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Western Gas Sands Project Quarterly Basin Activities Report

MASTER

January 31, 1979

Prepared for
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Abbreviations and Acronyms

Completed Wells

WF	unsuccessful new field wildcat
WFD	new field discovery
WD	unsuccessful deeper pool wildcat
WDD	deeper pool discovery
WS	unsuccessful shallower pool wildcat
WSD	shallow pool discovery
WP	unsuccessful new pool wildcat
WPD	new pool discovery
WO	unsuccessful wildcat outpost
WOE	wildcat outpost extension
D	unsuccessful development well
DG	development gas well

Drilling/Staked Wells

WF	new field wildcat
WD	deeper pool wildcat
WS	shallower pool wildcat
WP	new pool wildcat
WO	wildcat outpost
D	development

BHC	Borehole Compensated Log
Comp	Drilling completed
DIL	Dual Induction Laterolog
D&A	Dry and Abandoned
FDC	Formation Density Log
FR	First Report
GR	Gamma Ray
MICT	Moving in Cable Tools
PB	Plugged back
SDW	Shut down for weather
SI	Shut in
Spud	Commencement of drilling
SP	Spontaneous Potential
SDR	Shut down for repairs
SN	Sidewall Neutron
Swb(d)(g)	Swabbed, swabbing
TD	Total Depth
WOCT	Waiting on completion tools

1. Introduction

This quarterly basin activities report is a summation of three months drilling and testing activities in the four primary study areas of the WGSP. This report details information in each study area for the months of October, November, and December, 1978. Refer to Figure 1-1 for the location of study areas in the WGSP.

Figure 1-1 Map of Western United States, Showing Areas of Interest

The monitoring of basin activities is an important part of resource assessment and promotes cooperation between industry and government. This is especially evident in the Core Program. Certain areas in each study area have been recommended by USGS for obtaining core. Operators active in these specific areas are located by monitoring new activity in each area and contacted by DOE to negotiate contracts for a joint industry/government coring operation.

The summary of information on each study area is divided into two sections. The core program division identifies industry activity within the core sites and relates the status of WGSP core acquisition developments. The second section details drilling and testing operations of interest and tabulates production figures from horizons of interest. Newly staked and completed wells are listed and located on a map with orange and green numbers, respectively.

The drilling information used in this report was compiled primarily from *The Rocky Mountain Region Report*, published daily by Petroleum Information Corporation. Additional sources used were the *Montana Oil and Gas Journal*, *The Oil and Gas Journal* and the *Western Oil Reporter*.

Background and geologic information can be obtained from the Quarterly Basin Activities Reports, dated January 1, 1978, (NVO/0655-03), April 1, 1978, (NVO/0655-05) and July 31, 1978, (NVO/0655-06). Included in these reports are stratigraphic correlation charts, cross-sections and a brief account of the geology of each area and information relating to the USGS recommended coring locations. For information on the Core Program, refer to the *WGSP Core Program, January 12, 1978*. All of these reports may be obtained from Technical Information Center (TIC), P. O. Box 62, Oak Ridge, Tennessee, 37830, except the Core Program document, which is available from CER Corporation, 4220 So. Maryland Parkway, Suite 801, Las Vegas, Nevada 89109.

2. Northern Great Plains Province

2.1 CORE PROGRAM

Specific areas within Montana were selected by the USGS for the initiation of the WGSP Core Program (Figure 2-1 and 2-2). Four sites were chosen for the following reasons:

- The sites are removed from productive fields and little data is available.
- There are two or more potential reservoir intervals and adjacent source beds at the selected sites.
- The combination of these sites will test several different reservoir types, including sections with fine-grained carbonates, such as chalk, and fractured reservoirs found along lineament zones.

The objectives are Cretaceous horizons ranging from the Judith River Formation through the older Mowry Formation. Figure 2-3 is a correlation chart of Cretaceous rocks in the Northern Great Plains Province. Drilling depths to reach these objectives are shallower in the Province (2,000 - 4,000 ft) than the basins of Wyoming, Colorado and Utah. Therefore, costs for recovering core and obtaining complete log data should be less than in basins where the objectives are deeper.

However, the extent of the areas under study within the Northern Great Plains Province has expanded with time. Several operators working in diverse areas throughout the Province have been contacted concerning possible Core Program participation. Companies contacted during the quarter include Erico Resources, Joseph J.C. Paine & Associates, Midland Gas Company, Odessa Natural Corporation, Trio Petro, and Universal Gas.

2.2 DRILLING ACTIVITY

During the fourth quarter of 1978, 127 wells were completed in horizons of interest to the WGSP in the Northern Great Plains Province. Exploratory drilling increased by 12 wells over the previous quarter's total of 24. The overall success rate for the wildcats was five wells out of 36, or 16 percent. Development well completions were also up nearly 50 percent over the third quarter. Fifty-five of the 91 wells completed were producers.

Producing horizons were the Judith River, Eagle, Bowdoin, Phillips, Frontier, Blackleaf, and Bow Island. In several instances production from two or more horizons was commingled. Completions in the above horizons resulted in a minimum 28,183 MCFD of new production during the quarter (Table 2-2).

Figure 2-1 Northern Great Plains Province

Figure 2-2 Detail of USGS Designated Core Areas and Wells of Interest, Northern Great Plains Province (refer to Table 2-1)

Activity was concentrated primarily in the northern counties of Montana, within and around the established fields (see Table 2-1 and Figure 2-2). Fuel Resources Development Corporation was among the most active operators, completing 18 shallow Eagle tests around Leroy Field, Blaine County. Tricentrol U.S. was active in Blaine County and Hill County drilling both development and wildcat wells to the Eagle. Joseph J.C. Paine & Associates commenced a Greenhorn drilling campaign in Valley County in an area of interest to the Core Program. Midlands Gas and Odessa Natural Corporation completed wells in the Bowdoin Field area to test both the Bowdoin and Phillips. Small frac jobs (13,000 gal emulsion and 40,000 lb sand) were carried out on some Bowdoin Field wells with resulting production varying between 50 and 1,118 MCFD. The largest frac job attempted during the quarter was on the Joseph J.C. Paine & Associates well 1-0762 Murdock, a 1,700 ft Phillips test in Phillips County. The well was shut in with no IPF reported after stimulation with 28,014 gal water and 70,000 lb sand.

Refer to Tables 2-3 and 2-4 for summaries of wells completed and newly staked, respectively, and Figures 2-4 and 2-5 for locations of these wells.

Table 2-1 Summary of Wells Located in USGS Designated Core Areas—Northern Great Plains Province¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
FR: 6-26-78 Spud: 7-3-78	Joseph J.C. Paine & Associates	1-0296 Federal	1	Lot 6 2/29N/36E Wildcat Field Valley Cty, MT	Phillips	1,780		WF, cored for WGSP Core Program	
Spud: 3-6-78 Comp: 3-7-78	Xeno Inc.	9-35 Boucher Ranch	2	nese 35/30N/35E Wildcat Field Valley Cty, MT	Eagle	810		WF D&A	
FR: 10-5-78 Spud: 11-21-78	Joseph J.C. Paine & Associates	1-1306 Strommen	3	nwse 13/30N/36E Unnamed Field Valley Cty, MT	Greenhorn	1,595		WO, WOCT	
FR: 10-5-78	Joseph J.C. Paine & Associates	1-2306 Kuki	3	sese 23/30N/36E Unnamed Field Valley Cty, MT	Greenhorn (1,750)			WO	
FR: 11-8-78 Spud: 11-29-78	Joseph J.C. Paine & Associates	1-2706 Federal	3	sese 27/30N/36E Unnamed Field Valley Cty, MT	Greenhorn	1,770		D, WOCT	
FR: 10-5-78 Spud: 11-16-78	Joseph J.C. Paine & Associates	1-0407 Strommen	4	nesw 4/30N/37E Unnamed Field Valley Cty, MT	Greenhorn	1,425		D, WOCT, Operator has 6 Greenhorn in this locale.	
FR: 10-16-78	Joseph J.C. Paine & Associates	1-1907 Federal	4	nwnw 19/30/37E Unnamed Field Valley Cty, MT	Phillips (1,900)			WO	

¹ From Petroleum Information

Table 2-2 Summary of Drilling Activities, Northern Great Plains Province*

	NO. OF WELLS					Producing Horizons in MCFD																	
	Wildcats		Development		Total																		
	D&A	Disc	D&A	Prod.		Judith River	Clagett	Eagle				Undifferentiated	Carlisle		Greenhorn		Blackleaf	Mowry Shale	Bow Island - Muddy	Combedded	Total		
								Undifferentiated	Vigelle	Shannon	Telamach Creek		Nobara	Undifferentiated	Bowdoin	Undifferentiated						Phillips	Belle Fourche Shale
2nd Quarter 1977	24	7	10	34	75	0	0	5,345 ¹³	0	700	0	0	0	460	0	2,699	0	4,123	5	0	5,529	2,768	21,629 ¹⁴
3rd Quarter 1977	13	6	13	40	72	0	0	1,249 ⁹	0	0	0	0	0	4,924	0	354	0	622	630 ¹⁰	0	6,280 ¹¹	23,719 ¹²	37,778
4th Quarter 1977	13	6	17	50	86	340	0	7,068 ¹	0	1,348	0	0	0	1,126	0	1,911	0	227	1,417	0	5,373	12,359 ²	31,169
1st Quarter 1978	13	3	13	26	55	40	0	6,985	0	0	0	not available	0	0	0	50	0	0	259	0	2,489	17,943 ⁵	27,766
2nd Quarter 1978	9	1	4	10	24	0	0	5,174 ⁴	0	0	0	0	0	0	0	0	0	0	645	0	0	253 ²	6,072
3rd Quarter 1978	17	7	38	25	87	0	0	18,975 ⁶	0	0	0	0	0	1,406	0	410 ⁸	0	0	0	0	1,406	1,798 ⁷	23,995
4th Quarter 1978	31	5	36	55	127	189	0	7,406 ¹⁵	0	0	0	0	0	5,197	0	4,301 ¹⁷	0	610	157	0	7,560 ¹⁸	2,386 ¹⁶	28,183

1. IPF not available from 1 producing well.

2. Commingled production - Bowdoin/Greenhorn - 12,359 MCFD

3. Commingled production - Judith River/Eagle - 60 MCFD
Bowdoin/Phillips - 15,894 MCFD
Bowdoin/Greenhorn/Phillips - 844 MCFD
Greenhorn/Phillips - 1,145 MCFD

4. IPF not available from 1 producing well.

5. Commingled Production - Fish Scales/Bow Island - 253 MCFD

6. Eagle production: natural - 13,931 MCFD
treated - 5,044 MCFD

7. Commingled production - Bowdoin/Phillips - 284 MCFD
Bowdoin/Greenhorn - 368 MCFD
Blackleaf/Spike (natural) - 699 MCFD
Bowdoin/Greenhorn/Phillips - 447 MCFD

8. 158 MCFD of 410 MCFD was natural "White Specks" (Phillips production)

9. Natural Eagle production

10. Natural Blackleaf production

11. 4,245 MCFD - natural Bow Island, 735 MCFD treated Bow Island and 1,300 MCFD - Muddy production

12. Commingled production - Bowdoin/Greenhorn/Phillips - 14,878 MCFD
Bowdoin/Greenhorn - 1,180 MCFD
Bowdoin/Phillips - 3,446 MCFD
Prairie/Greenhorn/Phillips - 3,890 MCFD
Colorado/Blackleaf/Bow Island - 89 MCFD
Colorado/2nd Bow Island - 436 MCFD

13. 4,560 MCFD - natural Eagle

14. Commingled production - Bowdoin/Phillips - 205 MCFD
Blackleaf/Bow Island - 2,500 MCFD
Judith River/Eagle - 63 MCFD

15. 2,490 MCFD - natural Eagle

16. Commingled production - Bowdoin/Phillips - 1,710 MCFD
Bowdoin/Greenhorn/Phillips - 676 MCFD
Blackleaf/Bow Island - not available

17. IPF not available from one producing well

18. IPF not available from two producing wells

*Data Compiled from P.I. Rocky Mountain Region Report "Completions."

Table 2-3 Summary of Wells Completed—Northern Great Plains Province¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 10-9-78 Comp: 10-17-78	A.K. Guthrie	1 Federal M-37119	1	nwse 35/7S/53E Wildcat Field Powder River Cty, MT	Muddy	4,834		WF	D&A
Spud: 10-16-78 Comp: 12-3-78	Webb Resources	9-7 Federal (M-9522)	2	swne 9/8S/22E Wildcat Field Carbon Cty, MT	?	8,200		WF	D&A
FR: 8-30-78	Macquest Petroleum	1 Kirchner	3	sene 8/2N/20E Rapelge Field Stillwater Cty, MT	Eagle			D, abandoned location	
FR: 7-31-78 Spud: 9-26-78	Montana Power	3-22 Castle Unit	4	nenw 22/2N/21E N Lake Basin Field Stillwater Cty, MT	Eagle	1,425		D, WOCT	
Spud: 6-24-78 Comp: 10-7-78	Fuel Resources Development	10-24-18B Olson	5	swsw 10/24N/18E Leroy Field Blaine Cty, MT	Eagle (1,437-1,440)	1,743	Natural	DG, no cores or tests	442
FR: 9-12-78	Polumbus Petroleum	28-7 Rossmiller	6	swne 28/26N/3E Wildcat Field Chouteau Cty, MT	Bow Island (1,335)			WF, abandoned location	
Spud: 10-27-78 Comp: 10-31-78	Fuel Resources Development	1-21-26-21-N Federal	7	nese 21/26N/21E Wildcat Field Blaine Cty, MT	Eagle	1,750		WF, no cores or tests	D&A
Spud: 9-4-78 Comp: 9-18-78	Energetics Inc.	24-18-2 Federal	8	sesw 18/27N/20E Sawtooth Mtn. Blaine Cty, MT	Eagle (1,229-1,277) Open hole	1,277	Natural	DG, no cores or tests	99
Spud: 10-21-78 Comp: 10-22-78	Elenburg Exploration	28-28-13 CanKee	9	sene 28/28N/13 E Wildcat Field Chouteau Cty, MT	Eagle	553		WF, no cores or tests, projected to 1,200 ft	D&A
FR: 9-29-78 Spud: 10-6-78	Montana Power	16-8 Trunk	10	sese 8/28N/14E Unnamed Field Chouteau Cty, MT	Eagle	1,538		D, WOCT, projected to 3,500 ft	
Spud: 6-22-78 Comp: 9-21-78	Montana Power	7-17-J Pursley	10	swne 17/28N/14E Unnamed Field Chouteau Cty, MT	Eagle (1,850-1,893)	2,017		DG, no cores	77
Spud: 10-25-78 Comp: 11-28-78	Balcron Oil	2B-11X McCracken	11	nwse 11/29N/1W Ledger Field Pondera Cty, MT	Bow Island (1,435-1,446)	1,146	Open hole, natural	DG, no cores or tests	125
FR: 4-13-78 Spud: 4-10-78	J. Burns Brown	1-29-14 Rocky Boy	12	sese 1/29N/14E Unnamed Field Chouteau Cty, MT	Eagle	1,829		D, WOCT	
FR: 6-26-78 Spud: 7-3-78	Joseph J.C. Paine & Associates	1-0296 Federal	13	Lot 6 2/29N/36E Wildcat Field Valley Cty, MT	Phillips	1,780		WF, cored for WGSP core program	
Spud: 8-21-78 Comp: 9-25-78	Marquis Petroleum	21-1 JGL Ranch	14	nene 21/30N/2W Wildcat Field Pondera Cty, MT	Bow Island	1,510		WF, no cores or tests	D&A

