PAVILLION FIELD
WELL INTEGRITY REVIEW

WYOMNG OIL AND GAS CONSERVATION COMMISSION

OCTOBER 8, 2014

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INTRODUCTION

This report by the Wyoming Oil and Gas Conservation Commission (WOGCC) is a technical and regulatory analysis relating to the integrity of all identified oil and gas wells within one-quarter mile of domestic water wells identified by the Wyoming Department of Environmental Quality (WDEQ) as having quality and palatability issues in the vicinity of the Pavillion Gas Field in Fremont County, Wyoming (**Figure 1**). It was determined that all wells drilled in the Pavillion Field produced primarily gas, and have therefore been classified as gas wells.

The report addresses the adequacy of drilling and completion techniques relating to gas well construction and operation, and the likelihood of fluid migration via these wellbores from deep known natural gas producing sands to shallower sands accessed by landowners for domestic water in the vicinity of the producing wells.

The report is part of an effort by the State of Wyoming to determine if gas and other constituents observed in domestic water wells are naturally occurring or a result of gas field development. Formation natural gas and fluids can migrate out of the containing reservoirs due to geologic conditions (natural formation fractures, faulting, lack of impermeable sealing containment strata, interconnected sand bodies), wellbore pathways (casing leaks, inadequate cement or hydraulic barrier behind the surface or production casing), or induced pathways resulting from hydraulic fracture stimulation or other drilling and completion events (improper mud weight, cementing technique).

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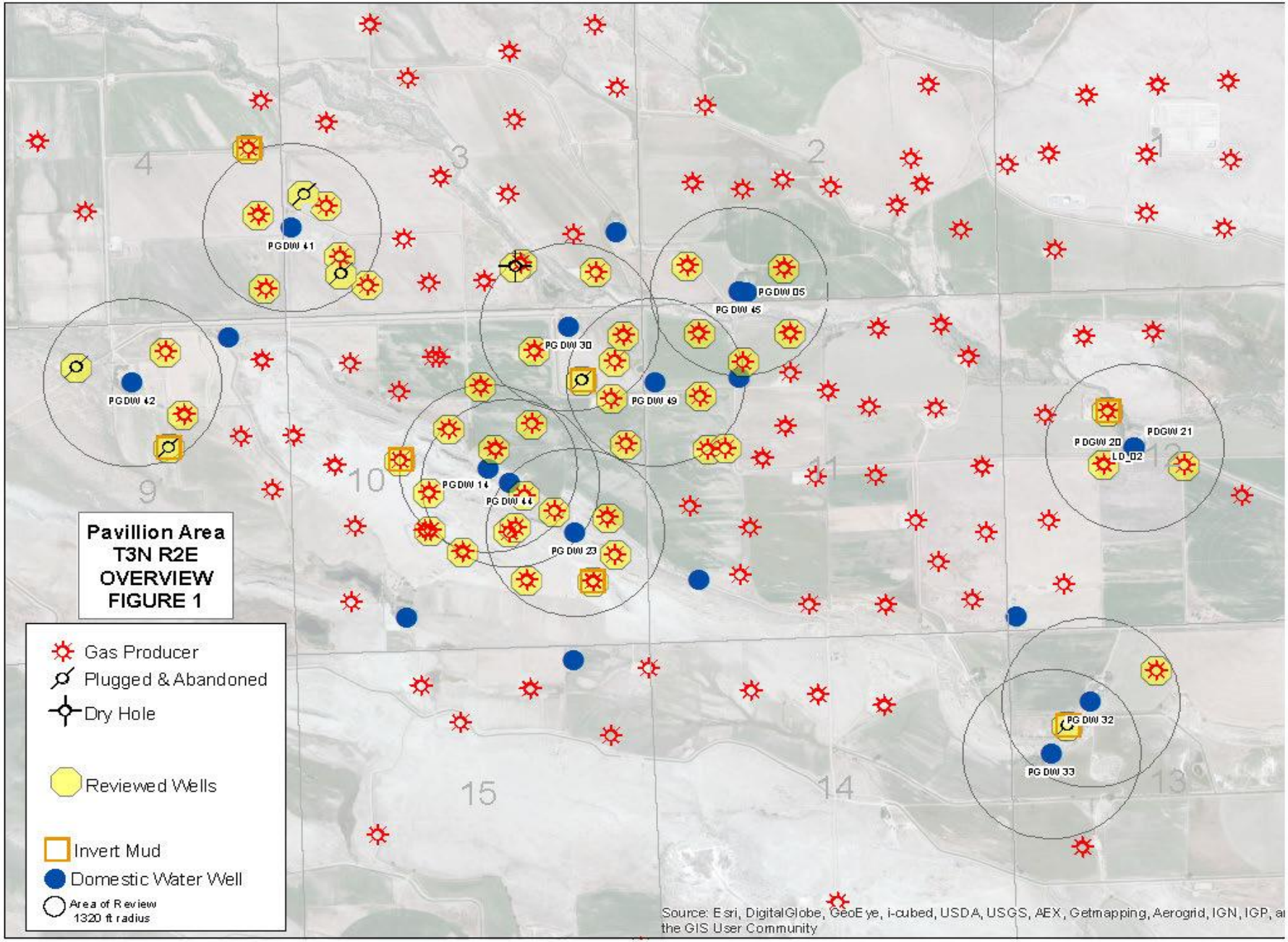

Pavillion Area
T3N R2E
OVERVIEW
FIGURE 1
Gas Producer
Plugged & Abandoned
Dry Hole
Reviewed Wells
Invert Mud
Domestic Water Well
Area of Review
1320 ft radius
PGDW 41
PGDW 42
PG DW 30
PG DW 49
PGDW 05
PG DW 45
PG DW 14
PG DW 44
PG DW 23
PDGW 20
PDGW 21
LD_02
PG DW 32
PG DW 33
4
3
2
1
9
10
11
12
15
14
13
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, a
the GIS User Community

SCOPE OF WORK

The scope of this work includes:

- Review of available drilling and completion data for the domestic water wells and gas wells identified within the areas of review,
- Determination of mineral ownership (Eastern Shoshone/Northern Arapaho Tribal or patented),
- Analysis of surface and production casing setting depths,
- Adequacy of the cementing jobs performed to secure casings,
- Drilling and completion procedures,
- Subsequent remedial work done to repair or enhance cement placement behind casings,
- Results of testing the annular space between surface casings and production casings,
- Cumulative production, and
- Proximities of the gas wells to domestic water wells within the areas investigated.

The report does not specifically address the influence of regional geology and hydrology of the Pavillion area on potential fluid migration pathways.

The report also identifies areas where specific information is lacking, and recommends additional action required to further evaluate and understand the relationships and connectivity that may exist between gas wells and domestic water wells in the Pavillion Field.

Primary data sources include all available technical well information on file with the Wyoming Oil and Gas Conservation Commission in Casper, Wyoming, water well information from the Wyoming State Engineer's Office (SEO) in Cheyenne, Wyoming, water well information from the Wyoming Department of Environmental Quality in Cheyenne, technical information from the U.S. Environmental Protection Agency Region VIII (EPA) in Denver, Colorado, Wind River Indian Reservation Tribal well information and files, administered by the U.S. Bureau of Land Management in Lander, Wyoming, and additional information provided by Encana Oil and Gas USA, Inc. from their records in Denver, Colorado and Riverton, Wyoming.

SUMMARY OF RESULTS

General Well Summary:

1. This report reviewed fifty (50) Pavillion Field gas well completions located in Sections 2-4 and 9-13 of T3N, R2E. These wells are located within approximately one-quarter mile (1,320') of fourteen (14) domestic water wells identified by the Wyoming Department of Environmental Quality as having quality and palatability issues and were reviewed by the Wyoming Oil and Gas Conservation Commission to evaluate wellbore integrity. Of the fifty wells reviewed, forty two of the wells were completed in the Wind River and/or Fort Union Formation with completion attempts ranging in depth from 699' in the Tribal Pavillion 44-3 (SESE Section 3) to 5,812' in the Tribal Pavillion 23-10 (NESW Section 10), and eight wells are permanently plugged and abandoned.

2. The domestic water wells reviewed in the report were completed at depths ranging from 30' (PGDW33) to 750' (PGDW44), and all wells are within the accepted boundaries of the Pavillion Field. The Wyoming State Engineer's Office has on file approved applications and records for seven (7) of these water wells: PGDW05 (SWSW Section 2), PGDW23 (NESE Section 10), PGDW32 (NWNW Section 13), PGDW33 (SWNW Section 13), PGDW41 (NWSW Section 3), PGDW42 (NWNE Section 9), and PGDW44 (NWSE Section 10).

3. Eight (8) gas wells have been permanently plugged and abandoned. Seven of these wells were drilled between 1953 and 1981, and one well was drilled in 1999. These wells all had surface or intermediate casings cemented to the surface and set deeper than reported depths of the nearest domestic water wells and were plugged between 1954 and 1999 in accordance with state and/or federal plugging guidelines. These guidelines required, among other things, the isolation of potential gas zones from domestic water sources. Plugging consisted of cement squeeze jobs through casing perforations and casing annuli, cement plugs inside casing, and/or mechanical plugs set above producing intervals.

4. Surface distance between gas wells within the areas of interest and the nearest identified domestic water well ranged from 252' between the Tribal Pavillion 32-10C (SWNE Section 10) and PGDW14 (SWNE Section 10) to 1,408' between the Tribal Pavillion 23-10 (NESW Section 10) and PGDW44 (NWSE Section 10). Vertical distance from the top of currently producing perforations in the gas wells to the reported bottom of the nearest domestic water well ranged from 882' between the Tribal Pavillion 33-10B (NWSE Section 10) and PGDW44 (NWSE Section 10) to 5,103' between the Tribal Pavillion 32-10 (SENW Section 10) and PGDW14 (SWNE Section 10), and the calculated direct (angular) distance from the top of currently producing perforation in the gas wells to the reported bottom of the nearest domestic water well ranged from 1,122' between the Tribal Pavillion 33-10B and PGDW44 to 5,155' between the Tribal Pavillion 32-10 and PGDW14.

5. Review of available records for the gas wells determined that all wells were properly permitted, drilled, completed, and operated in compliance with applicable State and/or federal rules and regulations, and in accordance with accepted industry standards and practices.

Surface Casing Summary:

6. The surface casings used in the oil and gas well reviewed in this report were set at depths ranging from 221' KB in the Govt. Tribal 33X-10 (NWSE Section 10) to 911' KB in the W.E. Lloyd 1 (SWSE Section 3). All surface casings were cemented from setting depth to the surface.

7. Of the domestic water wells reviewed in this report, three water wells were drilled to a depth deeper than the surface casing depths of oil and gas wells in the surrounding one quarter mile area. These include ten (10) oil and gas wells located within one-quarter mile from PGDW44 (including the Tribal Pavillion 23-10, Tribal Pavillion 23-10B, Tribal Pavillion 23-10C, Tribal Pavillion 32-10, Tribal Pavillion 32-10B, Tribal Pavillion 32-10C, Tribal Pavillion 33-10, Tribal Pavillion 33-10B, Tribal Pavillion 33-10W, and Govt. Tribal 33X-10)), three (3) oil and gas wells within one-quarter mile from LD02 (including the Pavillion Fee 13-12, Unit 22-12, and Pavillion Fee 23-12)), and two (2) oil and gas wells within one-quarter mile from PGDW32 (including the Tribal Pavillion 12-13 and Pavillion Fee 21-13).

Production Casing Summary:

8. Drilling mud displaced by the cement slurry prior to cementing production casings ranged from 8.6 pounds per gallon to 9.6 pounds per gallon for wells drilled after 1973. These mud weights are typical for controlling normally pressured formations. Eight wells drilled prior to 1982 used a diesel oil-based "invert" mud system below surface casing. These were the Tribal 14-2 (SWSW Section 2), Blankenship 4-8 (SENE Section 4), Tribal 21-9 (NENW Section 9), Maxson 32-9 (SWNE Section 9), USA Tribal 22-10 (SENW Section 10), Unit 41X-10 (NENE Section 10), Unit 44-10 (SESE Section 10), and Unit 22-12 (SENW Section 10).

9. Production casings were set and cemented through the Wind River and Fort Union Formations at KB depths ranging from 3,180' in the Pavillion Fee 41-10 (NENE Section 10) to 6,482' in the Pavillion Unit 12-11 (SWNW Section 11). Cement weights used on production casing vary in the wells reviewed from 9.5 pounds per gallon to 15.8 pounds per gallon.

10. Cement bond logs were run on all wells drilled after 1971 to determine actual cement top and adequacy of the cement placement behind the production casings. None of the cement bond logs reviewed was run under pressure. Nineteen wells showed primary cement rose to a height insufficient to reach the base of the surface casing. Cement bond logs of interest referenced in completion records for four of the 50 wells reviewed were not located in WOGCC files, BLM Tribal files, or Encana well records. These wells are the Tribal 14-2 (SWSW Section 2) drilled in 1981, Tribal Pavillion 43-10 (NESE Section 10) drilled in 1994, Unit 22-12 (SENW Section 12) drilled in 1980, and Tribal Pavillion 12-13 (SWNW Section 13) drilled in 1979.

11. Ten wells within the areas of review were identified as having supplemental cement "squeeze" jobs performed after primary cementing to place additional cement behind the production casing. These include the Tribal 14-2 (SWSW Section 2), Tribal Pavillion 24-2 (SESW Section 2), Tribal Pavillion 44-3 (SESE

Section 3), Blankenship 4-8 (SENE Section 4), Pavillion Fee 31-10B (NWNE Section 10), Tribal 42-10 (SENE Section 10), Tribal Pavillion 43-10B (NESE Section 10), Pavillion Fee 11-11 (NWNW Section 11), Pavillion Fee 12-11B (SWNW Section 11), and Pavillion Fee 12-11W (SWNW Section 11).

12. All completed wells were selectively perforated in the production casing opposite potentially productive Fort Union and/or Wind River Sands. Most intervals were hydraulic fracture treated using carbon dioxide energized gelled water and sand. Productive intervals were then down-hole commingled, and produced up tubing.

Mechanical Integrity Summary:

13. Mechanical integrity tests of the production casing were performed on five wells witnessed by WOGCC, and all passed satisfactorily, with no observed pressure bleed-off. Wells MIT tested were the Blankenship 4-8 (SENE Section 4), Tribal Pavillion 23-10 (NESW Section 10), Pavillion Fee 31-10 (NWNE Section 10), Pavillion Fee 41-10B (NENE Section 10), and Pavillion Fee 12-11W (SWNW Section 10). All wells were tested to 500 psig except the Blankenship 4-8, which was tested to 300 psig due to its inactive status.

Bradenhead Testing Summary:

14. Bradenhead testing of the annuli between the production casing and surface casing of 41 wells within the areas of review were performed between 2011 and 2013 by Encana. Twenty five wells tested measured zero annulus pressure, and five tested wells had pressure that when bled off did not re-build. Annulus pressures were observed on 11wells that, when bled off, re-charged over a few days. Tubing and bradenhead gas samples were taken and analyzed for ten of these wells: Pavillion Fee 13-3W (NWSW Section 3), Pavillion Fee 43-4 (NESE Section 4), Pavillion Fee 44-4 (SESE Section 4), Pavillion Fee 31-10 (NWNE Section 10), Tribal Pavillion 32-10C (SWNE Section 10), Pavillion Fee 41-10B (NENE Section 10), Tribal Pavillion 42-10B (SENE Section 10), Unit 44-10 (SESE Section 10), Pavillion Unit 12-11 (SWNW Section 11), and Pavillion Fee 12-11W (SWNW Section 11). Water samples were also taken and analyzed for two of the wells that flowed water from the bradenhead, Unit 44-10 and Pavillion Fee 12-11W.

15. Bradenhead pressure reoccurred after bleed-off in six wells that showed the top of cement to be above surface casing setting depth. These six wells were the Pavillion Fee 13-3W (NWSW Section 3), Pavillion Fee 43-4 (NESE Section 4), Pavillion 44-4 (SESE Section 4), Tribal Pavillion 32-10C (SWNE Section 10), Pavillion Fee 41-10B (NENE Section 10), and Tribal Pavillion 42-10B (SENE Section 10). Six wells where cement bond logs showed the cement top behind production casing to be below the base of the surface casing reported no recurring pressure on the bradenhead. These were: USA Tribal 22-10 (SWNW Section 10), Tribal Pavillion 23-10 (NESW Section 10), Tribal Pavillion 23-10B (NESW Section 10), Tribal Pavillion 33-10 (NWSE Section 10), Pavillion Fee 13-12 (NWSW Section 12), and Pavillion Fee 21-13 (NENW Section 13).

16. Analysis of gas samples taken during bradenhead testing indicates a different gas composition between the bradenhead gas and the gas produced from the Wind River/Fort Union formations.

PRINCIPAL CONCLUSIONS

1. Information is lacking or unverified regarding construction details of the domestic water wells. Of the fifteen water wells reviewed in this report, seven wells have no water well permit filed with the Office of the State Engineer and two water wells were drilled many years prior to the filing of the well permit. Missing or questionable data includes information concerning date drilled, total depth, water zone(s) penetrated, casing size and type, cementing procedures, producing depth, pump setting depth, and any other information that might prove to be beneficial in determining possible relationships to, and impacts from, surrounding gas wells.

2. Several domestic water wells within the Pavillion Field are completed in Wind River Formation sands, which are known to contain both water and natural gas. Gas bearing zones were observed as shallow as 699' and domestic water wells are reported as deep as 750'. Because of this geologic condition, it is difficult to ascertain correlations between the gas well surface casing depths and domestic water sources. 30% of the gas wells reviewed reported surface casing set shallower than the depth of three nearby domestic water wells.

3. Wind River and Fort Union sands appear to be normally or under-pressured, at the time of drilling based on drilling records and reported mud weights.

4. The height of cement behind production casing does not by itself determine if gas or other fluids migrate behind casing within the Pavillion Field. The presence or absence of cement is only one of several factors to be considered in determining if a potential pathway exists behind the casing that could allow migration upward or downward. Other factors include hydrostatic pressure differentials, formation rock properties (permeability and porosity), gas/water contacts, location with respect to other wells, geologic and hydrologic environment, and drilling mud characteristics. Hydrostatic pressure from fluids behind the casing can create a hydraulic seal that prevents migration of fluids between formations until or unless the pressure in one of the formations is great enough to displace the liquids in the wellbore annulus. No evidence was found indicating this formation pressure differential condition is present in the Pavillion Field.

5. Permanently plugged and abandoned gas wells within the Areas of Review drilled between 1953 and 1999 were plugged in accordance with state and/or federal plugging guidelines and adequately isolate potential gas zones from domestic water sources.

6. The casing and tubing pressures observed during bradenhead testing of the annular space between the production casing and surface casing showed no indication of casing or wellhead leaks that would result in pressure communication. Of the wells with recurring bradenhead pressure where samples were analyzed, there was enough variance in chemical composition between produced gas from intervals perforated in the Fort Union and/or Wind River Formations, and bradenhead gas to conclude the bradenhead (annulus) gas likely did not result from behind-the-pipe migration of gas from the producing intervals, but rather from shallow gas bearing Wind River Sands penetrated after surface casing was set.

RECOMMENDATIONS FOR FURTHER ACTION

The Wyoming Oil and Gas Conservation Commission recommends the following additional action as a result of this review.

1. Accurate information regarding water well depths and water well construction will be necessary before a full analysis of aquifer impacts due to oil and gas development can be completed. To help gather this information, the State Engineer's Office, in conjunction with the Wyoming Oil and Gas Conservation Commission and Wyoming Department of Environmental Quality should obtain current, reliable domestic water well data, including date drilled, total depth, water zone(s) penetrated, casing size and type, cementing procedures, producing depth, pump setting depth, and any other information that might prove to be beneficial in determining possible relationships to, and impacts from, surrounding gas wells. This information should be obtained through direct measurement or from written well records when possible. Wells of particular concern are: PGDW23, PGDW44, and LD02.

2. A comprehensive geologic and hydrologic study of the Wind River Formation within the Pavillion Field should be undertaken using all available well logs, cores, and other pertinent data in order to better understand the structural and stratigraphic relationship between individual reservoirs, and to more accurately predict natural fluid flow pathways. This work could be done in partnership with the Wyoming Oil and Gas Conservation Commission, Wyoming State Geological Survey, United States Geological Survey, and the field operator, Encana Oil and Gas USA, Inc.

3. Producing well operators should monitor and bleed off on a quarterly basis the bradenhead pressure of all gas wells with reported positive bradenhead pressure. These results should be reported to the Wyoming Oil and Gas Conservation Commission for possible further remediation action. The results should include information regarding any changes in well bore tubing and casing pressures observed during bradenhead testing.

4. Producing well operators should obtain and submit to the Wyoming Oil and Gas Conservation Commission cement bond logs for gas wells Tribal 14-2, Tribal Pavillion 43-10, and Unit 22-12.

5. Producing well operators should perform Mechanical Integrity Tests on all gas wells with recurring bradenhead pressure not previously tested, and report results to the Wyoming Oil and Gas Conservation Commission for possible further remediation action. This would include Pavillion Fee 13-3W, Pavillion Fee 43-4, Pavillion Fee 44-4, Tribal Pavillion 32-10C, Tribal Pavillion 42-10B, Unit 44-10, and Pavillion Unit 12-11.

6. Producing well operators should provide the Wyoming Oil and Gas Conservation Commission with all available stimulation treatment records for all Pavillion wells. This would include detailed fluid descriptions and water sources, treatment schedules, pressures monitored during the treatments, and flow-back data for each

interval treated. Many records currently on file consist only of job summaries, hindering efforts to identify treatment anomalies.

7. Consideration should be given to installing groundwater monitor wells around selected domestic water wells to better understand fluid characteristics and groundwater flow patterns. This work could be done in partnership with the Wyoming Oil and Gas Conservation Commission, State Engineer's Office and Wyoming Department of Environmental Quality. Specific areas of notable concern are:

- PGDW41, offset by three gas wells with recurring bradenhead pressure,
- PGDW30, offset by two gas wells with recurring bradenhead pressure,
- PGDW44, offset by ten gas wells with surface casing set shallower than the reported depth of the water well, and
- LD02, offset by three gas wells with surface casing set shallower than the reported depth of the water well.

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

API	American Petroleum Institute
APD	Application for Permit to Drill
BBL	Barrel (42 U.S. gallons)
BLM	U.S. Bureau of Land Management
BO	Barrel of oil
BTU	British thermal unit (heat content of natural gas)
BW	Barrel of water
CBL	Cement bond log
CSG	Casing
CO2/CO_2	Carbon Dioxide
DV	Differential Valve (for multiple stage casing cementing)
EPA	U.S. Environmental Protection Agency
FEL	From east line of Section
FNL	From north line of Section
FSL	From south line of Section
FWL	From west line of Section
FU	Fort Union Geologic Formation
GL	Ground level
HCl	Hydrochloric acid
HLC	Halliburton Lite Cement (trade name)
KB	Kelly Bushing
KCL	Potassium Chloride
LSND	Low solids non-dispersed water-based drilling fluid
MCF	Thousand cubic feet
MIT	Mechanical Integrity Test
NA	Not applicable
NE	Northeast
NR	Not reported
NW	Northwest
N2/N_2	Nitrogen
OD	Outside diameter
PPG	Pounds per gallon
PSI/PSIG	Pounds per square inch / pounds per square inch gauge
PVC	Polyvinyl chloride (“plastic” pipe)
SE	Southeast
SEO	Wyoming State Engineer’s Office
SKS	Sacks (94 pounds of dry cement)
SQZ	Squeeze
SW	Southwest
TBG	Tubing
TD	Total depth
TOC	Top of cement
WDEQ	Wyoming Department of Environmental Quality
WOGCC	Wyoming Oil and Gas Conservation Commission
WR	Wind River Geologic Formation

DISCUSSION

Areas of Review

Wells selected for review include all Pavillion Field gas wells determined to be within one-quarter mile of the fourteen domestic water wells identified by the WDEQ as having quality and palatability issues.

These domestic water wells are referenced as PGDW05, PGDW14, PGDW20, PGDW21, PGDW23, PGDW30, PGDW32, PGDW33, PGDW41, PGDW42, PGDW44, PGDW45, PGDW49, and LD02. Water well ownership, location, available construction details, and SEO permit status are summarized in **Table 1**.

TABLE 1
PAVILLION FIELD DOMESTIC WATER WELLS
TOWNSHIP 3N, RANGE 2E
FREMONT COUNTY, WYOMING
IDENTIFIED BY WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY

		LOCATION						SEO Permit [3]			Year
Well ID [1]	Owner	Qtr/Qtr	Sec	Latitude [1]	Longitude [1]	Approximate Footage [2]	Depth [1]	U.W.	Depth	File Date	Completed
PGDW05	Meeks	SWSW	2	43.25884666	-108.6126481	226 ' FSL 1,509 ' FWL	210'	32161	210'	1/2/1976	1973
PGDW14	Griffin	SWNE	10	43.25154027	-108.6273311	2,414 ' FNL 2,368 ' FEL	190'	No permit on file			?
PGDW20	Locker	SENW	12	43.25166961	-108.5912756	2,142 ' FNL 1,810 ' FWL	460'	No permit on file			?
PGDW21	Locker	SENW	12	43.25167095	-108.5912762	2,384 ' FNL 1,916 ' FWL	460'	No permit on file			?
LD-02[4]	Locker	SENW	12	43.25167095	-108.5912762	2,384 ' FNL 1,916 ' FEL	610'	No permit on file			?
PGDW23	Fenton	NESE	10	43.24866472	-108.6225943	1,810 ' FSL 1,101 ' FEL	500'	24508	175'	8/31/1973	1964
PGDW30	Randall	NENE	10	43.25753218	-108.6225755	302 ' FNL 1,147 ' FEL	260'	No permit on file			?
PGDW32	Dennis	NWNW	13	43.24075256	-108.5941561	1,011 ' FNL 1,267 ' FWL	674'	64110	675'	9/2/1983	1983
PGDW33	Dennis	SWNW	13	43.23855522	-108.5964146	1,901 ' FNL 558 ' FWL	30'	22662	30'	12/28/1972	1934
PGDW41	Faris/Capps	NWSW	3	43.262146	-108.6378479	1,448 ' FSL 91 ' FWL	376'	66345	70'	6/30/1984	1984
PGDW42	Steele	NWNE	9	43.25574493	-108.647316	784 ' FNL 2,429 ' FEL	200'	41517	200'	2/21/1981	1981
PGDW44	Griffin	NWSE	10	43.25086975	-108.6261292	2,625 ' FSL 2,052 ' FEL	750'	24506	750'	8/31/1973	1932
PGDW45	Meeks	SWSW	2	43.25888062	-108.6130142	256 ' FSL 1,403 ' FWL	100'[5]	No permit on file			?
PGDW49	Meeks	NWNW	11	43.25505829	-108.6178741	1,116 ' FNL 151 ' FWL	50[5]	No permit on file			?
N/A	Meeks	SWSW	2				550'	170310	700'	12/31/2014[6]	

[1] From EPA December 2011 Draft Report, Investigation of Ground Water Contamination near Pavillion, Wyoming
[2] Estimated from mapping
[3] Wyoming State Engineer's Office
[4] Location reported the same as PGDW21
[5] From WDEQ
[6] SEO authorized completion date extension. See PGDW05 write-up for detail

In order to account for potential inaccuracies in distance determinations, gas wells reported to be within 100 feet beyond this one-quarter mile (1,320') boundary were also included in the review. **Figures 2-5** are maps depicting each domestic water well's reported location and the location of the gas wells within the reviewed area.

Drilling and completion records, and other pertinent information available from the WOGCC, Bureau of Land Management (BLM), and Encana for fifty (50) gas wells located in the Pavillion Field in Sections 2-4, and 9-13 of T3N, R2E, Fremont County, Wyoming were evaluated. Well records include completion reports and sundry notices filed with the WOGCC and/or BLM, daily drilling and completion report summaries, cementing records, cement bond logs, wellbore diagrams, and other pertinent information.

Gas Well Identification and Location

Gas wells reviewed are shown on **Table 2**. Also shown on Table 2 are the individual API (American Petroleum Institute) identification number assigned, leasehold mineral ownership, surface location, ground elevation, depth reference elevation (KB), completion date, total depth, and cumulative oil (condensate), gas and water production reported through April 2014 for each well reviewed.

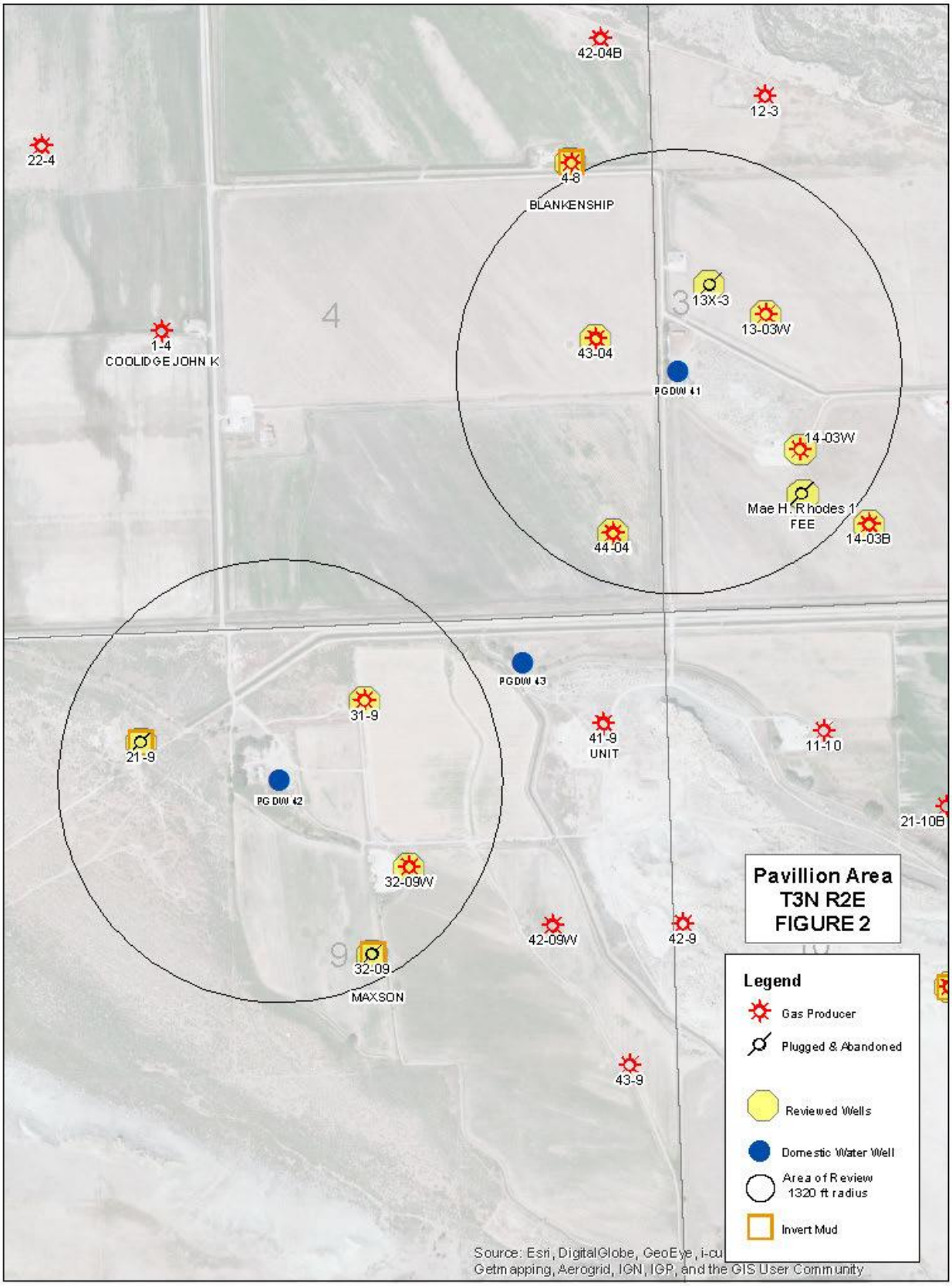
Drilling of these wells occurred during the following time periods:

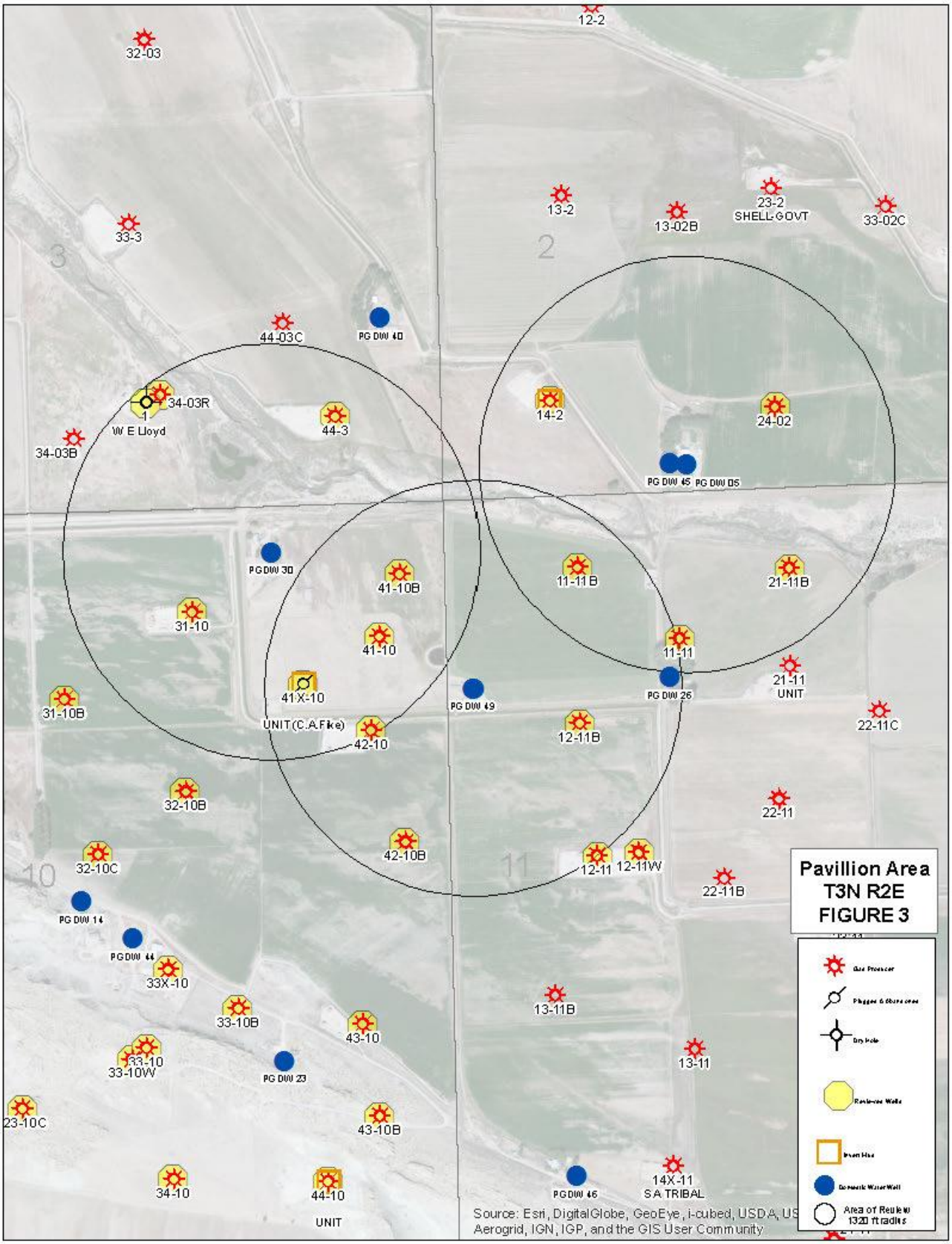
Year Range	Wells Drilled
1953 – 1981	12
1993 – 1994	5
1999 – 2002	18
2004 – 2005	15
Total	**50**

