; Lee; Lee, South; Martin; Monterey; New Richmond; Otsego; Overisel; Pullman; Pullman, East; Pullman, East; Rabbit River; Salem; Trowbridge; Wayland; Wayland, North

ALPENA
Alpena

ANTRIM
Mancelona

ARENAC
Adams; Adams, North; Au Gres; Clayton; Deep River; Lincoln; Moffatt; Standish; Sterling

BARRY
Freeport; Hope; Johnstown; Thornapple

BAY
Beaver; Crump; Essexville; Gibson; Kawkawlin; Lucht; Mt. Forest; Pinconning; Williams

BENZIE
Colfax

BERRIEN
Niles; Pipestone

CALHOUN
Albion; Cal-lee; Clarence; Convis; Lee; Pennfield; Tekonsha

CASS
Adamsville; Calvin; Jefferson; Juno Lake; North Porter

CHEBOYGAN
Forest

CLARE
Clare City; Cranberry Lake; Cranberry Lake, East; Freeman; Freeman-Lincoln; Freeman-Redding; Garfield; Greenwood; Hamilton; Harrison; Hatton; Lake George; McKay; Redding; Skeels; Surrey; Winterfield

CLINTON
Dallas; Lebanon

CRAWFORD
Beaver Creek Unit; Frederic; Hickeys Creek; Maple Forest; South Branch

EATON
Eaton; Eaton Rapids; Hamlin; Olivet

GENESEE
Otisville; Otter Lake

GLADWIN
Bard; Beaverton; Beaverton, South; Beaverton, West; Bentley; Billings; Billings, South; Buckeye, North; Buckeye, South; Butman; Grout; Hay; Sage; Secord; Skeels

GRAND TRAVERSE
Blair; East Bay; Grant; Mayfield; Paradise; Paradise; Union; Whitewater

GRATIOT
Elba; Ithaca; Newark; North Star; Pine River; Sumner

HILLSDALE
Adams; Albion-Pulawski-Scipio Trend; Lime Lake; Reading

HURON
Dwight; Grant

INGHAM
Aurelius; Ingham; Leslie; Onondaga; Stockbridge; Vevay; White Oak

IONIA
Hubbardston

ISABELLA
Brinton; Broomfield; Chippewa; Clare City; Coldwater; Coldwater, South; Currie; Fremont;

Gilmore; Isabella; Leaton; Lincoln; Rolland; Rosebush; Sherman; Union; Vernon; Wise

JACKSON
Concord; Hanover; Henrietta; Springport

KALAMZOO
Alamo; Comstock; Cooper

KALKASKA
Blue Lake; Boardman; Cold Springs; Excelsior; Kalkaska; Rapid River

KENT
Rockford; Tyrone; Walker; Wyoming Park

LAKE
Chase; Luther; Luther, North; Peacock; Sauble

LAPEER
Marathon; Rich

LENAWEE
Blissfield; Demings Lake; Franklin; Macon Creek; Medina; Newburg; North Morenci; Ridgeway; Woodstock

LIVINGSTON
Fowlerville; Green Oak; Hamburg; Iosco

MACOMB
Armada; Bruce; Chesterfield; Coon Creek; Lenox; Mt. Clemens; Richmond; Washington

MANISTEE
Bear Lake; Brown; Cleon; Filer; Manistee; Maple Grove; Marilla; Onekama; Pleasanton; Springdale

MASON
Eden; Fountain; Grant; Hamlin; Logan; Oxbow; Riverton; Riverton; Scottville; St. Mary's Lake; Victory; Wiley

MECOSTA
Bevens Lake; Big Rapids; Colfax; Fork, East; Fork;
Fork, West; Green; Hardy Dam; Martiny; Mecosta; Mecosta Lake; Morton; Paris; Sheridan; Wheatland

MIDLAND
Edenville; Geneva; Jerome; Larkin; Mills; Mt. Haley; Mt. Pleasant; Porter; Sanford

MISSAUKEE
Cannon Creek; East Norwich; Enterprise; Falmouth; Forward; McBain; Pioneer; Prosper; Prosper, South; Reeder; Riverside; Vogel Center

MONROE
Deerfield; Summerfield

MONTCALM
Belly Achers; Bloomer; Bushnell; Cato; Crystal; Day; Douglass; Edmore; Edmore-Richland; Entrican; Home; Maple Valley; Pine; Reynolds; Richland; Stanton; Turk Lake; Winfield