¹From Petroleum Information

Table 2-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 10-2-78 Comp: 10-5-78	Tricentrol U S	10-1 Blackwood	15	nene 6/30N/17E Tiger Ridge Field Blaine Cty, MT	Eagle	1,700		D	D&A
Spud: 7-30-78 Comp: 8-22-78	Midlands Gas	1 Federal-0102	16	senw 1/30N/32E Bowdoin Field Phillips Cty, MT	Phillips (1,128-1,179)	1,329 PB: 1,259	12,264 gal emul., 40,000 lb sand	DG	100
Spud: 9-24-78 Comp: 9-25-78	Diamond Shamrock	22-34 Underdahl Fee	17	senw 34/31N/2W Unnamed Field Toole Cty, MT	4th Bow Island (855-896)	896	Natural	WOE, no cores or tests	288
FR: 4-14-78 Spud: 4-24-78	Elenburg Exploration	12-32 Solomon	18	nws 32/31N/17E Tiger Ridge Field Hill Cty, MT	Eagle	1,701		D, perf 1,208- 1,212, testing	
Spud: 7-11-78 Comp: 7-14-78	Montana Power	10-17 Hayes	19	nws 17/31N/19E Bowes Field Blaine Cty, MT	Eagle	1,500		D	D&A
FR: 6-28-78 Spud: 8-20-78	Trio Petro	1 Nylander	20	nwn 1/31N/27E Wildcat Field Phillips Cty, MT	Phillips	2,194		WF, WOO, tight hole	
Spud: 5-30-78 Comp: 6-11-78	Midlands Gas	1 Federal 3415	21	nws 34/31N/35E Bowdoin Field Valley Cty, MT	Bowdoin (856-915)	1,300 PB: 1,249	12,306 gal acid, 40,000 lb sand	DG	1,118
Spud: 6-1-78	J. Burns Brown	5-32-15 B State	22	sene 5/32N/15E Unnamed Field Hill Cty, MT	Eagle	1,194		D, WOCT	
FR: 5-5-78 Spud: 6-9-78	J. Burns Brown	832-15 Sathre	22	nene 8/32N/15E Unnamed Field Hill Cty, MT	Eagle	1,133		D, WOCT, tight hole	
FR: 4-13-78 Spud: 4-14-78	J. Burns Brown	15-32-18 WERK	23	sww 15/32N/18E Wildcat Field Blaine Cty, MT	Eagle	1,400		WF, WOCT	
Spud: 10-13-78 Comp: 11-16-78	Falcon-Colorado Exploration	1-9 Fisher	24	nwn 9/32N/35E Swanson Creek Field Valley Cty, MT	Phillips (1,258-1,268)	1,450 PB: 1,383	14,500 gal water, 40,000 lb sand	DG, no cores or tests	112
FR: 9-8-78 Spud: 10-24-78	Denmark Resources	1-17 Fisher	24	nwn 17/32N/35E Swanson Creek Field Phillips Cty, MT	Phillips	1,342		D, WOCT	
Spud: 7-20-78 Comp: 9-13-78	Falcon-Colorado Exploration	1-19 Federal	24	nene 19/32N/35E Swanson Creek Field Phillips Cty, MT	Bowdoin (740-760) Phillips (937-944)	1,350	14,300 gal water 40,000 lb sand 14,439 gal water, 40,000 lb sand	DG, no cores or tests, commingled	293
FR: 9-29-78 Spud: 10-2-78	Wexpro	1-13 Potlatch	25	nws 13/33N/1W North Dunkirk Field Toole Cty, MT	Bow Island	861		WO, ran prod. casing, testing	

Table 2-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
FR: 4-19-78 Spud: 4-28-78	Elenburg Exploration	2-18 Gagle	26	swnw 18/33N/15E Wildcat Field Hill Cty, MT	Eagle	1,452		WF, WOCT, no cores	
FR: 4-24-78 Spud: 4-24-78	J. Burns Brown	30-33-15 Lang	26	nws 30/33N/15E Bandlands Gas Field Hill Cty, MT	Eagle	1,300		D, WOCT, tight hole	
FR: 6-5-78 Spud: 6-21-78	Havre Drilling	1 State	27	swse 28/33N/18E Lohman Gas Field Blaine Cty, MT	Eagle	1,144		D, WOCT	
FR: 5-4-78 Spud: 5-18-78	J. Burns Brown	29-33-18 Nemetz	27	swse 29/33N/18E Lohman Gas Field Blaine Cty, MT	Eagle	1,194		D, WOCT	
FR: 6-23-78 Spud: 11-16-78	Montana Power	8-12 Keith- Standiford	28	sene 12/35N/6E Unnamed Field Liberty Cty, MT	Bow Island	2,286		D, WOCT	
FR: 8-9-78 Spud: 8-16-78	Xeno Inc.	13-14 SW Saddle	29	swaw 14/35N/13E Wildcat Field Hill Cty, MT	Greenhorn	2,500		WF, WOCT	
Spud: 9-26-78 Comp: 9-30-78	Montana Power	15-4 Lenhart	30	swse 4/35N/15E Wildcat Field Hill Cty, MT	Bow Island	2,789		WF	D&A
Spud: 4-21-78	Xeno Inc.	6-7 E. Chouteau	31	senw 7/35N/20E Unnamed Field Blaine Cty, MT	Eagle	1,645		D, prep to run casing	
FR: 5-15-78 Spud: 6-20-78	Anschutz Corp.	1 Dyrdahl	32	senw 31/35N/30E Wildcat Field Phillips Cty, MT	Phillips	1,880		WF, WOCT, no cores or tests	
FR: 11-8-77 Spud: 11-16-77	Oil Resources	Pet Resources 30-4 Hodges	33	nwnw 30/36N/8E Unnamed Field Hill Cty, MT	2nd White Specks (Phillips)	2,500 PB: 1,871		D, SI	
FR: 7-5-78 Spud: 7-5-78	Xeno Inc.	12-12 NW Saddle	34	nws 12/36N/13E Unnamed Field Hill Cty, MT	2nd White Specks (Phillips)	2,600		WO, WOCT, ran prod. casing	
FR: 6-21-78 Spud: 6-21-78	Xeno Inc.	5-32 NE Saddle	35	swnw 32/36N/14E Wildcat Field Hill Cty, MT	2nd White Specks (Phillips)	2,620		WF, WOCT, ran prod. casing	
FR: 4-28-78 Spud: 6-2-78	Xeno Inc.	11-23 Battle	36	sese 23/36N/19E Unnamed Field Blaine Cty, MT	Eagle	1,640		D, WOCT	
FR: 4-3-78 Spud: 6-5-78	Xeno Inc.	13-24 Battle	36	swsw 24/36N/19E Unnamed Field Blaine Cty, MT	Eagle	1,707		D, WOCT	
FR: 4-10-78 Spud: 5-28-78	Xeno Inc.	6-27 Battle	36	senw 27/36N/19E Unnamed Field Blaine Cty, MT	Eagle	1,740		D, WOCT	

Table 2-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
FR: 8-14-78 Spud: 10-27-78	Midlands Gas	1 Federal 0660	37	nenw 6/36N/30E Unnamed Field Phillips Cty, MT	Phillips	1,908 PB: 1,768		WO, WOCT	
FR: 9-5-78 Spud: 8-19-78	Joseph J.C. Paine & Associates	1-0762 Murdock	38	nesw 7/36N/32E Unnamed Field Phillips Cty, MT	Phillips	1,700	28,014 gal water 70,000 lb sand	D, SI	
Spud: 7-26-78 Comp: 8-30-78	Joseph J.C. Paine & Associates	1-0562 Anderson	38	nesw 5/36N/32E Unnamed Field Phillips Cty, MT	Bowdoin (1,352-1,393)	1,650 PB: 1,450	13,356 gal water 40,000 lb sand	DG, no cores or tests	3,586
Spud: 8-14-78	Odessa Natural Corp.	313632 Fee	38	senw 31/36N/32E Unnamed Field Phillips Cty, MT	Phillips	1,625	Fract	D, perf, testing	
FR: 9-28-78 Spud: 11-1-78	Midlands Gas	1 Federal 0170	39	senw 1/37N/30E Unnamed Field Phillips Cty, MT	Phillips	1,967		D, SI	
FR: 5-17-78 Spud: 5-12-78	Jerry McCutchin	1-18 Heikkila	40	w 1/2 18/16N/2E West Short Pine Field Harding Cty, SD	Shannon	1,480		D, WOCT

Figure 2-4 Northern Great Plains Province Showing Wells of Interest (refer to Tables 2-3 and 2-4)

Figure 2-5 Detail of USGS Designated Core Areas and Wells of Interest, Northern Great Plains Province (refer to Table 2-3 and 2-4)

Table 2-4 Summary of Active Wells and New Locations—Northern Great Plains Province¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	PROJECTED HORIZON (Depth in ft)	COMMENTS
FR: 10-20-78	W.N. McMurry	1 Lane	1	swne 29/2N/23E Wildcat Field Yellowstone Cty, MT	Morrison (3,900)	WF
FR: 11-13-78	Nevel E. Murphy	1 Schwend	2	nws 14/7S/23E Wildcat Field Carbon Cty, MT	Dakota (825)	WF
FR: 11-13-78	Charles G. Knight	1 IRA	3	sesw 26/7S/52E Wildcat Field Powder River Cty, MT	Muddy (5,000)	WF
FR: 11-9-78	Kenneth L. Smith	1 Miller	4	sese 10/8S/2E Wildcat Field Fall River Cty, SD	Morrison (450)	WF
FR: 11-22-78	Grace Petroleum	26-2 Federal	5	nwne 26/8S/51E Leory Field Fall River Cty, SD	Muddy (5,750)	D
FR: 10-5-78	Gary Operating	1 SOT	6	sese 1/8S/54E Bell Creek Field Powder River Cty, MT	Muddy (4,730)	D, at 4,631 ft, crg
FR: 10-2-78	Jerry McCutchin	1 State-Placid	7	nwnw 16/15N/3E Wildcat Field Harding Cty, SD	Shannon (1,300)	WFX, old info: Sam G. Harrison, 1-6 State Placid, Spud 6-23-78, no cores or tests, OTD 3,500 ft, D&A
FR: 10-10-78	J. E. Shackelford	1-16 State	8	nene 16/16N/55E Dawson Cty, MT	Shallow test (1,083)	WF
FR: 10-17-78	Devon Corp.	1 Gladys Mees	9	nwse 1/22N/19E Wildcat Field Fergus Cty, MT	Eagle (2,000)	WF
FR: 10-17-78	Devon Corp.	2 Gladys Mees	9	nwne 2/22N/19E Wildcat Field Fergus Cty, MT	Eagle (2,000)	WF
FR: 10-17-78	Devon Corp.	2 Anderson, et al	10	nene 21/23N/20E Wildcat Field Fergus Cty, MT	Eagle (2,000)	WF
FR: 10-19-78	Devon Corp.	2 Olson	11	sene 26/23N/19E Leroy Field Fergus Cty, MT	Eagle (2,000)	D
FR: 10-17-78	Devon Corp.	1 A Osburnson	10	swsw 31/23N/20E Wildcat Field Fergus Cty, MT	Eagle (2,000)	WF
FR: 10-10-78	Montana Power	3-16	12	nenw 16/28N/14E Unnamed Field Chouteau Cty, MT	Eagle (3,500)	D
FR: 10-5-78	Joseph J.C. Paine & Associates	1-2306 Kuki	13	sese 23/30N/36E Unnamed Field Valley Cty, MT	Greenhorn (1,750)	WO, located in core area C
FR: 10-16-78	Joseph J.C. Paine & Associates	1-1907 Federal	14	nwnw 19/30N/37E Unnamed Field Valley Cty, MT	Phillips (1,900)	WO, located in core area C
FR: 11-6-78	Elenburg	15-32 Olson	15	swse 32/31N/17E Tiger Ridge Field Hill Cty, MT	Eagle (2,000)	D
FR: 11-8-78	Joseph J.C. Paine & Associates	1-0707 Federal	14	sese 7/30N/37E Unnamed Field Valley Cty, MT	Greenhorn (1,620)	D, located in core area C
FR: 6-9-78	J. Burns Brown	3-32-15 State	16	swne 3/32N/1W Unnamed Field Toole Cty, MT	Eagle (1,600)	D