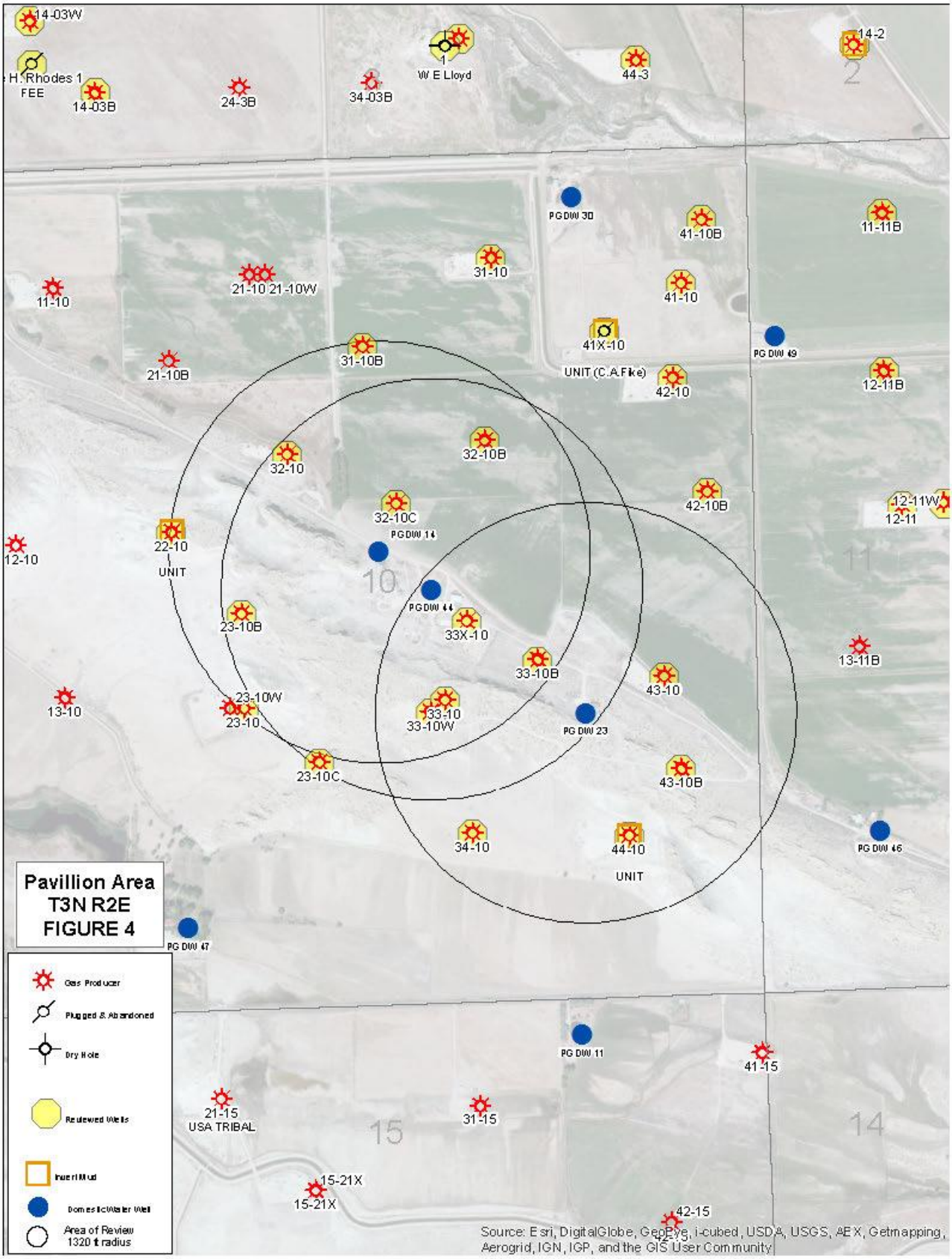
Shell Oil Company received WOGCC approval in December 1963 to develop the Pavillion Field on 640 acre well spacing (Docket 39-63). Shell drilled nine of the reviewed wells between 1965 and 1981, and operated the Pavillion Field until June 1986 when operatorship was assumed by Tom Brown, Inc. Tom Brown, Inc. received approval from the WOGCC in October 2000 to increase well density within most of the Pavillion Field to sixteen Fort Union wells per section and sixteen Wind River wells per section (Docket 454-2000). Tom Brown, Inc. drilled 27 wells within the areas of review between 1993 and 2004 prior to being purchased by Encana Oil & Gas (USA) Inc. In April 2002 the WOGCC authorized down-hole commingling of the Wind River and Fort Union Formations (Docket 128-2002). Encana, the current operator, drilled 11 additional wells within the areas of review since assuming operations January 1, 2005. Three wells reviewed were drilled by Gulf Oil (1953), Hickerson Oil Company (1971), and Palmer Oil Company (1977).

Of the 50 wells reviewed, 25 are located on Tribal mineral leases and 25 are located on fee (patented) mineral leases. As of April 2014, 40 of the wells reviewed remain as active producers, two wells are shut in, and eight wells have been permanently plugged and abandoned.

All wells drilled since 1973 were drilled and completed in the Tertiary Paleocene Fort Union and/or Tertiary Eocene Wind River Formations at depths ranging from 3,180' to 6,452'. The deepest well drilled, Gov't. Tribal 33X-10 (NWSE Section 10), was drilled in 1964 by Shell Oil Company as a 19,235' Madison test. After testing the Madison and Frontier Formations, the well was plugged back and completed in the Wind River Formation in 1965. It was permanently plugged and abandoned in 1981.


42-04B
12-3
22-4
4-8
BLANKENSHIP
13X-3
13-03W
4
3
1-4
COOLIDGE JOHN K
43-04
PGDW 41
14-03W
Mae H. Rhodes 1
FEE
14-03B
44-04
PGDW 43
31-9
41-9
UNIT
11-10
21-9
PG DW 42
21-10B
32-09W
42-09W
42-9
9
32-09
MAXSON
43-9
Pavillion Area
T3N R2E
FIGURE 2
Legend
Gas Producer
Plugged & Abandoned
Reviewed Wells
Domestic Water Well
Area of Review
1320 ft radius
Invert Mud
Source: Esri, DigitalGlobe, GeoEye, i-cu
Getmapping, Aerogrid, IGN, IGP, and the GIS User Community


Pavillion Area
T3N R2E
FIGURE 3
12-2
32-03
13-2
13-02B
23-2
SHELL-GOVT
33-02C
33-3
3
2
44-03C
PG DW 40
34-03R
W E Lloyd
44-3
34-03B
14-2
24-02
PG DW 45
PG DW 05
PG DW 30
41-10B
11-11B
21-11B
31-10
41-10
11-11
21-11
UNIT
41-X-10
UNIT (C.A.Fike)
PG DW 49
PG DW 26
31-10B
42-10
12-11B
22-11C
32-10B
22-11
42-10B
12-11
12-11W
22-11B
10
11
32-10C
PG DW 14
PG DW 44
33X-10
13-11B
33-10B
43-10
33-10
33-10W
PG DW 23
13-11
23-10C
43-10B
34-10
44-10
UNIT
PG DW 46
14X-11
SA TRIBAL
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, US
Aerogrid, IGN, IGP, and the GIS User Community


Pavillion Area
T3N R2E
FIGURE 4
Gas Producer
Plugged & Abandoned
Dry Hole
Reviewed Wells
Inactive Well
Domestic Water Well
Area of Review
1320 ft radius
14-03W
H. Rhodes 1
FEE
14-03B
24-3B
34-03B
1
W E Lloyd
44-3
14-2
2
PG DW 30
41-10B
11-11B
31-10
21-10 21-10W
11-10
41-10
41X-10
UNIT (C.A.Fike)
PG DW 49
21-10B
31-10B
42-10
12-11B
32-10
32-10B
42-10B
12-11W
12-11
32-10C
PG DW 14
22-10
UNIT
12-10
10
11
PG DW 44
23-10B
33X-10
13-11B
33-10B
43-10
13-10
23-10W
23-10
33-10
33-10W
PG DW 23
23-10C
43-10B
34-10
44-10
UNIT
PG DW 46
PG DW 47
PG DW 11
41-15
21-15
USA TRIBAL
31-15
15
14
15-21X
15-21X
42-15
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

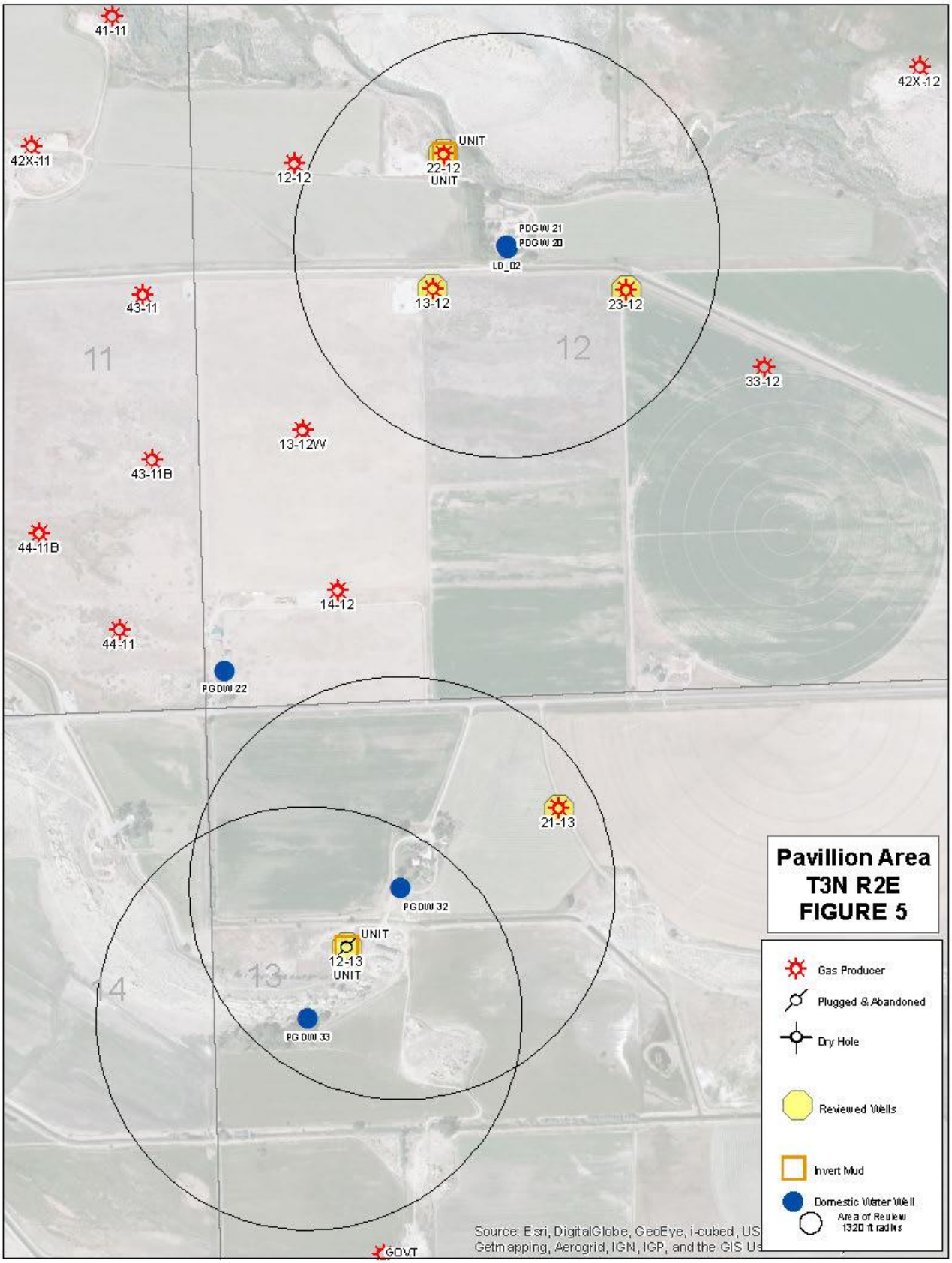

41-11
42X-12
42X-11
12-12
UNIT
22-12
UNIT
PDGW 21
PDGW 20
LD_02
13-12
23-12
43-11
11
12
33-12
13-12W
43-11B
44-11B
14-12
44-11
PGDW 22
21-13
PGDW 32
UNIT
12-13
UNIT
13
14
PGDW 33
GOVT
Pavillion Area
T3N R2E
FIGURE 5
Gas Producer
Plugged & Abandoned
Dry Hole
Reviewed Wells
Invert Mud
Domestic Water Well
Area of Review
1320 ft radius
Source: Esri, DigitalGlobe, GeoEye, i-cubed, US
Getmapping, Aerogrid, IGN, IGP, and the GIS Us

TABLE 2
PAVILLION FIELD GAS WELL LOCATIONS AND PRODUCTION
WITHIN WDEQ AREAS OF REVIEW

			Location						Completion			Cumulative Production[1]			
API #	Well Name	Mineral Ownership	Qtr/Qtr	Footage Location	Latitude	Longitude	Ground Elev., ft.	KB-GL, ft.[2]	Operator	Date	Total Depth	Well Status	BO	MCF	BW
Section 2 T3N R2E															
1321128	Tribal 14-2	Tribal	SWSW	682' FSL, 552' FWL	43.260210	-108.615830	5,368	15	Shell Oil Co.	5/28/81	5,175	Active	0	3,327,283	44
1322236	Tribal Pavillion 24-2	Tribal	SESW	592' FSL, 1980' FWL	43.259890	-108.610972	5,368	10	Tom Brown, Inc.	11/4/04	3,942	Active	0	475,693	174
Section 3 T3N R2E															
1322246	Pavillion Fee 13-3W	Fee	NWSW	1735' FSL, 472' FWL	43.262920	-108.636417	5,398	10	Encana O&G (USA) Inc.	4/23/05	4,602	Active	3	243,427	1,340
1321904	Pavillion Fee 13X-3	Fee	NWSW	1934' FSL, 152' FWL	43.263330	-108.634170	5,350	13	Tom Brown, Inc.	10/21/99	6,044	Plugged	0	0	0
1322623	Pavillion Fee 14-3B	Fee	SWSW	466' FSL, 1050' FWL	43.259440	-108.634250	5,389	10	Encana O&G (USA) Inc.	4/5/05	3,934	Active	5	1,129,901	1,901
1322219	Pavillion Fee 14-3W	Fee	SWSW	931' FSL, 654' FWL	43.260720	-108.635750	5,396	10	Tom Brown, Inc.	4/13/02	5,700	Active	3	3,532,722	5,687
1322087	Pavillion Fee 34-3R	Fee	SWSE	725' FSL, 1954' FEL	43.260280	-108.625278	5,376	12	Tom Brown, Inc.	5/4/01	3,400	Active	2	855,616	1,153
1321906	Tribal Pavillion 44-3	Tribal	SESE	550' FSL, 850' FEL	43.259440	-108.621110	5,377	13	Tom Brown, Inc.	6/21/99	6,009	Active	1	1,506,355	1,663
1320298	W.E. Lloyd 1	Fee	SWSE	660' FSL, 1980' FEL	43.260110	-108.625280	5,378	13	Hickerson Oil Co.	6/14/71	15,575	Plugged	0	0	0
1306388	Mae H. Rhodes 1	Fee	SWSW	660' FSL, 660' FWL	43.260090	-108.635190	5,387	12	Gulf Oil Corp.	12/31/53	11,000	Plugged	0	0	0
Section 4 T3N R2E															
1322633	Pavillion Fee 43-4	Fee	NESE	1630' FSL, 541' FEL	43.262610	-108.640222	5,399	10	Encana O&G (USA) Inc.	4/2/05	4,744	Active	44	389,582	19,681
1322634	Pavillion Fee 44-4	Fee	SESE	470' FSL, 470' FEL	43.259440	-108.639944	5,394	10	Encana O&G (USA) Inc.	3/15/05	5,700	Active	1,265	173,288	26,707
1320668	Blankenship 4-8	Fee	SENE	2525' FNL, 660' FEL	43.265560	-108.640090	5,404	11	Palmer Oil & Gas	3/25/77	5,204	Shut in	365	6,966,244	65,784
Section 9 T3N R2E															
1321130	Tribal 21-9	Tribal	NENW	660' FNL, 1979' FWL	43.256390	-108.650110	5,390	15	Shell Oil Co.	6/24/81	5,304	Plugged	0	271,143	11
1322172	Pavillion Fee 31-9	Fee	NWNE	465' FNL, 1975' FEL	43.256860	-108.644861	5,399	10	Tom Brown, Inc.	11/8/01	3,445	Active	2	426,670	1,346
1320084	Maxson 32-9	Fee	SWNE	1980' FNL, 1980' FEL	43.252780	-108.645110	5,390	11	Shell Oil Co.	5/27/68	3,511	Plugged	0	0	0
1322227	Pavillion Fee 32-9W	Fee	SWNE	1468' FNL, 1737' FEL	43.254080	-108.644722	5,398	10	Tom Brown, Inc.	3/22/02	3,460	Active	2	495,104	1,380
Section 10 T3N R2E															
1320876	USA Tribal 22-10	Tribal	SENW	2305' FNL, 1444' FWL	43.251940	-108.632220	5,408	14	Shell Oil Co.	10/13/79	5,152	Active	2	6,341,009	1,363
1321692	Tribal Pavillion 23-10	Tribal	NESW	1879' FSL, 1863' FWL	43.248890	-108.630680	5,406	15	Tom Brown, Inc.	7/14/94	6,000	Shut in	7	1,939,835	112,463
1322417	Tribal Pavillion 23-10B	Tribal	NESW	2474' FSL, 1866' FWL	43.250470	-108.631222	5,410	10	Tom Brown, Inc.	11/5/04	5,646	Active	6	1,692,683	4,620
1322418	Tribal Pavillion 23-10C	Tribal	NESW	1528' FSL, 2326' FWL	43.247890	-108.629472	5,433	10	Tom Brown, Inc.	10/13/04	5,730	Active	6	764,919	4,549
1321691	Pavillion Fee 31-10	Fee	NWNE	660' FNL, 1786' FEL	43.256330	-108.624600	5,372	15	Tom Brown, Inc.	6/25/94	5,972	Active	1,412	4,269,156	15,504
1322268	Pavillion Fee 31-10B	Fee	NWNE	1185' FNL, 2605' FEL	43.254940	-108.628222	5,378	10	Encana O&G (USA) Inc.	1/23/05	5,555	Active	2,570	243,516	14,008
1321968	Tribal Pavillion 32-10	Tribal	SENW	1788' FNL, 2166' FWL	43.253300	-108.626000	5,387	13	Tom Brown, Inc.	5/10/00	5,593	Active	29	4,707,951	2,200
1322224	Tribal Pavillion 32-10B	Tribal	SWNE	1890' FNL, 1739' FEL	43.253280	-108.625389	5,374	10	Tom Brown, Inc.	3/28/02	5,850	Active	14	4,501,617	4,727
1322419	Tribal Pavillion 32-10C	Tribal	SWNE	2179' FNL, 2412' FEL	43.252220	-108.627500	5,381	10	Encana O&G (USA) Inc.	2/18/05	4,020	Active	8	315,995	7,099
1321862	Tribal Pavillion 33-10	Tribal	NWSE	1888' FSL, 2135' FEL	43.249170	-108.625560	5,470	13	Tom Brown, Inc.	5/6/99	5,970	Active	2	5,163,904	2,546
1322274	Tribal Pavillion 33-10B	Tribal	NWSE	2120' FSL, 1549' FEL	43.249530	-108.624278	5,395	10	Tom Brown, Inc.	12/14/04	5,610	Active	2	1,100,556	2,219
1322195	Tribal Pavillion 33-10W	Tribal	NWSE	1819' FSL, 2225' FEL	43.248690	-108.626806	5,473	10	Tom Brown, Inc.	12/6/01	5,070	Active	2	930,223	8,228
1306363	Govt Tribal 33X-10	Tribal	NWSE	2380' FSL, 1986' FEL	43.250190	-108.625280	5,391	24	Shell Oil Co.	5/11/65	19,235	Plugged	0	14,697,897	0
1322149	Tribal Pavillion 34-10	Tribal	SWSE	1050' FSL, 1980' FEL	43.246580	-108.625260	5,402	10	Tom Brown, Inc.	10/6/01	5,732	Active	5	3,092,923	4,816
1322198	Pavillion Fee 41-10	Fee	NENE	860' FNL, 660' FEL	43.255860	-108.620917	5,372	10	Tom Brown, Inc.	1/23/02	3,180	Active	0	939,858	157
1322624	Pavillion Fee 41-10B	Fee	NENE	465' FNL, 465' FEL	43.256940	-108.620167	5,371	10	Encana O&G (USA) Inc.	5/7/05	3,841	Active	0	284,408	293
1320414	Unit 41X-10	Tribal	NENE	1140' FNL, 1085' FEL	43.255110	-108.622010	5,366	10	Shell Oil Co.	1/29/73	5,047	Plugged	0	0	0

TABLE 2
PAVILLION FIELD GAS WELL LOCATIONS AND PRODUCTION
WITHIN WDEQ AREAS OF REVIEW

			Location						Completion			Cumulative Production[1]			
API #	Well Name	Mineral Ownership	Qtr/Qtr	Footage Location	Latitude	Longitude	Ground Elev., ft.	KB-GL, ft.[2]	Operator	Date	Total Depth	Well Status	BO	MCF	BW
Section 10 T3N R2E (continued)															
1321696	Tribal 42-10	Tribal	SENE	2100' FNL, 662' FEL	43.254540	-108.620440	5,368	15	Tom Brown, Inc.	6/15/94	5,995	Active	595	3,326,769	14,503
1322324	Tribal Pavillion 42-10B	Tribal	SENE	2172' FNL, 465' FEL	43.252190	-108.620194	5,366	10	Encana O&G (USA) Inc.	2/16/05	5,605	Active	0	957,773	2,882
1321704	Tribal Pavillion 43-10	Tribal	NESE	1996' FSL, 761' FEL	43.249250	-108.620760	5,378	15	Tom Brown, Inc.	9/21/94	5,956	Active	604	6,830,178	28,467
1322420	Tribal Pavillion 43-10B	Tribal	NESE	1410' FSL, 663' FEL	43.247610	-108.620944	5,439	10	Encana O&G (USA) Inc.	1/20/05	5,760	Active	2	524,410	2,606
1320879	Unit 44-10	Tribal	SESE	1000' FSL, 1000' FEL	43.246490	-108.621610	5,389	14	Shell Oil Co.	12/17/79	5,200	Active	2	4,515,619	1,751
Section 11 T3N R2E															
1322059	Pavillion Fee 11-11	Fee	NWNW	1136' FNL, 1274' FWL	43.255109	-108.613611	5,355	11	Tom Brown, Inc.	5/17/01	5,846	Active	0	820,286	9,051
1322220	Pavillion Fee 11-11B	Fee	NWNW	465' FNL, 665' FWL	43.256970	-108.615944	5,365	10	Tom Brown, Inc.	2/16/02	4,780	Active	4	775,677	13,056
1321669	Pavillion Unit 12-11	Fee	SWNW	2300' FNL, 750' FWL	43.252270	-108.614830	5,357	15	Tom Brown, Inc.	10/19/93	6,482	Active	229	5,706,151	8,451
1322272	Pavillion Fee 12-11B	Fee	SWNW	1457' FNL, 656' FWL	43.254220	-108.615972	5,362	9	Encana O&G (USA) Inc.	1/15/05	3,860	Active	0	354,281	731
1322102	Pavillion Fee 12-11W	Fee	SWNW	2292' FNL, 1014' FWL	43.251940	-108.615000	5,356	12	Tom Brown, Inc.	5/3/01	3,250	Active	0	851,732	460
1322586	Tribal Pavillion 21-11B	Tribal	NENW	481' FNL, 2000' FWL	43.256940	-108.610917	5,355	10	Encana O&G (USA) Inc.	4/19/05	3,875	Active	18	625,953	1,560
Section 12 T3N R2E															
1322060	Pavillion Fee 13-12	Fee	NWSW	2459' FSL, 1301' FWL	43.250830	-108.593056	5,323	12	Tom Brown, Inc.	6/1/01	3,275	Active	0	658,223	221
1320878	Unit 22-12	Tribal	SENW	1906' FNL, 1393' FWL	43.253060	-108.592690	5,324	14	Shell Oil Co.	1/17/80	5,200	Active	0	3,639,997	288
1322186	Pavillion Fee 23-12	Fee	NESW	2494' FSL, 2502' FWL	43.250720	-108.589167	5,323	10	Tom Brown, Inc.	9/19/01	3,260	Active	0	422,041	138
Section 13 T3N R2E															
1320855	Tribal Pavillion 12-13	Tribal	SWNW	1530' FNL, 660' FWL	43.239590	-108.595560	5,328	10	Shell Oil Co.	5/12/79	5,400	Plugged	0	1,043,834	18
1322057	Pavillion Fee 21-13	Fee	NENW	660' FNL, 1980' FWL	43.242179	-108.590496	5,315	12	Tom Brown, Inc.	2/23/01	3,500	Active	2	160,665	1,422

[1] Production reported through April 2014
[2] All depths measured from KB

Oil and Gas Drilling Methods

The methods used for oil and gas drilling in the Pavillion study area were standard procedures used in oil and gas development. All wells in the study area were constructed using two casing strings cemented using the pump and plug method. All wells in the study area were initiated by drilling through shallow aquifers to a depth of between 362' to 641'. Depths noted in this section and on the wellbore schematic are depths for active wells only. Several plugged and abandoned wells in the area were drilled to a deeper total depth and surface casing was set at a deeper or shallower depth than noted above. See summary point 7 for a full range of surface casing setting depths.

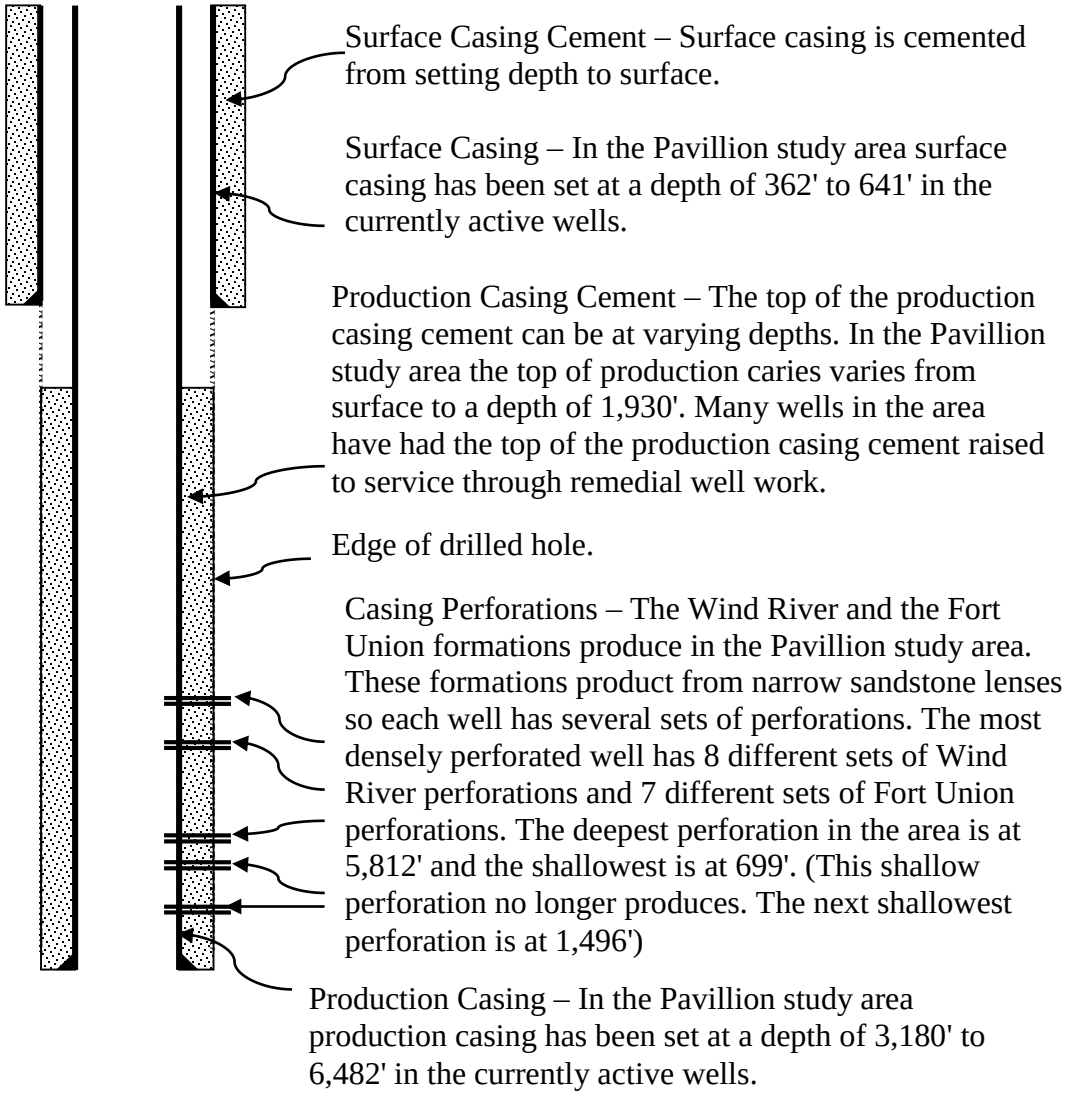
The first steel casing string (the surface casing string) was installed at this depth and cement was pumped down the inside of the surface casing and circulated up the outside of the casing between the casing and the drilled hole. Cement is pumped between the drilled hole and the casing to anchor the casing to the drilled rock and to seal the space between the casing and the drilled hole to prohibit the migration of oil, water, and gas from one formation to another.

After the surface casing was installed, drilling continued through and below the surface casing to the final depth of the well. A second string of casing (production casing) was installed at this depth. After the production casing was installed, cement was pumped down the casing and circulated between the outside of the casing and the drilled hole. This cement was occasionally brought all of the way to the surface but not always. In the Pavillion study area the cement often only covered the outside of the production casing from the final depth of the well to a height of approximately 1,000' to 2,000' when measured from the surface. In these cases, remedial cement work was often performed to cover the remaining production casing from the existing top of cement to the surface. The top of production casing cement can be located using a cement bond logs.

After production casing was set, the drilling rig was removed from the well site and a smaller completion rig was brought to the site to prepare the well for oil and gas production. In this phase, holes are blasted through the steel casing using explosive charges (known as perforating). Perforating the casing allows oil and gas from selected formations to enter the wellbore and be pumped to the surface. In the Pavillion study area two formations are hydrocarbon productive. These formations are the Wind River Formation and the Fort Union Formation. Although these formations are thousands of feet thick and contain different types of rock, only the sandstone portions of the formations were perforated. This means the perforated intervals in the wells were grouped into sets of perforations from 8' or 10' long to almost 200' long depending on the thickness of the sandstone interval. After the wells were perforated, they were stimulated using either hydrochloric acid or hydraulic fracturing. The majority, but not all, of these sandstone intervals were hydraulically fractured.

Figure 6 below is a schematic diagram of a well constructed in this manner. Although the schematic shows a well with the top of production casing cement below the surface casing setting depth, 17 wells in the Pavillion study area have cement tops of less than 300' from the surface. Detailed information concerning surface casing, production casing, cementing, and completions is included later in the report.

Wellbore Schematic
Figure 6



State Regulatory Requirements

Since its inception in 1951 resulting from passage of the ***Wyoming Oil and Gas Conservation Act***, the Wyoming Oil and Gas Conservation Commission has had in place rules to prohibit waste of oil and gas, and prohibit contamination of waters of the State by oil and gas wells located on all State and federal (including Tribal) lands.

WOGCC's requirements for operators to protect groundwater, since rules and regulations were first approved in 1951, have been:

> *"…sufficient surface casing shall be run to reach a depth below all known or reasonably estimated utilizable domestic fresh water levels…and shall be set in or through an impervious formation and shall be cemented…with sufficient cement to fill the annulus to the top of the hole, all in accordance to reasonable requirements of the Supervisor." (**August 1951 Rules and Regulations, Section 316(b)**)*

In September 2010, the Commission's rules were amended as follows:

> *"Surface casing shall be run to reach a depth below all known or reasonably estimated utilizable groundwater… to protect the Use Class category and to prevent blowouts or uncontrolled flows. Unless otherwise approved by the Supervisor, surface casing shall be set at a minimum of three (3) joints or approximately one hundred (100) to one hundred twenty (120) feet below the depth of any Wyoming Office of State Engineer permitted water supply wells designated for domestic, stock water, irrigation or municipal use, within a minimum of one-quarter (1/4) mile radius and shall be cemented to surface. Surface casing shall be…cemented…with sufficient cement to fill the annulus to the top of the hole, all in accordance with reasonable requirements of the Supervisor. The Supervisor may require the Owner or Operator to pump a specified quantity of excess cement above the design volume if severe washed out hole conditions are known to exist on the surface hole portion of wells in the immediate vicinity of the well to be drilled. If cement is not circulated to the surface during the primary operation, the Owner/Operator shall perform supplemental cementing operations to assure that the annular space from the casing shoe to the surface is filled with cement. The Supervisor may require the Owner or Operator to provide cased hole bond logs to be run for casing strings to demonstrate isolation from the placement of cement across and above the productive intervals or above the last casing shoe in the well, if there is a demonstrated reason to believe an inadequate cement job was performed." (**September 2010 Rules and Regulations, Chapter 3, Section 22(a)(i)**)*

Surface Casing

The surface casing is set to protect shallow groundwater and provide stabilization for blowout preventer equipment. Within the areas of review, surface casing setting depths range from the shallowest of 221' in the Govt. Tribal 33X-10 (NWSE Section 10) drilled in 1965, to the deepest at 911' in the W.E. Lloyd 1 (SWSE Section 3) drilled in 1971. With the exception of the W.E. Lloyd 1, where larger casing was set to allow for deeper drilling (discussed in detail below), the wells were drilled by setting and cementing either 7" or 8-5/8" O.D. (outside diameter) surface casing, and cementing with standard oilfield Class "G" cement.

