

APPENDIX E
MASTER DRILLING PLAN

MASTER DRILLING PROGRAM

**OPERATOR: Petroleum Development Corporation (Pedco)
Carbon County, Wyoming
Sections 5, 8 and 9, T.15N., R.91W., 6th PM
BLM Leases: WYW141276, WYW141277, WYW148481**

Drilling Program is for the subject wells listed below.

<u>WYW 141276</u>	<u>WYW 141277</u>	<u>WYW 148481</u>
ARFederal 1591-1-5	ARFederal 1591-3-5	ARFederal 1591-3-9
ARFederal 1591-7-5	ARFederal 1591-5-5	ARFederal 1591-5-9
ARFederal 1591-9-5	ARFederal 1591-1-8	ARFederal 1591-13-9
ARFederal 1591-11-5	ARFederal 1591-7-8	
ARFederal 1591-13-5	ARFederal 1591-11-9	
ARFederal 1591-15-5	ARFederal 1591-15-9	
ARFederal 1591-3-8		
ARFederal 1591-5-8		
ARFederal 1591-9-8		
ARFederal 1591-15-8		

1. AVERAGE ESTIMATED TOPS OF IMPORTANT GEOLOGIC MARKERS

<u>Formation</u>	<u>Depth (2,455)</u>	<u>Depth (3,600)</u>
Lewis Shale	Surface	Surface
Almond	1,325'	2,480'
Pine Ridge	1,785'	2,940'
Allen Ridge	1,905'	3,060'
TD	2,455'	3,600'

** these depths would be the shallowest and deepest

Table 1
Blue Sky POD CBM Project Well Information

No.	Well Information						Lease Information						Cementing Program					
	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)				
1	ARFederal	1591-1-5	NENE	5	15N	91W	WYW141276	6,520' GL	Lewis	0'	Surface	13 1/2"	246	124				
									Almond	1,330'	Production	9 7/8"	2,460	610				
									Pine Ridge	1,790'								
									Allen Ridge	1,910'								
									Total Depth	2,460'								
2	ARFederal	1591-3-5	NENW	5	15N	91W	WYW141277	6,504' GL	Lewis	0'	Surface	13 1/2"	284	143				
									Almond	1,710'	Production	9 7/8"	2,840	704				
									Pine Ridge	2,170'								
									Allen Ridge	2,290'								
									Total Depth	2,840'								
3	ARFederal	1591-5-5	SWNW	5	15N	91W	WYW141277	6,491' GL	Lewis	0'	Surface	13 1/2"	312	158				
									Almond	1,990'	Production	9 7/8"	3,120	774				
									Pine Ridge	2,450'								
									Allen Ridge	2,570'								
									Total Depth	3,120'								
4	ARFederal	1591-7-5	SWNE	5	15N	91W	WYW141276	6,510' GL	Lewis	0'	Surface	13 1/2"	274	138				
									Almond	1,610'	Production	9 7/8"	2,740	680				
									Pine Ridge	2,070'								
									Allen Ridge	2,190'								
									Total Depth	2,740'								
5	ARFederal	1591-9-5	NESE	5	15N	91W	WYW141276	6,497' GL	Lewis	0'	Surface	13 1/2"	263	133				
									Almond	1,500'	Production	9 7/8"	2,630	652				
									Pine Ridge	1,960'								
									Allen Ridge	2,080'								
									Total Depth	2,630'								
6	ARFederal	1591-11-5	NESW	5	15N	91W	WYW141276	6,484' GL	Lewis	0'	Surface	13 1/2"	300	152				
									Almond	1,840'	Production	9 7/8"	3,000	744				
									Pine Ridge	2,300'								
									Allen Ridge	2,420'								
									Total Depth	2,970'								