MONTMORENCY
Atlanta; Montmorency

MUSKEGON
Blue Lake; Cedar Creek; Dalton; Egelston; Holton; Laketon; Montague; Muskegon; Ravenna; Trent; White River; Wolf Lake

NEWAGO
Ashland; Barton; Big Prairie; Bishop; Cole Lake; Croton; Ensley; Goodwell; Goodwell, East; Huber; Kimball Lake; Reeman; Sheridan; Thompson Corners; White Cloud; Woodville

OAKLAND
Addison; Avon; Leonard; Lyon; Northville; Pontiac

OCEANA
Benona; Claybanks; Crystal Vailey; Crystal Valley, South; Elbridge; Ferry; Forest River; Gilbert Lake; Hart; Mears; Otto; Otto; Pentwater; Pentwater Lake; Rothbury; Shelby; Stony Lake; Weare

OGEMAW
Edwards; Logan; Rose City; West Branch

OSCEOLA
Ashton; Ashton, East; Burdell; Cat Creek; Cedar; Evart; Fork, North; Hartwich; Hersey; Leroy; Middle Branch; Mineral Springs; Pecks Lake; Reed City; Reed City, East; Rose Lake; Sears; Sylvan

OSCODA
Mio

OSTEGO
Bagley; Charlton; Chester; Dover; Hayes; Otsego; Otsego Lake

OTTAWA
Coopersville; Dennison; Fillmore; Marne; Polkton; Robinson; Wright; Zeeland

PRESQUE ISLE
Allis; Belknap; Bismarck; Case; North Allis; Pulawski

ROSCOMMON
Headquarters; Nellsville; St. Helen

SAGINAW
Birch Run; Birch-Bela; Chesaning; Fremont; Lakefield; New Lothrop; Richland; Saginaw; St. Charles; Taymouth

ST. CLAIR
Adair; Algonac; Alpine; Berlin; Big Hand; Boyd; China; China Belle; China, South; Columbus; Columbus, North; Cottrellville; Diamond Crystal Salt; East China; Kimball; Marine City; Marine City, South; Peters; Peters, East; Port Huron; St. Clair; Starrville; Wales; Yankee

TUSCOLA
Akron; Akron, East; Arbela; Elkland; Elmwood; Fostoria; Vassar

VAN BUREN
Bangor; Bloomingdale; Breedsville; Clear Lake; Coffee
Lake; Geneva; Lacota; Lawton; Paw Raw

WASTENAW
Clinton; Freedom; Lyndon; Northville

WAYNE
New Boston; Northville; Romulus

WEXFORD
Cherry Grove; Henderson; Wexford

CROSS-REFERENCE FIELDS by PRODUCING FORMATION

A 2 CARBONATE – Silurian
Akron; Fillmore; Pentwater; Pullman, East

A 2 CARBONATE-NIAGARIAN – Silurian
Charlton

A 1 CARBONATE – Silurian
Akron; Alpena; Charlton; Chester; Dover; Fillmore; Lee; Olivet; Romulus; Stockbridge; Washington; Lee

A 1 CARBONATE-NIAGARIAN – Silurian
Bagley; Lee

ANTRIM – Devonian
Algonac; Charlton; Chester; Dover; Mayfield; Otsego; Otsego Lake

BEREA – Mississippian
Adams, North; Beaver; Birch Run; Blue Lake; Buckeye, South; Cedar Creek; Chase; Clayton; Coopersville; Deep River; Dorr; Edenville; Egelston; Ferry; Fostoria; Fremont; Hay; Huber; Kawkawlin; Larkin; Logan; Marathon; Marne; New Lothrop; Otisville; Otter Lake; Otto; Porter; Ravenna; Ravenna; Rich; Rothbury; Saginaw; Stony Lake; Walker; Williams; Wolf Lake; Wright; Zeeland

BEREA-TRAVERSE-DETROIT RIVER - Mississippian/Devonian
Walker

DETROIT RIVER – Devonian
Atlanta; Billings; Dorr; Dwight; Edenville; Essexville; Excelsior; Fostoria; Garfield; Grant; Kawkawlin; Lyndon; Otter Lake; Salem; Walker; Wise

DETROIT RIVER SOUR ZONE – Devonian
Adams; Akron; Au Gres; Buckeye, South; Cannon Creek; Clayton; Cranberry Lake; Grout; Headquarters; Marathon; Reed City; Rich; Skeels; Sterling; Vassar; Vernon; West Branch