¹ From Petroleum Information

Table 2-4 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	PROJECTED HORIZON (Depth in ft)	COMMENTS
FR: 11-14-78 Spud: 12-5-78	Marquis Petroleum	23-11 Dumas	17	nesw 23/32N/3W Marias River Gas Field, Toole Cty, MT	Bow Island (1,500)	WO, at 300 ft, SDW
FR: 9-8-78 Spud: 10-1-78	Tricentrol United States	19-16 Fox	18	sese 19/32N/18E Tiger Ridge Field Blaine Cty, MT	Eagle (1,500)	D, at 157 ft, WOC
FR: 11-6-78	Southland Royalty	1-1-23 NE Whitaker	19	nene 1/32N/33E Bowdoin Field Phillips Cty, MT	Phillips (1,200)	D
FR: 11-6-78	Southland Royalty	1-6-24 NE Whitaker	20	nwnw 6/32N/34E Bowdoin Field Phillips Cty, MT	Phillips (1,300)	D
FR: 11-28-78	Western Natural Gas	1-24 Wilson	21	swse 24/33N/13E Fresno Field Hill Cty, MT	Eagle (1,300)	D
FR: 11-28-78	Wüber V. Watkins	Big Ten 2-26 Somers	21	sene 26/33N/13E Fresno Field Hill Cty, MT	Eagle (1,300)	D
FR: 9-18-78 Spud: 9-30-78	Benson Mineral Group	1-23 Hoehn	22	nenw 23/34N/17E Wildcat Field Blaine Cty, MT	Greenhorn (2,400)	WF, at 175 ft, WOC
FR: 11-6-78	Xeno Inc.	7-3 Chouteau	23	swne 3/35N/19E Unnamed Field Blaine Cty, MT	Eagle (1,750)	D
FR: 10-3-78	Xeno Inc.	13-2 E. Chouteau	24	swsw 2/35N/20E Wildcat Field Blaine Cty, MT	Eagle (1,900)	WF
FR: 11-21-78	Fulton Petroleum et al	44-5 US	25	sese 5/36N/2E West Butte Shallow Field Toole Cty, MT	Bow Island (1,800)	D
FR: 11-27-78	Fulton Producing	22-14 Christian	25	senw 14/36N/2E Miners Coulee Field Toole Cty, MT	Bow Island (2,000)	D
FR: 11-27-78	Universal Gas	11-36-23 Rasmussen	26	nwse 11/36N/23E Wildcat Field Blaine Cty, MT	Greenhorn (2,600)	WF
FR: 12-13-78	Universal Gas	26-36-26 Bill Mayer	27	nwse 26/36N/26E Wildcat Field Blaine Cty, MT	Greenhorn (2,600)	WF
FR: 11-20-78	Southland Royalty	1-8-60 NE Fee	28	swne 8/36N/30E Unnamed Field Phillips Cty, MT	Phillips (1,800)	D
FR: 9-14-78	Odessa Natuml	1 Maven Camp	29	swnesw 7/36N/33E Wildcat Field Phillips, MT	Phillips (1,600)	WF
FR: 8-9-78	Xeno Inc.	1-22 E. Signal	30	nene 23/37N/16E Wildcat Field Hill Cty, MT	Eagle (1,700)	WF
FR: 11-13-78 Spud: 12-4-78	Xeno Inc.	5-24 E Signal	30	swnw 24/37N/16E Wildcat Field Hill Cty, MT	Eagle (1,700)	WF, drilling, no depth reported, tight hole
FR: 11-27-78	Xeno Inc.	5-10 Border	31	swnw 10/37N/18E Wildcat Field Blaine Cty, MT	Eagle (1,900)	WF

3. Greater Green River Basin

3.1 CORE PROGRAM

To assess the resource potential within the Greater Green River Basin the USGS recommended core acquisition in the following areas:

Area A

The crest of the Wamsutter Arch in Sweetwater and Carbon Counties, the Northern edge of which borders on the Red Desert Basin and the southern edge occupies part of the Washakie Basin, T17N to T21N, and R91W to R97W. The section below the commercial Almond and Ericson (Mesaverde) is of primary interest in this area.

Area B

The area east of the Big Piney/LaBarge Field in Sweetwater and Sublette Counties running north and south through the Pinedale area and to the northern edge of the Green River Basin. These areas skirt the edge of the Wind River Range. Production here is primarily Frontier, with some Mesaverde and Ft. Union tests.

Area B has been divided into four subdivisions which are:

B₁ West of R104W to R109W and from T22N, north to T28N

B₂ R106 W to R111W and from T27N to T31N

B₃ R108W to R112W but not including development drilling, and T30N to T35N

B₄ North edge of Green River Basin; north into the Hoback Basin, T36N to 39N and R11W to 114W.

The core sites contain thick sections of tight, but generally untested gas sands with "tight gas sand" potential in Upper Cretaceous and Tertiary formations. Operators active in these areas are being contacted concerning possible participation in DOE's Core Program.

Many operators were active in core area A during the fourth quarter (Table 3-1 and Figure 3-1). However, most were drilling to the commercial Almond and Ericson Formations of the Mesaverde Group (9,200 - 11,000 ft), which are not of primary interest to the WGSP.

Figure 3-1 USGS Designated Core Areas and Wells of Interest, Greater Green River Basin (refer to Table 3-1)

Table 3-1 Summary of Wells Located in USGS Designated Core Areas—Greater Green River Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
FR: 10-4-77 Comp: 8-16-78	Sinclair Oil	1-18 Federal	1	swsw 18/17N/93W Wild Rose Field Carbon Cty, WY	Mesaverde (9,429-10,219)	10,384 PB: 10,310	72,000 gal gel 148,000 lb sand	DG	580
FR: 11-8-78	Cotton Petroleum	12-1 Marshall & Winston Federal	2	cse 12/17N/95W Wild Rose Field Sweetwater Cty, WY	Mesaverde (11,470)			D	
Spud: 10-15-77 Comp: 10-14-78	Amoco Production	1 Champlin 534 Amoco A	3	csw 31/18N/96W Wildcat Field Sweetwater Cty, WY	Mesaverde	11,802	Acidized 5,628 gal	WF D&A	
FR: 11-21-78	Davis Oil	1 Bayard-Federal	4	csw 18/20N/92W Wildcat Field Sweetwater Cty, WY	Mesaverde (10,700)			WF	
Spud: 10-9-78	Pacific Transmission Supply	3-36X State	5	sesw 36/20N/93W Echo Springs Field Sweetwater Cty, WY	Mesaverde (10,100)			D, drilling 5,806 ft	
Spud: 5-9-78	Marathon Oil	1-14 Latham	5	sese 14/20N/93W Wildcat Field Sweetwater Cty, WY	Almond	10,836 PB: 10,692	150,000 gal emulsion, 293,000 lb sand	WF, SI, flowed 42 MCFD, cored 7 intervals in Ft. Union - Upper Almond	
Spud: 4-23-78 Comp: 7-22-78	Champlin Petroleum	3 UPRR 3-3 (20-95)	6	cse 3/20N/95W Wamsutter Field Sweetwater Cty, WY	Lewis (8,338 - 8,353)	8,460	76,692 gal emulsion, 75,000 lb sand	DG	5,500
FR: 9-1-78	Patrick Petroleum	1 Red Desert Federal	6	cse 32/20N/95W Wildcat Field Sweetwater Cty, WY	Mesaverde (9,600)			WF, abandoned location	
Spud: 12-28-77 Comp: 9-6-78	Marathon Oil	1-16 State	7	cse 16/21N/94W Siberia Ridge Field Sweetwater Cty, WY	Mesaverde (10,332 - 10,700)	11,320	Sand frac	DG, cored 10,275 - 10,326, 10,340 - 10,361, 20 BC no tests	1,000
FR: 10-3-78	Texas Oil & Gas	1 Jamieson-A	8	n4se 1/23N/104W Nitchie Gulch Field Sweetwater Cty, WY	Dakota (9,225)			D, drilling, no depth reported	
Spud: 10-28-78	Davis Oil	1 Parrish Mark Unit	9	nwse 12/26N/109W Wildcat Field Sweetwater Cty, WY	Mesaverde (10,200)			WF drilling 13,728 ft	
FR: 10-27-78	Davis Oil	1 Bright Trail Unit	10	swne 21/27N/108W Wildcat Field Sweetwater Cty, WY	Mesaverde (12,000)			WF	
Spud: 7-27-75	Davis Oil	1 Yellow Point Ridge	11	nesw 7/27N/109W Wildcat Field Sublette Cty, WY	Mesaverde	15,772		WF	
Spud: 8-9-78 Comp: 11-23-78	Davis Oil	1 Sugar Loaf Unit	11	nenw 7/27N/109W Wildcat Field Sublette Cty, WY	Frontier	15,850	Sand emulsion frac	WF, D&A	
Spud: 6-1-77 Comp: 7-4-78	Davis Oil	1 Ferry Island Unit	12	csw 29/28N/109W Wildcat Field Sublette Cty, WY	Frontier	16,812 PB: 16,670	Acidized 6,000 gal 199,962 gal gel 125,000 lb sand	WF	

¹ From Petroleum Information

Operators planning to drill in various areas of the basin were contacted during the quarter concerning participation in the WGSP Core Program. Discussions with Davis Oil, Pacific Transmission Supply, Southland Royalties, True Oil and Michigan-Wisconsin Pipeline led to finalizing one coring contract and tentative agreement on a second contract.

J.E. Evered and E.R. Allen of CER Corporation were on location in early December for the coring of the Pacific Transmission Supply well, Federal 24-19, Section 19, T33N, R114W, Sublette County, Wyoming. However, due to several delays, the coring operation did not begin until the evening of December 17. E.R. Allen, H.E. Newman and L.T. Hodges of CER were on location at that time.

The coring operation ended on December 23 after coring a continuous interval from 5,100 to 5,319 ft (219 ft). One-hundred percent recovery was achieved through the interval. Although it was originally hoped that some core in the first run would be from the Tertiary section below the overthrust, all core was in fact from the Cretaceous Mesaverde. Samples were sent to LLL, LASL, and BETC per their requests prior to the beginning of the operation. All lab samples were sealed in a plastic coating ("seal peel") supplied by Core Labs. The remaining core was shipped to Core Labs, Casper, Wyoming for extensive analysis.

On December 12, C.H. Atkinson and R.L. Mann met with True Oil personnel in Casper, Wyoming. Tentative participation was arranged on a proposed well in the Washakie Basin, Smokey Oil, Bluewater Federal 3-18, Sweetwater County, Wyoming.

3.2 DRILLING ACTIVITY

Major objectives in the Greater Green River Basin are the Mesaverde Group in Carbon and Sweetwater Counties, and the Frontier Formation in Sublette, Uinta, and Lincoln Counties. The Lewis Formation is most often the target in the Sand Wash Basin, Moffat County, Colorado.

During October, November, and December of 1978, new gas production from Upper Cretaceous and Tertiary horizons totalled 57,831 MCFD, a 13 percent decrease from the previous quarter. The Frontier Formation accounted for 36 percent of the total new production, the Lewis Formation contributed 35 percent, the Mesaverde Group added 26 percent, and the commingled Lewis/Lance produced the remaining 3 percent.

Sixty-nine wells were completed this quarter. Thirty exploratory wells were completed with a 40 percent success (12 discoveries). Thirty-nine development wells were also completed with 26 being producers (67 percent success rate). Producing horizons were the Ft. Union, Lewis, Mesaverde Group (Almond and Ericson Formations), Frontier, and commingled Lance/Lewis (Table 3-2). Figure 3-2 is a stratigraphic correlation chart of the Greater Green River, Piceance, and Uinta Basins.

The most active areas were the Washakie and Red Desert Basins on the eastern side of Sweetwater County and the western side of Carbon County. Completions in the eastern half of the basin produced from the Cretaceous Mesaverde Group. Active operators were Amoco Production, Marathon Oil, Pacific Transmission Supply, Sinclair Oil, CIG Exploration, and Getty Oil (Table 3-3 and Figure 3-3).

Table 3-2 Summary of Drilling Activities, Greater Green River Basin*

	NO. OF WELLS					Producing Horizons in MCFD													
	Wildcats		Development		Total	Mesaverde													
	D&A	Disc	D&A	Prod.		Ft. Union	Lance	Lewis	Undifferentiated	Almond	Edison	Rock Springs	Blair	Hillard	Frontier	Aspen-Mowry	Bear River	Commingled	Total
2nd Quarter 1977	13	21	6	10	50	4,640	0	11,633	3,651	5,444	500	0	0	0	32,924	0	0	0	58,792
3rd Quarter 1977	18	13	6	19	56	4,813	0	19,695	16,929+ 25 BC	2,871	0	0	0	0	9,016	0	0	0	53,324+ 25 BC
4th Quarter 1977	20	13	10	31	74	450	1,026	9,218	19,156	17,001	3,982	0	1,298	0	21,189	0	760	362 ¹	74,442
1st Quarter 1978	7	5	6	12	30	0	0	1,852	5,385 ⁷	450	0	0	0	0	8,603	400	0	1,500 ²	18,190
2nd Quarter 1978	7	6	3	27	43	0	0	11,020	14,304	6,994	0	0	0	0	5,179	0	0	4,239 ³	45,595
3rd Quarter 1978	18	15	3	27	63	449	53	5,504+ 37 BC	16,999+ 69 BC	11,432	536	0	0	0	21,268+ 26 BC	0	0	10,048 ⁵	66,289+ 132 BC
4th Quarter 1978	18	12	13	26	69	1,925	0	20,388	5,070	8,690	1,199	0	0	0	20,969	0	0	789 ⁶	57,831

1. Commingled production - Lewis/Almond - 362 MCFD
2. Commingled production - Lewis/Almond - 1,500 MCFD
3. Commingled production - Frontier/Bear River - 4,239 MCFD
4. IPF not available for 1 producing well
5. Commingled production - Frontier/Bear River - 10,048 MCFD
6. Commingled production - Lance/Lewis - 789 MCFD

*Data compiled from P.I. Rocky Mountain Region Report "Completions."