Blue Sky POD CBM Project Well Information																	
Well Information						Lease Information						Cementing Program					
No.	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)			
7	ARFederal	1591-13-5	SWSW	5	15N	91W	WYW141276	6,481' GL	Lewis	0'	Surface	13 1/2"	340	172			
									Almond	2,090'	Production	9 7/8"	3,400	843			
									Pine Ridge	2,550'							
									Allen Ridge	2,670'							
									Total Depth	3,220'							
8	ARFederal	1591-15-5	SWSE	5	15N	91W	WYW141276	6,489' GL	Lewis	0'	Surface	13 1/2"	290	146			
									Almond	1,740'	Production	9 7/8"	2,900	719			
									Pine Ridge	2,200'							
									Allen Ridge	2,320'							
									Total Depth	2,870'							
9	ARFederal	1591-1-8	NENE	8	15N	91W	WYW141277	6,500' GL	Lewis	0'	Surface	13 1/2"	289	146			
									Almond	1,760'	Production	9 7/8"	2,890	717			
									Pine Ridge	2,220'							
									Allen Ridge	2,340'							
									Total Depth	2,890'							
10	ARFederal	1591-3-8	NENW	8	15N	91W	WYW141276	6,480' GL	Lewis	0'	Surface	13 1/2"	329	166			
									Almond	2,160'	Production	9 7/8"	3,290	816			
									Pine Ridge	2,620'							
									Allen Ridge	2,740'							
									Total Depth	3,290'							
11	ARFederal	1591-5-8	SWNW	8	15N	91W	WYW141276	6,476' GL	Lewis	0'	Surface	13 1/2"	360	182			
									Almond	2,480'	Production	9 7/8"	3,600	893			
									Pine Ridge	2,940'							
									Allen Ridge	3,060'							
									Total Depth	3,610'							
12	ARFederal	1591-7-8	SWNE	8	15N	91W	WYW141277	6,500' GL	Lewis	0'	Surface	13 1/2"	314	159			
									Almond	2,010'	Production	9 7/8"	3,140	779			
									Pine Ridge	2,470'							
									Allen Ridge	2,590'							
									Total Depth	3,140'							

Table 1 (continued) Blue Sky POD CBM Project Well Information														
Well Information					Lease Information					Cementing Program				
No.	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)
13	ARFederal	1591-9-8	NESE	8	15N	91W	WYW141276	6,565' GL	Lewis	0'	Surface	13 1/2"	319	161
									Almond	2,060'	Production	9 7/8"	3,190	791
									Pine Ridge	2,520'				
									Allen Ridge	2,640'				
									Total Depth	3,190'				
14	ARFederal	1591-15-8	SWSE	8	15N	91W	WYW141276	6,607' GL	Lewis	0'	Surface	13 1/2"	353	178
									Almond	2,400'	Production	9 7/8"	3,530	876
									Pine Ridge	2,860'				
									Allen Ridge	2,980'				
									Total Depth	3,530'				
15	ARFederal	1591-3-9	NENW	9	15N	91W	WYW148481	6,572' GL	Lewis	0'	Surface	13 1/2"	246	124
									Almond	1,330'	Production	9 7/8"	2,460	610
									Pine Ridge	1,790'				
									Allen Ridge	1,910'				
									Total Depth	2,460'				
16	ARFederal	1591-5-9	SWNW	9	15N	91W	WYW148481	6,539' GL	Lewis	0'	Surface	13 1/2"	268	135
									Almond	1,550'	Production	9 7/8"	2,680	665
									Pine Ridge	2,010'				
									Allen Ridge	2,130'				
									Total Depth	2,680'				
17	ARFederal	1591-11-9	NESW	9	15N	91W	WYW141277	6,572' GL	Lewis	0'	Surface	13 1/2"	251	127
									Almond	1,380'	Production	9 7/8"	2,510	623
									Pine Ridge	1,840'				
									Allen Ridge	1,960'				
									Total Depth	2,510'				
18	ARFederal	1591-13-9	SWSW	9	15N	91W	WYW148481	6,571' GL	Lewis	0'	Surface	13 1/2"	290	146
									Almond	1,775'	Production	9 7/8"	2,905	721
									Pine Ridge	2,235'				
									Allen Ridge	2,355'				
									Total Depth	2,905'				