All surface casings were cemented to the surface by pumping cement down the inside of the casing followed by water or "native mud" to displace the cement slurry up the outside of the casing. Four wells within the areas of review required "top jobs" (pumping cement from the surface down the outside of the casing) to fill the annular space after the initial (primary) cement dropped below surface after pumping ceased. Surface casing data and details, including size, weight (pounds per foot), grade of steel, and strength characteristics are shown on **Table 3** and **Table 3a**.

Drilling Fluid Systems

The drilling fluid ("mud") is designed to control fluid influx from drilled formations, maintain drilled hole stability, and aid in returning drilled cuttings to the surface for removal and analysis. All wells reviewed used a "native mud" (water supplemented with bentonite to increase viscosity) to drill the initial hole to surface casing setting depth. As a general practice, through 1981 Shell Oil Company drilled its wells from the base of the surface casing to total depth with a diesel based mud system (also referred to as an invert mud system) circulated to an unlined reserve pit at the drill site. Tom Brown, Inc. and Encana converted to a low solids, non-dispersed (LSND) water based mud system circulated to steel tanks (closed system) without the use of earthen reserve pits for drilling to total depth. Six of the Tom Brown wells were drilled with a water based potassium chloride (KCl) polymer system, also using steel tanks for drilling fluid returns.

Mud densities, reported as weight in pounds per gallon, are indicators of the hydrostatic pressure needed in the drilled wellbore to prevent formation fluids from entering the wellbore prior to installing and cementing the production casing. Normally pressured formations are considered those formations with fresh water pressure gradients of 8.34 pounds per gallon (0.433 psi/foot). Based on review of available drilling records, it appears the Wind River and Fort Union Sands penetrated in the Pavillion Field were normally pressured at the time of drilling. Wells drilled after 1973 reported mud weights ranging from 8.6 pounds per gallon pounds to 9.6 pounds per gallon. These mud weights are typical for controlling normally pressured formations.

The type of mud system used below surface casing and the mud weight reported during open-hole logging operations for each well reviewed are shown on Table 3.

Plugged and Abandoned Wells

Within the Areas of Review, eight (8) gas wells were identified as having been permanently plugged and abandoned. Seven of these wells, W.E. Lloyd 1 (SWSE Section 3), Mae H. Rhodes 1 (SWSW Section 3), Tribal 21-9 (NENW Section 9), Maxson 32-9 (SWNE Section 9), Gov't. Tribal 33X-10 (NWSE Section 10), Unit 41X-10 (NENE Section 10), and Tribal Pavillion 12-13 (SWNW Section 13) were drilled between 1953 and 1981, and one well, Pavillion Fee 13X-3 (NWSW Section 3) was drilled in 1999. All wells were plugged between 1954 and 1999 in accordance with state

and/or federal plugging guidelines in place to isolate potential gas zones from domestic water sources, and all had surface or intermediate casings cemented to the surface and set deeper than reported depths of the nearest domestic water wells. Plugging procedures are detailed in the individual Gas Well Summaries, and consisted of combinations of cement squeeze jobs through casing perforations and casing annuli, cement plugs inside casings, and/or mechanical plugs set above producing intervals.

TABLE 3
PAVILLION FIELD CASING AND CEMENTING DESCRIPTIONS
WITHIN WDEQ AREAS OF REVIEW

		SURFACE CASING			PRODUCTION CASING				
API#	Well Name	Casing Description	Depth, ft.	Cement Job Description (All jobs circulated cement to surface)	Mud System below surface casing	Mud Weight, #/gal[1]	Casing Description	Depth, ft.	Cementing Job Description
Section 2 T3N R2E									
1321128	Tribal 14-2	8-5/8" 24#	599	450 sks Class G	Oil base w/ pits	9.2	5-1/2" 15.5#/17#	5,170	800 sks Class G
1322236	Tribal Pavillion 24-2	7" 20# J-55	562	280 sks Class G	LSND, closed	9.0	4-1/2" 11.6# N-80	3,939	175 sks CemCrete
Section 3 T3N R2E									
1322246	Pavillion Fee 13-3W	7" 20# J-55	608	280 sks Class G	LSND, closed	8.9	4-1/2" 11.6# N-80	4,596	355 sks CemCrete (2.35 cf/sk, 9.5 ppg) 18 bbls returns to surface
1321904	Pavillion Fee 13X-3	8-5/8" 24# J-55	630	256 sks Class G	LSND, closed	9.5	5-1/2" 17# J-55	6,044	325 sks HLC (13 ppg, 1.69 cf/sk) & 545 sks 50/50 poz
1322623	Pavillion Fee 14-3B	7" 20# J-55	620	280 sks Class G	LSND, closed	9.0	4-1/2" 11.6# N-80	3,908	420 sks Cemcrete (2.35 cf/sk, 9.5 ppg)
1322219	Pavillion Fee 14-3W	7" 20# J-55	620	230 sks Class G	LSND, closed	9.0	4-1/2" 11.6# J-55	5,700	1st stage 212 sks Type C - circ 1 bbl cement to surface. 2nd stage 338 sks Type C (13 ppg, 1.97 cf/sk.) DV @ 3,191'. Circ 29 bbls cement to surface
1322087	Pavillion Fee 34-3R	7" 20# J-55	362	125 sks Type III & 50 sks top job	LSND, closed	8.8	4-1/2" 10.5# J-55	3,364	180 sks 50/50 poz
1321906	Tribal Pavillion 44-3	8-5/8" 24# J-55	563	85 sks 65/35 poz (12.7 ppg, 1.86 cf/sk) & 90 sks Class G (15.8 ppg, 1.18 cf/sk)	LSND, closed	9.6	5-1/2" 17# J-55	6,009	240 sks 65/35 poz & 647 sks 50/50 poz. Lost returns, pumped 18-20 bbls mud down backside
1320298	W.E. Lloyd 1	16" H-40	911	1,025 sks - assumed to be Class G	Water base w/ pits	9.0	10-3/4" 51# S-95	6,944	1st stage 500 sks 50/50 poz & 150 sks Class G. 2nd stage 525 sks 50/50 poz & 150 sks Class G. DV @3,719'
1306388	Mae H. Rhodes 1	13-3/8" 48# H-40	514	500 sks Ideal Portland	Water base w/	10.1	9-5/8" J-55	2,107	150 sks Ideal Portland
Section 4 T3N R2E									
1322633	Pavillion Fee 43-4	8-5/8" 24# J-55	600	265 sks Class G	LSND, closed	9.0	4-1/2" 11.6# N-80	4,744	730 sks light G (2.38 cf/sk, 9.6 ppg)
1322634	Pavillion Fee 44-4	8-5/8" 24# J-55	611	280 sks Class G	LSND, closed	8.8	4-1/2" 11.6# N-80	5,700	928 sks CemCrete. 16 bbls cement circ. to surface
1320668	Blankenship 4-8	8-5/8" 24#	444	325 sks Class G. No returns, filled backside w/ gravel	Oil base w/ pits	9.5	4-1/2" 10.5# K-55	5,203	700 sks 50/50 poz
Section 9 T3N R2E									
1321130	Tribal 21-9	8-5/8" 24#	815	600 sks Class G	Oil base w/ pits	8.8	5-1/2" 15.5#/17#	5,298	620 sks Class G
1322172	Pavillion Fee 31-9	7" 20# J-55	534	200 sks Type III (1.39 cf/sk)	LSND, closed	8.9	4-1/2" 10.5# J-55	3,445	365 sks 50/50 poz (1.59 cf/sk, 13.0 ppg)
1320084	Maxson 32-9	7-5/8" 24# H-40	616	300 sks Class G	Oil base w/ pits	9.6	NA	NA	P&A 35 sks 3,300'-3,200', 35 sks 1,300'-1,200', 35 sks 667'-567', 10 sks surface
1322227	Pavillion Fee 32-9W	7" 20# J-55	532	230 sks Class G. 100 sks Class G top job	LSND, closed	8.8	4-1/2" 11.6# J-55	3,460	285 sks Class C (1.97 cf/sk.) 6 bbls cement to surface
Section 10 T3N R2E									
1320876	USA Tribal 22-10	8-5/8" 24# K-55	608	400 sks Class G	Oil base w/ pits	9.0	4-1/2" 10.5# K-55	5,089	1,180 sks Class G
1321692	Tribal Pavillion 23-10	8-5/8" 24# J-55	605	160 sks 50/50 poz & 200 sks Class G	KCl polymer, closed	9.2	5-1/2" 15.5# J-55	5,988	1,085 sks 50/50 poz
1322417	Tribal Pavillion 23-10B	7" 20# J-55	641	280 sks Class G	LSND, closed	8.8	4-1/2" 11.6# N-80	5,617	268 sks Class C Cemcrete (2.34 cf/sk, 9.51 ppg)
1322418	Tribal Pavillion 23-10C	7" 20# J-55	576	280 sks Class G	LSND, closed	9.3	4-1/2" 11.6# N-80	5,718	328 sks CemCrete (2.35 cf/sk, 9.51 ppg)

TABLE 3
PAVILLION FIELD CASING AND CEMENTING DESCRIPTIONS
WITHIN WDEQ AREAS OF REVIEW

		SURFACE CASING			PRODUCTION CASING				
API#	Well Name	Casing Description	Depth, ft.	Cement Job Description (All jobs circulated cement to surface)	Mud System below surface casing	Mud Weight, #/gal[1]	Casing Description	Depth, ft.	Cementing Job Description
Section 10 T3N R2E									
1321691	Pavillion Fee 31-10	8-5/8" 24# K-55	598	160 sks Lite & 200 sks premium	KCl polymer, closed	9.4	5-1/2" 15.5# J-55	5,722	1,108 sks 50/50 poz
1322268	Pavillion Fee 31-10B	7" 20# J-55	630	280 sks Class G	LSND, closed	8.9	4-1/2" 11.6# N-80	5,546	307 sks CemCrete. Squeeze @1,000' w/ 4 bbls cement. Squeeze @ 700' w/ 18 bbls cement
1321968	Tribal Pavillion 32-10	8-5/8" 24# K-55	626	280 sks Premium	LSND, closed	9.2	5-1/2" 15.5# J-55	5,612	350 sks Type III (12 ppg, 2.27 cf/sk) & 310 sks Type III (12.7 ppg,1.91 cf/sk)
1322224	Tribal Pavillion 32-10B	7" 20# J-55	622	230 sks Class G	LSND, closed	8.6	4-1/2" 11.6# J-55	5,842	1st stage 220 sks Class C (1.97 cf/sk,13 ppg, 77 bbls), circ 15 bbls to surface. 2nd stage 330 sks Class C, circ 18 bbls to surface
1322419	Tribal Pavillion 32-10C	8-5/8" 24# J-55	626	280 sks Class G	LSND, closed	8.8	4-1/2" 11.6# J-55	4,020	Unknown amount. CBL shows cement to surface
1321862	Tribal Pavillion 33-10	8-5/8" 24# J-55	514	75 sks 65/35 poz & 85 sks Class G	KCl polymer, closed	?	5-1/2" 17# K-55	5,970	335 sks 35/65 poz (1.98 cf/sk, 12.7 ppg) & 587 sks 50/50 poz (1.31 cf/sk, 14.0 ppg)
1322274	Tribal Pavillion 33-10B	7" 20# J-55	639	280 sks Class G	LSND, closed	8.7	4-1/2" 11.6# N-80	5,464	310 sks Lite (2.55 cf/sk, 9.46 ppg). No cement to surface
1322195	Tribal Pavillion 33-10W	7" 20# J-55	528	230 sks Class G	LSND, closed	8.9	4-1/2" 11.6# J-55	5,070	1st stage 210 sks 50/50 poz. 2nd stage 350 sks 50/50 poz. DV @ 3,031'. Circ 2 bbls cement to surface
1306363	Govt Tribal 33X-10	20" 94#	221	325 sks Class G	Water base to 4,054' w/ pits	9.6	13-3/8" weight ?	4,054	1st stage 1,520 sks 50/50 poz & 200 sks Class G. 2nd stage 1,250 sks Class G. DV @ 2,014'. Circ cement to surface
1322149	Tribal Pavillion 34-10	7" 20# J-55	648	200 sks Type III	LSND, closed	9.2	4-1/2" 11.6# J-55	5,712	1st stage 275 sks 50/50 poz. 2nd stage 560 sks 50/50 poz. DV @ 3,018'. Circ 70 bbls cement to surface
1322198	Pavillion Fee 41-10	7" 20# J-55	534	230 sks Class G	LSND, closed	9.1	4-1/2" 10.5# J-55	3,180	225 sks Class C (1.96 cf/sk, 13 ppg) No cement to surface
1322624	Pavillion Fee 41-10B	7" 20# J-55	640	245 sks Class G	LSND, closed	8.9	4-1/2" 11.6# J-55	3,839	214 sks CemCrete (2.35 cf/sk, 9.5 ppg)
1320414	Unit 41X-10	8-5/8" 24# K-55	619	425 sks Class G	Oil base w/ pits	10.0	4-1/2" 11.6# K-55	5,047	775 sks 50/50 poz (14.3 ppg)
1321696	Tribal 42-10	8-5/8" 24# J-55	626	170 sks Lite & 210 sks Premium	KCl polymer, closed	9.2	5-1/2" 15.5# J-55	5,995	1st stage 428 sks 50/50 poz, 2nd stage 998 sks 50/50 poz. DV @ 4,278'
1322324	Tribal Pavillion 42-10B	8-5/8" 24# J-55	621	280 sks Class G	LSND, closed	8.7	4-1/2" 11.6# N-80	5,605	900 sks CemCrete (2.38 cf/sk, 9.6 ppg)
1321704	Tribal Pavillion 43-10	8-5/8" 24# K-55	641	160 sks Lite & 200 sks Class G	KCl polymer, closed	9.4	5-1/2" 15.5# K-55	5,956	1,200 sks 50/50 poz, 35 bbls cmt to surface
1322420	Tribal Pavillion 43-10B	7" 20# J-55	636	280 sks Class G	LSND, closed	8.9	4-1/2" 11.6# N-80	5,759	270 sks Lite (2.53 cf/sk, 9.5 ppg)
1320879	Unit 44-10	8-5/8" 24# K-55	605	375 sks Class G	Oil base w/ pits	8.9	5-1/2" 14# K-55	5,191	1300 sks Class G. Lost returns last 40 bbls
Section 11 T3N R2E									
1322059	Pavillion Fee 11-11	7" 20# J-55	531	115 sks Type III, 40' top job	LSND, closed	9.5	4-1/2" 11.6# J-55	5,842	1st stage 325 sks 50/50 poz (13.5 ppg, 1.39 cf/sk). 2nd stage 355 sks 50/50 poz (same yield). DV @ 2,835'. Perf @ 1,600', cement w/250 sks AG-300 (1.18 cf/sk, 15.6 ppg). Re-squeeze w/ 20 bbls cement

TABLE 3
PAVILLION FIELD CASING AND CEMENTING DESCRIPTIONS
WITHIN WDEQ AREAS OF REVIEW

		SURFACE CASING			PRODUCTION CASING				
API#	Well Name	Casing Description	Depth, ft.	Cement Job Description (All jobs circulated cement to surface)	Mud System below surface casing	Mud Weight, #/gal[1]	Casing Description	Depth, ft.	Cementing Job Description
Section 11 T3N R2E									
1322220	Pavillion Fee 11-11B	7" 20# J-55	560	230 sks Class G	LSND, closed	8.9	4-1/2" 11.6# J-55	4,776	1st stage 150 sks Class C (13 ppg, 1.97 cf/sk). 2nd stage 250 sks Class C (same yield). DV @ 2,814'. Circ 8 bbls cement to surface
1321669	Pavillion Unit 12-11	8-5/8" 24# K-55	627	360 sks Premium	KCl polymer, closed	9.1	5-1/2" 15.5# K-55	6,482	1,345 sks 50/50 poz. Lost circulation, no cement to surface
1322272	Pavillion Fee 12-11B	7" 20# J-55	551	280 sks Class G	LSND, closed	9.0	4-1/2" 11.6# N-80	3,854	255 sks CemCrete (9.25 ppg, 2.4 cf/sk). Circ 4 bbls cement to surface
1322102	Pavillion Fee 12-11W	8-5/8" 24# J-55	430	160 sks Type III	LSND, closed	8.7	5-1/2" 17# J-55	3,250	660 sks 50/50 poz. No cement to surface
1322586	Tribal Pavillion 21-11B	7" 20# J-55	642	240 sks Class G	LSND, closed	8.9	4-1/2" 11.6# N-80	3,868	230 sks CemCrete (2.35 cf/sk, 9.5 ppg)
Section 12 T3N R2E									
1322060	Pavillion Fee 13-12	7" 20# J-55	327	85 sks Type III	LSND, closed	9.1	4-1/2" 10.5# J-55	3,725	215 sks HLC (1.9 cf/sk)
1320878	Unit 22-12	8-5/8" 24# K-55	586	450 sks Class G	Oil base w/ pits	9.2	4-1/2" 10.5# K-55	5,200	825 sks Class G
1322186	Pavillion Fee 23-12	7" 20# J-55	534	210 sks Type III	LSND, closed	9.0	4-1/2" 10.5# J-55	3,260	300 sks 50/50 poz (13 ppg, 1.59 cf/sk). Circ 15 bbls cement to surface
Section 13 T3N R2E									
1320855	Tribal Pavillion 12-13	8-5/8" 24# K-55	576	430 sks Class G	Oil base w/ pits	9.6	5-1/2" 14# K-55	5,399	1,010 sks Class G (1.15 cf/sk)
1322057	Pavillion Fee 21-13	7" 20# J-55	442	110 sks Type III	LSND, closed	9.2	4-1/2" 10.5# J-55	3,500	255 sks 50/50 poz

[1] As reported on open-hole electric logs

TABLE 3a
API CASING SPECIFICATIONS

Casing Description	Collapse, psi	Internal Yield, psi
SURFACE		
20" 94# (H40)	520	1,530
16" 65# H-40	670	1,640
13-3/8" 48# H-40	770	1,730
10-3/4" 51# S-95	4,460	6,960
8-5/8" 24# J-55 & K-55	1,370	2,950
7-5/8" 24# H-40	2,040	2,750
7" 20# J-55	2,270	3,740
PRODUCTION		
5-1/2" 14# K-55	3,120	4,270
5-1/2" 15.5# J-55 & K-55	4,040	4,810
5-1/2" 17# J-55 & K-55	4,910	5,320
4-1/2" 10.5# J-55 & K-55	4,010	4,790
4-1/2" 11.6# J-55 & K-55	1,960	5,350
4-1/2" 11.6# N-80	6,350	7,780

Production Casing

The production casing is typically set at the total depth of the well and provides a conduit for produced fluids to flow to the surface, as well serving to isolate deeper permeable zones after cementing.

Production casing setting depths for wells reviewed range from the shallowest of 3,180' in the Pavillion Fee 41-10 (NENE Section 10) and drilled in 2002, to the deepest of 6,482' in the Pavillion Unit 12-11 (SWNW Section 11) and drilled in 1993. With the exception of the earlier drilled W.E. Lloyd 1 (SWSE Section 3) and Govt. Tribal 33X-10 (NWSE Section 10), all wells reviewed were completed with either 4 -1/2" or 5-1/2" O.D. (outside diameter) production casing. Production casing data and details, including size, weight (pounds per foot), grade of steel, and strength characteristics are shown on Tables 3 and 3a.

Cement Job Design

Production casings were cemented by pumping a cement slurry down the inside of the casing followed by water to displace the drilling mud and cement slurry up the outside of the casing. Displaced drilling mud weights ranged from 8.6 pounds per gallon to 10.0 pounds per gallon. Production casing cement job summaries are shown on Table 3. With the exception of six wells completed by Shell between 1979 and 1981, all production casings were cemented with a slurry weight less dense than the standard cement blend of Class "G" (1.15 cubic feet per sack yield and 15.8 pounds per gallon), with cement volumes and procedures designed to circulate the cement slurry to the surface. The lighter weight cement slurries were used to decrease the hydrostatic pressure on the adjacent formations during slurry pumping, yet still result in sufficient strength when set to secure the casings and isolate formations. This design increased the likelihood of maintaining full circulation during the cement pumping and not losing cement into the formation. Additives in the cement were standard oilfield materials designed to affect slurry viscosity, cement setting time, lost circulation, fluid loss, friction reduction, and foaming tendencies. Nine wells were identified as having the production casing cemented in two stages using a "DV" (differential valve) stage collar placed in the casing string at an intermediate depth to aid in circulating cement to the surface. The wells with multiple stage cementing procedures are identified in Table 3.

Ten wells within the areas of review were identified as having supplemental cement "squeeze" jobs performed after primary cementing to place additional cement behind the production casing. Cement squeeze procedures consisted of perforating the production casing at a depth or depths where cement placement from the primary cementing job was determined by cement bond log or other diagnostic means to be inadequate, setting a mechanical cement retainer in the casing above these perforations, and pumping a volume of cement through the retainer and into the "squeeze" perforations. The retainer and cement left inside the casing would then be drilled out to regain access to the wellbore below the squeezed interval. These wells, along with a brief description of the cement squeeze jobs, are identified in **Table 4** and discussed in the Gas Well Summaries Section below.

TABLE 4
PAVILLION FIELD CEMENT BOND LOG DATA
WITHIN WDEQ AREAS OF REVIEW

API	Well Name	Surface Casing Depth, ft.	Cement Bond Log Run Date	Interval Logged	Top of Cement, ft.	Remarks
Section 2 T3N R2E						
1321128	Tribal 14-2	599	11/28/80	2,000' - 5,074'	2,220'	Log not located
			8/23/82	600' - 2,100'		Perforate 2,180', circulated 600 sks Class G cement to surface (January 1981). Squeeze cement 50 sks into casing leak @ 2,196' - 2,201' (March 1981). Log not located
1322236	Tribal Pavillion 24-2	562	10/19/04	400' - 3,885'	558'	
			4/20/05	0'-1,460'	Surface	Logged after cement squeeze @ 580' w/ 86 sks (April 2005)
Section 3 T3N R2E						
1322246	Pavillion Fee 13-3W	608	4/12/05	0' - 4,526'	Surface	
1321904	Pavillion Fee 13X-3	630	1/27/99	400' - 5,872'	535'	Plugged and abandoned October 1999
1322623	Pavillion Fee 14-3B	620	3/29/05	0' - 3,857'	<34'	Bond log top of fluid @ 34'
1322219	Pavillion Fee 14-3W	620	4/4/02	0' - 5,614'	Surface	
1322087	Pavillion Fee 34-3R	362	3/16/01	300' - 3,282'	<300'	
1321906	Tribal Pavillion 44-3	563	2/17/99	400' - 5,716'	2,150'	Squeeze cemented @ 2,120' w/ 41 bbls Class G, lost circulation. Perforate 1,680', circulate 300 sks Class G to surface (March 1999). Squeeze cemented @ 699'-711' w/ 100 sks. Class G, 1,574'-1,589' w/ 550 sks Class G (April 1999).
			3/29/99	1,500' - 2,034'	1,700'	Logged after cement squeeze @ 2,120' w/ 41 barrels Class G
			4/6/99	500' - 2,540'	<500'	Logged after cement squeeze @ 1,680' w/ 300 sks Class G
1320298	W.E. Lloyd 1	911				Plugged and abandoned August 1981
1306388	Mae H. Rhodes 1	514	11/12/53	1,000' - 2,077'	1,776'	Temperature survey (no CBL). Plugged and abandoned November 1954
Section 4 T3N R2E						
1322633	Pavillion Fee 43-4	600	3/11/05	0' - 4,628'	<48'	Bond log top of fluid @ 48'
1322634	Pavillion Fee 44-4	611	3/2/05	0' - 5,648'	<68'	Bond log top of fluid @ 68'
1320668	Blankenship 4-8	444	1/11/05	0' - 4,800'	1,850'	Squeeze cemented @ 1,775' w/ 90 sks, 1,062' w/ 4.5 bbls. cement, 1,025' w/ 5 bbls cement (January 2005)
Section 9 T3N R2E						
1321130	Tribal 21-9	815	4/28/81	846' - 5,122'	1,044'	Plugged and abandoned September 1992
1322172	Pavillion Fee 31-9	534	10/11/01	0' - 3,368'	120'	
1320084	Maxson 32-9	606				Plugged and abandoned May 1968
1322227	Pavillion Fee 32-9W	532	3/14/02	0' - 3,396'	<30'	Bond log top of fluid @ 30'
1320875	USA Tribal 41-9	604	10/8/04	1,000' - 4,658'	<1,000'	
Section 10 T3N R2E						
1320876	USA Tribal 22-10	608	7/23/79	699' - 4,968'	1,805'	
1321692	Tribal Pavillion 23-10	605	6/29/94	1,200' - 5,900'	1,340'	
1322417	Tribal Pavillion 23-10B	641	10/12/04	600' - 5,554'	970'	
1322418	Tribal Pavillion 23-10C	576	9/28/04	50' - 5,660'	150'	
1321691	Pavillion Fee 31-10	598	6/17/94	1,950' - 5,526'	2,114'	
			10/4/12	0' - 5456'		Temperature Survey - no anomalies.
1322268	Pavillion Fee 31-10B	630	12/29/04	1,100' - 5,491'	1,340'	
			1/11/05	200' - 1,600'	1,010'	Squeeze cemented @ 1,250' w/ 8 bbls, 1,000' w/ 4 bbls, 700' w/ 20 bbls cement circulated to surface. Casing tested to 500 psig (January 2005)
			1/15/05	200' - 1,024'	743'	Logged after cement squeeze @ 1,000'

TABLE 4
PAVILLION FIELD CEMENT BOND LOG DATA
WITHIN WDEQ AREAS OF REVIEW

API	Well Name	Surface Casing Depth, ft.	Cement Bond Log Run Date	Interval Logged	Top of Cement, ft.	Remarks
Section 10 T3N R2E						
1321968	Tribal Pavillion 32-10	626	3/28/00	1,000' - 5,540'	~1,000'	
1322224	Tribal Pavillion 32-10B	622	3/7/02	0' - 5,784'	<130'	Bond log top of fluid @ 130'
1322419	Tribal Pavillion 32-10C	626	2/7/05	0' - 3,940'	110'	
1321862	Tribal Pavillion 33-10	514	3/11/99	400' - 5,887'	680'	
1322274	Tribal Pavillion 33-10B	639	11/19/04	0' - 5,416'	74'	
1322195	Tribal Pavillion 33-10W	528	10/29/01	550' - 5,004'	<550'	Bond log top of fluid @ 550'
1306363	Govt Tribal 33X-10	221				No logs for 13-3/8" casing. Plugged November 1981
1322149	Tribal Pavillion 34-10	648	9/21/01	618' - 5,647'	<618'	
1322198	Pavillion Fee 41-10	534	1/17/02	300' - 3,160'	518'	
1322624	Pavillion Fee 41-10B	640	4/25/05	0' - 3,762'	<42'	Bond log top of fluid @ 42'
1320414	Unit 41X-10	619	11/22/72	800' - 4,990'	1,370'	Plugged and abandoned November 1981
1321696	Tribal 42-10	626	6/6/94	2,300' - 5,926'	2,590'	Squeeze cemented @ 2,540' w/ 100 sks (December 2004)
			12/18/04	1,700' - 2,430'	1,750'	Logged with 500 psig after 12/17/04 squeeze job
1322324	Tribal Pavillion 42-10B	621	1/28/05	0' - 5,537'	<42'	Bond log top of fluid @ 42'
1321704	Tribal Pavillion 43-10	641	9/15/94		Surface	Log not located
1322420	Tribal Pavillion 43-10B	636	11/8/04	890' - 5,699'	1,170'	Squeeze cemented @ 1,070' w/ 111 sks, casing tested to 500 psig (January 2005)
1320879	Unit 44-10	605	7/23/79	600' - 5,144'	1,918'	
Section 11 T3N R2E						
1322059	Pavillion Fee 11-11	542	2/7/01	330' - 5,768'	<330'	Squeeze cemented @ 1,600' w/ 348 sks cement (January 2001)
1322220	Pavillion Fee 11-11B	560	2/8/02	520' - 4,736'	<520'	
1321669	Pavillion Unit 12-11	627	9/9/93	600' - 6,391'	852'	
1322272	Pavillion Fee 12-11B	550	12/29/04	700' - 3,802'	970'	
			1/11/05	100' - 1,300'	226'	Logged after cement squeeze @ 930' w/ 24 bbls cement. Circulated cement to surface (January 2005)
1322102	Pavillion Fee 12-11W	430	4/25/01	1,200' - 3,182'	1,930'	
			5/22/13	0' - 2,000'	Surface	Logged with 500 psig after 5/16/13 squeeze job
1322586	Tribal Pavillion 21-11B	642	4/5/05	0' - 3,805'	<30'	Bond log top of fluid @ 30'
Section 12 T3N R2E						
1322060	Pavillion Fee 13-12	327	1/10/01	323' - 3,140'	915'	
1320878	Unit 22-12	586	?			Bond log referenced on Completion Report, not in files
1322186	Pavillion Fee 23-12	534	7/30/01	0' - 3,173'	<29'	Bond log top of fluid @ 29'
Section 13 T3N R2E						
1320855	Tribal Pavillion 12-13	576	1/22/79	500' - 5,200'	544'	Bond log referenced on Completion Report, not in files
			7/14/00	576' - 3,340'	950'	Plugged and abandoned July 2001 w/ squeeze holes @ 625' cemented to surface w/ 200 sks
1322057	Pavillion Fee 21-13	492	2/7/01	450' - 3,386'	1,190'	

Cement Bond Logs

Cement bond logs (CBL) are run on electric cable, and are intended to aid in evaluating the presence and quality of cement behind casing. The tool continuously sends signals to a recording device at the surface, and will not work unless it is immersed in fluid. The instruments relate travel time and amplitude of an acoustic signal to the quality of cement bond between casing and formation. High amplitude indicates there is little or no cement bond to attenuate the acoustic signal, and low amplitude implies bonding between the casing and formation. A cement bond log can be used to determine uncemented pipe, pipe and formation bonding quality of a primary or remedial squeeze job in cemented pipe, channeling, and the presence of a micro-annulus (an annular gap between the casing and cement sheath caused by temperature variation, mudcake deposits, and pipe coatings). Cement bond logs do not measure or quantify hydraulic seal.

The CBL can give a more accurate indication of bonding between the casing and formation if it is run with pressure on the casing in order to reduce the potential effect of a micro-annulus. The presence of a micro-annulus may show a poorer bond, without necessarily destroying the cement's ability to form a hydraulic seal. Lightweight cements such as those used in many of the Pavillion well completions have properties that may also impact the log quality. Cement evaluation relies on a contrast in the acoustic properties of the cement and liquid. The higher the contrast between liquid and hardened cement, the easier the log is to interpret. The acoustic properties of hardened lightweight cement are close to those of the cement slurry, making it difficult to distinguish between the two. Cement weights used on production casing vary in the wells reviewed from the lowest of 9.5 pounds per gallon to the highest of 15.8 pounds per gallon.

Another factor that can have an influence on the cement bond log determination of cement quality behind casing is casing centralization within the open hole. If casing is not centralized, it is likely there will be less apparent bonding on the portion of the casing where the distance between casing and formation wall is less. Direct casing contact with the formation will also prevent cement from adequately isolating formations.

Cement bond logs were generally run after the primary cement job was performed, and before completion efforts were undertaken. In certain wells, cement bond logs were also ran after remedial squeeze jobs. Cement bond logs ran to determine placement of cement behind pipe after the primary and/or remedial cementing of the production casing were located for most of the Pavillion wells within the areas of review. Table 4 references the date cement bond logs were run, the interval logged, and WOGCC's determination of the top of cement (TOC) for each of the well logs reviewed. Cement bond logs of interest referenced in completion records for four of the 50 wells reviewed were not located in WOGCC files, BLM Tribal files, or Encana well records. These wells are the Tribal 14-2 (SWSW Section 2) drilled in 1981 by Shell Oil Co., Tribal Pavillion 43-10 (NESE Section 10) drilled in 1994 by Tom Brown, Inc., Unit 22-12 (SENW Section 12 drilled in 1980 by Shell Oil Co., and Tribal Pavillion 12-13 (SWNW Section 13) drilled in 1979 by Shell Oil Co.