Figure 3-2 Stratigraphic Correlation Chart of Greater Green River, Piceance and Uinta Basins

Modified from Symposium
on Deep Drilling Frontiers
in the Central Rocky Mountains,
R.M.A.G., 1975, Edited by
Dudley W. Bolyard

Table 3-3 Summary of Wells Completed—Greater Green River Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 11-5-78	Energy Reserves Group	1 Van Dorn	1	swsw 29/7N/90W Wildcat Field Moffat Cty, CO	Mesaverde	5,010		WF, WOCT	
Spud: 6-24-78 Comp: 9-15-78	Chandler & Associates	15-22 McWilliams	2	swse 22/8N/90W North Craig Field Moffat Cty, CO	Fort Union (1,120-1,122) Lewis (2,491-2,628)	3,030 PB: 2,640	60,000 gal emul., 70,000 lb sand	WOE, no cores, Fort Union-Lewis extension, dual completion	628 Ft. Union 1,323 Lewis
Spud: 7-7-78 Comp: 10-9-78	Chandler & Associates	2-31 McWilliams	2	nwnw 31/8N/90W North Craig Field Moffat Cty, CO	Lewis (3,376-3,395)	3,550 PB: 3,499	Acidized-1,000 gal, 42,850 gal emul., 35,350 lb sand	DG, no cores	61
Spud: 8-29-78	Northwest Exploration	1 Bruder	3	nene 4/9N/93W Unnamed Field Moffat Cty, CO	Lewis	7,800		WO, prep to frac	
Spud: 6-10-78 Comp: 8-29-78	Northwest Exploration	1 Randolph	3	sene 5/9N/93W Great Divide Field Moffat Cty, CO	Lewis (7,458-7,600)	8,053 PB: 7,987	75,000 gal water, 151,000 lb sand		1,050
FR: 8-4-78 Spud: 11-9-78	Northwest Exploration	1 Natural Resources	4	nesw 28/10N/93W Great Divide Field Moffat Cty, CO	Mesaverde	7,785		WO, WOCT	
FR: 8-21-78 Spud: 10-16-78	Sun Oil	1-34 Mar-Win Little	4	nene 34/10N/93W Great Divide Field Moffat Cty, CO	?	9,150		WO, swbg	
FR: 7-17-78 Spud: 9-16-78	Energy Reserves Group	3 Federal	5	nenw 18/11N/97W Powder Wash Field Moffat Cty, CO	?	7,645		D, WOCT	
Spud: 8-7-78 Comp: 9-25-78	Northwest Exploration	1 Sterrett	4	sene 32/10N/93W Great Divide Field Moffat Cty, CO	Lewis (7,446-7,546)	7,900 PB: 7,857	Acidized-1,200 gal, 58,212 gal water, 96,000 lb sand	DG, no cores or tests	2,806
FR: 4-21-78 Spud: 8-14-78	Gary Operating	2-4 Chambers Federal	6	nwnw 2/12N/93W Wildcat Field Carbon Cty, WY	Wasatch	1,788		WF, testing	
Spud: 6-10-78	Gary Operating	10-4 Jerry Chambers	6	nwnw 10/12N/93W Smith Ranch Field Carbon Cty, WY	Fort Union	2,277	Acidized-1,000 gal nitrogen frac	D, SI	
Spud: 5-31-78 Comp: 10-31-78	Anadarko Production	1 Fireplace Rock Unit	7	sese 16N12N/95W Unnamed Field Sweetwater Cty, WY	Fort Union (4,597-4,617)	9,773 PB: 4,645	Acidized-500 gal, 43,000 gal water, 75,000 lb sand	WFD, no cores Ft. Union discovery	1,297
Spud: 10-10-78	Wexpro	17-2 MFS-Federal	8	sese 17/12N/99W Hiawatha Field Sweetwater Cty, WY	Fort Union	5,445		D, WOCT	
FR: 8-28-78	Energy Reserves Group	1 Federal-2	9	swsw 2/12N/103W Middle Mtn Field Sweetwater Cty, WY	Wasatch			WS, abandoned location	
Spud: 7-21-78 Comp: 10-10-78	Oil Development of Texas	13-35 Unit	10	swse 35/13N/101W Canyon Creek Field Sweetwater Cty, WY	Lance (4,007-4,013) Lewis (4,181-4,186)	4,226 PB: 4,194	Acidized-500 gal, 56,000 gal gel, 55,000 lb sand	DG, commingled	789
FR: 9-14-78 Spud: 11-4-78	Trigg Drilling	1-18 State of Wyoming	11	swse 18/14N/91W Robbers Gulch Field Carbon Cty, WY	Mesaverde	9,825		D, WOCT	
FR: 5-3-78 Spud: 7-31-78	Sinclair Oil	2-1 Grynberg Federal	12	cne 2/14N/92W Blue Gap Field Carbon Cty, WY	Mesaverde	8,150	Acidized	D, tested, prep to reperfr	
FR: 8-9-78 Comp: 11-12-78	Getty Oil	11-23 Robbers Gulch	12	nesw 23/14N/92W Robbers Gulch Field Carbon Cty, WY	Mesaverde	9,780		D	D&A

¹ From Petroleum Information

Table 3-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 6-23-78 Comp: 7-16-78	Jerry Chambers	1-20 Scheggs Draw	13	sese 20/15N/101W	Mesaverde Wildcat Field Sweetwater Cty, WY	6,000		WF	D&A
Spud: 5-12-78	CIG Exploration	1-23-16-94 Federal	14	sVse 23/16N/94W	Mesaverde Wildcat Field Sweetwater Cty, WY	11,399 PB: 11,374	Acidized-5,000 gal 92,442 gal emul., 114,240 lb sand	WF, milling	
Spud: 6-1-78 Comp: 10-31-78	Smokey Oil	2-12 King Resources-Federal	15	csw 12/16N/98W	Mesaverde Unnamed Field Sweetwater Cty, WY (13,206-13,396) Ericson	13,828 PB: 13,580	110,000 gal gel 170,000 lb sand	WFD, no cores, Mesaverde discovery	796
Spud: 9-27-78 Comp: 10-5-78	Amoco Production	2 Unit	16	csw 23/16N/99W	Mesaverde Bitter Creek Field Sweetwater Cty, WY	2,492		D, projected 12,000	D&A
FR: 10-14-77 Comp: 8-16-78	Sinclair Oil	1-18 Federal	17	sww 18/17N/93W	Mesaverde Wildrose Field Carbon Cty, WY (9,429-10,219)	10,384 PB: 10,310	72,000 gal gel 148,000 lb sand	DG	580
Spud: 7-19-77 Comp: 7-28-78	Amoco Production	1 Champlin 440 Amoco-A	18	nwnw 11/17N/98W	Mesaverde Wildcat Field Sweetwater Cty, WY	9,250	Acidized-6,860 gal, 185,440 gal emul., 243,400 lb sand	WF, no tests	D&A
Spud: 8-17-77 Comp: 9-10-77	Kemmerer Coal Company	21-1 Creston	19	nese 21/18N/92W	Mesaverde Creston Field Carbon Cty, WY (8,664-10,182)	10,926 PB: 10,284	Acidized-17,650 gal, 174,464 gal emul., 137,000 lb sand	DG, no cores or tests, located in core area A	850
Spud: 12-14-76 Comp: 12-30-77	Marathon Oil	1-2 Marathon Federal	20	nVse 2/19N/93W	Almond Echo Springs Field Carbon Cty, WY	11,700 PB: 11,350	96,630 gal water, 54,500 lb sand	DG, no tests. Cored in the Almond, core area A	3,412
FR: 4-25-78 Spud: 9-2-78	Amoco Production	1 Champlin 285 Amoco B	21	sesw 3/19N/112W	Frontier Wildcat Field Lincoln Cty, WY	11,503 PB: 11,440		WF, cored 11,302-11,359, flowed 500 MCFD	
Spud: 5-9-78	Marathon Oil	1-14 Latham	22	sese 14/20N/93W	Almond Wildcat Field Sweetwater Cty, WY	10,836 PB: 10,692	150,000 gal emul., 293,000 lb sand	WF, SI, flowed 42 MCFD, cored 7 intervals in Ft. Union-Upper Almond	
Spud: 7-30-78 Comp: 10-15-78	Davis Oil	1 Janet-Federal	22	sesw 34/20N/93W	Almond Echo Springs Field Sweetwater Cty, WY (9,550-9,577)	10,303 PB: 10,244	Acidized-3,000 gal, 127,764 gal emul., 237,500 lb sand	DG, no cores, located in core area A	3,233 202 BC
Spud: 4-23-78 Comp: 7-22-78	Champlin Petroleum	3 UPRR 3-3 (20-95)	23	cse 3/20N/95W	Lewis Wamsutter Field Sweetwater Cty, WY (8,338-8,353)	8,460	76,692 gal emul., 75,000 lb sand	DG, located in core area A	5,500
FR: 8-1-78 Spud: 9-7-78	Marathon Oil	1-34 Fabian Ditch	24	csw 34/20N/112W	Frontier Fabian Ditch Field Lincoln Cty, WY	11,552		D, testing, cored 11,367-11,427	
Spud: 12-28-77 Comp: 9-16-78	Marathon Oil	1-16 State	25	cse 16N21N/94W	Mesaverde Siberia Ridge Field Sweetwater Cty, WY (10,332-10,700)	11,320	Sand frac	DG, cored 10,275-10,326, 10,340-10,361, no tests	1,000 20 BC
FR: 3-31-78 Spud: 10-15-78	Amoco Production	21 Unit	26	nesw 9/21N/112W	Frontier Whiskey Buttes Field Lincoln Cty, WY	11,278		D, WOCT	
Spud: 6-27-78 Comp: 10-30-78	Woods Petroleum	1 Steamboat Mtn. Unit	27	senw 3/23N/102W	2nd Frontier Unnamed Field Sweetwater Cty, WY (11,858-11,876)	13,044 PB: 12,100	60,000 gal emul., 33,500 lb sand	WFD, no cores 2nd Frontier discovery	1,546
Spud: 1-12-78 Comp: 6-18-78	Davis Oil	11 Unit	28	senw 28/24N/97W	Lewis Hay Reservoir Field Sweetwater Cty, WY (9,930-9,960)	10,141 PB: 10,081	180,000 gal emul., 143,000 lb sand	DG, cored 9,916-9,918, no tests	7,218 112 BC

Table 3-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 7-8-78 Comp: 10-10-78	Davis Oil	19 Unit	28	swne 33/24N/97W	Lewis Hay Reservoir Field (9,720-9,726 Sweetwater Cty, WY)	9,828 PB: 9,820	Acidized-3,000 gal	DG, no cores or tests	2,420
Spud: 9-15-78 Comp: 10-20-78	Davis Oil	1 Rigby Road Unit	29	nwnw 14/24N/98W	Almond Wildcat Field Sweetwater Cty, WY	10,462		WF	D&A
FR: 7-6-78 Spud: 8-1-78	Davis Oil	3 Hem Canyon Unit	30	swnw 9/24N/110W	Dakota Unnamed Field Sweetwater Cty, WY	11,760		WO, testing	
Spud: 5-23-78 Comp: 7-29-78	Davis Oil	1 Five Fingers Unit	31	swne 14/25N/98W	Mesaverde Wildcat Field Sweetwater Cty, WY	13,005		WF, cored 12,050-12,080, 12,080-12,110	D&A
FR: 8-3-78 Spud: 8-25-78	Woods Petroleum	1 Lost Valley Unit	31	senw 17/25N/98W	Baxter Wildcat Field Sweetwater Cty, WY	14,410		WF, SD, no cores	
Spud: 11-15-77 Comp: 8-23-78	John J. Christmann	1-15 Allen-Wells	32	swse 15/28N/114W	Frontier Tip Top Field Sublette Cty, WY (7,009-7,182)	7,600	67,900 gal water, 116,000 lb sand	DG	1,668
Spud: 6-8-78 Comp: 10-2-78	Mobil Oil	F21-29G TR 5 Unit	33	nenw 29/29N/113W	2nd Frontier Tip Top Field Sublette Cty, WY (6,88-7,130)	7,700		DG	7,000
Spud: 4-26-78 Comp: 7-26-78	Mobil Oil	T75-32G Unit TR7	33	nese 32/29N/113W	Frontier Tip Top Field Sublette Cty, WY (6,256-6,743)	7,487 PB: 6,466	Acidized-4,000 gal, Frac (6,256-6,743) 70,000 gal emul., 228,000 lb sand	DG, no cores or tests	6,300

Figure 3-3 Wells Completed and Staked, USGS Designated Core Areas, Greater Green River Basin (refer to Tables 3-3 and 3-4)

Another principal area of activity was the Moxa Arch. Completions in this western portion of the basin produced gas from the Cretaceous Frontier sandstone. Active operators were Mountain Fuel Supply, Davis Oil, Belco Petroleum, Pacific Transmission Supply, Amoco Oil Company, and Marathon Oil (Table 3-3, Figure 3-3).

The principal objectives of the new wells were the Mesaverde Group and Frontier Formation (Table 3-4 and Figure 3-3).

Anadarko Production, Northwest Exploration, Energy Reserves Group, and Chandler and Associates are the most active operators in the southernmost portion of the Greater Green River Basin. Energy Reserves Group and Anadarko Production are concentrating their testing within the Mesaverde Group, while Chandler and Associates and Northwest Exploration are continuing to test the Lewis Formation.

Table 3-4 Summary of Active Wells and New Locations—Greater Green River Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	PROJECTED HORIZON (Depth in ft.)	COMMENTS
FR: 6-23-78	Sun Gas	29-1 Federal Fox	1	nwnw 29/8N/90W North Craig Field Moffat Cty, CO	Lance (3,800)	D
FR: 7-5-78	CIG Exploration	1-2-8-91 Visintainer Sheep	2	nesw 2/8N/91W Blue Gravel Field Moffat Cty, CO	? (5,200)	WO, at 4,775 ft, running logs
FR: 9-20-78	Northwest Exploration	1 Wilson	3	nene 3/9N/93W Great Divide Field Moffat Cty, CO	Lewis (8,150)	D
FR: 9-12-78	Sun Gas	1-16 State	3	cne 16/9N/93W Great Divide Field Moffat Cty, CO	Lewis (8,000)	WO
FR: 11-17-78	Champlin Petroleum	1 Champlin- Sunmark Expl.	4	senw 24/9N/94W Wildcat Field Moffat Cty, CO	9,000	WF
FR: 10-18-78	Wexpro Co.	1 Unit	5	nenw 22/12N/100W Hiawatha Field Moffat Cty, CO	Chinle (15,100)	WD
FR: 10-27-78	Getty Oil	2-23 Mcpherson Springs	6	nwne 23/13N/94W Wildcat Field Sweetwater Cty, WY	Mesaverde (11,500)	WF
FR: 12-27-78	Davis Oil	1 Triton Unit	7	nesw 33/14N/95W Wildcat Field Sweetwater Cty, WY	Mesaverde (14,500)	WF
FR: 8-8-78	Sinclair Oil	34-1 Hamilton Federal	8	nese 34/15N/92W Blue Gap Field Carbon Cty, WY	Mesaverde (8,900)	D
FR: 6-12-78 Spud: 8-14-78	Koch Exploration	1 Adobe Town Unit	9	swse 20/15N/97W Wildcat Field Sweetwater Cty, WY	Mesaverde (17,500)	WF, drilling 15,633 ft; close to core area A
FR: 9-21-78	Smokey Oil	3-18 Bluewater Federal	10	cne 18/15N/99W Wildcat Field Sweetwater Cty, WY	Mesaverde (13,500)	WF
FR: 9-21-78	Diamond Shamrock	1 Hank Unit	11	swne 20/15N/118W Wildcat Field Uinta Cty, WY	Dakota (13,400)	WF
FR: 11-1-78	Northwest Exploration	1 Moffat County	12	swsw 29/10N/93W Great Divide Field Moffat Cty, CO	Lewis (8,000)	D, Operator has 2 additional Lewis tests in this area
FR: 12-4-78	Davis Oil	1 Coronet Federal	13	cse 8/18N/92W Creston Field Carbon Cty, WY	Mesaverde (9,800)	WO, located in core area A
FR: 11-14-78	Amoco Production	1 Champlin 226 Amoco G	14	csw 33/18N/93W Unnamed Field Carbon Cty, WY	Mesaverde (9,265)	WO, located in core area A
FR: 8-1-78	St. Michael Exploration	1-36 State	15	sene 36/18N/100W Wildcat Field Sweetwater Cty, WY	Almond (4,200)	WF
FR: 10-19-78	Amoco Production	1 Champlin 358 Amoco C	16	nenw 19/18N/111W Wildcat Field Sweetwater Cty, WY	Frontier (12,000)	WF
FR: 9-14-78	Amoco Production	1 Champlin 149 Amoco H	17	nwnw 3/18N/112W Bruff Field Uinta Cty, WY	Frontier (11,600)	D
FR: 10-12-78	Amoco Production	1 Champlin 149 Amoco J	18	swnw 11/19N/112W Bruff Unit Sweetwater Cty, WY	Frontier (11,628)	D, Operator has 4 additional Frontier tests in this locale
FR: 10-20-78	Amoco Production	1 Champlin 206 Amoco F	19	swnw 31/19N/111W Bruff Field Sweetwater Cty, WY	Frontier (12,000)	WO