Table 1 (continued)
Blue Sky POD CBM Project Well Information

Blue Sky POD CBM Project Well Information														
Well Information					Lease Information					Cementing Program				
No.	Name	Number	Qtr/Qtr	Sec	Tns	Rng	Lease No.	Elevation	Formation	Depth	Casing	Hole	Depth	Cement (sx)
19	ARFederal	1591-15-9	SWSE	9	15N	91W	WYW141277	6,627' GL	Lewis	0'	Surface	13 1/2"	245	124
									Almond	1,325'	Production	9 7/8"	2,455	609
									Pine Ridge	1,785'				
									Allen Ridge	1,905'				
									Total Depth	2,455'				

2. ESTIMATED DEPTH OF ANTICIPATED WATER, OIL, GAS OR MINERAL FORMATIONS

Allen Ridge	Methane gas
Almond	Methane gas

The Lewis Shale is not anticipated to contain any zones capable of producing water. There are several zones within the Mesa Verde capable of producing fresh water, including the coal seams. Several coal seams may be tested for gas producing formations to total depth. All shallow water zones will be protected with casing and cement. Cement will be brought to surface to isolate all Mesa Verde formations.

Planned Objective: Mesa Verde

3. MINIMUM BOP REQUIREMENTS (refer to attached BOP schematics)

- a. The BOPE shall be closed whenever the well is unattended.
- b. The BOPE shall be pressure tested when initially installed, whenever any seal subject to pressure testing is broken, after repairs, or every 30 days.
- c. Pedco shall notify the Rawlins BLM office 24 hours prior to the BOPE test.

4. SUPPLEMENTARY INFORMATION

The primary objective of this project is to drill, stimulate, and produce coalbed methane gas from the coal seams of the Mesa Verde Group Formations.

Pedco proposes to test the coal formations between 1,910' and 3,090'. Stimulation of the perforated coal seams will be done by hydraulic fracturing. Fresh water, gelled water, and/or foam fracturing techniques will be used.

Please see the attached schematics for Typical CBM Drill Site Layout, Configuration Options, Typical CBM Completed Well, Typical CBM Well Site, and Bottom Flange and Choke Manifold Schematic.

5. CASING PROGRAM

Hole Size	Casing Size	Casing Weight	Grade	Joint	Depth Set	New/Used	Range
13 1/2"	10 3/4"	32.75#	H-40	ST&C	0-245/360	New	3
9 7/8"	7"	23#	MC-50	LT&C	0-TD	New	3

Surface Casing: 10 3/4" 32.75 ppf. H-40 STC Collapse Burst Tension Ratings: 880 1820 205M

A. Burst = 0.052 * MW * TVD(shoe)
 = 0.052 * 9.3ppg * 360'
 = 174.1psi
 Safety Factor = Rating/Burst
 = 1820/174.1
 = 10.45

B. Collapse = $[0.052 * MW * TVD(\text{shoe})] - [\text{Gas Gradient} * TVD]$
 = $[0.052 * 9.3\text{ppg} * 360'] - [0.1\text{psi/ft} * 360']$
 = 138.1psi
 Safety Factor = Rating/Collapse
 = $880/138.1$
 = 6.37

C. Tension = Weight * D * $[1 - (MW/65.5\text{ppg})]$
 = $32.75\text{ppf} * 360' * [1 - (9.3\text{ppg}/65.5\text{ppg})]$
 = 10139.4 lbs.
 Safety Factor = Rating/Tension
 = $205,000/10139.4$
 = 20.22

Surface casing shall have centralizers on the bottom 3 joints of the casing, starting with the shoe joint.