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion			Casing Test, psig	Fracture Treatment			Remarks
		Date	Form.	Perforated Interval		Water, bbls	Sand Vol., lbs	Max. Treating Pressure, psig	
Section 2 T3N R2E									
1321128	Tribal 14-2	8/25/82	W.R.	1,581 -2,980				100	Acidized
		4/23/81		2,180 -2,192				NA	No treatment
		4/9/81	Ft. Union	3,409 -3,416				1,250	Acidized
				3,767 -3,779				1,150	Acidized
		4/4/81		3,902 -3,986				2,600	Acidized
		3/26/81		4,495 -4,682		715	52,000	NA	
		3/23/81		4,860 -4,962	1,000	220	20,000	NA	Casing tested after squeeze
1322236	Tribal Pavillion 24-2	10/27/04	Wind River	1,538 -1,550		86	15,471	2,100	CO2 assist
				1,631 -1,655		118	21,168	1,500	CO2 assist
				2,294 -2,308		128	21,377	2,100	CO2 assist
				2,614 -2,620		108	13,833	2,400	CO2 assist
			Ft. Union	3,662 -3,724		170	23,929	2,800	CO2 assist
				3,786 -3,820		264	25,414	2,500	CO2 assist
		10/26/04		3,846 -3,878	5,000	227	35,583	3,000	CO2 assist
Section 3 T3N R2E									
1322246	Pavillion Fee 13-3W	4/16/05	Wind River	1,496 -1,504		60	14,293	1,550	
				2,324 -2,342		74	14,510	2,380	
				2,426 -2,436		66	13,457	2,490	
				2,691 -2,733		93	24,542	2,770	
				2,822 -2,830		68	5,329	2,880	
				3,161 -3,172		100	15,589	3,225	
			F.U.	4,473 -4,497	5,000	134	14,815	2,175	
1321904	Pavillion Fee 13X-3	2/17/99	W.R.	1,348 -2,270				1,340	Acidized
		2/15/99	Ft. Union	3,868 -3,898				NR	Acidized
		2/7/99		4,530 -4,962				NR	Acidized
				5,112 -5,120	NR			NR	Acidized
1322623	Pavillion Fee 14-3B	4/2/05	W.R.	2,911 -2,918		54	14,876	2,993	
				3,090 -3,100		111	25,398	2,167	
			F.U.	3,759 -3,780	NR	125	23,832	NR	
1322219	Pavillion Fee 14-3W	4/9/02	Ft. Union	4,460 -4,504		650	51,200	3,300	CO2 assist
				4,818 -4,890		630	49,140	3,300	CO2 assist
				5,046 -5,074		338	26,140	3,300	CO2 assist
		4/6/02		5,178 -5,188		209	15,753	3,800	CO2 assist
		4/5/02		5,274 -5,284	3,000	206	15,670	4,300	CO2 assist
1322087	Pavillion Fee 34-3R	5/4/01	Wind River	2,383 -2,389		68	13,401	1,555	CO2 assist
				2,538 -2,548		102	21,098	1,614	CO2 assist
				2,655 -2,665		127	29,373	1,955	CO2 assist
				2,764 -2,774		109	18,496	1,934	CO2 assist
				3,093 -3,099	3,000	104	18,411	1,717	CO2 assist
1321906	Tribal Pavillion 44-3	4/6/99	Wind River	699 -711				1,100	Acidized
				1,574 -1,589					
		4/8/99		1,658 -2,091		516	101,610	1,800	
		4/6/99		2,230 -2,234				989	Acidized
				2,752 -2,812				1,650	Acidized
		3/18/99	Ft. Union	3,405 -3,763				NR	Acidized
		3/9/99		3,880 -4,108				2,000	Acidized
		3/4/99		4,338 -4,502				NR	Acidized
		2/25/99		4,761 -4,870	2,000			NR	Acidized, csg test after sqz
1320298	W.E. Lloyd 1			none	2,000				
1306388	Mae H. Rhodes 1			none	NR				

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion Date	Completion Form.	Completion Perforated Interval	Casing Test, psig	Fracture Treatment Water, bbls	Fracture Treatment Sand Vol., lbs	Fracture Treatment Max. Treating Pressure, psig	Remarks
Section 4 T3N R2E									
1322633	Pavillion Fee 43-4	3/16/05	Wind River	1,720 -1,782		85	22,707	1,240	CO2 assist
				2,117 -2,126		61	15,797	2,117	CO2 assist
				2,652 -2,678		68	20,517	1,854	CO2 assist
				3,131 -3,182		73	20,998	1,450	CO2 assist
			Ft. Union	3,456 -3,466		82	17,017	2,414	CO2 assist
				3,794 -3,867		197	45,234	2,247	CO2 assist
				4,599 -4,606	5,000	73	15,042	1,987	CO2 assist
1322634	Pavillion Fee 44-4	3/8/05	Ft. Union	3,784 -3,806		160	36,268	NR	
				4,490 -4,558		178	45,037	NR	
				4,628 -4,656		175	35,157	NR	
				5,464 -5,497	5,000	107	22,760	NR	
1320668	Blankenship 4-8	2/4/05	W.R.	2,070 -2,079		104	22,395	3,778	CO2 assist
				2,671 -2,682		121	21,000	5,546	CO2 assist
		3/25/77	F.U.	4,870 -5,105	1,000	2,428	135,000	NR	N2 assist
Section 9 T3N R2E									
1321130	Tribal 21-9	6/15/81	W.R.	2,158 -2,239					
		6/8/81		2,380 -2,386				1,000	Acidized
		6/6/81		2,614 -2,846				1,000	Acidized
		5/28/81	Ft. Union	3,356 -3,360		357	25,914	3,400	
		5/26/81		3,705 -3,805				1,700	Acidized
		5/21/81		3,967 -4,034				1,700	Acidized
		5/20/81		4,249 -4,350				1,700	Acidized
		5/18/81		4,398 -4,426				1,200	Acidized
		5/16/81		4,471 -4,566				1,800	Acidized
		5/7/81		4,679 -4,693				1,100	Acidized
		5/2/81		5,020 -5,232				1,500	Acidized
		4/29/81		4,819 -4,834	2,000			2,200	Acidized
1322172	Pavillion Fee 31-9	10/18/01	Wind River	2,313 -2,319		66	16,275	3,786	CO2 assist
				2,632 -2,642		92	25,705	NR	CO2 assist
				2,722 -2,729		82	15,265	4,088	CO2 assist
				2,927 -2,933		95	15,480	3,584	CO2 assist
				3,306 -3,312	NR	87	15,771	2,481	CO2 assist
1320084	Maxson 32-9			none	NR				
1322227	Pavillion Fee 32-9W	3/19/02	Wind River	2,558 -2,636		133	29,586	3,000	CO2 assist
				2,730 -2,738		105	16,507	1,900	CO2 assist
				2,936 -2,946		128	21,570	3,100	CO2 assist
				3,285 -3,312	3,000	103	20,949	3,900	CO2 assist
Section 10 T3N R2E									
1320876	USA Tribal 22-10	12/14/04	Wind River	1,994 -2,000		89	14,450	NR	CO2 assist
				2,168 -2,211		129	24,030	NR	CO2 assist
				2,409 -2,424		270	14,460	NR	CO2 assist
				3,076 -3,088		165	23,900	NR	CO2 assist
				3,262 -3,267		242	24,000	NR	CO2 assist
		10/4/79		3,274 -3,294					No treatment
		12/11/04	Ft. Union	4,541 -4,549		119	17,250	NR	CO2 assist
		12/9/04		4,581 -4,664		260	53,300	NR	CO2 assist
		9/13/79		4,819 -5,034	1,850				Acidized

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion Date	Completion Form.	Completion Perforated Interval	Casing Test, psig	Fracture Treatment Water, bbls	Fracture Treatment Sand Vol., lbs	Fracture Treatment Max. Treating Pressure, psig	Remarks
Section 10 T3N R2E									
1321692	Tribal Pavillion 23-10	7/16/00	Ft. Union	4,592 -4,676		226	49,360	1,320	CO2 assist
		6/27/00		4,843 -4,903		156	27,600	2,164	CO2 assist
		6/25/00		5,080 -5,096					No treatment
		6/21/00		5,202 -5,216					No treatment
		7/11/94		5,316 -5,335		393	32,500	NR	N2 assist
		6/29/94		5,792 -5,812	NR				No treatment
1322417	Tribal Pavillion 23-10B	10/21/04	Wind River	2,290 -2,297		92	14,297	2,700	CO2 assist
				2,689 -2,699		150	14,270	2,600	CO2 assist
		10/20/04		2,863 -2,868		97	14,460	2,850	CO2 assist
				2,932 -2,938		117	14,612	2,900	CO2 assist
				3,067 -3,089		141	20,240	2,500	CO2 assist
			Ft. Union	3,550 -3,560		149	20,225	2,800	CO2 assist
				3,720 -3,792		224	22,730	2,700	CO2 assist
		10/16/04		4,576 -4,646		235	39,872	2,300	CO2 assist
				4,784 -4,856		248	34,130	2,500	CO2 assist
				5,350 -5,434		267	34,842	3,000	CO2 assist
				5,476 -5,556	5,000	224	35,249	3,100	CO2 assist
1322418	Tribal Pavillion 23-10C	10/13/04	Wind River	1,771 -1,792		150	17,066	NR	CO2 assist, water vol. est.
				1,828 -1,832		150	14,782	1,067	CO2 assist, water vol. est.
				2,300 -2,333		150	23,258	1,900	CO2 assist, water vol. est.
				2,398 -2,446		150	17,478	1,243	CO2 assist, water vol. est.
		10/12/04		2,664 -2,674		150	15,200	2,167	CO2 assist, water vol. est.
				2,835 -2,852		150	18,390	1,650	CO2 assist, water vol. est.
				3,043 -3,048		150	14,509	2,660	CO2 assist, water vol. est.
				3,116 -3,138		150	15,504	1,330	CO2 assist, water vol. est.
			Ft. Union	3,532 -3,584			0	4,400	CO2 assist
		10/4/04		3,750 -3,834		131	20,493	2,250	CO2 assist
				4,628 -4,646		180	20,698	2,200	CO2 assist
				5,067 -5,108		166	17,000	3,200	CO2 assist
				5,230 -5,244		182	22,523	2,400	CO2 assist
				5,400 -5,418		225	28,698	3,200	CO2 assist
				5,544 -5,566	NR	268	28,631	3,500	CO2 assist
1321691	Pavillion Fee 31-10	1/16/02	Ft. Union	3,335 -3,342		80	18,103	2,200	CO2 assist
				3,593 -3,605		152	27,618	2,100	CO2 assist
		1/15/02		4,519 -4,580		232	45,305	2,300	CO2 assist
		1/11/02		4,630 -4,689		254	23,598	2,450	CO2 assist
		6/20/94		4,770 -5,478	3,500				No treatment
1322268	Pavillion Fee 31-10B	12/30/04	W.R.	1,702 -1,750		125	27,000	1,507	CO2 assist
				2,571 -2,584		118	21,000	2,526	CO2 assist
				2,866 -2,873		102	15,000	2,682	CO2 assist
			Ft. Union	3,416 -3,454		143	24,000	2,682	CO2 assist
				4,579 -4,644		185	30,000	2,143	CO2 assist
				4,875 -4,946	NR	190	30,000	3,126	CO2 assist
1321968	Tribal Pavillion 32-10	5/11/00	F.U.	5,306 -5,344		574	37,340	1,100	CO2 assist
		5/2/00		5,450 -5,482	NR	130	16,054	1,223	CO2 assist

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion Date	Completion Form.	Completion Perforated Interval	Casing Test, psig	Fracture Treatment Water, bbls	Fracture Treatment Sand Vol., lbs	Fracture Treatment Max. Treating Pressure, psig	Remarks
Section 10 T3N R2E									
1322224	Tribal Pavillion 32-10B	3/22/02	Ft. Union	4,521 -4,604		296	60,347	2,800	CO2 assist
				4,731 -4,794		275	42,758	2,800	CO2 assist
		3/21/02		4,844 -4,876		198	40,293	3,850	CO2 assist
				5,149 -5,226		314	40,313	3,900	CO2 assist
		3/20/02		5,296 -5,324		218	31,040	3,200	CO2 assist
				5,456 -5,497		234	39,198	3,700	CO2 assist
				5,629 -5,635		204	15,800	3,500	CO2 assist
		3/9/02		5,714 -5,728	3,000				No treatment
1322419	Tribal Pavillion 32-10C	2/10/05	Wind River	1,920 -1,968		104	30,741	NR	CO2 assist
		2/9/05		2,130 -2,137		57	14,240	NR	CO2 assist
				2,482 -2,489		49	7,141	NR	CO2 assist
				2,592 -2,601		71	18,055	NR	CO2 assist
				2,846 -2,852		61	13,953	NR	CO2 assist
				3,382 -3,392		103	20,659	NR	CO2 assist
				3,476 -3,484	NR	80	14,921	NR	CO2 assist
1321862	Tribal Pavillion 33-10	1/5/05	Wind River	2,101 -2,113		170	21,000	NR	CO2 assist
				2,428 -2,436		125	18,000	NR	CO2 assist
		1/4/05		2,482 -2,536		148	24,000	NR	CO2 assist
				2,777 -2,782				NR	No treatment
			Ft. Union	3,760 -3,772		170	21,000	NR	CO2 assist
				3,910 -3,920		71	14,909	NR	CO2 assist
		4/16/99		5,126 -5,272		73	55,700	2,256	CO2 assist
		3/30/99		5,372 -5,490	NR	98	54,900	1,965	CO2 assist
1322274	Tribal Pavillion 33-10B	12/6/04	Wind River	1,642 -1,652		96	20,000	NR	CO2 assist
				1,710 -1,755		83	18,000	3,588	CO2 assist
				1,910 -1,956		89	23,000	1,963	CO2 assist
				2,227 -2,233					No treatment
				2,310 -2,315		87	15,000	3,938	CO2 assist
				2,389 -2,399		85	13,000	3,102	CO2 assist
				2,654 -2,706		140	32,000	2,514	CO2 assist
		12/5/04		2,838 -2,899		89	13,500	2,566	CO2 assist
				3,150 -3,158		108	15,000	2,853	CO2 assist
			Ft. Union	3,524 -3,580		177	35,200	2,979	CO2 assist
				3,840 -3,872		187	35,000	3,151	CO2 assist
				4,612 -4,638		261	36,000	2,482	CO2 assist
		11/23/04		4,768 -4,776		102	15,162	2,755	CO2 assist
				5,036 -5,050	NR	126	22,153	3,858	CO2 assist
1322195	Tribal Pavillion 33-10W	12/14/04	W.R.	1,766 -1,774		100	14,889	3,138	CO2 assist
				2,483 -2,522		81	19,119	5,234	CO2 assist
				2,939 -2,946		180	14,991	3,810	CO2 assist
		12/1/01	Ft. Union	3,492 -3,502		104	21,890	3,350	CO2 assist
		12/10/04		3,528 -3,596		110	9,269	8,196	CO2 assist
		11/30/01		3,760 -3,776		97	27,829	NR	CO2 assist
		12/9/04		3,838 -3,912		123	15,519	3,283	CO2 assist
		11/29/01		4,356 -4,366					No treatment
		11/16/01		4,488 -4,506		113	24,993	3,750	CO2 assist
		11/15/01		4,642 -4,697		172	45,326	4,000	CO2 assist
		11/14/01		4,954 -4,966	2,800	154	26,287	3,430	CO2 assist
1306363	Govt Tribal 33X-10	2/22/65	W.R.	3,236 -3,272	NR	357	13,000	NR	
1322149	Tribal Pavillion 34-10	10/6/01	Ft. Union	4,616 -4,634		143	38,697	4,193	CO2 assist
		10/5/01		4,746 -4,752		120	18,601	3,900	CO2 assist
		10/4/01		5,046 -5,064		136	30,288	3,836	CO2 assist
		10/3/01		5,215 -5,250		156	35,980	2,859	CO2 assist
		9/26/01		5,377 -5,456		145	35,351	3,048	CO2 assist
				5,520 -5,526	3,000	94	18,607	2,462	CO2 assist

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion Date	Form.	Perforated Interval	Casing Test, psig	Fracture Treatment Water, bbls	Sand Vol., lbs	Max. Treating Pressure, psig	Remarks
Section 10 T3N R2E									
1322198	Pavillion Fee 41-10	1/20/02	Wind River	1,618 -1,626		70	26,084	2,100	CO2 assist
				2,171 -2,181		96	24,481	2,000	CO2 assist
		1/19/02		2,516 -2,524		64	21,000	2,100	CO2 assist
				2,589 -2,599		64	24,510	2,300	CO2 assist
				2,760 -2,770		63	23,279	2,300	CO2 assist
				2,834 -2,840		144	14,467	2,700	CO2 assist
		1/18/02		3,148 -3,152	NR	150	15,934	2,340	CO2 assist
1322624	Pavillion Fee 41-10B	4/30/05	W.R.	1,792 -1,799		48	11,652	1,679	CO2 assist
				2,228 -2,280		82	26,156	1,742	CO2 assist
				3,016 -3,024		53	14,095	3,383	CO2 assist
			F.U.	3,545 -3,641	5,000	144	29,750	2,040	CO2 assist
1320414	Unit (C.A. Fike) 41X-10	1/28/73	W.R.	1,809 -2,892		252	7,250	2,800	N2 assist
		3/26/73	F.U.	3,825 -4,855					No treatment
				4,044 -4,158	3,500	645	104,000	NR	N2 assist
1321696	Tribal 42-10	12/20/04	W.R.	2,502 -2,518		86	15,000	1,838	CO2 assist, sand vol. est.
		12/15/04		2,648 -2,656		104	15,147	1,930	CO2 assist
		6/24/01		3,298 -3,305		125	20,000	1,800	CO2 assist, vols. est.
		6/23/01	Ft. Union	3,394 -3,402		125	12,917	2,250	CO2 assist, water vol. est.
				3,504 -3,528		125	20,000	1,725	CO2 assist, vols. est.
		6/22/01		3,945 -3,991		267	25,000	1,950	CO2 assist, sand vol. est.
				4,065 -4,079		197	25,000	1,675	CO2 assist, sand vol. est.
				4,122 -4,137		84	16,590	1,450	CO2 assist
		6/21/01		4,529 -4,589		302	25,000	1,525	CO2 assist, sand vol. est.
		9/16/94		4,750 -4,802					No treatment
		9/10/94		5,315 -5,486					No treatment
		6/2/01		5,511 -5,515					No treatment
		6/6/94		5,747 -5,762	NR				No treatment
1322324	Tribal Pavillion 42-10B	2/3/05	Wind River	1,890 -1,902		53	11,283	NR	CO2 assist
				2,166 -2,174		60	15,428	NR	CO2 assist
				2,443 -2,472		79	21,288	NR	CO2 assist
				2,683 -2,694		62	14,884	NR	CO2 assist
				2,984 -2,992		62	15,110	NR	CO2 assist
				3,082 -3,092		75	15,000	NR	CO2 assist
				3,298 -3,308		72	15,112	NR	CO2 assist
		2/2/05	Ft. Union	3,485 -3,499		75	18,000	NR	CO2 assist
				3,546 -3,563		99	20,568	NR	CO2 assist
				4,518 -4,548		102	21,902	NR	CO2 assist
				4,812 -4,859	NR	127	31,034	NR	CO2 assist
1321704	Tribal Pavillion 43-10	2/6/02	Ft. Union	4,559 -4,631		125	43,273	2,800	CO2 assist
				4,812 -4,882		235	63,783	2,500	CO2 assist
				5,164 -5,180		130	35,144	3,670	CO2 assist
				5,240 -5,281		156	43,200	3,500	CO2 assist
		9/20/94		5,324 -5,486				NR	No treatment
		1/26/02		5,505 -5,512	3,500	317	67,353	2,720	CO2 assist
1322420	Tribal Pavillion 43-10B	11/18/04	Wind River	1,810 -1,816		84	14,697	2,412	CO2 assist
				1,895 -1,899		100	15,029	3,498	CO2 assist
				2,094 -2,102		103	14,425	2,606	CO2 assist
				2,404 -2,413		109	15,582	2,622	CO2 assist
				2,521 -2,541		125	15,500	NR	CO2 assist, vols. est.
				2,725 -2,739		158	17,839	5,000	CO2 assist
		11/13/04	Ft. Union	3,618 -3,628		162	15,082	2,560	CO2 assist
				3,816 -3,856		114	20,445	3,240	CO2 assist
				4,660 -4,708		210	35,354	2,930	CO2 assist
				4,938 -4,975		171	23,955	3,320	CO2 assist
				5,180 -5,191		169	17,657	4,090	CO2 assist
				5,242 -5,325		277	37,300	3,760	CO2 assist
				5,457 -5,470	NR	263	20,500	3,010	CO2 assist

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion Date	Completion Form.	Completion Perforated Interval	Casing Test, psig	Fracture Treatment Water, bbls	Fracture Treatment Sand Vol., lbs	Fracture Treatment Max. Treating Pressure, psig	Remarks
Section 10 T3N R2E									
1320879	Unit 44-10	10/14/04	W.R.	2,691 -2,716		150	20,000	NR	CO2 assist, vols. est.
				2,854 -2,904		218	17,890	NR	CO2 assist
		12/11/79	Ft. Union	3,230 -3,342				1,700	Acidized
		10/8/04		3,592 -3,614		134	18,000	NR	CO2 assist
		10/5/04		3,674 -3,713		197	22,000	NR	CO2 assist
		10/1/04		3,765 -3,836		276	60,000	NR	CO2 assist
		9/24/04		4,595 -4,669		263	49,500	NR	CO2 assist
		9/21/04		4,764 -4,777		164	16,000	NR	CO2 assist
		9/17/04		4,864 -4,925		269	45,000	NR	CO2 assist
		12/5/79		5,026 -5,084	1,800			2,900	Acidized
Section 11 T3N R2E									
1322059	Pavillion Fee 11-11	5/31/01	Ft. Union	3,359 -3,396		161	46,896	2,879	CO2 assist
		5/30/01		3,834 -3,902		200	48,239	3,000	CO2 assist
				4,082 -4,102		179	34,640	3,600	CO2 assist
				4,456 -4,466		153	26,777	2,222	CO2 assist
		5/11/01		4,526 -4,537		85	35,583	3,530	CO2 assist
				4,575 -4,582		136	26,911	3,570	CO2 assist
		5/5/01		4,814 -4,832	1,000	179	39,757	2,975	CO2 assist, csg test after sqz.
1322220	Pavillion Fee 11-11B	2/18/05	Wind River	1,516 -1,521		68	15,919	2,810	CO2 assist
				1,719 -1,726		79	14,440	2,943	CO2 assist
				1,856 -1,871		95	20,402	2,467	CO2 assist
				2,162 -2,176		91	18,332	3,064	CO2 assist
				2,260 -2,280		124	24,843	2,587	CO2 assist
				3,166 -3,180		232	28,991	1,665	CO2 assist
		2/14/02	Ft. Union	3,370 -3,378		64	10,853	3,190	CO2 assist
		2/13/05		3,430 -3,448		211	35,459	2,716	CO2 assist
		2/14/02		3,537 -3,547		141	23,761	2,700	CO2 assist
		2/13/02		3,800 -3,810		138	23,369	2,600	CO2 assist
		2/12/02		4,316 -4,326		157	25,456	3,150	CO2 assist
		2/9/02		4,510 -4,532		145	34,323	2,900	CO2 assist
		2/10/05		4,608 -4,662		356	44,353	3,090	CO2 assist
		2/8/02		4,730 -4,738	3,000	83	20,976	3,314	CO2 assist
1321669	Pavillion Unit 12-11	11/23/04	Ft. Union	3,382 -3,389		107	20,000	NR	CO2 assist, sand vol. est.
				3,562 -3,568		175	40,000	NR	CO2 assist, sand vol. est.
				3,614 -3,624		196	40,000	NR	CO2 assist, sand vol. est.
				3,746 -3,756		200	40,000	NR	CO2 assist, vols. est.
		11/5/04		3,822 -3,893		200	53,239	NR	CO2 assist, water vol. est.
		10/30/04		4,374 -4,404		210	15,013	NR	CO2 assist
		1/27/94		4,530 -4,548					No treatment
		10/19/04		4,587 -4,615		128	18,477	NR	CO2 assist
		10/14/04		4,754 -4,804		236	42,454	NR	CO2 assist
		10/12/93		5,167 -5,192		281	72,100	2,718	CO2 assist
		10/12/04		5,331 -5,354	NR	206	31,300	NR	CO2 assist
1322272	Pavillion Fee 12-11B	12/31/04	Wind River	1,406 -1,473		110	29,514	1,916	CO2 assist, water vol. est.
				1,534 -1,542		100	15,986	23,064	CO2 assist, water vol. est.
				1,640 -1,652		100	17,438	2,036	CO2 assist, water vol. est.
				1,716 -1,727		100	17,436	2,495	CO2 assist, water vol. est.
				2,663 -2,674		100	17,962	1,249	CO2 assist, water vol. est.
			F.U.	3,444 -3,466	5,000	100	24,956	2,834	CO2 assist, water vol. est.
1322102	Pavillion Fee 12-11W	5/3/01	Wind River	2,529 -2,541		144	31,791	1,720	CO2 assist
		5/2/01		2,767 -2,774		120	19,056	1,089	CO2 assist
				2,835 -2,841		117	17,203	2,200	CO2 assist
				2,898 -2,968		131	21,129	2,046	CO2 assist
				3,029 -3,096	NR	146	20,687	1,594	CO2 assist

TABLE 5
PAVILLION GAS WELL COMPLETION AND STIMULATION DATA
WIND RIVER AND FORT UNION FORMATIONS
WITHIN WDEQ AREAS OF REVIEW

API #	Well Name	Completion Date	Completion Form.	Completion Perforated Interval	Casing Test, psig	Fracture Treatment Water, bbls	Fracture Treatment Sand Vol., lbs	Fracture Treatment Max. Treating Pressure, psig	Remarks
Section 11 T3N R2E									
1322586	Tribal Pavillion 21-11B	4/12/05	Wind River	1,444 -1,474		54	15,015	1,041	CO2 assist
				2,055 -2,070		77	24,043	1,040	CO2 assist
				2,281 -2,288		55	14,999	1,098	CO2 assist
				2,433 -2,440		58	16,559	1,490	CO2 assist
				3,017 -3,025		63	15,048	2,550	CO2 assist
			Ft. Union	3,368 -3,394		89	21,472	1,337	CO2 assist
				3,496 -3,506		74	15,193	2,054	CO2 assist
				3,614 -3,624	NR	87	15,471	1,609	CO2 assist
Section 12 T3N R2E									
1322060	Pavillion Fee 13-12	6/1/01	Wind River	2,170 -2,180		88	18,748	1,780	CO2 assist
				2,317 -2,333		135	33,044	2,750	CO2 assist
				2,477 -2,481		76	11,855	2,787	CO2 assist
				2,761 -2,813		125	27,146	2,550	CO2 assist
				2,883 -2,889		103	18,375	2,630	CO2 assist
		5/31/01		2,971 -3,125	3,000	145	32,440	2,550	CO2 assist
1320878	Unit 22-12	4/30/93	W.R.	1,701 -2,388					No treatment
		12/29/79		3,218 -3,327		1,190	61,000	4,900	
		12/21/79	Ft. Union	3,510 -3,524				1,900	Acidized
		12/17/79		4,080 -4,226				1,900	Acidized
		12/11/79		4,290 -4,444				2,300	Acidized
		12/7/79		4,700 -4,998	1,500			2,500	Acidized
1322186	Pavillion Fee 23-12	9/19/01	Wind River	1,730 -1,758		112	37,560	2,600	CO2 assist
				2,228 -2,243		118	33,229	2,490	CO2 assist
				2,338 -2,345		78	16,444	2,450	CO2 assist
				2,881 -2,927		106	24,360	3,000	CO2 assist
		9/18/01		3,110 -3,118	3,000	111	24,286	2,918	CO2 assist
Section 13 T3N R2E									
1320855	Tribal Pavillion 12-13	8/17/00	W.R.	1,898 -2,432		177	22,618		N2 assist
		8/12/00		2,330 -2,335					
		3/28/79		3,388 -3,462		952	59,000		Acidized
		3/22/79	F.U.	3,721 -3,814					Acidized
		3/19/79		4,252 -4,580	1,800				Acidized
1322057	Pavillion Fee 21-13	2/17/01	W.R.	1,654 -1,664		98	24,000	1,700	CO2 assist
				2,136 -2,176		170	43,000	2,700	CO2 assist
				2,640 -2,654	NR	174	42,000	2,200	CO2 assist

Completion Practices

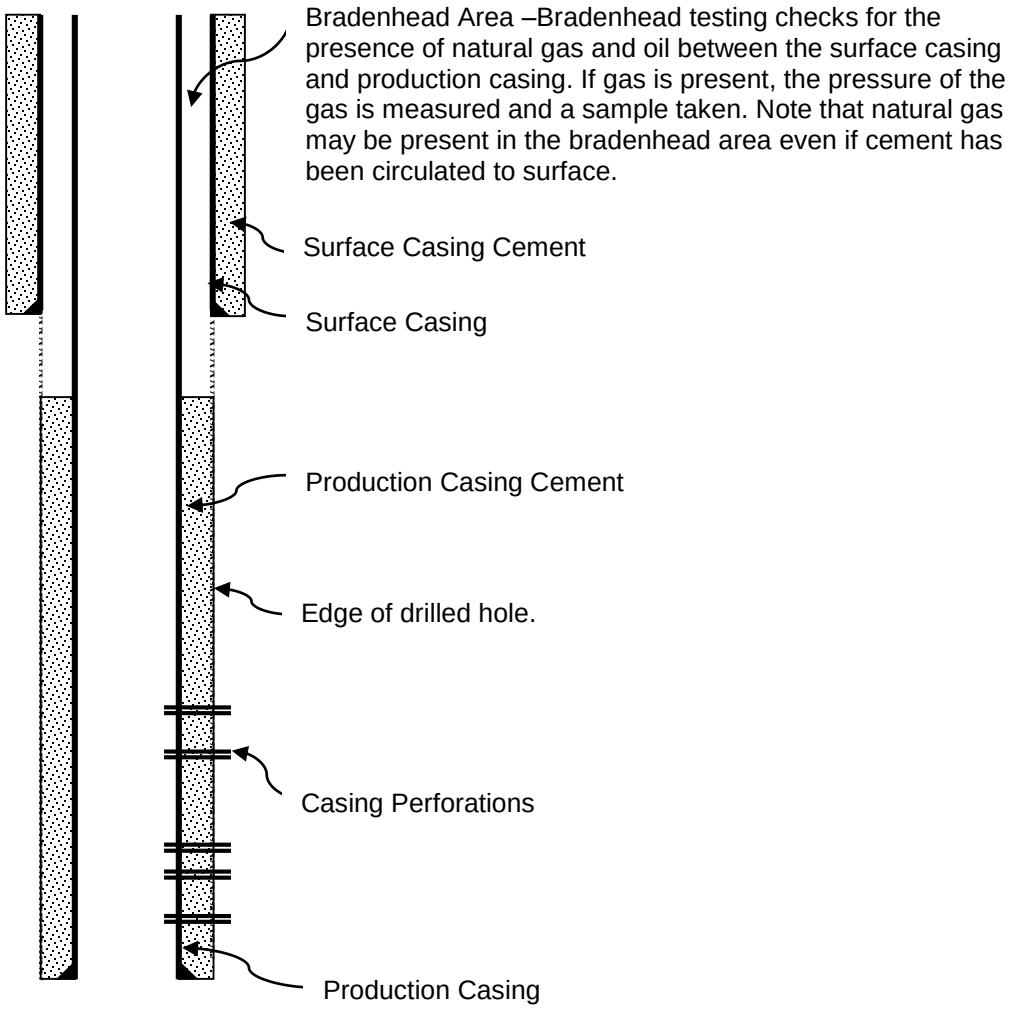
Pavillion gas well completion practices since the early 1990's typically consisted of 1) identifying Fort Union and/or Wind River Sands with commercial gas potential from open-hole electric log interpretation, 2) setting production casing to total depth of the well, 3) cementing the production casing to surface with light-weight cement, 4) running a cement bond log to confirm cement placement behind the production casing, 5) selectively perforating the production casing opposite prospective gas producing intervals, 6) hydraulic fracture treating groups of perforations with gelled water energized with carbon dioxide and propagated with sand, and 7) commingling the perforated intervals. Fracture treatments averaged about 145 barrels of water and 25,000 pounds of sand per stage. Within the areas of review, completions averaged seven fracture treatment stages per well, with the most being 14 fracture treatments on the Pavillion Fee 11-11B (NWNW Section 11). **Table 5** is a summary of each reviewed well's perforated and fracture treated intervals, as well as any reported casing pressure tests prior to perforating. Completion configurations are also detailed on the completion reports and wellbore diagrams included in **Appendix A**.

Bradenhead Testing

To address concerns about possible gas migration via existing gas well wellbores in the Pavillion Field from the Wind River and Fort Union Formations, in 2011 through 2013 Encana undertook a program to 1) measure pressure between the production casing and surface casing of wells, 2) bleed off any pressure observed, 3) monitor subsequent pressure buildup, and 4) evaluate characteristics of any gas and/or liquids recovered. This procedure, known as "bradenhead" testing, helped determine to what extent, if any, gas and/or reservoir fluids might have migrated upward from deeper gas bearing formations to the surface due to inadequate or insufficient cement or other hydraulic seal in the annular space behind the production casing. This procedure was approved by the WOGCC, and was also approved by the BLM for wells on Tribal lands. All 42 of the non-plugged wells within the areas of review, with the exception of the Tribal Pavillion 44-3 (SESE Section 3), which reported cement in the bradenhead valve, were tested as described. Of the 41 gas wells bradenhead tested, 25 wells were found to have no pressure, five wells had measurable pressure that bled off with no subsequent buildup, and 11 wells were observed to have pressure that, when bled off, rebuilt to measurable levels.

Table 6 summarizes the bradenhead testing results observed for all of the wells within the areas of review. **Figure 7** is a wellbore schematic depicting down-hole conditions of wells with recurring bradenhead pressure where gas composition analyses were performed to compare production gas to annulus (bradenhead) gas. **Figure 7a** depicts wells with recurring bradenhead pressure where gas composition analyses were performed to compare production gas to annulus (bradenhead) gas.

Wellbore Schematic of Bradenhead Testing
Figure 7



Bradenhead testing by itself will not identify subsurface cross-flow between formations. Gas in the surface casing/production casing annular space could originate from 1) a casing or wellhead leak resulting in communication from the inside of the casing to the annulus, 2) dissolved air or gas in the mud from drilling operations, or 3) flow of gas from a source below the base of the surface casing to the surface through the production casing annulus as a result of inadequate hydraulic seal in the production casing annulus.

The bradenhead testing pressure data and the compositional analysis of the sampled bradenhead gas indicates there is a shallow and separate gas zone in the Pavillion area that may have been penetrated by several water wells. This zone is considered part of the Wind River formation but occurs at a depth of approximately 699' (4,678' above sea level) in at least one well. This gas zone is 649' shallower than other producing zones in the field and has only been tested in the Tribal Pavillion 44-3. Records indicate the zone produced 151 barrels of water in 3 hours with a trace of gas before being cement squeezed. This shallow gas zone may also be the source of the gas

found in the Meeks water well located in the SW/SW of Section 2 and drilled to a depth of 550' (4818' above sea level). The Meeks water well was being unloaded with compressed air when natural gas began flowing to surface. The well was eventually plugged.

This shallow gas zone is indicated by information shown on Tables 6 and 7. Except for the very low bradenhead pressures that bled off immediately, most of the measured bradenhead pressures were in the range of 120 psi to 185 psi. This narrow band of bradenhead pressure data seems to indicate a single pressure source separated from the normal Wind River producing sands. The low producing pressures in the Ft. Union/Wind River formations may be caused by fluid buildup in the wellbores but only one recorded casing pressure is equal to reoccurring bradenhead pressures. All other pressures are slightly below or extremely below the measured bradenhead pressures. If the bradenhead pressure were a result of a casing leak or wellhead seal failure, the pressure in the casing would over time equalize with the pressure on the annulus.