¹ From Petroleum Information

Table 3-4 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	PROJECTED HORIZON (Depth in ft)	COMMENTS
FR: 11-21-78	Davis Oil	1 Bayard-Federal	20	csw 18/20N/92W Wildcat Field Sweetwater Cty, WY	Mesaverde (10,700)	WF, located in core area A
FR: 10-6-78 Spud: 10-9-78	Pacific Transmission Supply	3-36X Statc	21	sesw 36/20N/93W Echo Springs Field Sweetwater Cty, WY	Mesaverde (10,100)	D, drilling at 5,806 ft, located in core area A
FR: 8-29-78	Mobil Oil	T66-16-S A Gilbert	22	nese 16/20N/98W Desert Springs Field Sweetwater Cty, WY	Mesaverde (6,100)	D, RURT
FR: 11-10-78	Amoco Production	7 Seven Mile Gulch	23	nesw 31/20N/112W Wildcat Field Sweetwater Cty, WY	Frontier (12,000)	WF, Operator has 6 additional Frontier tests in this locale
FR: 7-11-78	Cotten Petroleum	18-1 Hammond Federal	24	e $\frac{1}{2}$ sw 18/21N/94W Siberia Ridge Field Sweetwater Cty, WY	Mesaverde (10,600)	D, located in core area A
FR: 9-14-78	Amoco Production	1 Champlin 536 Amoco C	25	csw 31/22N/91W Unnamed Field Sweetwater Cty, WY	Mesaverde (13,100)	WO
FR: 11-21-78	Pacific Transmission Supply	1-8 Federal	26	swnw 8/22N/92W Wildcat Field Sweetwater Cty, WY	Mesaverde (13,400)	WF, Operator has 1 other Mesaverde test, and 2 other Ft. Union tests in the locale
FR: 12-18-78	Pacific Transmission Supply	3-2 Federal	27	csw 2/22N/94W Wildcat Field Sweetwater Cty, WY	Ft. Union (3,400)	WF
FR: 9-26-78	Pacific Transmission Supply	3-26 Federal	27	e $\frac{1}{2}$ sw 26/22N/94W Siberia Ridge Field Sweetwater Cty, WY	Mesaverde (11,400)	D, MIRT
FR: 10-31-78	Kenneth Luff	4-34 C Federal	28	swnw 34/22N/102W Wildcat Field Sweetwater Cty, WY	Dakota (9,000)	WF, drilling, no depth reported (tight hole)
FR: 10-9-78	Davis Oil	23 Hay Reservoir Unit	29	senw 8/24N/96W Hay Reservoir Field Sweetwater Cty, WY	Lewis (11,000)	D, Operator has 4 other Lewis tests in this locale
FR: 9-15-78	Texas Oil & Gas	1 Federal 477	30	csw 21/25N/96W Unnamed Field Sweetwater Cty, WY	Rock Springs (14,300)	WO, at 12,625 ft, rng DST (tight hole)
FR: 11-30-78	Davis Oil	2 Bastard Butte Unit	31	n $\frac{1}{2}$ se 36/25N/97W Unnamed Field Sweetwater Cty, WY	Mesaverde (11,847)	WFX, RURT, old info: OTD 11,847 ft, Comp 10-10-78, 101 MCFD. Prod zone- Lewis (10,925 - 10,934 ft)
FR: 8-11-78	Pacific Transmission Supply	23-1 Federal	32	nesw 1/25N/112W Fontenelle Field Lincoln Cty, WY	Frontier (8,770)	D
FR: 9-27-78	John J. Christmann	3-28 Red Gap	33	nenw 28/26N/113W South Hog's Back Field Lincoln Cty, WY	Frontier (8,600)	D
FR: 12-12-78	Davis Oil	1 Bright Trail Unit	34	swne 21/27N/108W Wildcat Field Sublette Cty, WY	Mesaverde (12,000)	WF
FR: 10-27-78	Energetics Inc.	10-5 Federal	35	cnw 5/27N/111W Wildcat Field Sublette Cty, WY	Bear River (10,800)	WF, Operator has 5 additional tests in this locale: 2 Bear River, 2 Mowry and 1 Morrison horizon
FR: 9-27-78	J. B. Roden	5-4 Tartar's Island Unit	36	nenw 4/27N/112W Tartar's Island Field Sublette Cty, WY	Mesaverde (3,500)	D
FR: 9-11-78	Western Oil Refining	14-9 Federal	37	swsw 9/27N/113W North LaBarge Field Sublette Cty, WY	Mesaverde (2,300)	D

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4. Uinta Basin

4.1 CORE PROGRAM

The Uinta Basin is located in northeastern Utah (Figure 4-1) and has potential production from "tight gas sands" in a thick section of Upper Cretaceous through Tertiary sediments. Cretaceous tight horizons include the Castlegate and Sego sandstones and the Blackhawk, Price River, Neslen and Farrer Formations. In the Tertiary, tight gas sands are found in the Tuscher, North Horn, Wasatch and Green River Formations.

Areas recommended by the USGS for the acquisition of core for the WGSP Core Program are listed below (see Figure 4-1).

Area A

Wasatch and Duchesne Counties—T4S to T7S, R5W to R11W; in Wasatch County, T9S to T11S, R7, 8, and 9E; in Carbon County, T11S to T12S, R7E to R13E.

Area B

Duchesne and Uintah Counties—T3S to T4S, R2E to R2W and parts of T8S, R16E to R18E.

Area C

Uintah County—T8S and T9S and R23, 24, and 25E.

Area D

Uintah and Grand Counties— T10S, R18E, T11S to T16S, R18E to R25E; and in T17S, T18S, and T19S, R21E and R22E.

These areas were selected due to their lack of core and well data, and location outside the main productive fields of the Uinta Basin. Activity is concentrated in and around the Natural Buttes and Red Wash Fields, where production is primarily from the Green River and Wasatch Formations, and Mesaverde Group.

Within the core areas, newly staked locations are monitored so that operators can be contacted concerning participation in the WGSP Core Program (Table 4-1).

The operators listed below were contacted between October 1 and December 31, 1978:

Figure 4-1 USGS Designated Core Areas and Wells of Interest, Uinta Basin (refer to Table 4-1)

Coseka Resources, Denver, Colorado
Enserch Exploration, Denver, Colorado
Odessa Natural Corporation, Odessa, Texas
Pacific Transmission Supply, Casper, Wyoming

4.2 DRILLING ACTIVITY

Twenty-eight wells were completed during the fourth quarter of 1978 in Upper Cretaceous and Tertiary horizons of concern to the WGSP. Five of the 28 wells were wildcats, with only one being a discovery. Twenty-two of 23 development were productive. Production well completions increased 275 percent over the previous quarter.

Although the number of productive wells completed during the fourth quarter was up by 14, new gas production was 60 percent less, totalling 7,455 MCFD. Wasatch production decreased from 4,124 MCFD in the third quarter to 2,084 MCFD in the fourth quarter. The Green River Formation produced 108 MCFD less and the Mesaverde Group (undifferentiated) increased production from 2,918 MCFD in the third quarter to 3,679 MCFD over the fourth quarter. The increase in Mesaverde production continues the trend noted during 1978. A summary of drilling activities in the Uinta Basin is shown in Table 4-2.

A majority of the quarter's exploratory and development activities was located near Red Wash Field and the Natural Buttes area of Uintah County. CIG Exploration and Belco Petroleum continued to stake and drill Wasatch tests in the Natural Buttes Field, while Chevron and Gulf Oil carried out Green River tests in the Red Wash Field.

Summaries of completed wells and new wells appear in Tables 4-3, and 4-4 respectively. Figure 4-2 shows the location of completed and new wells.

Table 4-1 Summary of Wells Located in USGS Designated Core Areas—Uinta Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IFF in MCFD
FR: 10-17-78 Spud: 9-4-78	Oil Development of Utah	10-1 Ute-Tribal	1	senw 10/4S/5W Starvation Field Duchesne Cty, UT	Wasatch (8,163)			D. at 7,136, ring lnr, tight hole. Old info: Brinkerhoff, Drig 10-1 Ute- Tribal, Spud: 11-30-71. Comp: 2-20-72 D&A	
FR: 10-9-78 Supd: 10-20-78	W.A. Moncrief	8-1 Pender	2	nene 8/4S/6W Wildcat Field Duchesne Cty, UT	(Wasatch)	6,536		WF, WOO	
FR: 8-21-78 Spud: 9-4-78	Koch Exploration	10-1 Reiman	2	nesw 10/4S/6W Wildcat Field Duchesne Cty, UT	Unavailable			WF, drilling 6,133 ft	
FR: 12-6-78 Spud: 12-5-78	W.A. Moncrief	11-1 Koch Tribal	2	nws 11/4S/6W Unnamed Field Duchesne Cty, UT	Wasatch			WO, drilling 6,620 ft	
FR: 12-7-78	W.A. Moncrief	12-1 Ute-Tribal	2	nwn 12/4S/6W (USM) Unnamed Field Duchesne Cty, UT	Unavailable			WO	
FR: 12-19-78	Gulf Oil	1-14 B4 Ute- Tribal	2	swne 14/4S/6W Unnamed Field Duchesne Cty, UT	Wasatch (6,500)			WO	
FR: 12-19-78	Gulf Oil	1-16 B2 Ute- Tribal	2	nene 16/4S/6W Unnamed Field Duchesne Cty, UT	Wasatch (6,500)			WO	
FR: 8-11-78	Gulf Oil	1-19 Ute-Tribal	2	nws 19/4S/6W (USM) Wildcat Field Duchesne Cty, UT	Wasatch (8,000)			WF	
FR: 5-15-78 Spud: 6-15-78	Gulf Oil	1-22 B1 Ute Tribal	2	nwn 22/4S/6W Wildcat Field Duchesne Cty, UT		7,470	Acidized 3,000 gal	WF, Swbg, tight hole	
FR: 8-21-78	Gulf Oil	1-28 Ute Tribal	2	sene 28/4S/6W Wildcat Field Duchesne Cty, UT	Wasatch (8,000)			WF, abandoned location	
FR: 9-8-78	Odessa Natural	18-1 Sowers Canyon Unit	3	senw 16/6S/5W (USM) Wildcat Field Duchesne Cty, UT	Mesaverde (15,400)			WF	
Spud: 10-10-77 Comp: 5-8-78	Phoenix Resources	22-1 Wolf Hollow	3	swsw 22/6S/5W Unnamed Field Duchesne Cty, UT	Green River (3,959 - 3,966)	5,183	Acidized 1,000 gal, 29,621 gal foam, 33,700 gal water, 99,000 lb sand	WFD	not available
FR: 11-21-78	Pacific Transmission Supply	21-19 Devil's Playground Federal	4	nenw 19/8S/24E Natural Buttes Field, Uintah Cty, UT	Mesaverde (7,125)			D	
FR: 4-26-78	Mapco Inc.	5-11 D RBU	5	swnw 11/10S/18E Uteland Butte Field, Uintah Cty, UT	Mesaverde (8,455)			D	
FR: 11-1-78	Ensearch Exploration	1-6 PTS Federal	6	senw 6/10S/24E Natural Buttes Field, Uintah Cty, UT	Mesaverde (9,000)			D	
FR: 11-1-78	Ensearch Exploration	1-3 Bitter Creek Federal	7	swne 3/11S/22E Natural Buttes Field, Uintah Cty, UT	Mesaverde (7,500)			D	
FR: 10-23-78 Spud: 10-25-78	Pacific Transmission Supply	44-3 Federal	8	sese 3/14S/20E Wildcat Field Uintah Cty, UT	Mancos (7,000)			WF, drilling 6,759 ft	
FR: 10-8-78	Palmer Oil & Gas	13-9 Federal	9	nese 16/16S/25E San Arroyo Field Grand Cty, UT	Morrison (5,600)			D	

¹ From Petroleum Information

Table 4-2 Summary of Drilling Activities, Uinta Basin*

	NO. OF WELLS					Producing Horizons in MCFD										
	Wildcats		Development		Total	Uinta	Green River	Wasatch	Undifferentiated	Mesaverde				Mancos B	Commingled	Total
	D&A	Disc	D&A	Prod.						Price River	Black Hawk	Star Point	Mancos			
2nd Quarter 1977	7	2	0	6	15	0	93	3,553	1,743	0	0	0	0	0	0	6,226
3rd Quarter 1977	5	2	1	8	16	0	not available	12,611	0	0	0	0	0	0	0	12,611
4th Quarter 1977	4	0	2	14	20	0	0	21,901	1,850	0	0	0	0	0	1,400 ¹	25,151
1st Quarter 1978	5	1	0	6	12	0	0	8,182	0	0	0	0	0	0	0	8,182
2nd Quarter 1978	1	1	1	15	18	0	0	19,411	329	0	0	0	314	0	750 ²	20,804
3rd Quarter 1978	3	1	0	8	12	0	1,800	4,214 ⁴	2,918	0	0	0	0	288	15,742 ³	24,962
4th Quarter 1978	1	4	1	22	28	0	1,692	2,084 ⁵	3,679	0	0	0	0	0	0	7,455