Production Casing:	7"	23 ppf.	MC-50	STC	Collapse	Burst	Tension
				Ratings:	3110	3960	273M

A. Burst = $0.052 * 13\text{ppg} * 3600'$
 = 2433.6psi
 Safety Factor = Rating/Burst
 = $3960/2433.6$
 = 1.63

B. Collapse = $[0.052 * 13\text{ppg} * 3600'] - [0.1\text{psi/ft} * 3600']$
 = 2073.6psi
 Safety Factor = Rating/Collapse
 = $3110/2073.6$
 = 1.5

C. Tension weight = $23\text{lbs./ft} * 3600' * [1 - (13\text{ppg}/65.5\text{ppg})]$
 = $23\text{lbs./ft} * 3600' * .8015$
 = 66364.20 lbs.
 Safety Factor = Rating/Tension
 = $273,000/66364.20$
 = 4.11

6. MUD PROGRAM

Drilling mud will be used as the circulation medium. A fresh water, polymer, gel drilling mud will be used and visual monitoring will be done from spud to total depth. The anticipated mud weight will be between 8.5 – 13 ppg. Sufficient quantities of lost circulation material and barite will be available at the well site at all times for the purpose of assuring well control.

7. CEMENTING PROGRAM

The following is the proposed procedure for cementing the 10 3/4" surface pipe and 7" long string:

a. Surface Casing

Lead: Class "C" Type III, 14.4 ppg., yield 1.44ft³/sk @ 101% excess. Compressive strength in 24 hours at 80°F 3100psi.

The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.

b. Long String

Lead: Class "C" Type III, 14.4 ppg., yield 1.44ft³/sk @ 35% excess. Compressive strength in 24 hours at 95°F 3200psi.

Estimated top of cement back to surface.

8. LOGGING PROGRAM

Cores: Rotary Cores will be taken as needed to evaluate the coal seams.

DSTs: None Planned

Logs: Induction, GR, SP, Density, Neutron and Caliper – From surface to TD
Cement Bond Log – From 10 ¾" casing shoe TD
Mud Logger – As Needed.

9. PRESSURE DATA, POTENTIAL HAZARDS

Bottom hole pressures anticipated @ 1000 – 1100 psi.

There is no history of hydrogen sulfide gas in the area and none is anticipated.

10. ANTICIPATED STARTING DATES AND NOTIFICATION OF OPERATIONS

a. Anticipated Starting Dates

Anticipated Commencement Date	- Spring 2002, or upon approval
Drilling Days	- Approximately 7 Days/Per Well
Completion Days	- Approximately 2 Days/Per Well
Testing Days	- Approximately 7-14 Days/Per Well

Note: Drilling operations will commence as soon as practical after approval of all necessary permits including the APDs.

b. Notification of Operations

Rawlins Field Office, BLM
1300 North Third
Rawlins, Wyoming 82301
(307) 328-4200 (Office Hours)

**CONDITIONS OF APPROVAL FOR APPLICATION FOR PERMIT TO DRILL
INJECTION WELL**

Lease Number: Blue Sky Pod

Date: January 22, 2002

Operator: Petroleum Development

Well/Project Name: Master Drilling Plan (Injection Wells)

Legal Description: Sections 5, 8 and 9; T.15N., R.91W.; 6th PM

DRILLING PLAN

BOP

1. All BOPE shall meet minimum standards for well control requirements as set forth in Onshore Order No. 2.
2. The BOPE approved for this Pod shall be tested to a minimum of 1000 psi.
3. A Sundry Notice (Form 3160-5), along with a copy of the BOP test report, shall be submitted to this office within five working days following the test.
4. If the bleed line is connected into the buffer tank (header), all BOP equipment including the buffer tank and associated valves will be rated at the required BOP pressure.

Casing and Cementing

1. The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.
2. Pea gravel or other similar materials shall not be used to fill up around the surface casing in the event cement falls back.
3. A Sundry Notice (Form 3160-5), along with a copy of the service company's materials ticket and job log, shall be submitted to this office within five working days following the running and cementing of all casing strings.
4. All casing strings shall be tested, prior to drilling out the casing shoe, to 0.22 psi/ft of casing string length or 1500 psi, whichever is greater, but not to exceed 70% of the internal yield pressure of the casing.
5. Any change in the casing and cement design will be approved by the Authorized Officer prior to running casing and cementing.
6. No freshly hard-banded pipe/collars will be rotated in the surface casing.
7. All surface casing will be blocked and centered prior to cut off and installation of the wellhead.