Measured Pressures of Wells Having Initial Bradenhead Pressure

	Tubing psi	Casing psi	Bradenhead psi
Fee 13-3W	37	37	120
Fee 43-4	41	41	150
Fee 44-4	45	110	185
Fee 31-10	70	108	160
Tribal 32-10C	30	160	165
Fee 41-10B	39	39	165
Tribal 42-10B	140	40	20
Unit 44-10	85	85	150
Unit 12-11	42	100	150
Fee 12-11W	45	45	150

A chemical analysis of the bradenhead gas was obtained on 10 wells showing continually high bradenhead pressures. This gas analysis indicates the bradenhead gas is from a different source than the producing Ft. Union or lower Wind River Formations. The mole % for nitrogen and carbon dioxide is substantially different between produced gas and bradenhead gas in almost all samples. This difference in gas analysis indicates the bradenhead gas is from a different and separate source than the produced gas and is not just gas that has migrated from a deeper horizon. The difference between produced gas from the Fort Union and Lower Wind River formations and the gas found during bradenhead testing is shown in the table below:

Gas Analyses of Wells Having Initial Bradenhead Pressure

	Nitrogen (Mole %)		CO_2 (Mole %)	
	Tubing	Bradenhead	Tubing	Bradenhead
Fee 13-3W	0.3936	0.5851	0.0502	0
Fee 43-4	0.3936	0.5851	0.0295	0
Fee 44-4	0.3952	0.7962	0.0295	0
Fee 31-10	0.3529	0.8255	0.0006	0.0005
Tribal 32-10C	0.4696	1.4023	0.1336	0
Fee 41-10B	0.5704	0.7897	0.0467	0
Tribal 42-10B*	0.4577	1.1921	0.0592	0
Unit 44-10	0.358	1.3997	0.209	0
Unit 12-11	0.3545	0.7963	0.3991	0
Fee 12-11W	0.46991	0.9415	0.0575	0

*Gas analysis information for this well is included for informational purposes. Although other wells in the table had bradenhead pressures varying from 120 to 185 psi, the Tribal Pavillion 42-10B showed 20 psi bradenhead pressure.

In all cases the gas produced from the bradenhead has a higher concentration of nitrogen and a lower concentration of carbon dioxide than the gas being produced for the well bore, indicating a separate gas source. Surface casing depths in the wells noted above varies from 430' to 640' in depth.

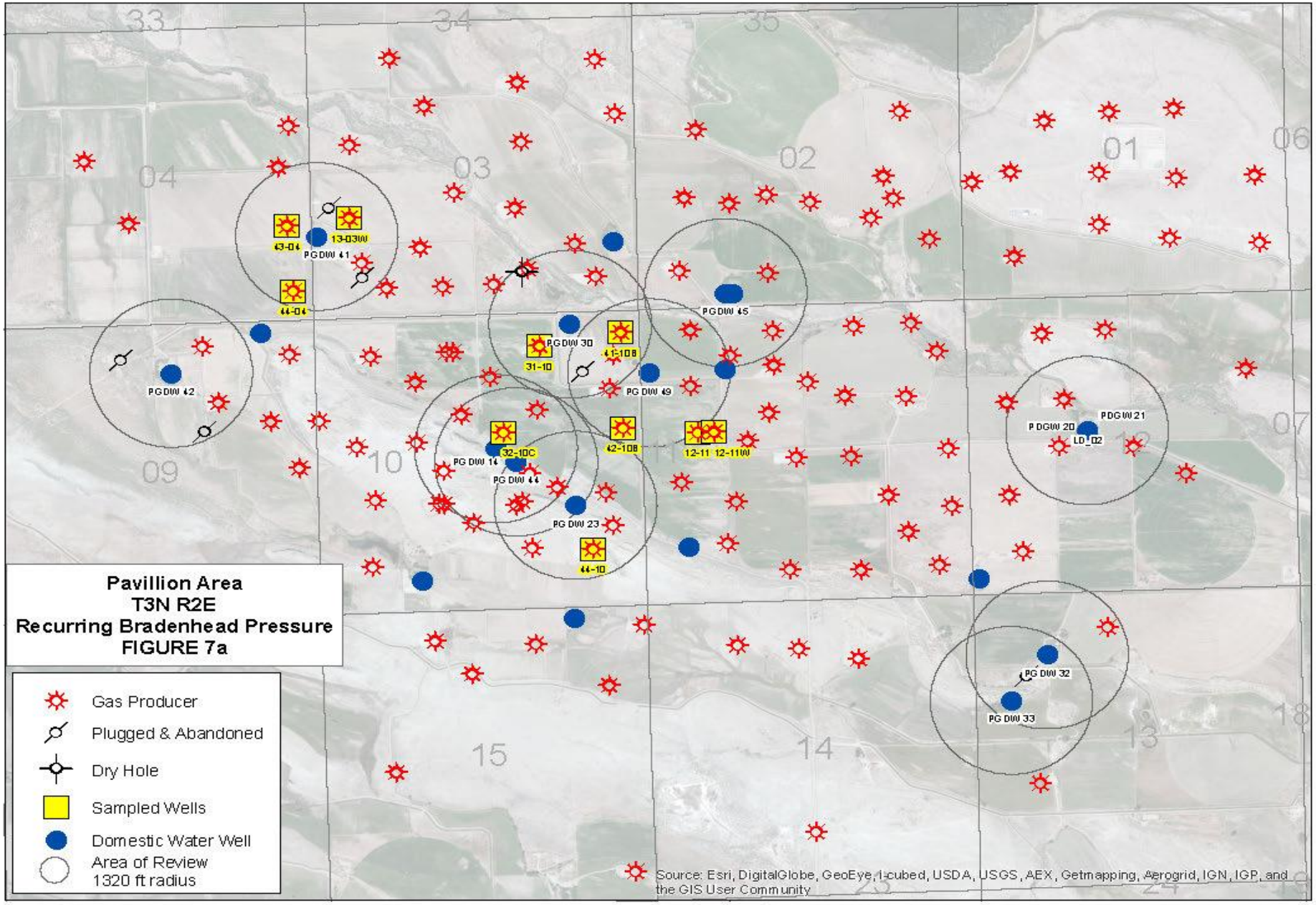
TABLE 6
PAVILLION FIELD BRADENHEAD[1] TEST RESULTS
WITHIN WDEQ AREAS OF REVIEW

API	Well Name	Bradenhead Test Results				Remarks
		Report Date	Tubing psig	Casing psig	Bradenhead psig	
Section 2 T3N R2E						
1321128	Tribal 14-2	11/7/11	10	20	5	Bradenhead bled to 0 psig, no buildup in 7 days. No water recovery.
1322236	Tribal Pavillion 24-2	4/24/12	24	24	12	Bradenhead bled to 0 psig, no buildup in 7 days. No water recovery.
Section 3 T3N R2E						
1322246	Pavillion Fee 13-3W	3/6/12	57	87	120	Bradenhead bled off, built to 168 psig in 7 days. No water recovery.
		5/14/12	37	37	120	15-day flow test. Bradenhead bled to 0 psig in 12 hours. Shut in after 15 days, built to 24 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead.
1321904	Pavillion Fee 13X-3					Plugged and abandoned October 1999.
1322623	Pavillion Fee 14-3B	3/19/12	50	60	0	No bradenhead pressure.
1322219	Pavillion Fee 14-3W	5/15/12	49	80	0	No bradenhead pressure.
1322087	Pavillion Fee 34-3R	10/26/11	40	40	0	No bradenhead pressure.
1321906	Tribal Pavillion 44-3					No test. Bradenhead valve filled with cement.
1320298	W.E. Lloyd 1					Plugged and abandoned August 1981.
1306388	Mae H. Rhodes 1					Plugged and abandoned November 1954.
Section 4 T3N R2E						
1322633	Pavillion Fee 43-4	3/6/12	41	41	150	Bradenhead bled off, built to 165 psig in 7 days. No water recovery.
		7/9/12	45	45	132	15-day flow test. Bradenhead bled to 0 psig in 12 hours. Shut in after 15 days, built to 118 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead.
1322634	Pavillion Fee 44-4	3/6/12	45	110	185	Bradenhead bled off, built to 201 psig in 7 days. No water recovery.
		7/9/12	47	105	175	15-day flow test. Bradenhead bled to 0 psig in 12 hours. Shut in after 15 days, built to 37 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead.
1320668	Blankenship 4-8	11/7/11	0	0	0	No bradenhead pressure. Mechanical Integrity Test performed 2/1/12, casing tested OK to 300 psig.
Section 9 T3N R2E						
1321130	Tribal 21-9					Plugged and abandoned September 1992.
1322172	Pavillion Fee 31-9	3/20/12	45	45	0	No bradenhead pressure.
1320084	Maxson 32-9					Plugged and abandoned May 1968.
1322227	Pavillion Fee 32-9W	6/6/12	44	44	0	No bradenhead pressure.
Section 10 T3N R2E						
1320876	USA Tribal 22-10	11/7/11	48	52	0	No bradenhead pressure.
1321692	Tribal Pavillion 23-10	11/9/11	45	42	5	Bradenhead bled to 0 psig, no buildup in 7 days. No water recovery. Mechanical Integrity Test performed 1/30/12, casing tested OK to 500 psig.
1322417	Tribal Pavillion 23-10B	11/7/11	42	82	0	No bradenhead pressure.
1322418	Tribal Pavillion 23-10C	11/7/11	42	70	0	No bradenhead pressure.
1321691	Pavillion Fee 31-10	11/7/11	70	108	160	Bradenhead bled off, built to 35 psig in 7 days. No water recovery.
		4/18/12	0	45	178	15-day flow test. Bradenhead bled to 0 psig in 3 days. Shut in after 15 days, built to 28 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead. Mechanical Integrity Test performed 10/5/12, casing tested OK to 500 psig.
		7/10/13			20	Bled to 10 psig, remained steady blow, no fluid recovery.
1322268	Pavillion Fee 31-10B	3/20/12	38	38	0	No bradenhead pressure.
1321968	Tribal Pavillion 32-10	11/7/11	60	80	20	Bradenhead bled off, built to 10 psig in 7 days. No water recovery.
1322224	Tribal Pavillion 32-10B	11/7/11	90	82	0	No bradenhead pressure.
1322419	Tribal Pavillion 32-10C	4/18/12	30	160	165	15-day flow test. Bradenhead bled to 0 psig in 9 hours. Shut in after 15 days, built to 65 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead.

TABLE 6
PAVILLION FIELD BRADENHEAD[1] TEST RESULTS
WITHIN WDEQ AREAS OF REVIEW

API	Well Name	Bradenhead Test Results				Remarks
		Report Date	Tubing psig	Casing psig	Bradenhead psig	
Section 10 T3N R2E						
1321862	Tribal Pavillion 33-10	11/7/11	45	51	0	No bradenhead pressure.
1322274	Tribal Pavillion 33-10B	3/22/12	36	39	0	No bradenhead pressure.
1322195	Tribal Pavillion 33-10W	6/6/12	31	31	0	No bradenhead pressure.
1306363	Govt Tribal 33X-10					Plugged and abandoned November 1981.
1322149	Tribal Pavillion 34-10	6/20/12	62	134	0	No bradenhead pressure.
1322198	Pavillion Fee 41-10	3/21/12	36	36	0	No bradenhead pressure.
1322624	Pavillion Fee 41-10B	5/14/12	39	39	165	15-day flow test. Bradenhead bled to 0 psig in 1 hour. Shut in after 15 days, built to 173 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead. Mechanical Integrity Test performed 12/20/12, casing tested OK to 500 psig.
		7/10/13			140	Bled to 0 psig in 56 seconds, no fluid recvovery.
1320414	Unit 41X-10					Plugged and abandoned November 1981.
1321696	Tribal 42-10	11/7/11	48	48	0	No bradenhead pressure.
1322324	Tribal Pavillion 42-10B	4/23/12	140	40	20	15-day flow test. Bradenhead bled to 0 psig instantly. Shut in after 15 days, built to 20 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead.
1321704	Tribal Pavillion 43-10	3/23/12	44	110	0	No bradenhead pressure.
1322420	Tribal Pavillion 43-10B	6/20/12	61	63	0	No bradenhead pressure.
1320879	Unit 44-10	11/26/11	85	85	150	15-day flow test. Bradenhead flowed gas and water. Shut in after 15 days, built to 105 psig in 7 days. Recovered 410 barrels water in first 8 hours. Gas and water samples taken from tubing and bradenhead.
Section 11 T3N R2E						
1322059	Pavillion Fee 11-11	3/7/12	36	36	0	No bradenhead pressure.
1322220	Pavillion Fee 11-11B	3/14/12	36	36	0	No bradenhead pressure.
1321669	Pavillion Unit 12-11	6/25/12	42	100	150	15-day flow test. Bradenhead bled to 0 psig in 2 hours. Shut in after 15 days, built to 54 psig in 7 days. No water recovery. Gas samples taken from tubing and bradenhead.
1322272	Pavillion Fee 12-11B	3/19/12	40	42	0	No bradenhead pressure.
1322102	Pavillion Fee 12-11W	7/24/12	45	45	150	15-day flow test. Bradenhead flowed gas and water. Shut in after 15 days, built to 142 psig in 7 days. Recovered 4303 barrels water. Gas and water samples taken from tubing and bradenhead. Mechanical Integrity Test performed 10/3/12, casing tested OK to 500 psig.
1322586	Tribal Pavillion 21-11B	3/19/12	40	40	0	No bradenhead pressure.
Section 12 T3N R2E						
1322060	Pavillion Fee 13-12	10/26/11	41	45	30	Bradenhead bled to 0 psig, no buildup in 7 days. No water recovery.
1320878	Unit 22-12	4/4/12	38	38	150	Bradenhead bled to 0 psig, no buildup in 7 days. No water recovery.
1322186	Pavillion Fee 23-12	3/19/12	36	36	0	No bradenhead pressure.
Section 13 T3N R2E						
1320855	Tribal Pavillion 12-13					Plugged and abandoned July 2001.
1322057	Pavillion Fee 21-13	10/26/11	50	50	0	No bradenhead pressure.

[1] Annulus between surface casing and production casing


Pavillion Area
T3N R2E
Recurring Bradenhead Pressure
FIGURE 7a
Gas Producer
Plugged & Abandoned
Dry Hole
Sampled Wells
Domestic Water Well
Area of Review
1320 ft radius
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community
33
34
35
04
03
02
01
06
09
10
11
12
07
15
14
13
18
13-03W
43-04
PG DW 41
44-04
PG DW 42
PG DW 30
31-10
41-10B
PG DW 49
PG DW 45
32-10C
PG DW 14
PG DW 44
42-10B
12-11
12-11W
PG DW 23
44-10
PDGW 20
PDGW 21
LD_02
PG DW 32
PG DW 33

Absorbed air or gas in the annular fluid introduced during drilling will dissociate from the fluid over time and rise to the surface, creating bradenhead pressure (analogous to opening a soda bottle). Once this pressure is bled off, it will not recur. This condition was observed in some of the wells tested.

Formation gas from below the base of the surface casing that has possibly migrated upward as a result of insufficient hydraulic seal in the production casing annulus could originate from either the deep producing gas sands, or shallower Wind River Sands penetrated during drilling that are known to contain gas. Where this condition is suspected to occur, chemical comparison of the gas produced from the targeted formation(s) to the gas observed in the bradenhead annulus will aid in determining if these gases originate from the same source. Ten wells within the areas of review were sampled in this manner. Detailed analyses of tubing and bradenhead gas for these wells are included in **Appendix B**, and summarized in the Well Summary Section for each well. Also included in Appendix B are water analyses for two wells, Unit 44-10 and Pavillion Fee 12-11W, that flowed water during the bradenhead testing.

Mechanical Integrity Testing

In order to evaluate casing integrity of certain wells, Encana performed Mechanical Integrity tests (MIT) on five wells within the areas of review. These tests were witnessed by WOGCC, and consisted of pulling the tubing, setting a mechanical bridge plug in the production casing above open perforations, filling the casing with water, pressure testing the casing, and observing for any pressure leak-off. Wells MIT tested were the Blankenship 4-8 (SENE Section 4), Tribal Pavillion 23-10 (NESW Section 10), Pavillion Fee 31-10 (NWNE Section 10), Pavillion Fee 41-10B (NENE Section 10), and Pavillion Fee 12-11W (SWNW Section 10). All wells were tested to 500 psig except the Blankenship 4-8, which was tested to 300 psig due to its inactive status. All wells tested satisfactory, with no observed pressure bleed-off.

Gas Well Proximity to Domestic Water Wells

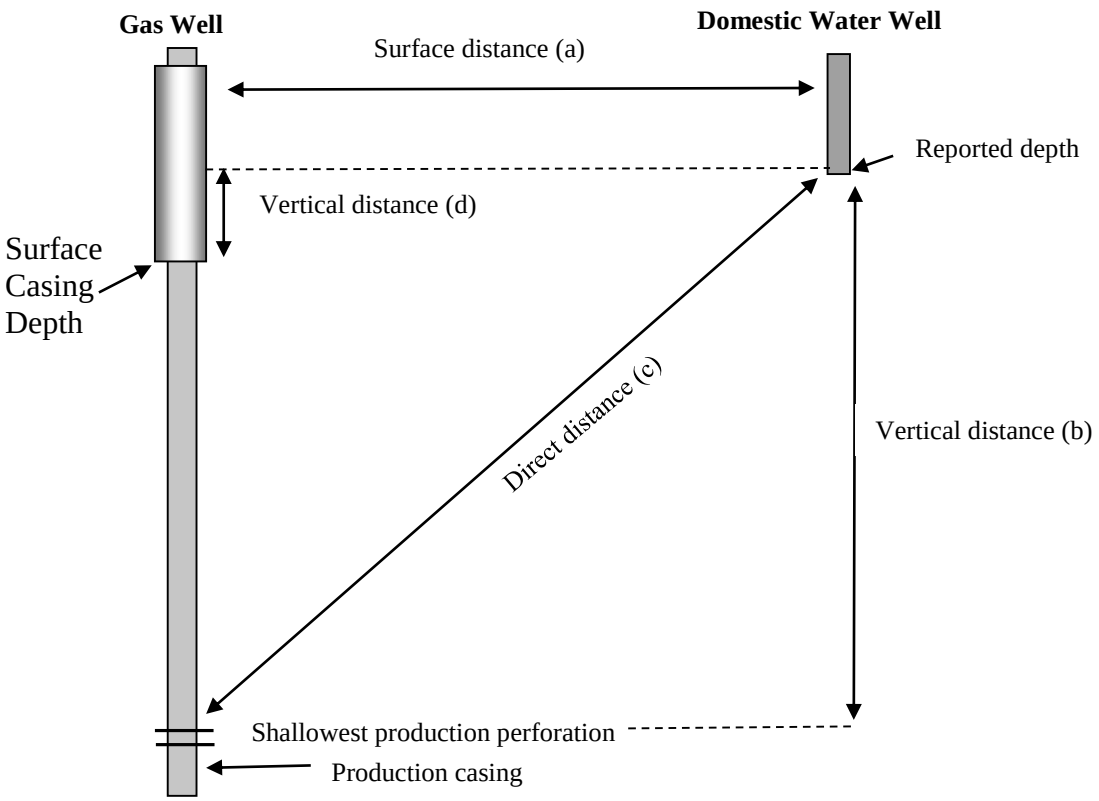
For each of the gas wells identified within the areas of review, a determination was made as to the surface (horizontal) distance to the nearest domestic water wells identified by the WDEQ as having quality and palatability issues within one-quarter mile of the gas well (**Figure 7b**, (a)). This determination was made using the decimal degrees of latitude and longitude as represented by the EPA in their Draft Report ***Investigation of Ground Water Contamination near Pavillion, Wyoming*** (EPA 600/R-00/000) for the domestic water wells and by the WOGCC for the gas wells. Distance calculations were made using the latitude and longitude distance calculator at

http://www.csgnetwork.com/gpsdistcalc.html.

In order to account for potential inaccuracies in distance determinations and data sources, gas wells within 100 feet beyond this one-quarter mile boundary were also included in the review.

As represented in Figure 7b, calculations were also made to determine the vertical distance from the gas well surface casing setting depth to the reported bottom of the domestic water well (d), the vertical distance from the top reported producing perforation in the gas wells to the reported bottom of the nearest domestic water well (b), and the calculated direct (angular) distance from the top perforation of the gas well to the reported bottom of the water well (c). All calculated distances are presented in **Table 7**.

Figure 7b
WELL PROXIMITY



Shown on **Figure 8** are the gas wells where surface casing is reported to be set shallower than the nearby domestic water wells reviewed.

TABLE 7
PROXIMITY OF PAVILLION GAS WELLS TO DOMESTIC WATER WELLS
WITHIN WDEQ AREAS OF REVIEW

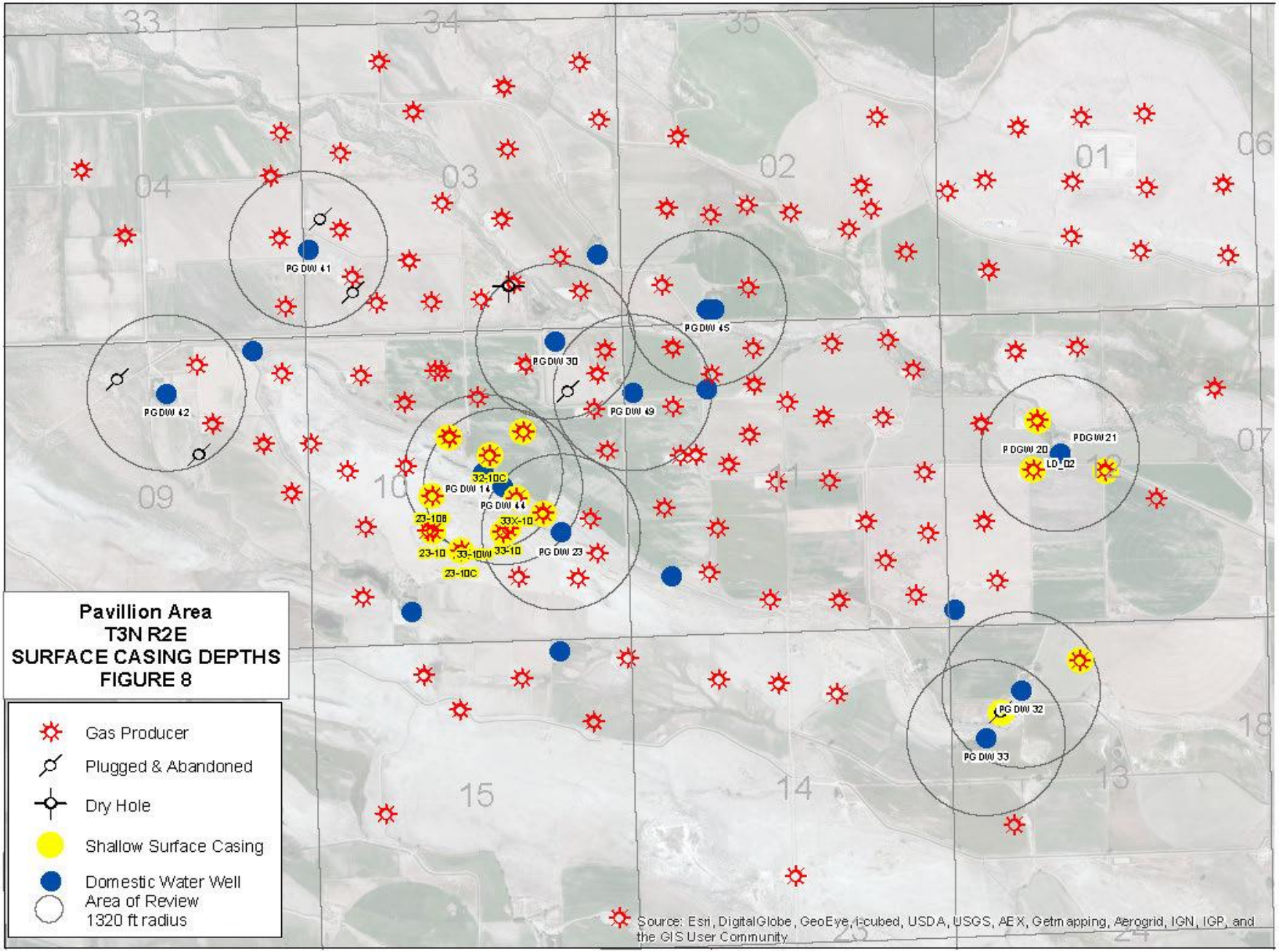
Gas Wells					Domestic Water Wells Within 1/4 Mile				Distance, ft.[1]			
Well Name	Latitude	Longitude	Surface Casing Depth, ft.[2]	Highest Perforation, ft.[2]	Well ID	Latitude	Longitude	Reported Depth, ft.	a	b	c	d
Section 2 T3N R2E												
Tribal 14-2	43.260210	-108.615830	584	1,566	PGDW05	43.25885	-108.61265	210	980	1,356	1,673	374
			584	1,566	PGDW45	43.258881	-108.61301	100	891	1,466	1,716	484
Tribal Pavillion 24-02	43.25972	-108.61083	552	1,528	PGDW05	43.25885	-108.61265	210	585	1,318	1,442	342
			552	1,528	PGDW45	43.258881	-108.61301	100	655	1,428	1,571	452
Section 3 T3N R2E												
Pavillion Fee 13-3W	43.262920	-108.636417	598	1,486	PGDW41	43.262146	-108.63785	100	473	1,386	1,464	498
Pavillion Fee 13X-3	43.263330	-108.634170	617	1,335	PGDW41	43.262146	-108.63785	100	1,068	1,235	1,633	517
Pavillion Fee 14-3B	43.259440	-108.634250	610	2,901	PGDW41	43.262146	-108.63785	100	1,373	2,801	3,119	510
Pavillion Fee 14-3W	43.260720	-108.635750	610	4,450	PGDW41	43.262146	-108.63785	100	762	4,350	4,416	510
Pavillion Fee 34-03R	43.26028	-108.62528	350	2,371	PGDW30	43.25753	-108.62258	260	1,232	2,111	2,444	90
Tribal Pavillion 44-03	43.25944	-108.62111	550	1,645	PGDW30	43.25753	-108.62258	260	797	1,385	1,598	290
W.E. Lloyd 1	43.26011	-108.62528	896	NA	PGDW30	43.25753	-108.62258	260	1,183	NA	NA	636
Mae H. Rhodes 1	43.260090	-108.635190	502		PGDW41	43.262146	-108.63785	100	1,029	-100	1,034	402
Section 4 T3N R2E												
Pavillion Fee 43-4	43.262610	-108.640222	590	1,710	PGDW41	43.262146	-108.63785	100	653	1,610	1,737	490
Pavillion Fee 44-4	43.259440	-108.639944	601	3,774	PGDW41	43.262146	-108.63785	100	1,133	3,674	3,845	501
Blankenship 4-8	43.265560	-108.640090	433	2,059	PGDW41	43.262146	-108.63785	100	1,380	1,959	2,396	333
Section 9 T3N R2E												
Tribal 21-9	43.256390	-108.650110	800	2,143	PGDW42	43.255745	-108.64732	200	778	1,943	2,093	600
Pavillion Fee 31-9	43.256860	-108.644861	524	2,303	PGDW42	43.255745	-108.64732	200	768	2,103	2,239	324
Maxson 32-9	43.252780	-108.645110	605		PGDW42	43.255745	-108.64732	200	1,229	-200	1,245	405
Pavillion Fee 32-9W	43.254080	-108.644722	522	2,548	PGDW42	43.255745	-108.64732	200	918	2,348	2,521	322
Section 10 T3N R2E												
USA Tribal 22-10	43.251940	-108.632220	594	1,980	PGDW14	43.25154	-108.62733	190	1,306	1,790	2,216	404
Tribal Pavillion 23-10	43.248890	-108.630680	590	4,577	PGDW14	43.25154	-108.62733	190	1,313	4,387	4,579	400
			590	4,577	PGDW44	43.25087	-108.62613	750	1,408	3,827	4,078	-160
Tribal Pavillion 23-10B	43.250470	-108.631222	631	2,280	PGDW14	43.25154	-108.62733	190	1,104	2,090	2,364	441
			631	2,280	PGDW44	43.25087	-108.62613	750	1,360	1,530	2,047	-119
Tribal Pavillion 23-10C	43.247890	-108.629472	566	1,761	PGDW44	43.25087	-108.62613	750	1,403	1,011	1,729	-184
Pavillion Fee 31-10	43.25633	-108.62460	593	3,330	PGDW30	43.25753	-108.62258	260	707	3,070	3,150	333
Pavillion Fee 31-10B	43.254940	-108.628222	620	1,692	PGDW14	43.25154	-108.62733	190	1,262	1,502	1,962	430
Tribal Pavillion 32-10	43.253300	-108.626000	613	5,293	PGDW14	43.25154	-108.62733	190	732	5,103	5,155	423
			613	5,293	PGDW44	43.25087	-108.62613	750	887	4,543	4,629	-137
Tribal Pavillion 32-10B	43.253280	-108.625389	612	4,511	PGDW14	43.25154	-108.62733	190	817	4,321	4,398	422
			612	4,511	PGDW44	43.25087	-108.62613	750	900	3,761	3,867	-138
Tribal Pavillion 32-10C	43.252220	-108.627500	616	1,910	PGDW14	43.25154	-108.62733	190	252	1,720	1,738	426
			616	1,910	PGDW44	43.25087	-108.62613	750	612	1,160	1,312	-134
Tribal Pavillion 33-10	43.249170	-108.625560	501	2,088	PGDW14	43.25154	-108.62733	190	984	1,898	2,138	311
			501	2,088	PGDW23	43.248665	-108.62259	500	809	1,588	1,782	1
			501	2,088	PGDW44	43.25087	-108.62613	750	638	1,338	1,482	-249
Tribal Pavillion 33-10B	43.249530	-108.624278	629	1,632	PGDW14	43.25154	-108.62733	190	1,093	1,442	1,809	439
			629	1,632	PGDW23	43.248665	-108.62259	500	547	1,132	1,257	129
			629	1,632	PGDW44	43.25087	-108.62613	750	693	882	1,122	-121
Tribal Pavillion 33-10W	43.248690	-108.626806	518	1,756	PGDW14	43.25154	-108.62733	190	1,048	1,566	1,884	328
			518	1,756	PGDW23	43.248665	-108.62259	500	1,118	1,256	1,682	18
			518	1,756	PGDW44	43.25087	-108.62613	750	815	1,006	1,295	-232
Govt Tribal 33X-10	43.250190	-108.625280	197	3,212	PGDW14	43.25154	-108.62733	190	734	3,022	3,110	7
			197	3,212	PGDW23	43.248665	-108.62259	500	904	2,712	2,859	-303
			197	3,212	PGDW44	43.25087	-108.62613	750	335	2,462	2,485	-553
Tribal Pavillion 34-10	43.246580	-108.625260	638	4,606	PGDW23	43.248665	-108.62259	500	1,039	4,106	4,235	138
Pavillion Fee 41-10	43.25586	-108.62092	524	1,608	PGDW30	43.25753	-108.62258	260	752	1,348	1,544	264
			524	1,608	PGDW49	43.25506	-108.61787	50	860	1,558	1,780	474
Pavillion Fee 41-10B	43.25694	-108.62017	630	1,782	PGDW30	43.25753	-108.62258	260	675	1,522	1,665	370
			630	1,782	PGDW49	43.25506	-108.61787	50	917	1,732	1,960	580

TABLE 7
PROXIMITY OF PAVILLION GAS WELLS TO DOMESTIC WATER WELLS
WITHIN WDEQ AREAS OF REVIEW

Gas Wells					Domestic Water Wells Within 1/4 Mile				Distance, ft.[1]			
Well Name	Latitude	Longitude	Surface Casing Depth, ft.[2]	Highest Perforation, ft.[2]	Well ID	Latitude	Longitude	Reported Depth, ft.	a	b	c	d
Section 10 T3N R2E												
Unit (C.A. Fike) 41X-10	43.25511	-108.62201	609	1,799	PGDW30	43.25753	-108.62258	260	896	1,539	1,781	349
			609	1,799	PGDW49	43.25506	-108.61787	50	1,098	1,749	2,065	559
Tribal 42-10	43.25454	-108.62044	611	2,487	PGDW30	43.25753	-108.62258	260	1,229	2,227	2,544	351
			611	2,487	PGDW49	43.25506	-108.61787	50	707	2,437	2,537	561
Tribal Pavillion 42-10B	43.252190	-108.620194	611	1,880	PGDW49	43.25506	-108.61787	50	1,214	1,830	2,196	561
Tribal Pavillion 43-10	43.249250	-108.620760	626	4,544	PGDW23	43.248665	-108.62259	500	532	4,044	4,079	126
Tribal Pavillion 43-10B	43.247610	-108.620944	626	1,800	PGDW23	43.248665	-108.62259	500	583	1,300	1,425	126
Unit 44-10	43.246490	-108.621610	591	2,677	PGDW23	43.248665	-108.62259	500	835	2,177	2,332	91
Section 11 T3N R2E												
Pavillion Fee 11-11	43.255109	-108.613611	520	3,348	PGDW05	43.25885	-108.61265	210	1,386	3,138	3,430	310
			520	3,348	PGDW45	43.258881	-108.61301	100	1,384	3,248	3,531	420
			520	3,348	PGDW49	43.25506	-108.61787	50	1,132	3,298	3,487	470
Pavillion Fee 11-11B	43.25697	-108.61594	550	1,506	PGDW05	43.25885	-108.61265	210	1,111	1,296	1,707	340
			550	1,506	PGDW45	43.258881	-108.61301	100	1,044	1,406	1,751	450
			550	1,506	PGDW49	43.25506	-108.61787	50	865	1,456	1,694	500
Pavillion Unit 12-11	43.252270	-108.614830	612	3,367	PGDW49	43.25506	-108.61787	50	1,299	3,317	3,562	562
Pavillion Fee 12-11B	43.254220	-108.615972	541	1,397	PGDW49	43.25506	-108.61787	50	590	1,347	1,471	491
Pavillion Fee 12-11W	43.251940	-108.615000	418	2,517	PGDW49	43.25506	-108.61787	50	1,369	2,467	2,821	368
Tribal Pavillion 21-11B	43.256940	-108.610917	632	1,434	PGDW05	43.25885	-108.61265	210	833	1,224	1,481	422
			632	1,434	PGDW45	43.258881	-108.61301	100	900	1,334	1,609	532
Section 12 T3N R2E												
Pavillion Fee 13-12	43.25083	-108.59306	315	2,158	PGDW20	43.25167	-108.60151	460	563	1,698	1,789	-145
			315	2,158	PGDW21	43.25167	-108.60151	460	563	1,698	1,789	-145
			315	2,158	LD02	43.25167	-108.60151	610	563	1,548	1,647	-295
Unit 22-12	43.25306	-108.59269	572	1,687	PGDW20	43.25167	-108.60151	460	631	1,227	1,380	112
			572	1,687	PGDW21	43.25167	-108.60151	460	630	1,227	1,379	112
			572	1,687	LD02	43.25167	-108.60151	610	630	1,077	1,248	-38
Pavillion Fee 23-12	43.25072	-108.58917	524	1,720	PGDW20	43.25167	-108.60151	460	685	1,260	1,434	64
			524	1,720	PGDW21	43.25167	-108.60151	460	659	1,260	1,422	64
			524	1,720	LD02	43.25167	-108.60151	610	659	1,110	1,291	-86
Section 13 T3N R2E												
Tribal Pavillion 12-13	43.239590	-108.595560	566	1,888	PGDW32	43.240753	-108.59416	674	565	1,214	1,339	-108
			566	1,888	PGDW33	43.238555	-108.59641	30	440	1,858	1,909	536
Pavillion Fee 21-13	43.242179	-108.590496	430	1,642	PGDW32	43.240753	-108.59416	674	514	968	1,096	-244

[1] a = surface distance between gas well and water well
b = vertical distance from gas well top producing perforation to reported bottom of water well
c = calculated direct distance from gas well top producing perforation to bottom of water well
d = vertical distance from base of surface casing to bottom of nearest domestic water well

[2] Depths adjusted to ground level


Pavillion Area
T3N R2E
SURFACE CASING DEPTHS
FIGURE 8
Gas Producer
Plugged & Abandoned
Dry Hole
Shallow Surface Casing
Domestic Water Well
Area of Review
1320 ft radius
PG DW 41
PG DW 42
PG DW 30
PG DW 45
PG DW 49
PG DW 14
PG DW 44
PG DW 23
PG DW 32
PG DW 33
PDGW 20
PDGW 21
LD_02
32-10C
23-10B
23-10
33-10W
33-10
33X-10
23-10C
33
34
35
04
03
02
01
06
09
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18
Source: Esri, DigitalGlobe, GeoEye, i-cubed, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, and the GIS User Community

DOMESTIC WATER WELL SUMMARIES

All domestic water wells identified within the areas of review are completed in, and produce from, the Tertiary Eocene Wind River Formation. Records available from the State Engineer's Office give little or no data relating to water well completion techniques. Domestic water well identification numbers are referenced from Appendix A, Table 1A of the December 8, 2011 EPA Draft Report ***Investigation of Ground Water Contamination near Pavillion, Wyoming*** (EPA 600/R-00/000). Ownership, location, and completion information are taken from the EPA, SEO, and/or WDEQ records, and are shown on Table 1. Available permitting information on file with the State Engineer's Office for the seven water wells permitted is provided in **Appendix C**.