1. Commingled production - Wasatch/Mesaverde - 1,400 MCFD

2. Commingled production - Wasatch/Mesaverde - 750 MCFD

3. Commingled production - Wasatch/Mesaverde - 15,742 MCFD

4. IPF not available for one producing well

5. IPF not available for eight producing wells

*Data compiled from P.I. Rocky Mountain Region Report "Completions,"

Table 4-3 Summary of Wells Completed—Uinta Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R or Producing Interval	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IFF in MCFD
FR: 5-15-78 Spud: 6-15-78	Gulf Oil	1-22 B1 Ute Tribal	1	nwne 22/4S/8W (USM) Wildcat Field Duchesne Cty, UT	Wasatch	7,470	Acidized-3,000 gal	WF, Swbg, tight hole. Operator has 2 additional Wasatch tests in this locale	
Spud: 10-10-77 Comp: 5-8-78	Phoenix Resources	22-1 Wolf Hollow	2	sww 22/6S/5W Unnamed Field Duchesne Cty, UT	Green River (3,959-3,966)	5,183	Acidized-1,000 gal 29,621 gal foam 33,700 gal water	WFD	not avail- able
FR: 4-6-78 Spud: 6-29-78 Comp: 10-4-78	Chevron	USA 247 (22-17C) Red Wash Unit	3	senw 17/7S/24E Red Wash Field Uintah Cty, UT	Green River (4,434-5,223)	5,700 PB: 5,640	Acidized-5,000 gal 23,000 gal water 24,000 lb sand	DG, no cores or tests	224 20 BC
FR: 7-25-78 Spud: 7-18-78	Pacific Transmission Supply	44-36 State	4	sese 36/8S/15E (SLM) Wildcat Field Duchesne Cty, UT	Wasatch	7,120	Acidized-10,000 gal	WF, testing	
FR: 3-7-78 Spud: 4-13-78	Gulf Oil	2 Uinta Test	5	nws 16/8S/21E (SLM) Red Wash Field Uintah Cty, UT	Uinta	1,700		WS, SI	
FR: 4-18-78 Spud: 6-13-78	Continental Oil	34-2 Conoco Mtn. Lion	5	nese 34/8S/21E (SLM) Wildcat Field Uintah Cty, UT	Mancos	10,250 PB: 10,210	Sand-water frac	WF, testing	
FR: 5-9-78 Spud: 7-26-78	Gas Producing Enterprises	11-14-9-20 NBU CIGE	6	swse 14/9S/20E (SLM) Natural Buttes Field	Wasatch	6,500	Acidized-2,000 gal 50,000 gal emul. 100,000 lb sand	D, testing	
FR: 7-21-78 Spud: 8-24-78 Comp: 11-6-78	CIG Exploration	19-16-9-21 Natural Buttes Unit	7	sww 16/9S/21E Natural Buttes Field Uintah Cty, UT	(5,635-6,303)	7,011	Acidized-5,000 gal, 91,000 gal acid, 187,000 lb sand	DG	not avail- able
Spud: 3-29-78 Comp: 10-16-78	CIG Exploration	6-19-9-21 Natural Buttes Unit	7	swse 19/9S/21E Bitter Creek Field Uintah Cty, UT	Wasatch (5,163-6,281)	6,794	Acidized-3,000 gal, 24,000 gal gel, 142,000 lb sand	DG, no cores or tests	300
Spud: 1-19-78 Comp: 9-30-78	Pacific Transmission Supply	41-9 Devil's Playground	8	nene 9/9S/24E Natural Buttes Field Uintah Cty, UT	Mesaverde (5,530-5,610)	6,470	Acidized-12,500 gal, 132,000 gal gel, 477,000 lb sand, 120,000 gal water	WOE, no cores	1,291
FR: 9-8-78 Spud: 12-3-78	Wexpro	9 Island Unit	9	nws 11/10S/19E Island Field Uintah Cty, UT	Wasatch	8,730		D, WOCT	
Spud: 6-4-78 Comp: 9-12-78	Mapco, Inc.	11-13 E. Riverbend Unit	9	nesw 13/10S/19E Island Field Uintah Cty, UT	Wasatch (5,911-6,043)	8,429 PB: 8,393	Acidized-10,000 gal, 48,250 gal water, 42,750 lb sand	DG, no cores or tests	882
FR: 9-28-78 Spud:	CIG Exploration	41-12-10-21 NBU	10	nese 12/10S/21E Bitter Creek Field Uintah Cty, UT	9,715 test	6,525	Acidized-7,500 gal, 125,000 gal emul., 250,000 lb sand	D, WOCT	
Spud: 9-10-78 FR: 8-14-78	CIG Exploration	39-28-10-21 CIGE	10	nws 28/10S/21E (SLM) Natural Buttes Field Uintah Cty, UT	Wasatch	5,800	72,000 gal gel, 132,000 lb sand	D, F/200 MCFD, testing	

¹ From Petroleum Information

Table 4-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
FR: 5-9-78 Spud: 7-8-78	Enserch Exploration	11-1 Jack Rabbit Federal	11	swne 11/10S/23E Southman Canyon Field Uintah Cty, UT	Mesaverde	8,050	Acidized-6,000 gal, 160,000 gal gel, 182,000 lb sand	D, SI	
FR: 7-25-78 Spud: 8-8-78	Enserch Exploration	1-15 Cliff Edge- Federal	11	nwse 15/10S/23E Natural Buttes Field Uintah Cty, UT	Mesaverde	7,931		D, WOCT	
FR: 11-27-78 Spud: 8-8-78	Enserch Exploration	2-15 Cliff Edge- Federal	11	nenw 15/10S/23E Natural Buttes Field Uintah Cty, UT	Mesaverde	7,931	D, WOCT, pro- jected to 9,000 ft		
Spud: 6-6-78 Comp: 9-19-78	Enserch Exploration	1-9 No Name Canyon	11	sene 9/10S/23E Natural Buttes Field	Mesaverde (6,434-7,341)	7,501 PB: 7,438	Acidized-64,500 gal, 254,000 gal gel, 408,000 lb sand	DG, no cores or tests	
FR: 6-12-78 No spud date	Taiga Energy	2 Dry Burn Unit	12	nwne 35/13S/25E Wildcat Field (SLM) Uintah Cty, UT	Mancos	6,130		WF, WOCT

Figure 4-2 Wells Completed and Staked, USGS Designated Core Areas, Uinta Basin (refer to Tables 4-3 and 4-4)

Table 4-4 Summary of Active Wells and New Locations—Uinta Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	PROJECTED HORIZON (Depth in ft)	COMMENTS
FR: 10-17-78 Spud: 9-4-78	Oil Development of Utah	10-1 Ute-Tribal	1	senw 10/4S/5W Starvation Field Duchesne Cty, UT	Wasatch (8,163)	D, located in core area A, at 7,136 ft, rng Inr, tight hole. Old info: formerly Brinkerhoff Drilling 10-1 Ute-Tribal, Spud 11-30-71, Comp 2-20-72, D&A
FR: 8-21-78 Spud: 9-4-78	Koch Exploration	10-1 Reiman	2	nesw 10/4S/6W Wildcat Field Duchesne Cty, UT	?	WF, drilling 6,133 ft, located in core area A
FR: 8-11-78	Gulf Oil	1-19 Ute Tribal	2	nwsW 19/4S/6W (USM) Wildcat Field Duchesne Cty, UT	Wasatch (8,000)	WF, located in core area A
FR: 9-8-78	Odesa Natural	18-1 Sowers Canyon Unit	3	senw 16/6S/5W(USM) Wildcat Field Duchesne Cty, UT	Mesaverde (15,400)	SF, located in core area A
FR: 7-17-78	Energy Reserves Group	1 State of Utah	4	nwsW 29/7S/21E (SLM) Brennan Bottom Field Uintah Cty, UT	Wasatch (7,000)	D
FR: 6-13-78	Continental Oil	35-8 Conoco- Ute Tribal	5	nese 35/8S/20E (SLM) Natural Buttes Field Uintah Cty, UT	Mesaverde (11,743)	D
FR: 7-24-78	Amoco Production	1 Cottonwood Canyon USA	6	swnw 7/9S/6E (SLM) Wildcat Field Uintah Cty, UT	13,000 ft test	WF, located in core area C
FR: 4-26-78	Mapco Inc.	7-25 B RBU	7	swne 25/9S/19E (SLM) Natural Buttes Field Uintah Cty, UT	Mesaverde (8,730)	D
FR: 7-31-78	Belco Petroleum	49-12B Natural Buttes	8	swne 12/9S/20E (SLM) Natural Buttes Field Uintah Cty, UT	Wasatch (8,700)	D, Operator has 6 other Wasatch tests in this locale
FR: 9-27-78	CIG Exploration	22-15-9-20 CIGE	8	senw 15/9S/20E (SLM) Natural Buttes Field Uintah Cty, UT	Wasatch (7,200)	D
FR: 11-21-78	Pacific Transmission Supply	21-19 Devil's Playground Federal	9	nenw 19/9S/24E Natural Buttes Field Uintah Cty, UT	Mesaverde (7,125)	D, located in core area C
FR: 4-26-78	Mapco, Inc.	5-1 D RBU	10	swnw 11/10S/18E Uteland Butte Field Uintah Cty, UT	Mesaverde (8,455)	D, located in core area D
FR: 8-14-78	Enserch Exploration	1-14 White River- Federal	11	nenw 14/10S/23E Natural Buttes Field Uintah Cty, UT	Wasatch (7,000)	D
FR: 3-27-78	Enserch Exploration	1-6 Sage HEN Federal	11	nese 6/10S/23E Natural Buttes Field Uintah Cty, UT	Mesaverde (7,000)	D, Operator has 4 other Mesaverde tests in this locale
FR: 11-1-78	Enserch Exploration	1-6 PTS Federal	12	senw 6/10S/24E Natural Buttes Field Uintah Cty, UT	Mesaverde (9,000)	D
FR: 11-1-78	Enserch Exploration	1-3 Bitter Creek Federal	13	swne 3/11S/22E Natural Buttes Field Uintah Cty, UT	Mesaverde (7,500)	D, located in core area D
FR: 10-9-78	Palmer Oil & Gas	13-9 Federal	14	nese 13/16S/25E San Arroyo Field Grand Cty, UT	Morrison (5,600)	D, located in core area D
FR: 10-23-78 Spud: 10-25-78	Pacific Transmission Supply	44-3 Federal	15	sese 3/14S/20E Wildcat Field Uintah Cty, UT	Mancos (7,000)	WF, drilling 6,759 ft, located in core area D

¹ From Petroleum Information

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5. Piceance Basin

5.1 CORE PROGRAM

The Piceance Basin of northwestern Colorado (Figure 5-1) has numerous tight Upper Cretaceous and Tertiary gas sands. Within the Mancos Formation, the Castlegate (Rollins) and the Mancos "B" sands are the principal objectives. The Iles Formation of the Mesaverde Group contains the Corcoran, Cozzette, Sego and Trout Creek sand units which all have gas potential. Within the continental portion of the Mesaverde Group (Williams Fork Formation) and the continental Ft. Union and Wasatch Formations, potential is present in both lenticular and blanket sand deposits. Most of these units are productive somewhere within the Piceance Basin. Actively producing gas fields include Cathedral, Piceance Creek, Trail Canyon, Thunder, Dragon Trail, and Texas Mountain. However, in areas removed from productive fields, or in horizons below known producing zones, very little information is available. For example, in the Piceance Creek Field, very few wells have penetrated below the commercial Wasatch and therefore data is limited.

In an effort to better understand areas or horizons with minimal control, the USGS has recommended several key areas from which cores should be obtained. Within the Piceance Basin these areas are:

Area A

East of Rangely Field in Rio Blanco County, T1S to T2N, R98W to R99W.

Area B

Piceance Creek Field area, Rio Blanco Cty, T2S, R96W to R97W (below the Wasatch

Area C

Garfield and Mesa Counties, T5S to T8S, R95W in the north tapering down to T98W to R99W on the southern part of the area.

Area D

Garfield and Mesa Counties, T8S to T10S, R92W to R94W (this area is flanked on the northwest and southeast by the Grand Mesa National Forest, see Table 5-1, Figure 5-1).

Operators are contacted to discuss WGSP Core Program participation whenever a new well is staked in a designated core area and the well is scheduled to penetrate program objectives. During the fourth quarter of 1978, the following Piceance Basin operators were contacted:

Figure 5-1 USGS Designated Core Areas and Wells of Interest, Piceance Basin (refer to Table 5-1)

Adolph Coors Company, Golden, Colorado
Koch Exploration, Denver, Colorado
Dome Petroleum, Denver, Colorado
Teton Energy, Denver, Colorado

During October a coring agreement was finalized with Twin Arrow, Inc., Rangely, Colorado, to recover core from the continental Williams Fork Formation (Mesaverde Group). Twin Arrow's well C&K 4-14 was located in the Douglas Creek Arch area, Section 14, T3S, R101W, Rio Blanco County, Colorado.

DOE had a dual interest in the Twin Arrow well. TRW, working on a DOE contract for methane drainage from coal, was interested in a series of coal seams in the Williams Fork between about 600 and 800 ft. CER, working on obtaining core for the WGSP, had picked a Williams Fork core interval between 950 and 1,210 ft. By agreement between CER and TRW, CER personnel were responsible for most of the coring operation, including the TRW interval.

The Twin Arrow well was originally intended to spud in on November 15, but various delays were experienced while rigging up and actual spud in did not take place until November 25. D.C. Bleakly of CER arrived on location November 17 and was joined shortly by a TRW representative as well as H.E. Newman and L.T. Hodges of CER. G.C. Kukul of CER replaced H.E. Newman midway through the coring operations.

Coring of the TRW interval commenced on November 30 and was completed on December 2. Coring of the WGSP interval began later that day and proceeded through December 5. Approximately 288 ft of 2-1/4 in. core was cut in the WGSP interval with about 90 percent recovery. Samples from the interval were protected with "seal peel" and shipped to LLL and BETC. Six feet of core were sealed in special cannisters for shipment to LASL. Core descriptions for both the methane drainage and the WGSP cores were furnished to the labs.

The WGSP core was shipped to Core Labs in Casper, Wyoming for analysis. In December only a limited analysis was authorized, as the C&K 4-14 hole had been lost, and logs were not available for comparison purposes. Further analysis was authorized at a later date when an extension hole was drilled and logs were obtained.