Mud Programs

1. Sufficient quantities of mud materials shall be maintained at the well site, at all times, for the purpose of assuring well control.

Other

1. A summary of the drilling operation and/or completion operation shall be submitted on Sundry Notice (Form 3160-5), to this office, along with copies of the daily drilling reports and/or daily completion reports, on a weekly basis.
2. Any temporary or permanent plugs placed in the well must have **prior** approval of the Authorized Officer.
3. A copy of all logs, formation test reports, stimulation reports, etc., shall be promptly submitted to this office.
4. Gas produced from this well may not be vented or flared beyond an initial test period, 30 days or 50 MMcf, whichever first occurs, without approval of the Authorized Officer. Should gas be vented or flared without approval beyond the test period authorized above, you may be directed to shut-in the well until the gas can be captured or approval to continue the venting or flaring as uneconomic is granted, and you shall be required to compensate the lessor for that portion of the gas vented or flared without approval which is determined to have been avoidably lost.

**CONDITIONS OF APPROVAL FOR APPLICATION FOR PERMIT TO DRILL
CBM WELLS**

Lease Number: Blue Sky Pod

Date: January 22, 2002

Operator: Petroleum Development

Well/Project Name: Master Drilling Plan

Legal Description: Sections 5, 8 and 9; T.15N., R.91W.; 6th PM

DRILLING PLAN

BOP

1. All BOPE shall meet minimum standards for well control requirements as set forth in Onshore Order No. 2.
2. The BOPE approved for this Pod shall be tested to a minimum of 1000 psi.
3. A Sundry Notice (Form 3160-5), along with a copy of the BOP test report, shall be submitted to this office within five working days following the test.
4. If the bleed line is connected into the buffer tank (header), all BOP equipment including the buffer tank and associated valves will be rated at the required BOP pressure.

Casing and Cementing

1. The surface casing shall be cemented back to surface. In the event cement does not circulate to surface or fall back of the cement column occurs, remedial cementing shall be done to cement the casing back to surface.
2. Pea gravel or other similar materials shall not be used to fill up around the surface casing in the event cement falls back.
3. A Sundry Notice (Form 3160-5), along with a copy of the service company's materials ticket and job log, shall be submitted to this office within five working days following the running and cementing of all casing strings.
4. All casing strings shall be tested, prior to drilling out the casing shoe, to 0.22 psi/ft of casing string length or 1500 psi, whichever is greater, but not to exceed 70% of the internal yield pressure of the casing.
5. Any change in the casing and cement design will be approved by the Authorized Officer prior to running casing and cementing.
6. No freshly hard banded pipe/collars will be rotated in the surface casing.
7. All surface casing will be blocked and centered prior to cut off and installation of the wellhead.

Mud Programs

1. Sufficient quantities of mud materials shall be maintained at the well site, at all times, for the purpose of assuring well control.

Other

1. A summary of the drilling operation and/or completion operation shall be submitted on Sundry Notice (Form 3160-5), to this office, along with copies of the daily drilling reports and/or daily completion reports, on a weekly basis.
2. Any temporary or permanent plugs placed in the well must have **prior** approval of the Authorized Officer.
3. A copy of all logs, formation test reports, stimulation reports, etc., shall be promptly submitted to this office.
4. Gas produced from this well may not be vented or flared beyond an initial test period, 30 days or 50 MMcf, whichever first occurs, without approval of the Authorized Officer. Should gas be vented or flared without approval beyond the test period authorized above, you may be directed to shut-in the well until the gas can be captured or approval to continue the venting or flaring as uneconomic is granted, and you shall be required to compensate the lessor for that portion of the gas vented or flared without approval which is determined to have been avoidably lost.