PGDW05 is owned by Louis Meeks and is located in the SWSW of Section 2 (Figure 3). EPA reports the depth at 64.0 meters (210'). Based on latitude and longitude given in the EPA report, the approximate location is 226' FSL and 1,509' FWL (Figure 1). The Wyoming State Engineer's Office issued a permit in the quarter/quarter section for a 210' water well described as the K&J Huelle #1, and filed January 22, 1976 with the SEO (U.W. 32161). The permit shows the well was completed in January 1973 with 6" steel casing at 150'. The SEO also has permit applications for two other water wells in the SWSW of Section 2, the Meeks #1 (U.W. 190920, estimated depth 60') and the Meeks #2 (U.W. 170310). Permit U.W. 190920 is reported as not valid. Permit U.W. 170310 was applied for in October 2005 at a depth of 300', and according to records received from the EPA (not on file with the SEO), was drilled in December 2005 to a depth of 550'. Six inch (6") PVC casing was set at 540' with a gravel packed screen from 520'-540'. During the process of developing the well (unloading wellbore fluids with compressed air), gas began flowing to the surface. The gas field operator, Encana, plugged the well on December 27, 2005. 151 barrels of water were pumped to kill the gas flow. 10.3 barrels of cement were pumped into the bottom of the well measured by wire line tools at 518'. The casing was perforated at 267' but could not be pumped into, and was re-perforated at 150'. 11.4 barrels of cement were pumped into these perforations. In March 2008 a request was submitted to the SEO to change the approved depth of this well from 300' to 700', and was subsequently approved by the SEO in April 2008. In January 2012 the SEO extended until December 31, 2014 the time limit for Completion of Construction and Completion of Beneficial Use of Water for this permit.

Distance from the Tribal Pavillion 14-2 is 980', and the 14-2 surface casing is set 374' deeper than the reported bottom of PGDW05. Distance from the Tribal Pavillion 24-2 is 585', and the 24-2 surface casing is set 342' deeper than the reported bottom of PGDW05. Distance from the Pavillion Fee 11-11 is 1,386', and the 11-11 surface casing is set 310' deeper than the reported bottom of PGDW05. Distance from the Pavillion Fee 11-11B is 1,111', and the 11-11B surface casing is set 340' deeper than the reported bottom of PGDW05. Distance from the Tribal Pavillion 21-11B is 833', and the 21-11B surface casing is set 422' deeper than the reported bottom of PGDW05.

PGDW14 is owned by Marvin Griffin and is located in the SWNE of Section 10 (Figure 4). EPA reports the depth at 57.9 meters (190'). Based on latitude and longitude given in the EPA report, the approximate location is 2,414' FNL and 2,368' FEL (Figure 1). The Wyoming State Engineer's Office has not issued a water well permit at this location.

Distance from the USA Tribal 22-10 is 1,306', and the 22-10 surface casing is set 404' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 23-10 is 1,313', and the 23-10 surface casing is set 400' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 23-10B is 1,104', and the 23-10B surface casing is set 441' deeper than the reported bottom of PGDW14. Distance from the Pavillion Fee 31-10B is 1,262', and the 31-10B surface casing is set 430' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 32-10 is 732', and the 32-10 surface casing is set 423' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 32-10B is 817', and the 32-10B surface casing is set 422' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 32-10C is 252', and the 32-10C surface casing is set 426' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 33-10 is 984', and the 33-10 surface casing is set 311' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 33-10B is 1,093', and the 33-10B surface casing is set 439' deeper than the reported bottom of PGDW14. Distance from the Tribal Pavillion 33-10W is 1,048', and the 33-10W surface casing is set 328' deeper than the reported bottom of PGDW14. Distance from the Gov't. Tribal 33X-10 is 734', and the 33X-10 surface casing is set 7' deeper than the reported bottom of PGDW14.

PGDW20 is owned by Jeff Locker and is located in the SENW of Section 12 (Figure 5). EPA reports the depth at 140.2 meters (460'). Based on latitude and longitude given in the EPA report, the approximate location is 2,142' FNL and 1,810' FWL (Figure 1). The Wyoming State Engineer's Office has a water well permit application for the Locker #2 at this location with a depth of 640' (U.W. 97501), however no completion record was filed, and the permit was cancelled.

Distance from the Pavillion Fee 13-12 is 563', and the 13-12 surface casing is set 145' shallower than the reported bottom of PGDW20. Distance from the Unit 22-12 is 631', and the 22-12 surface casing is set 112' deeper than the reported bottom of PGDW20. Distance from the Pavillion Fee 23-12 is 685', and the 23-12 surface casing is set 64' deeper than the reported bottom of PGDW20.

PGDW21 is owned by Jeff Locker and is located in the SENW of Section 12 (Figure 5). EPA reports the depth at 140.2 meters (460'). Based on latitude and longitude given in the EPA report, the approximate location is 2,384' FNL and 1,916' FEL (Figure 1). The Wyoming State Engineer's Office has a water well permit application for the Locker #2 at this location with a depth of 640' (U.W. 97501), however no completion record was filed, and the permit was cancelled.

Distance from the Pavillion Fee 13-12 is 563', and the 13-12 surface casing is set 145' shallower than the reported bottom of PGDW21. Distance from the Unit 22-12 is 630', and the 22-12 surface casing is set 112' deeper than the reported bottom of PGDW21. Distance from the Pavillion Fee 23-12 is 659', and the 23-12 surface casing is set 64' deeper than the reported bottom of PGDW21.

LD02 is owned by Jeff Locker and is located in the SENW of Section 12 (Figure 5). EPA reports the depth at 185.9 meters (610'). Based on latitude and longitude given in the EPA report (identical to the coordinates for PGDW21), the approximate location is 2,384' FNL and 1,916' FEL (Figure 1). The Wyoming State Engineer's Office has a water well permit application for the Locker #2 at this location with a depth of 640' (U.W. 97501), however no completion record was filed, and the permit was cancelled.

Distance from the Pavillion Fee 13-12 is 563', and the 13-12 surface casing is set 295' shallower than the reported bottom of LD02. Distance from the Unit 22-12 is 630', and the 22-12 surface casing is set 38' shallower than the reported bottom of LD02. Distance from the Pavillion Fee 23-12 is 659', and the 23-12 surface casing is set 86' shallower than the reported bottom of LD02.

PGDW23 is owned by John Fenton and is located in the NESE of Section 10 (Figure 4). EPA reports the depth at 152.4 meters (500'). Based on latitude and longitude given in the EPA report, the approximate location is 1,810' FSL and 1,101' FEL (Figure 1). The Wyoming State Engineer's Office issued a water well permit for a 175' well in the quarter/quarter section described as the Miller #3, and filed August 31, 1973 with the SEO (U.W. 24508). The permit shows the well was completed in 1964 with 9" steel casing at 90'.

Distance from the Tribal Pavillion 33-10 is 809', and the 33-10 surface casing is set 1' deeper than the reported bottom of PGDW23. Distance from the Tribal Pavillion 33-10B is 547', and the 33-10B surface casing is set 129' deeper than the reported bottom of PGDW23. Distance from the Tribal Pavillion 33-10W is 1,118', and the 33-10W surface casing is set 18' deeper than the reported bottom of PGDW23. Distance from the Gov't. Tribal 33X-10 is 904', and the 33X-10 surface casing is set 303' shallower than the reported bottom of PGDW23. Distance from the Tribal Pavillion 34-10 is 1,039', and the 34-10 surface casing is set 138' deeper than the reported bottom of PGDW23. Distance from the Tribal 43-10 is 532', and the 43-10 surface casing is set 126' deeper than the reported bottom of PGDW23. Distance from the Tribal Pavillion 43-10B is 583', and the 43-10B surface casing is set 126' deeper than the reported bottom of PGDW23. Distance from the Unit 44-10 is 835', and the 44-10 surface casing is set 91' deeper than the reported bottom of PGDW23.

PGDW30 is owned by Brian Randall and is located in the NENE of Section 10 (Figure 3). EPA reports the depth at 79.2 meters (260'). Based on latitude and longitude given in the EPA report, the approximate location is 302' FNL and 1,147' FEL (Figure 1). The Wyoming State Engineer's Office has not issued a water well permit at this location.

Distance from the Pavillion Fee 34-3R is 1,232', and the 34-3R surface casing is set 90' deeper than the reported bottom of PGDW30. Distance from the Tribal Pavillion 44-3 is 797', and the 44-3 surface casing is set 290' deeper than the reported bottom of PGDW30. Distance from the W.E. Lloyd 1 is 1,183', and the Lloyd 1 surface casing is set 636' deeper than the reported bottom of PGDW30. Distance from the Pavillion 31-10 is 707', and the 31-10 surface casing is set 333' deeper than the reported bottom of PGDW30. Distance from the Pavillion Fee 41-10 is 752', and the 41-10 surface casing is set 264' deeper than the reported bottom of PGDW30. Distance from the Pavillion Fee 41-10B is 675', and the 41-10B surface casing is set 370' deeper than the reported bottom of PGDW30. Distance from the Unit 41X-10 is 896', and the 41X-10 surface casing is set 349' deeper than the reported bottom of PGDW30. Distance from the Tribal 42-10 is 1,229', and the 42-10 surface casing is set 351' deeper than the reported bottom of PGDW30.

PGDW32 is owned by Joe Dennis and is located in the NWNW of Section 13 (Figure 5). EPA reports the depth at 205.7 meters (674'). Based on latitude and longitude given in the EPA report, the approximate location is 1,011' FNL and 1,267' FWL (Figure 1). The Wyoming State Engineer's Office shows two approved completion

records for water wells in this quarter/quarter section: a 675' well described as the Dennis #1, filed September 21, 1983 (U.W. 64110), and the Hunt #1, completed in 1938 (U.W. 22660). SEO records show the Dennis #1 well was completed September 2, 1983 with 8" steel casing at 30' and 6" steel casing at 550'. The water zone was reported at 661'-669'. Records show the Hunt #1 well was completed in September 1938 with 7" steel casing at 25'.

Distance from the Tribal Pavillion 12-13 is 565', and the 12-13 surface casing is set 108' shallower than the reported bottom of PGDW32. Distance from the Pavillion Fee 21-13 is 514', and the 21-13 surface casing is set 244' shallower than the reported bottom of PGDW32.

PGDW33 is owned by Joe Dennis and is located in the SWNW of Section 13 (Figure 5). EPA reports the depth at 9.1 meters (30'). Based on latitude and longitude given in the EPA report, the approximate location is 1,901' FNL and 558' FWL (Figure 1). The Wyoming State Engineer's Office issued a water well permit for a 30' well in the quarter/quarter section described as the Hippe #1, and filed December 28, 1972 with the SEO (U.W. 22662). The permit shows the well was completed in 1934 with 7" steel casing at 25'.

Distance from the Tribal Pavillion 12-13 is 440', and the 12-13 surface casing is set 536' deeper than the reported bottom of PGDW33.

PGDW41 is owned by Guy Faris and Leslie Capps and is located in the NWSW of Section 3 (Figure 2). EPA reports the depth at 114.6 meters (376'). Based on latitude and longitude given in the EPA report, the approximate location is 1,448' FSL and 91' FWL (Figure 1). The Wyoming State Engineer's Office issued a water well permit for the Garland #1 at this location (U.W. 66345), with a reported depth of 70' and completed June 30, 1984. The permit shows the well was completed with 6" plastic casing at 70' and the water zone was perforated at 53'-68'.

Distance from the Pavillion Fee 13-3W is 473', and the 13-3W surface casing is set 498' deeper than the reported bottom of PGDW41. Distance from the Pavillion Fee 13X-3 is 1,068', and the 13X-3 surface casing is set 517' deeper than the reported bottom of PGDW41. Distance from the Pavillion Fee 14-3B is 1,373', and the 14-3B surface casing is set 510' deeper than the reported bottom of PGDW41. Distance from the Pavillion Fee 14-3W is 762', and the 14-3W surface casing is set 510' deeper than the reported bottom of PGDW41. Distance from the Mae H. Rhodes 1 is 1,029', and the Mae H. Rhodes 1 surface casing is set 402' deeper than the reported bottom of PGDW41. Distance from the Pavillion Fee 43-4 is 653', and the 43-4 surface casing is set 490' deeper than the reported bottom of PGDW41. Distance from the Pavillion Fee 44-4 is 1,133', and the 44-4 surface casing is set 501' deeper than the reported bottom of PGDW41. Distance from the Blankenship 4-8 is 1,380', and the Blankenship 4-8 surface casing is set 333' deeper than the reported bottom of PGDW41.

PGDW42 is owned by Dale Steele and is located in the NWNE of Section 9 (Figure 2). EPA reports the depth at 61.0 meters (200'). Based on latitude and longitude given in the EPA report, the approximate location is 784' FNL and 2,429' FEL (Figure 1). The Wyoming State Engineer's Office issued a water well permit for a 200' well in the NENW quarter/quarter section approximately 400' FWL described as the Newkirk #2, and filed February 21, 1981 with the SEO (U.W. 41517), and although there appears to be a discrepancy with the quarter/quarter description, it is believed this is the permitted

well. The permit shows the well was completed February 16, 1981 with 5" 200 gage PVC casing at 200' and perforated 180'-200'.

Distance from the Tribal 21-9 is 778', and the 21-9 surface casing is set 600' deeper than the reported bottom of PGDW42. Distance from the Pavillion Fee 31-9 is 768', and the 31-9 surface casing is set 324' deeper than the reported bottom of PGDW42. Distance from the Maxson 32-9 1,229', and the Maxson 32-9 surface casing is set 405' deeper than the reported bottom of PGDW42. Distance from the Pavillion Fee 32-9W is 918', and the 32-9W surface casing is set 322' deeper than the reported bottom of PGDW42.

PGDW44 is owned by Marvin Griffin and is located in the NWSE of Section 10 (Figure 4). EPA reports the depth at 228.6 meters (750'). Based on latitude and longitude given in the EPA report, the approximate location is 2,625' FSL and 2,052' FEL (Figure 1). The Wyoming State Engineer's Office issued a permit for a 750' water well in the quarter/quarter section described as the Miller #1, and filed August 31, 1973 with the SEO (U.W. 24506). The permit shows the well was drilled in 1932 with 6" steel casing at 500'.

Distance from the Tribal Pavillion 23-10 is 1,408', and the 23-10 surface casing is set 160' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 23-10B is 1,360', and the 23-10B surface casing is set 119' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 23-10C is 1,403', and the 23-10C surface casing is set 184' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 32-10 is 887', and the 32-10 surface casing is set 137' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 32-10B is 900', and the 32-10B surface casing is set 138' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 32-10C is 612', and the 32-10C surface casing is set 134' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 33-10 is 638', and the 33-10 surface casing is set 249' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 33-10B is 693', and the 33-10B surface casing is set 121' shallower than the reported bottom of PGDW44. Distance from the Tribal Pavillion 33-10W is 815', and the 33-10W surface casing is set 232' shallower than the reported bottom of PGDW44. Distance from the Gov't. Tribal 33X-10 is 335', and the 33X-10 surface casing is set 553' shallower than the reported bottom of PGDW44.

PGDW45 is owned by Louis Meeks and is located in the SWSW of Section 2 (Figure 3). EPA did not report the depth of this well. WDEQ reports a depth of 100'. Based on latitude and longitude given in the EPA report, the approximate location is 256' FSL and 1,403' FWL (Figure 1). The SEO has permit applications for three water wells in this quarter/quarter location, the K&J Huelle #1 (U.W. 32161, assumed to be PGDW05), the Meeks #1 (U.W. 190920, estimated depth 60') and the Meeks #2 (U.W. 170310, estimated depth 700'), however only U.W. 32161 is reported valid.

Distance from the Tribal Pavillion 14-2 is 891', and the 14-2 surface casing is set 484' deeper than the reported bottom of PGDW45. Distance from the Tribal Pavillion 24-2 is 655', and the 24-2 surface casing is set 452' deeper than the reported bottom of PGDW45. Distance from the Pavillion Fee 11-11 is 1,384', and the 11-11 surface casing is set 420' deeper than the reported bottom of PGDW45. Distance from the Pavillion Fee 11-11B is 1,044', and the 11-11B surface casing is set 450' deeper than the reported

bottom of PGDW45. Distance from the Tribal Pavillion 21-11B is 900', and the 21-11B surface casing is set 532' deeper than the reported bottom of PGDW45.

PGDW49 is owned by Louis Meeks and is located in the NWNW of Section 11 (Figure 3). EPA did not report the depth of this well. WDEQ reports a depth of 50'. Based on latitude and longitude given in the EPA report, the approximate location is 1,116' FNL and 151' FWL (Figure 1). The Wyoming State Engineer's Office has not issued a permit for a water well at this location.

Distance from the Pavillion Fee 41-10 860', and the 41-10 surface casing is set 474' deeper than the reported bottom of PGDW49. Distance from the Pavillion Fee 41-10B is 917', and the 41-10B surface casing is set 580' deeper than the reported bottom of PGDW49. Distance from the Unit 41X-10 is 1,098', and the 41X-10 surface casing is set 559' deeper than the reported bottom of PGDW49. Distance from the Tribal 42-10 is 707', and the 42-10 surface casing is set 561' deeper than the reported bottom of PGDW49. Distance from the Tribal Pavillion 42-10B is 1,214', and the 42-10B surface casing is set 561' deeper than the reported bottom of PGDW49. Distance from the Pavillion Fee 11-11 is 1,132', and the 11-11 surface casing is set 470' deeper than the reported bottom of PGDW49. Distance from the Pavillion Fee 11-11B is 865', and the 11-11B surface casing is set 500' deeper than the reported bottom of PGDW49. Distance from the Pavillion Unit 12-11 is 1,299', and the 12-11 surface casing is set 562' deeper than the reported bottom of PGDW49. Distance from the Pavillion Fee 12-11B is 590', and the 12-11B surface casing is set 491' deeper than the reported bottom of PGDW49. Distance from the Pavillion Fee 12-11W is 1,369', and the 12-11W surface casing is set 368' deeper than the reported bottom of PGDW49.

GAS WELL SUMMARIES

Following are summary discussions of the gas wells in the Pavillion Field within one-quarter mile of domestic water wells identified by the Wyoming Department of Environmental Quality as having quality and palatability issues. In order to account for potential inaccuracies in distance determinations, wells less than 100 feet outside of this quarter mile boundary were also included. Appendix A includes regulatory completion reports, wellbore completion diagrams, WOGCC well data summaries, and monthly production history plots for all wells reviewed.

As is common and accepted practice in documenting oil and gas well histories, depth references are "zeroed" at the Kelly Bushing (KB) of the drilling rig, ranging from 4' above ground level to 24' above ground level for the wells reviewed, as shown on Table 2.

Section 2, T3N, R2E

Tribal 14-2 (API #49-013-21128) was completed in May 1981 by Shell Oil Company at a total depth of 5,175' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-0258-6301), at a surface location of 682' FSL and 552' FWL (SWSW) and is shown on Figure 3. 8-5/8" surface casing was set at 599' and cemented to surface with 450 sacks of Class G cement. 5-1/2" production casing was set at 5,170' and cemented with 800 sacks of Class G cement (1.15 cubic feet/sack, 15.8 pounds per gallon). Mud weight prior to cementing was 9.2 pounds per gallon. A cement bond log reportedly ran in November 1980 from 5,074' - 2,000' measured cement top behind the 5-1/2" casing at 2,220' below surface. This log was not located in WOGCC files, BLM files, or Encana records. After cementing the 5-1/2" production casing, a gas flow was observed between the 5-1/2" and 8-5/8" casings. A temperature and noise log identified the inflow from 2,190'. The 5-1/2" casing was perforated at 2,180' in January 1981 and 600 sacks of Class G cement were circulated to surface. Subsequent to this cement job, a casing leak was identified between 2,196' and 2,201', and squeeze cemented with 50 sacks of Class G cement. Fort Union Sands were selectively perforated between 3,409' and 4,962' and fracture treated with a total of 935 barrels of gelled water and 72,000 pounds of sand. Wind River Sands were selectively perforated between 2,180' and 2,192', and were not fracture treated. In August 1982, additional Wind River Sands interval 1,581'-2,980' was selectively perforated, and not fracture treated. A cement bond log reportedly ran in August 1982 from 2,100' to 600' showed cement behind the 5-1/2" casing above 600'. This log was not located in WOGCC files, BLM files, or Encana records. The well is an active producer, with cumulative production through April 2014 of 3,327,283 mcf of gas and 44 barrels of water. The current producing interval is 1,581' to 3,773'.

Bradenhead pressure measured in November 2011 reported a pressure of 5 psig between the production casing and surface casing, with 10 psig on the tubing and 20 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and remained at 0 psig after seven days shut-in.

Surface distance from the Tribal Pavillion 14-2 to domestic water well PGDW05 is 980'. The vertical distance from the top producing perforation to the bottom of PGDW05 is 1,356', and the direct distance from the top producing perforation to the bottom of PGDW05 is 1,673'. The 8-5/8" surface casing is set 374' deeper than the reported bottom of PGDW05.

Surface distance from the Tribal Pavillion 14-2 to domestic water well PGDW45 is 891'. The vertical distance from the top producing perforation to the bottom of PGDW45 is 1,466', and the direct distance from the top producing perforation to the bottom of PGDW45 is 1,716'. The 8-5/8" surface casing is set 484' deeper than the reported bottom of PGDW45.

Tribal Pavillion 24-2 (API #49-013-22236) was completed in November 2004 by Tom Brown, Inc. at a total depth of 3,942' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-1310), at a surface location of 592' FSL and 1,980' FWL (SESW) and is shown on Figure 3. 7" surface casing was set at 562' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 3,939' and cemented with 175 sacks of CemCrete cement (2.3 cubic feet/sack, 9.5 pounds per gallon). Mud weight prior to cementing was 9.0 pounds per gallon. A cement bond log ran in October 2004 from 3,885' to 400' measured cement top behind the 4-1/2" casing at 558' below surface.

Fort Union Sands were selectively perforated between 3,662' and 3,878' and fracture treated with a total of 661 barrels of CO_2 assisted gelled water and 84,926 pounds of sand. Wind River Sands were selectively perforated between 1,538' and 2,620', and fracture treated with a total of 440 barrels of CO_2 assisted gelled water and 71,849 pounds of sand. The shallowest perforations are 1,538'-1,550' and this interval was fracture treated with 86 barrels of CO_2 assisted gelled water and 15,471 pounds of sand. Squeeze perforations at 580' were cemented with 86 sacks of Class G cement in April 2005, and a subsequent bond log showed cement to surface behind the 4-1/2" casing. The well is an active producer, with cumulative production through April 2014 of 475,693 mcf of gas and 174 barrels of water. The current producing interval is 1,538' to 3,878'.

Bradenhead pressure measured in April 2012 reported a pressure of 12 psig between the production casing and surface casing, with 24 psig on the tubing and 24 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and remained at 0 psig after seven days shut-in.

Surface distance from the Tribal Pavillion 24-2 to domestic water well PGDW05 is 585'. The vertical distance from the top producing perforation to the bottom of PGDW05 is 1,318', and the direct distance from the top producing perforation to the bottom of PGDW05 is 1,442'. The 7" surface casing is set 342' deeper than the reported bottom of PGDW05.

Surface distance from the Tribal Pavillion 24-2 to domestic water well PGDW45 is 655'. The vertical distance from the top producing perforation to the bottom of PGDW45 is 1,428', and the direct distance from the top producing perforation to the bottom of PGDW45 is 1,571'. The 7" surface casing is set 452' deeper than the reported bottom of PGDW45.

Section 3, T3N, R2E

Pavillion Fee 13-3W (API #49-013-22246) was completed in April 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 4,602' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,735' FSL and 472' FWL (NWSW) and is shown on Figure 2. 7" surface casing was set at 608' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 4,596' and cemented with 355 sacks of CemCrete cement (2.35 cubic feet/sack, 9.5 pounds per gallon). 18 barrels of cement slurry were circulated to surface. Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in April 2005 from 4,526' to surface measured cement top behind the 4-1/2" casing at surface.

Fort Union Sands were selectively perforated between 4,473' and 4,497' and fracture treated with 134 barrels of gelled water and 14,815 pounds of sand. Wind River Sands were selectively perforated between 1,496' and 3,172', and fracture treated with a total of 461 barrels of gelled water and 87,720 pounds of sand. The shallowest perforations are 1,496'-1,504' and this interval was fracture treated with 60 barrels of gelled water and 14,293 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 243,427 mcf of gas and 1,340 barrels of water. The current producing interval is 1,496' to 4,497'.

Bradenhead pressure measured in March 2012 reported a pressure of 120 psig between the production casing and surface casing, with 57 psig on the tubing and 87 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and built back to 168 psig after seven days shut-in. The bradenhead was tested again in April 2012, and gas samples were taken from the tubing and bradenhead. Results of these analyses, shown also in Appendix B, were:

Pavillion Fee 13-3W			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.3936	0.5851	48.7
Carbon Dioxide	0.0502	0	-100.0
Methane	91.7674	92.4747	0.8
Ethane	4.4037	4.1781	-5.1
Propane	1.5981	1.6185	1.3
iso-Butane	0.4771	0.3771	-21.0
n-Butane	0.4425	0.3383	-23.5
iso-Pentane	0.233	0.1425	-38.8
n-Pentane	0.1477	0.0863	-41.6
Hexanes +	0.4224	0.1807	-57.2
Benzene	0.0236	0.0082	-65.3
Toluene	0.0215	0.0064	-70.2
Ethyl-benzene	0.0027	0.0004	-85.2
Specific Gravity	0.6291	0.6141	-2.4
BTU (Saturated)	1103	1078	-2

Surface distance from the Pavillion Fee 13-3W to domestic water well PGDW41 is 473'. The vertical distance from the top producing perforation to the bottom of PGDW41 is 1,386', and the direct distance from the top producing perforation to the bottom of PGDW41 is 1,464'. The 7" surface casing is set 498' deeper than the reported bottom of PGDW41.

Pavillion Fee 13X-3 (API #49-013-21904) was drilled in January 1999 by Tom Brown, Inc. to a total depth of 6,044' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,934' FSL and 152' FWL (NWSW) and is shown on Figure 2. 8-5/8" surface casing was set at 630' and cemented to surface with 256 sacks of Class G cement. 5-1/2" production casing was set at 6,044' and cemented with 325 sacks of HLC (1.69 cubic feet per sack, 13 pounds per gallon) followed by 545 sacks of 50/50 pozmix cement (1.59 cubic feet per sack, 13.0 pounds per gallon). Mud weight prior to cementing was 9.5 pounds per gallon. A cement bond log ran in January 1999 from 5,872' to 400' measured cement top behind the 5-1/2" casing at 535'.

Fort Union Sands were selectively perforated between 3,868' and 4,962' and not fracture treated. Wind River Sands were selectively perforated between 1,348' and 2,270', and not fracture treated. The well reported no production, and was plugged and abandoned in October 1999 by setting a cement retainer at 1,310', squeeze cementing 50 sacks of cement into perforations 1,348'-58', and spotting cement plugs at 668'-500' and at surface. 20 sacks of cement were pumped into the 8-5/8" x 5-1/2" annulus.

Surface distance from the Pavillion Fee 13X-3 to domestic water well PGDW41 is 1,068'. The vertical distance from the top producing perforation to the bottom of PGDW41 is 1,235', and the direct distance from the top producing perforation to the bottom of PGDW41 is 1,633'. The 8-5/8" surface casing is set 517' deeper than the reported bottom of PGDW41.

Pavillion Fee 14-3B (API #49-013-22623) was completed in April 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 3,934' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 466' FSL and 1,050' FWL (SWSW) and is shown on Figure 2. 7" surface casing was set at 620' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 3,908' and cemented with 420 sacks of CemCrete cement (2.35 cubic feet/sack, 9.5 pounds per gallon). Mud weight prior to cementing was 9.0 pounds per gallon. A cement bond log ran in March 2005 from 3,857' to surface measured cement top behind the 4-1/2" casing at less than 34' from surface.

Fort Union Sands were selectively perforated between 3,759' and 3,780' and fracture treated with 125 barrels of gelled water and 23,832 pounds of sand. Wind River Sands were selectively perforated between 2,911' and 3,100', and fracture treated with a total of 165 barrels of gelled water and 40,274 pounds of sand. The shallowest perforations are 2,911'-2,918' and this interval was fracture treated with 54 barrels of gelled water and 14,876 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 1,129,901 mcf of gas and 1,901 barrels of water. The current producing interval is 2,911' to 3,780'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 50 psig on the tubing and 60 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 14-3B to domestic water well PGDW41 is 1,373'. The vertical distance from the top producing perforation to the bottom of PGDW41 is 2,801', and the direct distance from the top producing perforation to the bottom of PGDW41 is 3,119'. The 7" surface casing is set 510' deeper than the reported bottom of PGDW41.

Pavillion Fee 14-3W (API #49-013-22219) was completed in April 2002 by Tom Brown, Inc. at a total depth of 5,700' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 931' FSL and 654' FWL (SWSW) and is shown on Figure 2. 7" surface casing was set at 620' and cemented to surface with 230 sacks of Class G cement. 4-1/2" production casing was set at 5,700' and cemented in two stages with 212 sacks of Type C cement (1.97 cubic feet/sack, 13.0 pounds per gallon) for the first stage, and 338 sacks Type C cement through a DV tool at 3,191'. A total of 30 barrels of cement were circulated to surface. Mud weight prior to cementing was 9.0 pounds per gallon. A cement bond log ran in April 2002 from 5,614' to surface measured cement top behind the 4-1/2" casing at surface.

Fort Union Sands were selectively perforated between 4,460' and 5,284' and fracture treated with a total of 2,033 barrels of CO_2 assisted gelled water and 157,903 pounds of sand. The shallowest perforations are 4,460'-4,504' and this interval was fracture treated with 650 barrels of CO_2 assisted gelled water and 51,200 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 3,532,722 mcf of gas and 5,687 barrels of water. The current producing interval is 4,460' to 5,284'.

Bradenhead pressure measured in May 2012 reported no pressure between the production casing and surface casing, with 49 psig on the tubing and 80 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 14-3W to domestic water well PGDW41 is 762'. The vertical distance from the top producing perforation to the bottom of PGDW41 is 4,350', and the direct distance from the top producing perforation to the bottom of PGDW41 is 4,416'. The 7" surface casing is set 510' deeper than the reported bottom of PGDW41.

Pavillion Fee 34-3R (API #49-013-22087) was completed in May 2001 by Tom Brown, Inc. at a total depth of 3,400' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 725' FSL and 1,954' FEL (SWSE) and is shown on Figure 3. 7" surface casing was set at 362' and cemented to surface with 125 sacks of Type III cement with a 50 sack top job. 4-1/2" production casing was set at 3,364' and cemented with 180 sacks of 50/50 pozmix cement (1.59 cubic feet/sack, 13.0 pounds per gallon). Mud weight prior to cementing was 8.8 pounds per gallon. A cement bond log ran in March 2001 from 3,282' to 300' measured cement top behind the 4-1/2" casing at less than 300' from surface.

Wind River Sands were selectively perforated between 2,383' and 3,099' and fracture treated with a total of 510 barrels of CO_2 assisted gelled water and 100,779 pounds of sand. The shallowest perforations are 2,383'-2,389' and this interval was fracture treated with 68 barrels of CO_2 assisted gelled water and 13,401 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 855,616 mcf of gas and 1,153 barrels of water. The current producing interval is 2,383' to 3,099'.