DUNDEE – Devonian
Adams; Adams, North; Akron; Arbela; Ashton; Bard; Beaverton; Beaverton, South; Beaverton, West; Belly Achers; Bentley; Bevens Lake; Big Prairie; Big Rapids; Billings; Billings, South; Birch Run; Birch-Bela; Brinton; Broomfield; Buckeye, North; Buckeye, South; Burdell; Bushnell; Butman; Cat Creek; Cedar; Clayton; Coldwater; Coldwater, South; Colfax; Cranberry Lake; Cranberry Lake, East; Crump; Crystal; Crystal Valley; Currie; Day; Deep River; Douglass; East Norwich; Eden; Edenville; Edwards; Elkland; Elm-wood; Entrican; Essexville; Evart; Falmouth; Fork; Fork, North; Freedom; Freeman; Freeman-Lincoln; Freeman-Redding; Fremont; Geneva; Gibson; Gibson; Gil-more; Goodwell, East; Greenwood; Grout; Hamilton; Harrison; Hatton; Headquarters; Home; Hubbardston; Isabella; Jerome; Kawkawlin; Lake George; Lakefield; Laketon; Leaton; Lincoln; Marathon; McBain; Mears; Mills; Mineral Springs; Moffatt; Mt. Forest; Mt. Haley; Mt. Pleasant; Nellsville; Northville; Otisville; Paris; Pecks Lake; Pentwater; Pinconning; Pine River; Port Huron; Porter; Prosper; Prosper, South; Reed City; Riverside; Robinson; Rolland; Rosebush; Sage; Sanford; Secord; Sherman; Skeels; Sterling; Sylvan; Vernon; Vogel Center; West Branch; Wheatland; White River; Winterfield; Wise

DUNDEE-REED CITY – Devonian
Colfax; Winfield

E UNIT – Silurian
Lee

GLACIAL DRIFT - “Pleistocene”
Grant

LOWER NIAGARAN – Silurian
Blue Lake; Chester

MARSHALL – Mississippian
Barton; Ensley

MICHIGAN STRAY – Mississippian
Ashton; Ashton, East; Bevens Lake; Big Prairie; Big Rapids; Broomfield; Cedar; Cherry Grove; Clare City; Colfax; Day; Douglass; Edmore-Richland; Elba; Enterprise; Evart; Falmouth; Fork, East; Fork, North; Fork, West; Forward; Fremont; Gilmore; Goodwell, East; Green; Hamilton; Harrison; Hartwich; Headquarters; Hersey; Isabella; Ithaca; Leaton; Maple Valley; Martiny; McKay; Mecosta; Mecosta Lake; Middle Branch; Mineral Springs; Morton; Newark; North Star; Paris; Pine; Prosper; Redding; Reeder; Richland; Rolland; Sears; Sheridan; Surrey; Sylvan; Turk Lake; Union; Vernon; Wheatland; Wise

NIAGARAN – Silurian
Addison; Allis; Alpine; Armada; Aurelius; Avon; Bagley; Bear Lake; Belknap; Benona; Berlin; Big Hand; Bismarck; Blair; Blue Lake; Boardman; Brown; Bruce; Cal-lee; Case; Charlton; Chester; Chesterfield; China; China Belle; Clarence; Claybanks; Cleon; Cold Springs; Colfax; Columbus; Columbus, North; Convis; Coon Creek; Cottrellville; Diamond Crystal Salt; Dover;

East Bay; East China; Eaton; Eaton Rapids; Excelsior; Filer; Forest; Frederic; Grant; Green Oak; Hamburg; Hamlin; Hayes; Ingham; Iosco; Kalkaska; Kimball; Lee; Lee Twp.; Lenox; Leonard; Lyon; Mancelona; Manistee; Maple Forest; Maple Grove; Marilla; Mayfield; Montmorency; North Allis; Northville; Onekama; Onondaga; Otsego Lake; Paradise; Pennfield; Pleasanton; Pontiac; Port Huron; Rapid River; Richmond; Springdale; Starrville; Union; Vevay; Victory; Washington; Wexford; White Oak; Whitewater; Yankee

PRAIRIE DU CHIEN – Ordovician
Falmouth; Franklin; Lime Lake

REED CITY – Devonian
Burdell; Cato; Eden; Fountain; Goodwell, East; Hardy Dam; Kimball Lake; Leroy; Luther, North; Peacock; Reed City; Reynolds; Scottville