5.2 DRILLING ACTIVITIES

The Mancos ("B" sand) and Wasatch Formations in Rio Blanco County, the Cozzette and Corcoran Members of the Mesaverde Group in Mesa County, and the Dakota and Morrison Formations in the Douglas Creek Arch area of Garfield County are the major objectives in the Piceance Basin. Dakota and Morrison wells are not closely monitored for the Western Gas Sands Project.

Forty wells were completed in Upper Cretaceous and Tertiary horizons during the fourth quarter of 1978 in the Piceance Basin. Twenty-eight of the wells completed were classed as development, an increase of eight over the previous quarter. Twelve wildcat wells were also drilled during the quarter which is twice the number drilled in the third quarter. None of the wildcats were successful, all being completed D&A.

New production for the quarter totaled 18,663 MCFD. The Wasatch provided 64 percent of the production, more than 5 times the production of the previous quarter. The commingled Rollins/Cozzette/Corcoran yielded 16 percent of the new gas production. The Mancos B decreased its production contribution from 3,866 MCFD in the third quarter to 992 MCFD, 5.2 percent of the fourth quarter's production. The quarterly tabulation of production is summarized in Table 5-2.

Most new activity was in Rio Blanco County in the Douglas Creek Arch area during the quarter. Provident Resources and Coseka Resources were very active in staking Mancos tests. Other operators active in the basin were Chandler & Associates, American Resources Management, Twin Arrow, and Koch Petroleum.

Chandler & Associates completed 9 Mancos wells, mostly in the Douglas Creek Field. Fork Unit 9-15-1-2 produced 725 MCFD after a fracture treatment of 103,000 gal of water and 275,000 lb of sand. Refer to Table 5-3 and 5-4 for summaries of wells completed and newly staked, and to Figure 5-2 for their respective locations.

Table 5-1 Summary of Wells Located in USGS Designated Core Areas—Piceance Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 6-5-77 Comp: 8-20-77	American Resources Management	18-1-S Govt.	1	sew 18/2N/97W White River Dome Rio Blanco Cty, CO	Mesaverde	2,144		D	
FR: 12-12-78	American Resources Management	19-1-S Govt.	1	sese 19/2N/97W White River Dome Rio Blanco Cty, CO	Wasatch			D, Operator has 2 new Wasatch tests in this locale	
Spud: 9-27-74 Comp: 7-3-75	Rio Blanco Natural Gas	298-22-1 Govt.	2	sene 22/2S/98W Sulphur Creek Field Rio Blanco Cty, CO	(Wasatch)	7,014		D, temporarily abandoned	
FR: 1-8-79	CSG Exploration	298-29-2 Govt.	2	senw 29/2S/98W Sulphur Creek Field Rio Blanco Cty, CO	Mancos (17,800)			WD	
FR: 10-19-78 Spud: 11-27-78	Koch Exploration	1 Federal	3	nwnw 13/8S/99W Wildcat Field Mesa Cty, CO	Dakota (6,800)			WF, cored at 3,900 ft, drilling below 3,900 ft	
FR: 5-15-78	Union Oil of California	1 Gunderson	4	nwne 20/9S/93W Buzzard Creek Field Mesa Cty, CO	(Corcoran)	8,200		D, testing. Old info: Comp: 11-8-77 IPF 385 MCFD Prod zone: Mesaverde, commingled, no cores	

¹ From Petroleum Information

Table 5-2 Summary of Drilling Activities, Piceance Basin *

	NO. OF WELLS					Producing Horizons in MCFD														
	Wildcats		Development		Total	Green River				Mesaverde				Mancos				Total		
	D&A	Disc	D&A	Prod.		Undifferentiated	Douglas Creek	Wasatch	Ft. Union	Undifferentiated	Cozzette	Corcoran	Sage	Undifferentiated	Castlegate/Rollins	Mancos B	Morapos		Commingled	
2nd Quarter 1977	0	0	4	13	17	0	0	0	0	0	0	0	0	1,232	0	555	0	5,391 ⁵	7,178	
3rd Quarter 1977	2	0	5	9	16	0	0	2	0	0	0	0	0	2,585	0	157	0	183 ⁵	2,927	
4th Quarter 1977	1	3	8	41	53	0	2,000	3,816 ¹	0	1,000	0	0	0	4,627	0	4,753 ²	0	6,657 ³	22,853	
1st Quarter 1978	2	1	0	27	30	0	0	0	9	3,132	0	140	0	3,311	0	2,239 ¹	0	0	8,831	
2nd Quarter 1978	2	1	2	12	17	0	0	0	0	0	0	0	0	0	0	4,491	0	0	4,491	
3rd Quarter 1978	2	4	3	17	26	0	0	2,151	0	0	0	0	0	1,949 ¹	335	3,866	0	1,774 ⁴	10,075	
4th Quarter 1978	12	0	6	22	40	0	0 ¹	11,891	0	0	0	0	0	1,271	1,491	992	0	3,017 ⁷	18,663	

1. IPF not available for one producing well

2. IPF not available for two producing wells

3. Commingled production - Rollins/Cozzette/Corcoran - 4,422 MCFD
Cozzette/Corcoran - 2,235 MCFD

4. Commingled production - Cameo/Cozzette/Corcoran - 460 MCFD
Morapos/Mancos - 481 MCFD
Rollins/Cozzette/Corcoran - 833 MCFD

5. Commingled production - Rollins/Cozzette/Corcoran - 183 MCFD

6. Commingled production - Rollins/Cozzette/Corcoran - 5,391 MCFD

7. Commingled production - Rollins/Cozzette/Corcoran - 3,013 MCFD

*Data compiled from P.I. Rocky Mountain Region Report "Completions."

Table 5-3 Summary of Wells Completed—Piceance Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 6-5-77 Comp: 8-20-77	American Resources Management	18-1-S Govt	1	sew 18/2N/97W White River Dome Rio Blanco Cty, CO	Mesaverde	2,144		D	D&A
Spud: 7-16-78 Comp: 8-8-78	Chandler & Associates	2-15-1-2 Fork Unit	2	swne 15/1S/102W Dragon Trail Field Rio Blanco Cty, CO	Mancos (2,567-2,648)	2,848 PB: 2,781	Acidized-1,800 gal, 89,670 gal water, 165,000 lb sand	DG, no cores or tests	443
Spud: 7-9-78 Comp: 7-31-78	Chandler & Associates	9-15-1-2 Fort Unit	2	nese 15/1S/102W Dragon Trail Field Rio Blanco Cty, CO	Mancos (2,329-2,445)	2,660	103,000 gal water, 275,000 lb sand	DG, no cores or tests, Oper- ator has 4 other Mancos tests in this locale. D, WOCT	725
Spud: 7-1-78 Comp: 9-27-78	Mobil Oil	T73-19G-USA	3	sene 19/2S/93W Piceance Creek Field Rio Blanco Cty, CO	Wasatch (6,216-7,055)	7,155 PB: 7,111	47,000 gal gel 88,000 lb sand	DG, no cores or tests	517
Spud: 7-8-78 Comp: 9-21-78	Indian Wells Oil	21-2-95 Indian Wells- Federal	3	new 21/2S/95W Piceance Creek Field Rio Blanco Cty, CO	Douglas Creek (3,367-3,487)	7,350 PB: 4,020	Acidized- 7,500 gal, 11,000 gal foam, 15,000 lb sand	WOE, no cores or tests	
Spud: 5-22-78 Comp: 9-27-78	Mobil Oil	T73-30G-USA	3	swne 30/2S/95W Piceance Creek Field Rio Blanco Cty, CO	Wasatch (6,066-6,840)	6,915 PB: 6,870	15,000 gal emul., 60,000 lb sand Acidized-4,500 gal, 15,000 gal gel	DG, no cores or tests	700
Spud: 6-22-78 Comp: 7-28-78	Mobil Oil	T81-2G-USA	4	nene 2/2S/97W Piceance Creek Field Rio Blanco Cty, CO	Wasatch (2,583-2,712)	3,300 PB: 3,223	Acidized-1,300 gal	DG, no cores or tests	2,040
Spud: 5-13-78 FR: 1-13-78	Mobil Oil	T87-3G-USA	4	sese 3/2S/97W Piceance Creek Field Rio Blanco Cty, CO	Wasatch	3,300		D, SI	
Spud: 5-3-78 Comp: 7-21-78	Mobil Oil	T73-11G-USA	4	sene 11/2S/97W Piceance Creek Field Rio Blanco Cty, CO	Wasatch (2,899-3,060)	3,400 PB: 3,060	Acidized-3,000 gal	DG, no cores or tests	1,904
Spud: 8-10-78 Comp: 12-5-78	Mobil Oil	T18-13G-USA	4	swsw 13/2S/97W Piceance Creek Field Rio Blanco Cty, CO	Wasatch (2,338-2,684)	3,113	Perfed	DG	6,730
Spud: 9-27-74 Comp: 7-3-75	Rio Blanco Natural Gas	298-22-1 Govt	5	sene 22/2S/98W Sulphur Creek Field Rio Blanco Cty, CO	Wasatch	7,014		D, temp abandoned, located in core area B	
Spud: 8-30-78 Comp: 9-14-78	Chancellor & Ridgeway	33-2 Federal	2	swse 33/2S/101W Cathedral Field Rio Blanco Cty, CO	Mancos B (1,757-1,945)	2,156 PB: 2,091	Acidized-2,100 gal, 80,000 gal water, 200,000 lb sand	DG, no cores or tests	442
Spud: 8-8-77 Comp: 9-21-78	Fuel Resources Development	35-2 Federal	2	nwse 35/2S/101W Cathedral Field Rio Blanco Cty, CO	Emery (2,243-2,441)	2,736 PB: 2,641	30,000 gal gel, 150,000 lb sand	DG, no cores or tests	93
Spud: 8-4-78 FR: 8-11-78	Chandler & Associates	10-11-1-2X Fork Unit	2	nwse 11/1S/102W Douglas Creek North Field Rio Blanco Cty, CO	?	2,419	Acidized-1,800 gal, 93,000 gal water, 165,000 lb sand, testing	D	
FR: 4-24-78	Indian Wells Oil	9-2-95 Indian Wells Federal	3	senw 9/2S/95W Piceance Creek Field Rio Blanco Cty, CO	Wasatch			WO, abandoned location	

¹ From Petroleum Information

Table 5-3 Continued

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	HORIZON (Projected Depth or Producing Interval)	FINAL TD	FRACTURE TREATMENT	COMMENTS	IPF in MCFD
Spud: 9-25-78 FR: 6-12-78	David M. Munson	5-2-99 Federal	6	swnw 5/2S/99W Wildcat Field Rio Blanco Cty, CO	Mancos	8,494		WF, prep to perf	
Spud: 11-1-78	Wexpro	23-2 Federal	7	nws 23/2S/101W Cathedral Field Rio Blanco Cty, CO	Mancos	2,668		D, WOCT	
Spud: 9-29-78	Wexpro	10-1 MF- Federal-C	8	nws 10/2S/103W Lower Horse Draw Field Rio Blanco Cty, CO	Mancos	3,277		D, WOCT	
Spud: 8-31-78	Fuel Resources Development	0-27-3-101-S Federal	9	swse 27/3S/101W Cathedral Field Rio Blanco Cty, CO	Mancos B	4,740		D	
Spud: 10-27-78	Provident Resources	10-31-Federal C-561	10	swne 31/4S/102W Evacuation Creek Field Rio Blanco Cty, CO	Mancos B	5,510		D, WOCT	
Spud: 9-30-78	Chandler & Associates	13-31 Grumhous- Federal	11	swsw 31/9S/96W Shire Gulch Field Mesa Cty, CO	Corcoran	3,330		D, WOCT	
Spud: 7-15-78 Comp: 9-28-78	Norris Oil	13-3 Finch	12	nwn 13/10S/96W Plateau Field Mesa Cty, CO	Rollins (3,310-3,354) Cozzette (3,640-3,657) Corcoran (3,784-3,863)	4,008	312 gal water, 517,000 lb sand	DG	1,734
FR: 5-15-78	Union Oil of California	1 Gunderson	13	nwn 20/9S/93W Buzzard Creek Field Mesa Cty, CO	Corcoran	8,200		D, testing, old info: Comp 11-8-57, IPF = 385 MCFD, Prod zone was Mesaverde, WOE, commingled, no cores	
Spud: 1-27-78 Comp: 5-6-78	Flying Diamond Oil	13-2 Nichols	14	nwn 13/10S/96W Plateau Field Mesa Cty, CO	Rollins (3,164-3,200) Cozzette (3,487-3,540) Corcoran (3,628-3,721)	3,860 PB: 3,780	Perf 3,164-3,721 601,000 lb sand	DG, dropped 6-15-78, will be reissued	722

Figure 5-2 Wells Completed and Staked, USGS Designated Core Areas, Piceance Basin (refer to Tables 5-3 and 5-4)