Bradenhead pressure measured in October 2011 reported no pressure between the production casing and surface casing, with 40 psig on the tubing and 40 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 34-3R to domestic water well PGDW30 is 1,232'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 2,111', and the direct distance from the top producing perforation to the bottom of PGDW30 is 2,444'. The 7" surface casing is set 90' deeper than the reported bottom of PGDW30.

Tribal Pavillion 44-3 (API #49-013-21906) was completed in June 1999 by Tom Brown, Inc. at a total depth of 6,009' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6301), at a surface location of 550' FSL and 850' FEL (SESE) and is shown on Figure 3. 8-5/8" surface casing was set at 563' and cemented to surface with 175 sacks of 65/35 pozmix and Class G cement. 5-1/2" production casing was set at 6,009' and cemented with 240 sacks of 65/35 pozmix and 647 sacks 50/50 pozmix cement. Circulation was lost during primary cement displacement. Mud weight prior to cementing was 9.6 pounds per gallon. A cement bond log ran in February 1999 from 5,716' to 400' measured cement top behind the 5-1/2" casing at 2,150' from surface. Squeeze perforations at 2,120' were cemented with 41 barrels of Class G cement; however circulation up the 5-1/2" x 8-5/8" annulus was lost during the cement job. A cement bond log ran in March 1999 from 2,034' to 1,500' measured cement top behind the 5-1/2" casing at 1,700' from surface. The casing was perforated at 1,680', and 300 sacks of Class G cement were circulated to surface in March 1999. In April 1999 the interval 699'-711' was perforated, and flowed 151 barrels of water with some gas in three hours after being treated with 500 gallons of 15% HCl acid. This interval was then squeeze cemented with 100 sacks of Class G cement. The interval 1,574'-1,589' was squeeze cemented with a total of 550 sacks of Class G cement in April 1999. A cement bond log ran in April 1999 from 2,540' to 500' measured cement top behind the 5-1/2" casing at above 500' from surface. Solid cement was observed in the bradenhead valve during a bradenhead testing attempt in 2011.

Fort Union Sands were selectively perforated between 3,405' and 4,870' and were not fracture treated. Wind River Sands were selectively perforated between 699' and 2,812. Only the interval 1,658'-2,091' was fracture treated with 516 barrels of gelled water and 101,610 pounds of sand. The shallowest perforations tested, 699'-711', were acidized with 500 gallons of 15% HCl and flow tested 151 barrels of water in 3 hours with a trace amount of gas before being squeeze cemented. The well is an active producer, with cumulative production through April 2014 of 1,506,355 mcf of gas and 1,663 barrels of water. The current producing interval is 1,658' to 2,812'.

Surface distance from the Tribal Pavillion 44-3 to domestic water well PGDW30 is 797'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 1,385', and the direct distance from the top producing perforation to the bottom of PGDW30 is 1,598'. The 8-5/8" surface casing is set 290' deeper than the reported bottom of PGDW30.

W.E. Lloyd 1 (API #49-013-20298) was completed in June 1971 by the Hickerson Oil Company as a 15,575' Frontier test. The well is located on fee minerals, at a surface location of 660' FSL and 1,980' FEL (SWSE) and is shown on Figure 3. 16" surface casing was set at 911' and cemented to surface with 1,025 sacks of cement (blend not reported, but likely Class G). 10-3/4" intermediate casing was set at 6,944' and

cemented to surface with a 2-stage cement job totaling 1,325 sacks of 50/50 pozmix and Class G cement with a DV tool at 3,719'. Mud weight prior to cementing the 10-3/4" casing was 9.0 pounds per gallon. There were no cement bond logs or temperature surveys in this section of the well. 7-5/8" production casing was set and cemented at TD. After testing the Frontier interval 15,235'-15,504', the well was shut in until August 1981 when it was plugged and abandoned by Decalta International Corp. A bridge plug was set in the 7-5/8" casing above Frontier perforations, the 7-5/8" casing was cut off at 8,184', and cement plugs were set in the 10-3/4" casing. A bridge plug was set in the 10-3/4" casing at 4,000' and 176 sacks of cement were squeezed into the 10-3/4" x 16" annulus. The wellhead and casings were cut off below ground level and cement was placed over the casing stubs, thereby removing all valves, connections, and access to casings and annuli.

Because this well has been plugged and abandoned, no bradenhead testing could be performed due to the inability to access the 10-3/4" x 16" annulus.

Surface distance from the W.E. Lloyd 1 to domestic water well PGDW30 is 1,183'. The well was never tested in the Wind River or Fort Union Formations. The 16" surface casing is set 636' deeper than the reported bottom of PGDW30.

Mae H. Rhodes 1 (API #49-013-06388) was drilled in December 1953 by Gulf Oil Corp. as an 11,000' Mesaverde test using a 10.1 pound per gallon water based mud system with reserve pits. The well is located on fee minerals, at a surface location of 660' FSL and 660' FWL (SWSW) and is shown on Figure 2. 13-3/8" surface casing was set at 514' and cemented to surface with 500 sacks of Ideal Portland (Class G) cement. 9-5/8" intermediate casing was set at 2,107' and cemented with 150 sacks of Portland (Class G) cement. A temperature survey showed top of cement behind the 9-5/8" casing at 1,776' below surface. The well was plugged and abandoned in November 1954 by filling the hole with heavy mud, setting a 30 sack cement plug across the 9-5/8" casing shoe from 2,141'-2,071', pulling 1,700' of 9-5/8" casing and setting a 10 sack surface plug.

Because this well has been plugged and abandoned, no bradenhead testing could be performed due to the inability to access the annulus.

Surface distance from the Mae H. Rhodes 1 to domestic water well PGDW41 is 1,029'. The well was never tested or completed in the Wind River or Fort Union Formations. The 13-3/8" surface casing is set 402' deeper than the reported bottom of PGDW41.

Section 4, T3N, R2E

Pavillion Fee 43-4 (API #49-013-22633) was completed in April 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 4,744' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,630' FSL and 541' FEL (NESE) and is shown on Figure 2. 8-5/8" surface casing was set at 600' and cemented to surface with 265 sacks of Class G cement. 4-1/2" production casing was set at 4,744' and cemented with 730 sacks of CemCrete cement (2.38 cubic feet/sack, 9.6 pounds per gallon). Mud weight prior to cementing was 9.0 pounds per gallon. A cement bond log ran in March 2005 from 4,628' to surface measured cement top behind the 4-1/2" casing at less than 48' from surface.

Fort Union Sands were selectively perforated between 3,456' and 4,606' and fracture treated with a total of 352 barrels of CO_2 assisted gelled water and 77,293 pounds of sand. Wind River Sands were selectively perforated between 1,720' and 3,182', and fracture treated with a total of 287 barrels of CO_2 assisted gelled water and 80,019 pounds of sand. The shallowest perforations are 1,720'-1,782' and this interval was fracture treated with 85 barrels of CO_2 assisted gelled water and 22,707 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 389,582 mcf of gas and 19,681 barrels of water. The current open interval is 1,720' to 2,678'.

Bradenhead pressure measured in March 2012 reported a pressure of 150 psig between the production casing and surface casing, with 41 psig on the tubing and 41 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and built back to 165 psig after seven days shut-in. The bradenhead was tested again in April 2012, and gas samples were taken from the tubing and bradenhead. Results of these analyses, shown also in Appendix B, were:

Pavillion Fee 43-4			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.3756	1.0322	174.8
Carbon Dioxide	0.0295	0	-100.0
Methane	95.5235	92.4099	-3.3
Ethane	3.1025	4.3012	38.6
Propane	0.5134	1.4523	182.9
iso-Butane	0.1551	0.3484	124.6
n-Butane	0.0871	0.2765	217.5
iso-Pentane	0.0564	0.0858	52.1
n-Pentane	0.0247	0.0434	75.7
Hexanes +	0.1226	0.0464	-62.2
Benzene	0.006	0.0017	-71.7
Toluene	0.0019	0.0011	-42.1
Ethyl-benzene	0.0002	0.0008	300.0
Specific Gravity	0.5858	0.6073	3.7
BTU (Saturated)	1037	1060	2

Surface distance from the Pavillion Fee 43-4 to domestic water well PGDW41 is 653'. The vertical distance from the top producing perforation to the bottom of PGDW41 is 1,610', and the direct distance from the top producing perforation to the bottom of PGDW41 is 1,737'. The 8-5/8" surface casing is set 490' deeper than the reported bottom of PGDW41.

Pavillion Fee 44-4 (API #49-013-22634) was completed in March 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 5,700' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 470' FSL and 470' FEL (SESE) and is shown on Figure 2. 8-5/8" surface casing was set at 611' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,700' and cemented with 928 sacks of CemCrete cement (2.38 cubic feet/sack, 9.6 pounds per gallon). 16 barrels of cement were circulated to surface. Mud weight prior to cementing was 8.8 pounds per gallon. A cement bond log ran in March 2005 from 5,648' to surface measured cement top behind the 4-1/2" casing at less than 68' from surface.

Fort Union Sands were selectively perforated between 3,784' and 5,497' and fracture treated with a total of 620 barrels of gelled water and 139,222 pounds of sand. The shallowest perforations are 3,784'-3,806' and this interval was fracture treated with 160 barrels of gelled water and 36,268 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 1,265 barrels of oil, 173,288 mcf of gas and 26,707 barrels of water. The current open interval is 3,784' to 5,497'.

Bradenhead pressure measured in March 2012 reported a pressure of 185 psig between the production casing and surface casing, with 45 psig on the tubing and 110 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and built back to 201 psig after seven days shut-in. The bradenhead was tested again in April 2012, and gas samples were taken from the tubing and bradenhead. Results of these analyses, shown also in Appendix B, were:

Pavillion Fee 44-4			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.3952	0.7962	101.5
Carbon Dioxide	0.1602	0	-100.0
Methane	93.4057	91.2149	-2.3
Ethane	3.4166	4.5748	33.9
Propane	1.2606	1.8933	50.2
iso-Butane	0.424	0.5013	18.2
n-Butane	0.2753	0.439	59.5
iso-Pentane	0.158	0.1898	20.1
n-Pentane	0.0866	0.1209	39.6
Hexanes +	0.3899	0.2547	-34.7
Benzene	0.0211	0.0112	-46.9
Toluene	0.0127	0.0036	-71.7
Ethyl-benzene	0.0054	0.0001	-98.1
Specific Gravity	0.6148	0.6264	1.9
BTU (Saturated)	1078	1093	1

Surface distance from the Pavillion Fee 44-4 to domestic water well PGDW41 is 1,133'. The vertical distance from the top producing perforation to the bottom of

PGDW41 is 3,674', and the direct distance from the top producing perforation to the bottom of PGDW41 is 3,845'. The 8-5/8" surface casing is set 501' deeper than the reported bottom of PGDW41.

Blankenship 4-8 (API #49-013-20688) was completed in March 1977 by Palmer Oil & Gas Company at a total depth of 5,204' using an oil-based mud system with reserve pits. The well is located on a fee lease, and is part of a 318.81 acre Communitization Agreement that includes Tribal Lease 14-20-0258-3597. The well is at a surface location of 2,525' FNL and 660' FEL (SENE) and is shown on Figure 2. 8-5/8" surface casing was set at 444' and cemented with 325 sacks of Class G cement. Cement did not circulate to surface, and gravel was dumped down the backside. 4-1/2" production casing was set at 5,203' and cemented with 700 sacks of 50/50 pozmix cement. Mud weight prior to cementing was 9.5 pounds per gallon. A cement bond log ran in January 2005 from 4,800' to surface measured the cement top at 1,850' below surface. A casing leak located between 1,025' and 1,062' was squeeze cemented in January 2005 through squeeze perforations at 1,025', 1,062', and 1,775' with a total of 86 sacks of cement. The shallowest reported producing interval is 2,070'-2,079'. The well is currently reported as shut in.

Fort Union Sands were selectively perforated between 4,870' and 5,105' and fracture treated with 2,428 barrels of nitrogen assisted gelled water and 135,000 pounds of sand. Wind River Sands were selectively perforated between 2,070' and 2,682', and fracture treated with a total of 225 barrels of CO_2 assisted gelled water and 43,395 pounds of sand. The shallowest perforations are 2,070' – 2,079' and this interval was fracture treated with 104 barrels of CO_2 assisted gelled water and 22,395 pounds of sand. The well has been shut in since December 2005, with cumulative production of 365 barrels of oil, 6,966,244 mcf of gas and 65,784 barrels of water. The current open interval is 2,070' to 2,682'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, tubing, or tubing-casing annulus. A Mechanical Integrity test of the casing above 2,024' was performed in February 2012, and the casing tested to 300 psig with no bleed-off.

Surface distance from the Blankenship 4-8 to domestic water well PGDW41 is 1,380'. The vertical distance from the top producing perforation to the bottom of PGDW41 is 1,959', and the direct distance from the top producing perforation to the bottom of PGDW41 is 2,396'. The 8-5/8" surface casing is set 333' deeper than the reported bottom of PGDW41.

Section 9, T3N, R2E

Tribal 21-9 (API #49-013-21130) was completed in June 1981 by Shell Oil Company at a total depth of 5,304' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 660' FNL and 1,979' FWL (NENW) and is shown on Figure 2. 8-5/8" surface casing was set at 815' and cemented to surface with 600 sacks of Class G cement. 5-1/2" production casing was set at 5,298' and cemented with 620 sacks of Class G cement. Mud weight prior to cementing was 8.8 pounds per gallon. A cement bond log ran in April 1981 from 5,122' - 846' measured cement top behind the 5-1/2" casing at 1,044' below surface.

Fort Union Sands were selectively perforated between 3,356' and 5,232'. The only interval fracture stimulated was 3,356' – 3,360', which was treated with 357 barrels of gelled water and 25,914 pounds of sand. Wind River Sands were selectively perforated between 2,158' and 2,846', and were not fracture treated. The well was plugged and abandoned in September 1992 by setting a bridge plug at 3,261', spotting cement at 2,150'-2,070', cutting and pulling the 5-1/2" casing at 915', and spotting 100 sacks of cement 965'-715'. 20 sacks of cement were pumped as a surface plug. Cumulative production was 271,143 mcf of gas and 11 barrels of water at abandonment.

Because this well has been plugged and abandoned, no bradenhead testing could be performed due to the inability to access the annulus.

Surface distance from the Tribal 21-9 to domestic water well PGDW42 is 778'. The vertical distance from the top produced perforation to the bottom of PGDW42 is 1,943', and the direct distance from the top produced perforation to the bottom of PGDW42 is 2,093'. The 8-5/8" surface casing is set 600' deeper than the reported bottom of PGDW42.

Pavillion Fee 31-9 (API #49-013-22172) was completed in October 2001 by Tom Brown, Inc. at a total depth of 3,445' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 465' FNL and 1,975' FEL (NWNE) and is shown on Figure 2. 7" surface casing was set at 534' and cemented to surface with 200 sacks of Type III cement (1.39 cubic feet per sack). 4-1/2" production casing was set at 3,445' and cemented with 365 sacks of 50/50 pozmix cement (1.59 cubic feet/sack, 13.0 pounds per gallon). Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in October 2001 from 3,368' to surface measured cement top behind the 4-1/2" casing at 120' from surface.

Wind River Sands were selectively perforated between 2,313' and 3,312' and fracture treated with a total of 422 barrels of CO_2 assisted gelled water and 88,496 pounds of sand. The shallowest perforations are 2,313'-2,319' and this interval was fracture treated with 66 barrels of CO_2 assisted gelled water and 16,275 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 426,670 mcf of gas and 1,346 barrels of water. The current producing interval is 2,313' to 3,312'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 45 psig on the tubing and 45 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 31-9 to domestic water well PGDW42 is 768'. The vertical distance from the top producing perforation to the bottom of PGDW42 is 2,103', and the direct distance from the top producing perforation to the bottom of PGDW42 is 2,239'. The 7" surface casing is set 324' deeper than the reported bottom of PGDW42.

Maxson 32-9 (API #49-013-20084) was drilled as a dry hole to 3,511' in May 1968 by Shell Oil Company using a 9.6 pound per gallon oil-based mud system with reserve pits. The well is located on fee minerals, at a surface location of 1,980' FNL and 1,980' FEL (SWNE) and is shown on Figure 2. 7-5/8" surface casing was set at 616' and cemented to surface with 300 sacks of Class G cement. No production casing was run, and the well was plugged and abandoned with 35 sack cement plugs at 3,300', 1,300', and 667' (across the 7-5/8" casing shoe). A 10 sack cement plug was set at the surface.

Because this well has been plugged and abandoned with no production casing, no bradenhead testing could be performed.

Surface distance from the Maxson 32-9 to domestic water well PGDW42 is 1,229'. The 7-5/8" surface casing is set 405' deeper than the reported bottom of PGDW42.

Pavillion Fee 32-9W (API #49-013-22227) was completed in March 2002 by Tom Brown, Inc. at a total depth of 3,460' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,468' FNL and 1,737' FEL (SWNE) and is shown on Figure 2. 7" surface casing was set at 532' and cemented to surface with 230 sacks of Class G cement. A 100 sack top job was required. 4-1/2" production casing was set at 3,460' and cemented with 285 sacks of Class C cement (1.97 cubic feet/sack). Six barrels of cement slurry were circulated to surface. Mud weight prior to cementing was 8.8 pounds per gallon. A cement bond log ran in March 2002 from 3,396' to surface measured cement top behind the 4-1/2" casing at less than 30' from surface.

Wind River Sands were selectively perforated between 2,558' and 3,312' and fracture treated with a total of 469 barrels of CO_2 assisted gelled water and 88,612 pounds of sand. The shallowest perforations are 2,558'-2,636' and this interval was fracture treated with 13,366 barrels of CO_2 assisted gelled water and 29,586 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 495,104 mcf of gas and 1,380 barrels of water. The current producing interval is 2,558' to 3,312'.

Bradenhead pressure measured in June 2012 reported no pressure between the production casing and surface casing, with 44 psig on the tubing and 44 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 32-9W to domestic water well PGDW42 is 918'. The vertical distance from the top producing perforation to the bottom of PGDW42 is 2,348', and the direct distance from the top producing perforation to the bottom of PGDW42 is 2,521'. The 7" surface casing is set 322' deeper than the reported bottom of PGDW42.

Section 10, T3N, R2E

USA Tribal 22-10 (API #49-013-20876) was completed in October 1979 by Shell Oil Company at a total depth of 5,152' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,305' FNL and 1,444' FWL (SENW) and is shown on Figure 4. 8-5/8" surface casing was set at 608' and cemented to surface with 400 sacks of Class G cement. 4-1/2" production casing was set at 5,089' and cemented with 1,180 sacks of Class G cement. Mud weight prior to cementing was 9.0 pounds per gallon. A cement bond log ran in July 1979 from 4,968'-699' measured cement top behind the 4-1/2" casing at 1,805' below surface.

At the initial completion in 1979, Fort Union Sands were selectively perforated between 4,819' and 5,034', and Wind River Sands were selectively perforated between 3,274' and 3,294'. No intervals were fractured treated. In December 2004 additional Fort Union intervals between 4,541' and 4,664' were selectively perforated and fracture treated with a total of 379 barrels of CO_2 assisted gelled water and 70,550 pounds of sand. Also in December 2004, additional Wind River Sands were selectively perforated between 1,994' and 3,267', and were fracture treated with a total of 895 barrels of CO_2 assisted gelled water and 100,840 pounds of sand. The shallowest perforations are 1,994'-2,000' and this interval was fracture treated with 89 barrels of CO_2 assisted gelled water and 14,450 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 6,341,009 mcf of gas and 1,363 barrels of water. The current producing interval is 1,994' to 4,664'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 48 psig on the tubing and 52 psig on the tubing-casing annulus.

Surface distance from the USA Tribal 22-10 to domestic water well PGDW14 is 1,306'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 1,790', and the direct distance from the top producing perforation to the bottom of PGDW14 is 2,216'. The 8-5/8" surface casing is set 404' deeper than the reported bottom of PGDW14.

Tribal Pavillion 23-10 (API #49-013-21692) was completed in July 1994 by Tom Brown, Inc. at a total depth of 6,000' using a closed KCl polymer mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,879' FSL and 1,863' FWL (NESW) and is shown on Figure 4. 8-5/8" surface casing was set at 605' and cemented to surface with 160 sacks of 50/50 pozmix and 200 sacks of Class G cement. 5-1/2" production casing was set at 5,988' and cemented with 1,085 sacks of 50/50 pozmix cement. Mud weight prior to cementing was 9.2 pounds per gallon. A cement bond log ran in June 1994 from 5,900' to 1,200' measured cement top behind the 5-1/2" casing at 1,340' from surface.

In 1994, Fort Union Sands were selectively perforated between 5,316' and 5,812', and the interval 5,316'-5,335' was fracture treated with 393 barrels of nitrogen assisted gelled water and 32,500 pounds of sand. In July 2000, additional Fort Union Sands were selectively perforated between 4,592' and 5,216', and fracture treated with a total of 382 barrels of CO_2 assisted gelled water and 76,960 pounds of sand. The well has been shut in since September 2007, with cumulative production of 1,939,835 mcf of gas and 112,463 barrels of water. The current open interval is 4,592' to 5,216'.

Bradenhead pressure measured in November 2011 reported a pressure of 5 psig between the production casing and surface casing, with 45 psig on the tubing and 42 psig

on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and remained at 0 psig after seven days shut-in. A Mechanical Integrity test of the casing above 3,400' was performed in January 2012, and the casing tested to 500 psig with no bleed-off.

Surface distance from the Tribal Pavillion 23-10 to domestic water well PGDW14 is 1,313'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 4,387', and the direct distance from the top producing perforation to the bottom of PGDW14 is 4,579'. The 8-5/8" surface casing is set 400' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 23-10 to domestic water well PGDW44 is 1,408'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 3,827', and the direct distance from the top producing perforation to the bottom of PGDW44 is 4,078'. The 8-5/8" surface casing is set 160' shallower than the reported bottom of PGDW44.

Tribal Pavillion 23-10B (API #49-013-22417) was completed in November 2004 by Tom Brown, Inc. at a total depth of 5,646' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,474' FSL and 1,866' FWL (NESW) and is shown on Figure 4. 7" surface casing was set at 641' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,617' and cemented with 268 sacks of CemCrete cement (2.34 cubic feet/sack, 9.51 pounds per gallon). Mud weight prior to cementing was 8.8 pounds per gallon. A cement bond log ran in October 2004 from 5,554' to 600' measured cement top behind the 4-1/2" casing at 970' from surface.

Fort Union Sands were selectively perforated between 3,550' and 5,556' and fracture treated with a total of 1,347 barrels of CO_2 assisted gelled water and 187,048 pounds of sand. Wind River Sands were selectively perforated between 2,290' and 3,089' and fracture treated with a total of 597 barrels of CO_2 assisted gelled water and 77,879 pounds of sand. The shallowest perforations are 2,290'-2,297' and this interval was fracture treated with 92 barrels of CO_2 assisted gelled water and 14,297 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 1,692,683 mcf of gas and 4,620 barrels of water. The current open interval is 2,290' to 5,556'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 42 psig on the tubing and 82 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 23-10B to domestic water well PGDW14 is 1,104'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 2,090', and the direct distance from the top producing perforation to the bottom of PGDW14 is 2,364'. The 7" surface casing is set 441' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 23-10B to domestic water well PGDW44 is 1,360'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 1,530', and the direct distance from the top producing perforation to the bottom of PGDW44 is 2,047'. The 7" surface casing is set 119' shallower than the reported bottom of PGDW44.

Tribal Pavillion 23-10C (API #49-013-22418) was completed in October 2004 by Tom Brown, Inc. at a total depth of 5,730' using a closed LSND mud system. The

well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,528' FSL and 2,326' FWL (NESW) and is shown on Figure 4. 7" surface casing was set at 576' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,718' and cemented with 328 sacks of CemCrete cement (2.35 cubic feet/sack, 9.51 pounds per gallon). Mud weight prior to cementing was 9.3 pounds per gallon. A cement bond log ran in September 2004 from 5,660' to 50' measured cement top behind the 4-1/2" casing at 150' from surface.

Fort Union Sands were selectively perforated between 3,532' and 5,566' and fracture treated with a total of 1,152 barrels of CO_2 assisted gelled water and 138,043 pounds of sand. Wind River Sands were selectively perforated between 1,771' and 3,138' and fracture treated with an estimated total of 1,200 barrels of CO_2 assisted gelled water and 136,187 pounds of sand. The shallowest perforations are 1,771'-1,792' and this interval was fracture treated with an estimated 150 barrels of CO_2 assisted gelled water and 17,066 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 764,919 mcf of gas and 4,549 barrels of water. The current open interval is 1,771' to 5,566'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 42 psig on the tubing and 70 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 23-10C to domestic water well PGDW44 is 1,403'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 1,011', and the direct distance from the top producing perforation to the bottom of PGDW44 is 1,729'. The 7" surface casing is set 184' shallower than the reported bottom of PGDW44.

Pavillion Fee 31-10 (API #49-013-21691) was completed in June 1994 by Tom Brown, Inc. at a total depth of 5,972' using a closed KCl polymer mud system. The well is located on fee minerals, at a surface location of 660' FNL and 1,786' FEL (NWNE) and is shown on Figure 3. 8-5/8" surface casing was set at 598' and cemented to surface with 160 sacks of Lite and 200 sacks of premium cement. 5-1/2" production casing was set at 5,722' and cemented with 1,108 sacks of 50/50 pozmix cement. Mud weight prior to cementing was 9.4 pounds per gallon. A cement bond log ran in June 1994 from 5,526' to 1,950' measured the cement top at 2,114' below surface. A temperature log ran in October 2012 from 5,456' to surface showed no anomalies.

In 1994, Fort Union Sands were selectively perforated between 4,770' and 5,478', and were not fracture treated. In January 2002, additional Fort Union Sands were selectively perforated between 3,335' and 4,689', and fracture treated with a total of 718 barrels of CO_2 assisted gelled water and 114,624 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 1,412 barrels of oil, 4,269,156 mcf of gas and 15,504 barrels of water. The current open interval is 3,335' to 5,478'.

Bradenhead pressure measured in November 2011 reported a pressure of 160 psig between the production casing and surface casing, with 70 psig on the tubing and 108 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and built to 35 psig after seven days shut-in. The bradenhead was tested again in December 2011, and gas samples were taken from the tubing and bradenhead. Results of these analyses, shown also in Appendix B, were:

Pavillion Fee 31-10			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.3529	0.8255	133.9
Carbon Dioxide	0.0006	0.0005	-16.7
Methane	93.9675	92.0103	-2.1
Ethane	3.8277	4.5227	18.2
Propane	0.9373	1.5013	60.2
iso-Butane	0.3053	0.392	28.4
n-Butane	0.2356	0.3318	40.8
iso-Pentane	0.1307	0.1379	5.5
n-Pentane	0.0653	0.083	27.1
Hexanes +	0.1744	0.1897	8.8
Benzene	0.0024	0.0011	-54.2
Toluene	0.0003	0.002	566.7
Ethyl-benzene	0	0.0024	
Specific Gravity	0.6008	0.6156	2.5
BTU (Saturated)	1062	1076	1

A Mechanical Integrity test of the casing above 3,300' was performed in October 2012, and the casing tested to 500 psig with no bleed-off. The bradenhead was tested again in July 2013, measuring a steady gas blow at 10 psig with no fluid recovery.

Surface distance from the Pavillion 31-10 to domestic water well PGDW30 is 707'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 3,070', and the direct distance from the top producing perforation to the bottom of PGDW30 is 3,150'. The 8-5/8" surface casing is set 333' deeper than the reported bottom of PGDW30.

Pavillion Fee 31-10B (API #49-013-22268) was completed in January 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 5,555' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,185' FNL and 2,605' FEL (NWNE) and is shown on Figure 4. 7" surface casing was set at 630' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,546' and cemented with 307 sacks of CemCrete cement (2.38 cubic feet/sack, 9.6 pounds per gallon). Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in December 2004 from 5,491' to 1,000' measured cement top behind the 4-1/2" casing at 1,340' from surface. Squeeze perforations at 1,250' were cemented with 8 barrels of slurry, and squeeze perforations at 1,000' were cemented with 4 barrels of slurry. A cement bond log ran in January 2005 from 1,024' to 200' after these squeeze jobs measured cement top behind the 4-1/2" casing at 743' from surface. Squeeze perforations at 700' were then cemented with 20 barrels of 14.7 pound per gallon slurry circulated to surface.

Fort Union Sands were selectively perforated between 3,416' and 4,946' and fracture treated with a total of 518 barrels of CO_2 assisted gelled water and 84,000 pounds of sand. Wind River Sands were selectively perforated between 1,702' and 2,873' and fracture treated with a total of 345 barrels of CO_2 assisted gelled water and 63,000 pounds of sand. The shallowest perforations are 1,702'-1,750' and this interval was fracture treated with 125 barrels of CO_2 assisted gelled water and 27,000 pounds of sand.

The well is an active producer, with cumulative production through April 2014 of 2,570 barrels of oil, 243,516 mcf of gas and 14,008 barrels of water. The current open interval is 1,702' to 4,946'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 38 psig on the tubing and 38 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 31-10B to domestic water well PGDW14 is 1,262'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 1,502', and the direct distance from the top producing perforation to the bottom of PGDW14 is 1,962'. The 7" surface casing is set 430' deeper than the reported bottom of PGDW14.

Tribal Pavillion 32-10 (API #49-013-21968) was completed in May 2000 by Tom Brown, Inc. at a total depth of 5,600' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,788' FNL and 2,166' FWL (SENW) and is shown on Figure 4. 8-5/8" surface casing was set at 626' and cemented to surface with 280 sacks of Premium Class G cement. 5-1/2" production casing was set at 5,612' and cemented with 350 sacks of HLC Type III (2.27 cubic feet per sack, 12 pounds per gallon) and 310 sacks of HLC Type III (1.91 cubic feet per sack, 12.7 pounds per gallon) cement. Mud weight prior to cementing was 9.2 pounds per gallon. A cement bond log ran in March 2000 from 5,540' to 1,000' measured cement top behind the 5-1/2" casing at approximately 1,000' from surface.

Fort Union Sands were selectively perforated between 5,306' and 5,482' and fracture treated with a total of 704 barrels of CO_2 assisted gelled water and 53,394 pounds of sand. The shallowest perforations are 5,306'-5,344' and this interval was fracture treated with 574 barrels of CO_2 assisted gelled water and 37,340 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 4,707,951 mcf of gas and 2,200 barrels of water. The current producing interval is 5,306' to 5,482'.

Bradenhead pressure measured in November 2011 reported a pressure of 20 psig between the production casing and surface casing, with 60 psig on the tubing and 80 psig on the tubing-casing annulus. The bradenhead pressure bled off with no fluid recovery, and built to 10 psig after seven days shut-in.

Surface distance from the Tribal Pavillion 32-10 to domestic water well PGDW14 is 732'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 5,103', and the direct distance from the top producing perforation to the bottom of PGDW14 is 5,155'. The 8-5/8" surface casing is set 423' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 32-10 to domestic water well PGDW44 is 887'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 4,543', and the direct distance from the top producing perforation to the bottom of PGDW44 is 4,629'. The 8-5/8" surface casing is set 137' shallower than the reported bottom of PGDW44.

Tribal Pavillion 32-10B (API #49-013-22224) was completed in March 2002 by Tom Brown, Inc. at a total depth of 5,850' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,890' FNL and 1,739' FEL (SWNE) and is shown on Figure 4. 7" surface casing was set at 622' and cemented to surface with 230 sacks of Class G cement. 4-1/2" production casing was set

at 5,842' and cemented in two stages with 220 sacks of Type C cement (1.97 cubic feet/sack, 13.0 pounds per gallon) for the first stage, and 330 sacks Type C cement through a DV tool at 2,980'. 18 barrels of cement were circulated to surface. Mud weight prior to cementing was 8.6 pounds per gallon. A cement bond log ran in March 2002 from 5,784' to surface measured cement top behind the 4-1/2" casing at less than 130' from surface.

Fort Union Sands were selectively perforated between 4,521' and 5,728' and fracture treated with a total of 1,739 barrels of CO_2 assisted gelled water and 269,749 pounds of sand. The shallowest perforations are 4,521'-4,604' and this interval was fracture treated with 296 barrels of CO_2 assisted gelled water and 60,347 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 4,501,617 mcf of gas and 4,727 barrels of water. The current producing interval is 4,521' to 5,728'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 90 psig on the tubing and 82 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 32-10B to domestic water well PGDW14 is 817'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 4,321', and the direct distance from the top producing perforation to the bottom of PGDW14 is 4,398'. The 7" surface casing is set 422' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 32-10B to domestic water well PGDW44 is 900'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 3,761', and the direct distance from the top producing perforation to the bottom of PGDW44 is 3,867'. The 7" surface casing is set 138' shallower than the reported bottom of PGDW44.

Tribal Pavillion 32-10C (API #49-013-22419) was completed in February 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 4,020' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,179' FNL and 2,412' FEL (SWNE) and is shown on Figure 4. 8-5/8" surface casing was set at 626' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 4,020' and cemented, however the volume of cement was not reported. Mud weight prior to cementing was 8.8 pounds per gallon. A cement bond log ran in February 2005 from 3,940' to surface measured cement top behind the 4-1/2" casing at 110' from surface.

Wind River Sands were selectively perforated between 1,920' and 3,484' and fracture treated with a total of 525 barrels of CO_2 assisted gelled water and 119,710 pounds of sand. The shallowest perforations are 1,920'-1,968' and this interval was fracture treated with 104 barrels of CO_2 assisted gelled water and 30,741 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 315,995 mcf of gas and 7,099 barrels of water. The current open interval is 1,920' to 3,484'.

Bradenhead pressure measured in March 2012 reported a pressure of 165 psig between the production casing and surface casing, with 30 psig on the tubing and 160 psig on the tubing-casing annulus. The bradenhead pressure bled off in 9 hours with no fluid recovery, and built to 65 psig after seven days shut-in. Gas samples were taken from the tubing and bradenhead, and results of these analyses, shown also in Appendix B, were:

Tribal Pavillion 32-10C			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.4696	1.4023	198.6
Carbon Dioxide	0.1336	0	-100.0
Methane	94.0435	92.215	-1.9
Ethane	3.5933	4.0826	13.6
Propane	0.8749	1.2552	43.5
iso-Butane	0.2624	0.3486	32.9
n-Butane	0.1923	0.2593	34.8
iso-Pentane	0.1063	0.128	20.4
n-Pentane	0.0628	0.072	14.6
Hexanes +	0.2426	0.1296	-46.6
Benzene	0.0097	0.0047	-51.5
Toluene	0.0087	0.0018	-79.3
Ethyl-benzene	0	0.0005	
Specific Gravity	0.6021	0.6104	1.4
BTU (Saturated)	1058	1059	0

Surface distance from the Tribal Pavillion 32-10C to domestic water well PGDW14 is 252'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 1,720', and the direct distance from the top producing perforation to the bottom of PGDW14 is 1,738'. The 8-5/8" surface casing is set 426' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 32-10C to domestic water well PGDW44 is 612'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 1,160', and the direct distance from the top producing perforation to the bottom of PGDW44 is 1,312'. The 8-5/8" surface casing is set 134' shallower than the reported bottom of PGDW44.