RICHFIELD – Devonian
Adams; Akron; Akron, East; Au Gres; Beaver Creek Unit; Bentley; Butman; Cedar; Clayton; Cranberry Lake; Cranberry Lake, East; East Norwich; Enterprise; Evart; Falmouth; Fork; Freeman-Lincoln; Grout; Hamilton; Headquarters; Henderson; Hickeys Creek; Logan; Marathon; Mio; Nellsville; Prosper; Prosper, South; Reed City; Rose City; Rosebush; Skeels; South Branch; St. Helen; Standish; Sterling; West Branch; Winterfield

SALINA – Silurian
China; Crystal Valley; Dorr; Hopkins, West; Kawkawlin; Manistee; Mt. Clemens; Salem; Wayland; Zeeland

SALINA A 1 CARBONATE – Silurian
Clarence; Hilliards

SALINA B UNIT – Silurian
Cooper

SALINA E UNIT – Silurian
Diamond Springs; Lee

SALINA-NIAGARANN – Silurian
Adair; Bear Lake; Blue Lake; Boyd; Brown; Charlton; China, South; Clarence; Cold Springs; Convis; Cottrellville; Dover; East Bay; Eaton Rapids; Fowlerville; Grant; Hamlin; Hayes; Ingham; Kalkaska; Lee; Leslie; Manistee; Maple Grove; Marine City; Marine City, South; Bayfield; Montague; Northville; Onondaga; Otsego Lake; Paradise; Pennfield; Peters; Peters, East; Pulawski; Springdale; St. Clair; Union; Wales; Washington; White Oak

SAGINAW – Pennsylvanian
Edenville

SLYVANIA – Silurian
Jefferson

TRAVERSE-DUNDEE – Devonian
Muskegon

TRAVERSE-DUNDEE-DETRIOT RIVER – Devonian
Muskegon

TRAVERSE – Devonian
Adams; Adamsville; Alamo; Albion; Allegan; Ashland; Ashton; Bangor; Barton; Beaverton, South; Benona; Bentley; Bevens Lake; Bishop; Bloomer; Bloomingdale; Breedsville; Broomfield; Buckeye, South; Butman; Calvin; Cannon Creek; Casco; Cedar Creek; Cherry Grove; Chesaning; Cheshire; Chester; Chippewa; Clear Lake; Clinton; Coffee Lake; Coldwater; Cole Lake; Comstock; Concord; Cranberry Lake; Cranberry Lake, East; Crooked Lake; Croton; Crystal; Crystal Valley; Crystal Valley, South; Dallas; Dalton; Day; Demings Lake; Dennison; Diamond Springs; Dorr; Douglass; Dunningville; East Norwich; Eden; Edmore; Elba; Elbridge; Ensley; Entrican; Excelsior; Falmouth; Ferry; Fillmore; Forest River; Freedom; Freeport; Fremont; Geneva; Gibson; Gilbert Lake; Goodwell; Greenwood; Hart; Hawkhead; Headquarters; Heath; Hilliards; Holton; Home; Hope; Hopkins; Hopkins, South; Hopkins, West; Huber; Jefferson; Johnstown; Juno Lake; Kimball Lake; Lacota; Laketon; Lawton; Lebanon; Lee; Lee, South; Lincoln; Lucht; Luther; Lyndon; Martin; Mears; Moffatt; Monterey; Mt. Forest; Nellsville; New Richmond; Niles; North Morenci; North Porter; Otisville; Otsego; Otto; Overisel; Oxbow; Paradise; Paris; Paw Paw; Peacock; Pentwater; Pentwater Lake; Pinconning; Pine; Pine River; Pioneer; Pipestone; Polkton; Prosper; Pullman; Pullman, East; Rabbit River; Rapid River; Ravenna; Reed City; Reed City, East; Reeman; Reynolds; Richland; Riverside; Riverton; Rockford; Rose Lake; Salem; Sanford; Sauble; Scottville; Shelby; Sheridan; Sherman; Skeels; St. Charles; St. Mary's Lake; Stanton; Sterling; Stony Lake; Sumner; Taymouth; Thompson Corners; Thornapple; Trent; Trowbridge; Tyrone; Vevay; Victory; Walker; Wayland; Way-land, North; Weare; West Branch; White Cloud; Wiley; Winterfield; Wise; Wolf Lake; Woodstock; Woodville; Wright; Wyoming Park; Zeeland

TRENTON – Ordovician
Deerfield; Freedom; Henrietta; New Boston; Newburg; Reading; Ridgeway; Tekonsha

TRENTON-BLACK RIVER – Ordovician
Albion-Pulawski-Scipio Trend; Blissfield; Green Oak; Hanover; Macon Creek; Medina; Northville; Olivet; Springport; Summerfield

WEIR – Mississippian
Logan

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