Table 5-4 Summary of Active Wells and New Locations—Piceance Basin¹

DATE	OPERATOR	WELL NAME	MAP INDEX NO.	LOCATION Sec/T/R	PROJECTED HORIZON (Depth in ft)	COMMENTS
FR: 10-26-78	Chandler & Associates	11-18 Fork Unit	1	nesw 18/1S/101W Douglas Creek Field Rio Blanco Cty, CO	Mancos (2,640)	D, Operator has 3 other Mancos tests in this locale
FR: 12-18-78	Taiga Energy	9-10-1S-103W	2	sese 10/1S/103W Bank Ridge Field Rio Blanco Cty, CO	Mancos (4,300)	WD, USGS listing, operator has 1 other Mancos test in this locale
FR: 12-12-78	American Resources Management	19-1-S Govt	3	sese 19/2N/97W White River Field Rio Blanco Cty, CO	Wasatch	D, Operator has 3 other Wasatch tests in this locale
FR: 1-8-79	CSG Exploration	298-29-2 Govt	4	senw 29/2S/98W Sulphur Creek Field Rio Blanco Cty, CO	Mancos (17,800)	WD, located near core area B
FR: 10-13-78 Spud: 11-25-78	Twin Arrow	4-14 C&K	5	nese 14/3S/101W Cathedral Field Rio Blanco Cty, CO	Mancos (3,550)	D, drilling at 1,636 ft, fishing, operator has 3 other Mancos tests in the locale
FR: 10-11-78	Adolph Coors Co.	2-19 USA	6	nwsW 19/3S/103W Wildcat Field Rio Blanco Cty, CO	Mancos (4,000)	WF
FR: 11-29-78	Teton Energy	25-2 Indian Valley-Federal	7	senw 25/3N/97W Wildcat Field Rio Blanco Cty, CO	Morapos (8,000)	WF, close to core area A, MIRT
FR: 12-27-78	Joseph B. Gould	1-30 Gould- Dinosaur	8	senw 30/3N/103W Unnamed Field Rio Blanco Cty, CO	Emery (1,300)	WS
FR: 12-21-78	Provident Resources	5-35-4-102 Kirby-Robertson	9	nwsW 35/4S/102W Foundation Creek Field Rio Blanco Cty, CO	Mancos (3,840)	D, Operator has 4 other Mancos tests in this locale
FR: 10-3-78	Adolph Coors Co.	1-13 USA	10	swne 13/4S/104W Wildcat Field Rio Blanco Cty, CO	Mancos (4,000)	WF
FR: 10-26-78	Northwest Exploration	2 Clough	11	sesw 21/6S/94W Rullison Field Garfield Cty, CO	8,700 ft test	WO, Operator has 1 2,000 ft test in this locale
FR: 10-3-78 Spud: 10-24-78	Dome Petroleum	1-17 Baldy Creek Unit	12	senw 17/7S/90W Baldy Creek Field Garfield Cty, CO	Corcoran- Cozzette (10,365)	D, drilling at 8,063 ft
FR: 10-19-78 Spud: 11-27-78	Koch Exploration	1-Federal	13	nwnw 13/8S/99W Wildcat Field Mesa Cty, CO	Dakota (6,800)	WF, core at 3,900 ft, drilling below 3,900 ft, located in core area C
FR: 10-19-78	Koch Exploration	2-Federal	14	nwsW 12/9S/101W Wildcat Field Mesa Cty, CO	Dakota (6,000)	WF, located near core area C
FR: 10-19-78 Spud: 11-8-78	Koch Exploration	1-Federal	15	swne 15/9S/99W Wildcat Field Mesa Cty, CO	Dakota (7,000)	WF, located near core area C
FR: 11-9-78	Norris Oil	36-3 Federal	16	nene 36/9S/97W Shire Gulch Field Mesa Cty, CO	Corcoran (3,400)	D, located near core area C

¹ From Petroleum Information

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6. Special Report : Stratigraphy and Gas Production of the Washakie Basin, Wyoming

This is the first in a series of special reports, on the sub-basins of the Greater Green River Basin, prepared by L.T. Hodges, CER Corporation.

Stratigraphy of the Washakie Basin

The Washakie Basin is included as part of the Greater Green River Basin of southwestern Wyoming. It is separated from the Red Desert (Great Divide) Basin by the Wamsutter Arch, from the Sand Wash Basin by Cherokee Ridge, and from the Green River Basin proper by the Rock Springs Uplift.

Lower Tertiary and Upper Cretaceous rocks in the Washakie Basin have gas potential as being "tight" horizons and therefore, are important to the Western Gas Sands Project. These horizons include (in ascending order) the Mancos Shale equivalents, either the Steele Shale or the Baxter Shale (Upper Cretaceous); the Mesaverde Group—Blair, Rock Springs, Ericson, and Almond Formations; Lewis Shale (Upper Cretaceous); Lance Formation (Upper Cretaceous); Fort Union Formation (Paleocene); and the Wasatch Formation (Eocene).

The Steele Shale in the eastern Washakie Basin is divided into upper and lower parts (Hale, 1961) by the Cow Creek Sandstone, a prominent sandy zone. The Baxter Shale is equivalent to the Steele Shale over the western Washakie Basin.

The Mesaverde Group in the eastern Washakie Basin can be divided into a lower part of largely a marine sequence of intertonguing sandstones and shales and an upper part of dominantly continental, coal-bearing rocks (Hale, 1961). The basal sandstone of the Mesaverde in the Washakie Basin is the Deep Creek Sandstone, probably deposited under regressing marine conditions. A tongue of the Steele Shale (Espy tongue) which overlies the Deep Creek Sandstone may be the equivalent of the Black Butte tongue on the Rock Springs Uplift.

Above the Espy tongue in the eastern Washakie Basin, the Mesaverde assumes a prominent, white, cliff-forming sandstone locally known as the Hatfield Sandstone. This sandstone is considered to have been formed by regressive marine processes. Above the Hatfield, the Mesaverde is continental, and is correlated with the Ericson and Almond Formations (defined on the Rock Springs Uplift).

On the western edge of the Washakie Basin and on the Rock Springs Uplift, the Mesaverde Group is divided into the Blair, Rock Springs, Ericson and Almond Formations (ascending order).

The Blair Formation is entirely marine (Douglass and Blazzard, 1961), and loses its identity to the southeast in the Washakie Basin, where it grades into the upper part of the Baxter shale.

The Rock Springs Formation displays intertonguing of several marine sandstone units and coal bearing facies.

The Rock Springs Formation pinches out to the east of the Rock Springs Uplift. There has been no production in the Rock Springs Formation (Asquith, 1975), but deep tests into this unit are very limited in extent.

The Ericson Formation is a massive white sandstone unit considered to represent a non-marine fluvial environment (Douglass and Blazzard 1961). In subsurface, the Ericson is divided into two facies: the upper massive Ericson Ranch facies (inland facies) and the lower carbonaceous, less massive Table Rock facies (lowland facies). A schematic diagram relating Upper Cretaceous rocks across the Rock Springs Uplift, Washakie Basin, and Sand Wash Basin is shown in Figure 6-1 (from Douglass and Blazzard, 1961).

In the Washakie Basin, the Almond Formation may be divided into a basal unit which consists of carbonaceous shale interbedded with silty sandstone and coal, and an upper unit (from which most production is obtained) which consists of friable, porous, salt-and-pepper sandstone (Heppe, 1960). The Almond Formation is composed mainly of fluvial and paludal deposits.

Production of oil and gas from the Almond Formation is from stratigraphic traps in sandstones deposited during a local regression or pause in the overall transgression of the Lewis sea (Asquith, 1975).

No comprehensive regional subsurface study of Tertiary horizons in the Washakie Basin has been published (McDonald, 1975). There is some production from the Fort Union Formation sandstones. Depositional environments in the Fort Union are fluvial and paludal. There is also some production from the Wasatch Formation, but none as yet (McDonald, 1975) from the overlying Green River Formation.

Gas Production in the Washakie Basin

Production History and Summary

Gas production began in 1926 at Hiawatha Field in the Wasatch Formation in the southwest Washakie Basin (Asquith, 1975). The first significant production of gas from the Mesaverde was in the Ericson Formation in 1941 at Canyon

*From Wyoming Geological Association Guidebook

Creek in the southwest Washakie Basin. Major fields have since been discovered at Table Rock (1946), Trail and Desert Springs (1958), and Patrick Draw (1959). Cumulative production from Lewis and Mesaverde fields in the area is over 50 million BO and 675 BCF of gas (Asquith, 1975). Most of the oil and about half of the gas have been produced in roughly equal amounts from the Lewis and Ericson Formations. Rocks lower in the Mesaverde Group have yielded only small quantities of oil and gas.

Recent activity in the basin has been slow and sporadic due to gas prices, excessive drilling depths, and the fact that traps tend to be stratigraphically, rather than structurally, controlled. Most of the producing fields at present are concentrated at the rim of the basin, leaving the deeper parts of the basin relatively unexplored.

Cumulative Field Production

The area of the Washakie Basin proper used in this report for gas production and frac size data is given below. Gas fields on the rim are not included.

T13N	R91 - 99W
T14N	R91 - 100W
T15N	R91 - 101W
T16N	R92 - 101W
T17N	R92 - 100W
T18N	R92 - 98W
T19N	R92 - 97W

Table 6-1, Cumulative Gas Production (in MMCF), was compiled from the Wyoming Oil and Gas Commission's 1977 Oil and Gas Statistics. Twenty-three fields are listed in Table 6-1. The nine largest fields have a cumulative production of over 1,000 MMCF each and their production rank is indicated by number on Figure 6-2. Table Rock Field located in T18 - 19S, R97 - 98W has the largest cumulative production, 165,000 MMCF.

Recent Fracture Treatments in the Washakie Basin

Table 6-2 is a compilation of the 27 fractured wells taken from the Petroleum Information reports in the Washakie Basin during the calendar year 1978. The actual frac size of 2 of the 27 fracs is not indicated. None of the 27 wells had multiple fracs. The average frac size for a well is 141,150 gal of fluid (24 wells), and 203,910 lb of proppant (25 wells). Of the 25 wells with proppant amounts given, 11 wells had frac jobs in excess of 200,000 lb. The largest frac during the year was in a CIG Exploration well, 1-28 Haystack Unit, located in Section 28, T17N, R96W. The treatment used 505,176 gal of emulsion and 620,000 lb of proppant (580,000 lb sand, 40,000 lb sintered bauxite) to fracture the Mesaverde. Flow rates of interest on this well are as follows:

Table 6-1 Cumulative Gas Production—Washakie Basin Fields (end of 1977)

Field	Location T/R	Cumulative Gas Production, MMCF	Rank Rank
Antelope	17N/99W	17,104	4
Barrel Springs	16N/93W	101	
Blue Gap	15N/92W	963	
Brady	16N/101W	51,752	2
Browning	14N/91W	693	
Brown's Hill	14 - 16N/89 - 91W	23	
Cherokee Creek	15N/91W	1,798	7
Cow Creek	16N/92W	12,869	5
Creston	19N/92W	51	
Desert Flats	19N/95W	50	
Echo Springs	19N/93W	49	
Higgins	17N/99W	3,398	6
Neff	18N/98W	33	
Red Lakes	18N/94W	114	
Robbers Gulch	14N/91W	3	
Robin	19N/97W	231	
Salazar	16N/95W	103	
Sand Butte	17N/99W	1,665	8
Table Rock	18 - 19N/97 - 98W	165,143	1
Table Rock, S	18N/98W	1,008	9
Tipton	19N/97W	64	
Trail	13 - 14N/100W	46,597	3
Wild Rose	17 - 18N/94W	603

Figure 6-2 Major Gas and Oil Fields of the Washakie and Sand Wash Basins

Table 6-2 Washakie Basin Frac Sizes—1978

Fluid gal		Proppant lb		IPF Value Gas Flow MCFD
84,000		162,000		755
108,000		200,000		332
25,000	} 112,000	41,250	} 158,050	1,782
87,000		116,800		
53,000		105,000		1,149
505,176		580,000 sand 40,000 bauxite	} 620,000	789 IPF 890 IPCAOF
85,500	} 323,500	165,000		} 539,500
238,000		374,500		
55,000		105,000		1,650
Sand Emulsion		Sand Emulsion		4,600 IPCAOF
161,090		290,000		361
87,500	} 178,500	120,000	} 253,250	877
91,000		133,250		
235,000		360,000		N.A.
124,656		228,114		431
110,000		170,000		796
72,000		178,000		580
49,700	} 89,700	57,000	} 127,000	53
40,000		70,000		
185,440		243,400		D&A
Oil		44,625		220 IPP
33,222	} 174,464	33,000	} 137,000	850
40,300		30,000		
26,500		18,000		
24,108		18,000		
24,108		18,000		
26,226		20,000		
20,000		22,000		1,043
188,000		256,000		5,800
22,500	} 52,500	33,500	} 97,170	668
30,000		63,670		
12,000	} 46,400	30,000	} 80,400	D&A
34,440		50,400		
82,000		166,000		115 IPP
114,660	} 164,660	214,200	} 314,200	D&A
50,000		100,000		
Sd H ₂ O		Sd H ₂ O		3,412 IPCAOF
96,300		54,500		
110,000	} 250,500	200,500	} 411,100	970
96,500		148,100		
44,000		62,500		
12,000		30,000		1,000

Maximum flow before frac; 497 MCFD

After fracture: 12/14/77; IPF = 789 MCFD, IPCAOF = 890 MCFD

2/17/78; F = 1,000 MCFD

6/ 8/78; F = 1,200 MCFD

Three of the 27 wells were listed as dry and abandoned (D&A) after fracturing. Eight of 23 fractured wells indicating gas flow had IPF (or IPCAOF) values of at least 1,000 MCFD. The well with the highest IPF (5,800 MCFD) was fractured with 256,000 lb of sand. However, two wells with frac sizes over 200,000 lb of sand were abandoned.

References

Asquith, D.O., 1975, *Petroleum Potential of Deeper Lewis and Mesaverde sandstones in the Red Desert, Washakie and Sand Wash Basins, Wyoming and Colorado*, Rocky Mountain Association of Geologists, Symposium, p. 159-162.

Crews, G.C., Barlow, J.A., Jr., and Haun, J.D., 1973, *Natural Gas Resources, Green River Basin, Wyoming*, Wyoming Geological Association Guidebook, 25th Field Conference, p. 103-113.

Douglass, W.B., Jr., and Blazzard, T.R., 1961, *Facies Relationships of the Blair, Rock Springs and Ericson Formations of the Rock Springs Uplift and Washakie Basin*, Wyoming Geological Association Guidebook, 16th Field Conference, p. 81-86.

Hale, L.A., 1961, *Late Cretaceous (Montanan) Stratigraphy, Eastern Washakie Basin, Carbon County, Wyoming*, Wyoming Geological Association Guidebook, 16th Field Conference, p. 129-137.

Heppe, W.C., 1960, *A Brief Summary of the Stratigraphy of the Almond and Lewis formations of the Washakie Basin, Sweetwater County, Wyoming*, Wyoming Geological Association Guidebook, 15th Field Conference, p. 147-151.

McDonald, R.E., 1975, *Structure, Correlation and Depositional Envrionments of the Tertiary, Sand Wash and Washakie Basins, Colorado and Wyoming*, Rocky Mountain Association of Geologists, Symposium, p. 175-184.

Miller, F.X., 1977, *Biostratigraphic Correlation of the Mesaverde Group in Southwestern Wyoming and Northwestern Colorado*, Rocky Mountain Association of Geologists, Symposium, p. 117-137.

Smith, J.H., 1961, *A Summary of Stratigraphy and Paleontology, Upper Colorado and Montanan Groups, Southcentral Wyoming, Northeastern Utah, and Northwestern Colorado*, Wyoming Geological Association Guidebook, 16th Field Conference, p. 101-112.

Wyoming Oil and Gas Conservation Commission, 1977, *Wyoming Oil and Gas Statistics: Casper, Wyoming*.