Tribal Pavillion 33-10 (API #49-013-21862) was completed in May 1999 by Tom Brown, Inc. at a total depth of 6,000' using a closed KCl polymer mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,888' FSL and 2,135' FEL (NWSE) and is shown on Figure 4. 8-5/8" surface casing was set at 514' and cemented to surface with 75 sacks of 65/35 pozmix and 85 sacks of Class G cement. 5-1/2" production casing was set at 5,970' and cemented with 335 sacks of 35/65 pozmix (1.98 cubic feet per sack, 12.7 pounds per gallon) and 587 sacks of 50/50 pozmix (1.31 cubic feet per sack, 14.0 pounds per gallon) cement. A cement bond log ran in March 1999 from 5,887' to 400' measured cement top behind the 5-1/2" casing at 680' from surface.

In 1999, Fort Union Sands were selectively perforated between 5,126' and 5,490', and were fracture treated with 171 barrels of CO_2 assisted gelled water and 110,600 pounds of sand. In January 2005, additional Fort Union Sands between 3,760' and 3,920' were perforated and fracture treated with 241 barrels of CO_2 assisted gelled water and 35,909 pounds of sand. Also in January 2005, Wind River Sands were selectively perforated between 2,101' and 2,782' and fracture treated with a total of 443 barrels of CO_2 assisted gelled water and 63,000 pounds of sand. The shallowest perforations are 2,101'-2,113' and this interval was fracture treated with 170 barrels of CO_2 assisted gelled water and 21,000 pounds of sand. The well is an active producer, with cumulative

production through April 2014 of 5,163,904 mcf of gas and 2,546 barrels of water. The current producing interval is 2,101' to 5,490'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 45 psig on the tubing and 51 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 33-10 to domestic water well PGDW14 is 984'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 1,898', and the direct distance from the top producing perforation to the bottom of PGDW14 is 2,138'. The 8-5/8" surface casing is set 311' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 33-10 to domestic water well PGDW23 is 809'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 1,588', and the direct distance from the top producing perforation to the bottom of PGDW23 is 1,782'. The 8-5/8" surface casing is set 1' deeper than the reported bottom of PGDW23.

Surface distance from the Tribal Pavillion 33-10 to domestic water well PGDW44 is 638'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 1,338', and the direct distance from the top producing perforation to the bottom of PGDW44 is 1,482'. The 8-5/8" surface casing is set 249' shallower than the reported bottom of PGDW44.

Tribal Pavillion 33-10B (API #49-013-22274) was completed in December 2004 by Tom Brown, Inc. at a total depth of 5,610' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,120' FSL and 1,549' FEL (NWSE) and is shown on Figure 4. 7" surface casing was set at 639' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,464' and cemented with 310 sacks of Lite cement (2.55 cubic feet per sack, 9.46 pounds per gallon). Mud weight prior to cementing was 8.7 pounds per gallon. A cement bond log ran in November 2004 from 5,416' to surface measured cement top behind the 4-1/2" casing at 74' from surface.

Fort Union Sands were selectively perforated between 3,524' and 5,050' and were fracture treated with a total of 853 barrels of CO_2 assisted gelled water and 143,515 pounds of sand. Wind River Sands were selectively perforated between 1,642' and 3,158' and were fracture treated with a total of 777 barrels of CO_2 assisted gelled water and 149,500 pounds of sand. The shallowest perforations are 1,642'-1,652' and this interval was fracture treated with 96 barrels of CO_2 assisted gelled water and 20,000 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 1,100,556 mcf of gas and 2,219 barrels of water. The current producing interval is 1,642' to 5,050'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 36 psig on the tubing and 39 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 33-10B to domestic water well PGDW14 is 1,093'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 1,442', and the direct distance from the top producing perforation to the bottom of PGDW14 is 1,809'. The 7" surface casing is set 439' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 33-10B to domestic water well PGDW23 is 547'. The vertical distance from the top producing perforation to the bottom

of PGDW23 is 1,132', and the direct distance from the top producing perforation to the bottom of PGDW23 is 1,257'. The 7" surface casing is set 129' deeper than the reported bottom of PGDW23.

Surface distance from the Tribal Pavillion 33-10B to domestic water well PGDW44 is 693'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 882', and the direct distance from the top producing perforation to the bottom of PGDW44 is 1,122'. The 7" surface casing is set 121' shallower than the reported bottom of PGDW44.

Tribal Pavillion 33-10W (API #49-013-22195) was completed in December 2001 by Tom Brown, Inc. at a total depth of 5,070' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,819' FSL and 2,225' FEL (NWSE) and is shown on Figure 4. 7" surface casing was set at 528' and cemented to surface with 230 sacks of Class G cement. 4-1/2" production casing was set at 5,070' and cemented in two stages with a total of 560 sacks of 50/50 pozmix cement with DV tool at 3,031'. Two barrels of cement were circulated to surface. Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in October 2001from 5004' to 550' measured cement top behind the 4-1/2" casing at less than 550' from surface, where the logging tool found the fluid level.

In 2001, Fort Union Sands were selectively perforated between 3,492' and 4,966' and fracture treated with a total of 640 barrels of CO_2 assisted gelled water and 146,325 pounds of sand. In December 2004, additional Fort Union Sands were selectively perforated between 3,838'-3,912' and 3,528'-3,596' and fracture treated with a total of 233 barrels of CO_2 assisted gelled water and 24,788 pounds of sand. In addition, in December 2004, Wind River Sands were selectively perforated between 1,766' and 2,946' and were fracture treated with a total of 361 barrels of CO_2 assisted gelled water and 48,999 pounds of sand. The shallowest perforations fracture treated are 1,766'-1,774' and this interval was fractured with 100 barrels of CO_2 assisted gelled water and 14,889 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 930,223 mcf of gas and 8,228 barrels of water. The current producing interval is 1,766' to 4,966'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 31 psig on the tubing and 31 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 33-10W to domestic water well PGDW14 is 1,048'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 1,566', and the direct distance from the top producing perforation to the bottom of PGDW14 is 1,884'. The 7" surface casing is set 328' deeper than the reported bottom of PGDW14.

Surface distance from the Tribal Pavillion 33-10W to domestic water well PGDW23 is 1,118'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 1,256', and the direct distance from the top producing perforation to the bottom of PGDW23 is 1,682'. The 7" surface casing is set 18' deeper than the reported bottom of PGDW23.

Surface distance from the Tribal Pavillion 33-10W to domestic water well PGDW44 is 815'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 1,006', and the direct distance from the top producing perforation to the bottom of PGDW44 is 1,295'. The 7" surface casing is set 232' shallower than the reported bottom of PGDW44.

Gov't. Tribal 33X-10 (API #49-013-06363) was drilled in December 1964 by Shell Oil Company as a 19,235' Madison test using a water based mud system to 4,054' and oil-based mud for the deep portion of the hole. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,380' FSL and 1,986' FEL (NWSE) and is shown on Figure 4. 20" surface casing was set at 221' and cemented to surface with 325 sacks of Class G cement. 13-3/8" intermediate casing was set at 4,054' and cemented to surface using 1,520 sacks of 50/50 pozmix and 1,450 sacks of Class G cement in two stages with a DV tool at 2,014'. Mud weight prior to cementing was 9.6 pounds per gallon. No cement bond log was run in the 13-3/8" casing. 9-5/8" intermediate casing was set and cemented at 14,693', and 7" casing was set and cemented at 18,966'.

After testing the Madison interval 18,858' to 19,235' and Frontier interval 14,722' to 14,978', the well was plugged back to 4,032' and temporarily abandoned in December 1964. The 7" casing was cut at 7,500' and the 9-5/8" casing was cut at 4,150'. In May 1965 the well was completed in the Wind River Formation from perforations 3,236'-3,272', which were fracture treated with 357 barrels of gelled water and 13,000 pounds of sand. Cumulative production is reported to be 14,697,897 mcf of gas, however production from the nearby Unit 41X-10, located on the same lease, is likely included in this total. The well was plugged and abandoned in November 1981 by setting a cement retainer at 3,113' and squeezing 150 sacks of cement into the perforations. 150 sacks were spotted on top of the retainer. A 10 sack cement plug was set at the surface.

Because this well has been plugged and abandoned, no bradenhead testing could be performed.

Surface distance from the Gov't. Tribal 33X-10 to domestic water well PGDW14 is 734'. The vertical distance from the top producing perforation to the bottom of PGDW14 is 3,022', and the direct distance from the top producing perforation to the bottom of PGDW14 is 3,110'. The 20" surface casing is set 7' deeper than the reported bottom of PGDW14.

Surface distance from the Gov't. Tribal 33X-10 to domestic water well PGDW23 is 904'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 2,712', and the direct distance from the top producing perforation to the bottom of PGDW23 is 2,859'. The 20" surface casing is set 303' shallower than the reported bottom of PGDW23.

Surface distance from the Gov't. Tribal 33X-10 to domestic water well PGDW44 is 335'. The vertical distance from the top producing perforation to the bottom of PGDW44 is 2,462', and the direct distance from the top producing perforation to the bottom of PGDW44 is 2,485'. The 20" surface casing is set 553' shallower than the reported bottom of PGDW44.

Tribal Pavillion 34-10 (API #49-013-22149) was completed in October 2001 by Tom Brown, Inc. at a total depth of 5,732' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,050' FSL and 1,980' FEL (SWSE) and is shown on Figure 4. 7" surface casing was set at 648' and cemented to surface with 200 sacks of Type III cement. 4-1/2" production casing was set at 5,712' and cemented in two stages with 275 sacks of 50/50 pozmix cement for the first stage, and 560 sacks 50/50 pozmix cement through a DV tool at 3,018'. Cement circulated to surface in both stages. Mud weight prior to cementing was 9.2 pounds per

gallon. A cement bond log ran in September 2001 from 5,647' to 618' measured cement top behind the 4-1/2" casing at less than 618' from surface.

Fort Union Sands were selectively perforated between 4,616' and 5,526' and were fracture treated with a total of 794 barrels of CO_2 assisted gelled water and 177,524 pounds of sand. The shallowest perforations are 4,616'-4,634' and this interval was fracture treated with 143 barrels of CO_2 assisted gelled water and 38,697 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 3,092,923 mcf of gas and 4,816 barrels of water. The current producing interval is 4,616' to 5,456'.

Bradenhead pressure measured in June 2012 reported no pressure between the production casing and surface casing, with 62 psig on the tubing and 134 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 34-10 to domestic water well PGDW23 is 1,039'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 4,106', and the direct distance from the top producing perforation to the bottom of PGDW23 is 4,235'. The 7" surface casing is set 138' deeper than the reported bottom of PGDW23.

Pavillion Fee 41-10 (API #49-013-22198) was completed in January 2002 by Tom Brown, Inc. at a total depth of 3,180' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 860' FNL and 660' FEL (NENE) and is shown on Figure 3. 7" surface casing was set at 534' and cemented to surface with 230 sacks of Class G cement. 4-1/2" production casing was set at 3,180' and cemented with 225 sacks of Class "C" cement (1.96 cubic feet per sack, 13 pounds per gallon). Cement did not circulate to surface. Mud weight prior to cementing was 9.1 pounds per gallon. A cement bond log ran in January 2002 from 3,160' to 300' measured the cement top at 518' below surface.

Wind River Sands were selectively perforated between 1,618' and 3,152' and were fracture treated with a total of 651 barrels of CO_2 assisted gelled water and 149,755 pounds of sand. The shallowest perforations are 1,618'-1,626' and this interval was fracture treated with 70 barrels of CO_2 assisted gelled water and 26,084 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 939,858 mcf of gas and 157 barrels of water. The current producing interval is 1,618' to 3,152'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 36 psig on the tubing and 36 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 41-10 to domestic water well PGDW30 is 752'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 1,348', and the direct distance from the top producing perforation to the bottom of PGDW30 is 1,544'. The 7" surface casing is set 264' deeper than the reported bottom of PGDW30.

Surface distance from the Pavillion Fee 41-10 to domestic water well PGDW49 is 860'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 1,558', and the direct distance from the top producing perforation to the bottom of PGDW49 is 1,780'. The 7" surface casing is set 474' deeper than the reported bottom of PGDW49.

Pavillion Fee 41-10B (API #49-013-22624) was completed in May 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 3,841' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 465' FNL and 465' FEL (NENE) and is shown on Figure 3. 7" surface casing was set at 640' and cemented to surface with 245 sacks of Class G cement. 4-1/2" production casing was set at 3,839' and cemented with 214 sacks of CemCrete cement (2.35 cubic feet per sack, 9.5 pounds per gallon). Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in April 2005 from 3,762' to surface measured the cement top at less than 42'.

Fort Union Sands were selectively perforated between 3,545' and 3,641' and were fracture treated with 144 barrels of CO_2 assisted gelled water and 29,750 pounds of sand. Wind River Sands were selectively perforated between 1,792' and 3,024' and were fracture treated with a total of 183 barrels of CO_2 assisted gelled water and 51,903 pounds of sand. The shallowest perforations are 1,792'-1,799' and this interval was fracture treated with 48 barrels of CO_2 assisted gelled water and 11,652 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 284,408 mcf of gas and 293 barrels of water. The current producing interval is 1,792' to 3,024'.

Bradenhead pressure measured in March 2012 reported a pressure of 165 psig between the production casing and surface casing, with 39 psig on the tubing and 39 psig on the tubing-casing annulus. The bradenhead pressure bled off in 1 hour with no fluid recovery, and built to 173 psig after seven days shut-in. Gas samples were taken from the tubing and bradenhead, and results of these analyses, shown also in Appendix B, were:

Pavillion Fee 41-10B			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.5704	0.7897	38.4
Carbon Dioxide	0.0467	0	-100.0
Methane	92.6355	93.3746	0.8
Ethane	4.2192	4.2654	1.1
Propane	1.0353	0.9129	-11.8
iso-Butane	0.3903	0.2833	-27.4
n-Butane	0.3289	0.2509	-23.7
iso-Pentane	0.1784	0.0666	-62.7
n-Pentane	0.113	0.0303	-73.2
Hexanes +	0.4405	0.0217	-95.1
Benzene	0.0174	0.0009	-94.8
Toluene	0.0194	0.0034	-82.5
Ethyl-benzene	0.0044	0	-100.0
Specific Gravity	0.6188	0.5982	-3.3
BTU (Saturated)	1084	1050	-3

A Mechanical Integrity test of the casing above 1,742' was performed in December 2012, and the casing tested to 500 psig with no bleed-off. The bradenhead was tested again in July 2013, measuring an initial pressure of 140 psig that bled to 0 psig in 56 seconds with no fluid recovery.

Surface distance from the Pavillion Fee 41-10B to domestic water well PGDW30 is 675'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 1,522', and the direct distance from the top producing perforation to the

bottom of PGDW30 is 1,665'. The 7" surface casing is set 370' deeper than the reported bottom of PGDW30.

Surface distance from the Pavillion Fee 41-10B to domestic water well PGDW49 is 917'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 1,732', and the direct distance from the top producing perforation to the bottom of PGDW49 is 1,960'. The 7" surface casing is set 580' deeper than the reported bottom of PGDW49.

Unit 41X-10 (API #49-013-20414) was completed in January 1973 by Shell Oil Company at a total depth of 5,047' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-258-6300), at a surface location of 1,140' FNL and 1,085' FEL (NENE) and is shown on Figure 3. 8-5/8" surface casing was set at 619' and cemented to surface with 425 sacks of Class G cement. 4-1/2" production casing was set at 5,047' and cemented with 775 sacks of 50/50 pozmix cement (14.3 pounds per gallon). Mud weight prior to cementing was 10.0 pounds per gallon. A cement bond log ran in November 1972 from 4,990' to 800' measured the cement top at 1,370'.

Fort Union Sands were selectively perforated between 3,825' and 4,855'. The interval 4,044'-4,158' was fracture treated with 645 barrels of gelled water and 104,000 pounds of sand. Wind River Sands were selectively perforated between 1,809' and 2,892' and were not fracture treated. No production is attributed to the Unit 41X-10 in WOGCC records, however there is evidence it produced commercially in the 1970's and a portion of the volume reported for the Gov't. Tribal 33X-10 (API #49-013-06363) is from the Unit 41X-10.

The well was plugged and abandoned in November 1981 by filling the wellbore with heavy mud, and spotting 40 sacks cement plugs inside the production casing at 3,456', 2,900', and 2,400'. 60 sacks of cement were pumped into the 8-5/8" x 4-1/2" annulus. The wellhead and casings were cut off below ground level and cement was placed over the casing stubs, thereby removing all valves, connections, and access to casings and annuli. Because this well has been plugged and abandoned, no bradenhead testing could be performed due to the inability to access the 8-5/8" x 4-1/2" annulus.

Surface distance from the Unit 41X-10 to domestic water well PGDW30 is 896'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 1,539', and the direct distance from the top producing perforation to the bottom of PGDW30 is 1,781'. The 8-5/8" surface casing is set 349' deeper than the reported bottom of PGDW30.

Surface distance from the Unit 41X-10 to domestic water well PGDW49 is 1,098'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 1,749', and the direct distance from the top producing perforation to the bottom of PGDW49 is 2,065'. The 8-5/8" surface casing is set 559' deeper than the reported bottom of PGDW49.

Tribal 42-10 (API #49-013-21696) was completed in June 1994 by Tom Brown, Inc. at a total depth of 5,995' using a closed KCl polymer mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,100' FNL and 662' FEL (SENE) and is shown on Figure 3. 8-5/8" surface casing was set at 626' and cemented to surface with 170 sacks of Lite and 210 sacks of premium cement. 5-1/2" production casing was set at 5,995' and cemented in 2 stages with 1,426 sacks of 50/50 pozmix cement with a DV tool at 4,278'. Mud weight prior to cementing was 9.2

pounds per gallon. A cement bond log ran in June 1994 from 5,926' to 2,300' measured the cement top at 2,590' below surface. Perforations at 2,540' were squeeze cemented in December 2004 with 100 sacks. A cement bond log ran in December 2004 from 2,430' to 1,700' measured the cement top at 1,750' below surface.

In 1994, Fort Union Sands were selectively perforated between 4,750' and 5,762', and were not fracture treated. In June 2001, additional Fort Union Sands were selectively perforated from 3,394' to 5,515' and fracture treated with a total of 1,100 barrels of CO_2 assisted gelled water and 124,507 pounds of sand. Also in 2001, Wind River Sands were perforated between 3,298' and 3,305' and fracture treated with 125 barrels of CO_2 assisted gelled water and 20,000 pounds of sand. In December 2004, additional Wind River Sands were perforated between 2,502' and 2,656' and fracture treated with a total of 190 barrels of CO_2 assisted gelled water and 30,147 pounds of sand. The shallowest perforations are 2,502'-2,518' and this interval was fracture treated with 125 barrels of CO_2 assisted gelled water and 20,000 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 595 barrels of oil, 3,326,769 mcf of gas and 14,503 barrels of water. The current open interval is 2,502' to 3,528'.

Bradenhead pressure measured in November 2011 reported no pressure between the production casing and surface casing, with 48 psig on the tubing and 48 psig on the tubing-casing annulus.

Surface distance from the Tribal 42-10 to domestic water well PGDW30 is 1,229'. The vertical distance from the top producing perforation to the bottom of PGDW30 is 2,227', and the direct distance from the top producing perforation to the bottom of PGDW30 is 2,544'. The 8-5/8" surface casing is set 351' deeper than the reported bottom of PGDW30.

Surface distance from the Tribal 42-10 to domestic water well PGDW49 is 707'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 2,437', and the direct distance from the top producing perforation to the bottom of PGDW49 is 2,537'. The 8-5/8" surface casing is set 561' deeper than the reported bottom of PGDW49.

Tribal Pavillion 42-10B (API #49-013-22342) was completed in February 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 5,605' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 2,172' FNL and 465' FEL (SENE) and is shown on Figure 3. 8-5/8" surface casing was set at 621' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,605' and cemented with 900 sacks of CemCrete cement (2.38 cubic feet/sack, 9.6 pounds per gallon). Mud weight prior to cementing was 8.7 pounds per gallon. A cement bond log ran in January 2005 from 5,537' to surface measured cement top behind the 4-1/2" casing at less than 42' from surface.

Fort Union Sands were selectively perforated between 3,485' and 4,859' and fracture treated with a total of 403 barrels of CO_2 assisted gelled water and 91,504 pounds of sand. Wind River Sands were selectively perforated between 1,890' and 3,308' and fracture treated with a total of 463 barrels of CO_2 assisted gelled water and 108,105 pounds of sand. The shallowest perforations are 1,890'-1,902' and this interval was fracture treated with 53 barrels of CO_2 assisted gelled water and 11,283 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 957,773 mcf of gas and 2,892 barrels of water. The current open interval is 1,890' to 4,859'.

Bradenhead pressure measured in March 2012 reported a pressure of 0 psig between the production casing and surface casing, with 140 psig on the tubing and 40 psig on the tubing-casing annulus. A blow of gas was reported from the bradenhead. The bradenhead was left open for 15 days, and then shut in with no fluid recovery. Pressure built to 20 psig after seven days shut-in. Gas samples were taken from the tubing and bradenhead, and results of these analyses, shown also in Appendix B, were:

Tribal Pavillion 42-10B			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.4577	1.1921	160.5
Carbon Dioxide	0.0592	0	-100.0
Methane	93.3702	92.0918	-1.4
Ethane	3.8301	4.2286	10.4
Propane	1.1094	1.3753	24.0
iso-Butane	0.3318	0.3731	12.4
n-Butane	0.2681	0.3002	12.0
iso-Pentane	0.143	0.1512	5.7
n-Pentane	0.0841	0.0921	9.5
Hexanes +	0.3187	0.1862	-41.6
Benzene	0.0126	0.0061	-51.6
Toluene	0.0116	0.0029	-75.0
Ethyl-benzene	0.0031	0	-100.0
Specific Gravity	0.6102	0.614	0.6
BTU (Saturated)	1073	1068	0

Surface distance from the Tribal Pavillion 42-10B to domestic water well PGDW49 is 1,214'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 1,830', and the direct distance from the top producing perforation to the bottom of PGDW49 is 2,196'. The 8-5/8" surface casing is set 561' deeper than the reported bottom of PGDW49.

Tribal 43-10 (API #49-013-21704) was completed in September 1994 by Tom Brown, Inc. at a total depth of 5,956' using a closed KCl polymer mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,996' FSL and 761' FEL (NESE) and is shown on Figure 4. 8-5/8" surface casing was set at 641' and cemented to surface with 160 sacks of Lite and 200 sacks of Class G cement. 5-1/2" production casing was set at 5,956' and cemented with 1,200 sacks of 50/50 pozmix cement. 35 barrels of cement slurry were circulated to surface. Mud weight prior to cementing was 9.2 pounds per gallon. A cement bond log ran in September 1994 reported the cement top at surface, however this log was not located in WOGCC files, BLM files, or Encana records.

In 1994, Fort Union Sands were selectively perforated between 5,324' and 5,486', and not fracture treated. In January 2002, additional Fort Union Sands were selectively perforated between 4,559' and 5,512', and fracture treated with a total of 963 barrels of CO_2 assisted gelled water and 252,753 pounds of sand. The shallowest perforations are 4,559' – 4,631' and this interval was fracture treated with 125 barrels of CO_2 assisted gelled water and 43,273 pounds of sand. The well is an active producer, with cumulative

production through April 2014 of 604 barrels of oil, 6,830,178 mcf of gas and 28,467 barrels of water. The current open interval is 4,559' to 5,512'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 44 psig on the tubing and 110 psig on the tubing-casing annulus.

Surface distance from the Tribal 43-10 to domestic water well PGDW23 is 532'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 4,044', and the direct distance from the top producing perforation to the bottom of PGDW23 is 4,079'. The 8-5/8" surface casing is set 126' deeper than the reported bottom of PGDW23.

Tribal Pavillion 43-10B (API #49-013-22420) was completed in January 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 5,760' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,410' FSL and 663' FEL (NESE) and is shown on Figure 4. 7" surface casing was set at 636' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 5,759' and cemented with 270 sacks of Lite cement (2.53 cubic feet/sack, 9.5 pounds per gallon). Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in November 2004 from 5,699' to 890' measured cement top behind the 4-1/2" casing at 1,170' from surface. The casing was perforated at 1,070' and squeeze cemented with 111 sacks of cement.

Fort Union Sands were selectively perforated between 3,618' and 5,470' and fracture treated with a total of 1,366 barrels of CO_2 assisted gelled water and 152,654 pounds of sand. Wind River Sands were selectively perforated between 1,810' and 2,739' and fracture treated with a total of 679 barrels of CO_2 assisted gelled water and 93,072 pounds of sand. The shallowest perforations are 1,810'-1,816' and this interval was fracture treated with 84 barrels of CO_2 assisted gelled water and 14,697 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 524,410 mcf of gas and 2,606 barrels of water. The current open interval is 1,810' to 5,191'.

Bradenhead pressure measured in June 2012 reported no pressure between the production casing and surface casing, with 61 psig on the tubing and 63 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 43-10B to domestic water well PGDW23 is 583'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 1,300', and the direct distance from the top producing perforation to the bottom of PGDW23 is 1,425'. The 7" surface casing is set 126' deeper than the reported bottom of PGDW23.

Unit 44-10 (API #49-013-20879) was completed in December 1979 by Shell Oil Company at a total depth of 5,200' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-0258-6300), at a surface location of 1,000' FSL and 1,000' FEL (SESE) and is shown on Figure 4. 8-5/8" surface casing was set at 605' and cemented to surface with 375 sacks of Class G cement. 5-1/2" production casing was set at 5,191' and cemented with 1,300 sacks of Class G cement (1.15 cubic feet/sack, 15.8 pounds per gallon). Circulation was lost during the last 40 barrels of displacement. Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in July 1979 from 5,144'-600' measured cement top behind the 5-1/2" casing at 1,918' below surface.

In 1979, Fort Union Sands were selectively perforated between 3,230' and 5,084', and were not fracture treated. In October 2004 additional Fort Union Sands were selectively perforated between 3,592' and 4,925', and fracture treated with a total of 1,303 barrels of CO_2 assisted gelled water and 210,500 pounds of sand. Also in 2004, Wind River Sands were selectively perforated between 2,691' and 2,904', and fracture treated with a total of 368 barrels of CO_2 assisted gelled water and 37,890 pounds of sand. The shallowest perforations are 2,691'-2,716' and this interval was fracture treated with 150 barrels of CO_2 assisted gelled water and 20,000 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 4,515,619 mcf of gas and 1,751 barrels of water. The current producing interval is 2,691' to 4,610'.

Bradenhead pressure measured in November 2011 reported a pressure of 150 psig between the production casing and surface casing, with 85 psig on the tubing and 85 psig on the tubing-casing annulus. The bradenhead flowed gas and water during a 15-day flow in December 2011, and 410 barrels of water were recovered during the first 8 hours. Gas and water samples were taken and analyzed. Results of the gas analyses, shown also in Appendix B, were:

Unit 44-10			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.358	1.3997	291.0
Carbon Dioxide	0.209	0	-100.0
Methane	95.0794	91.5877	-3.7
Ethane	3.5282	4.2577	20.7
Propane	0.4236	1.5803	273.1
iso-Butane	0.1392	0.4681	236.3
n-Butane	0.076	0.3907	414.1
iso-Pentane	0.0502	0.1383	175.5
n-Pentane	0.0222	0.0727	227.5
Hexanes +	0.1105	0.1042	-5.7
Benzene	0.0019	0.0003	-84.2
Toluene	0.0008	0.0001	-87.5
Ethyl-benzene	0	0	
Specific Gravity	0.5875	0.6164	4.9
BTU (Saturated)	1036	1068	3

Surface distance from the Unit 44-10 to domestic water well PGDW23 is 835'. The vertical distance from the top producing perforation to the bottom of PGDW23 is 2,177', and the direct distance from the top producing perforation to the bottom of PGDW23 is 2,332'. The 8-5/8" surface casing is set 91' deeper than the reported bottom of PGDW23.

Section 11, T3N, R2E

Pavillion Fee 11-11 (API #49-013-22059) was completed in January 2002 by Tom Brown, Inc. at a total depth of 5,846' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,136' FNL and 1,274' FWL (NWNW) and is shown on Figure 3. 7" surface casing was set at 531' and cemented to surface with 115 sacks of Type III cement (1.39 cubic feet per sack, 14.5 pounds per gallon) with a 40' top job. 4-1/2" production casing was set at 5,842' and cemented in two stages with a total of 680 sacks of 50/50 pozmix cement (1.39 cubic feet per sack, 13.5 pounds per gallon) with DV tool at 2,835'. Mud weight prior to cementing was 9.1 pounds per gallon. The casing was perforated at 1,600' and cement squeezed with a total of 348 sacks AG-300 cement (1.18 cubic feet per sack, 15.6 pounds per gallon). A cement bond log ran in February 2001 from 5,768' to 330' measured the cement top at less than 330' below surface after the squeeze jobs.

Fort Union Sands were selectively perforated between 3,359' and 4,832' and fracture treated with a total of 1,093 barrels of CO_2 assisted gelled water and 248,803 pounds of sand. The shallowest perforations are 3,359'-3,396' and this interval was fracture treated with 161 barrels of CO_2 assisted gelled water and 46,896 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 820,286 mcf of gas and 9,051 barrels of water. The current producing interval is 3,359' to 4,582'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 36 psig on the tubing and 36 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 11-11 to domestic water well PGDW05 is 1,386'. The vertical distance from the top producing perforation to the bottom of PGDW05 is 3,138', and the direct distance from the top producing perforation to the bottom of PGDW05 is 3,430'. The 7" surface casing is set 310' deeper than the reported bottom of PGDW05.

Surface distance from the Pavillion Fee 11-11 to domestic water well PGDW45 is 1,384'. The vertical distance from the top producing perforation to the bottom of PGDW45 is 3,248', and the direct distance from the top producing perforation to the bottom of PGDW45 is 3,531'. The 7" surface casing is set 420' deeper than the reported bottom of PGDW45.

Surface distance from the Pavillion Fee 11-11 to domestic water well PGDW49 is 1,132'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 3,298', and the direct distance from the top producing perforation to the bottom of PGDW49 is 3,487'. The 7" surface casing is set 470' deeper than the reported bottom of PGDW49.

Pavillion Fee 11-11B (API #49-013-22220) was completed in February 2002 by Tom Brown, Inc. at a total depth of 4,780' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 465' FNL and 665' FWL (NWNW) and is shown on Figure 3. 7" surface casing was set at 560' and cemented to surface with 230 sacks of Class G cement (1.15 cubic feet per sack, 15.8 pounds per gallon). 4-1/2" production casing was set at 4,776' and cemented in two stages with a total of 400 sacks of Class C cement (1.97 cubic feet per sack, 13 pounds per gallon) with DV tool at 2,814'. Eight barrels of cement slurry were circulated to surface. Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in February 2002 from 4,736' to 520' measured the cement top behind the 4-1/2" at less than 520' below surface.

In 2002, Fort Union Sands were selectively perforated between 3,370' and 4,738' and fracture treated with a total of 1,295 barrels of CO_2 assisted gelled water and 218,550 pounds of sand. In February 2005, additional Fort Union Sands were perforated between 3,430' and 4,662' and fracture treated with a total of 567 barrels of CO_2 assisted gelled water and 79,812 pounds of sand. Also in February 2005, Wind River Sands were selectively perforated between 1,516' and 3,180' and fracture treated with a total of 689 barrels of CO_2 assisted gelled water and 122,927 pounds of sand. The shallowest perforations are 1,516' – 1,521' and this interval was fracture treated with 68 barrels of CO_2 assisted gelled water and 15,919 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 775,677 mcf of gas and 13,056 barrels of water. The current producing interval is 1,516' to 3,180'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 36 psig on the tubing and 36 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 11-11B to domestic water well PGDW05 is 1,111'. The vertical distance from the top producing perforation to the bottom of PGDW05 is 1,296', and the direct distance from the top producing perforation to the bottom of PGDW05 is 1,707'. The 7" surface casing is set 340' deeper than the reported bottom of PGDW05.

Surface distance from the Pavillion Fee 11-11B to domestic water well PGDW45 is 1,044'. The vertical distance from the top producing perforation to the bottom of PGDW45 is 1,406', and the direct distance from the top producing perforation to the bottom of PGDW45 is 1,751'. The 7" surface casing is set 450' deeper than the reported bottom of PGDW45.

Surface distance from the Pavillion Fee 11-11B to domestic water well PGDW49 is 865'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 1,456', and the direct distance from the top producing perforation to the bottom of PGDW49 is 1,694'. The 7" surface casing is set 500' deeper than the reported bottom of PGDW49.

Pavillion Unit 12-11 (API #49-013-21669) was completed in October 1993 by Tom Brown, Inc. at a total depth of 6,482' using a closed KCl polymer mud system. The well is located on fee minerals, at a surface location of 2,300' FNL and 750' FWL (SWNW) and is shown on Figure 3. 8-5/8" surface casing was set at 627' and cemented to surface with 360 sacks of Premium Class G cement. 5-1/2" production casing was set at 6,482' and cemented with 1,345 sacks of 50/50 pozmix cement. Circulation was lost during displacement, and cement was not circulated to surface. Mud weight prior to cementing was 9.1 pounds per gallon. A cement bond log ran in September 1993 from 6,391' to 600' measured the cement top behind the 5-1/2" at 852' below surface.

In 1993, Fort Union Sands were selectively perforated between 5,167' and 5,192' and fracture treated with 281 barrels of CO_2 assisted gelled water and 72,100 pounds of sand. In January 1994, Fort Union Sand perforations 4,530'-4,548' were added, with no fracture treatment. In October and November 2004, additional Fort Union Sands between 3,382' and 5,354' were perforated and fracture treated with an estimated 1,658 barrels of CO_2 assisted gelled water and 300,483 pounds of sand. The shallowest perforations are 3,382'-3,389' and this interval was fracture treated with 107 barrels of CO_2 assisted gelled water and an estimated 20,000 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 229 barrels of oil, 5,706,151 mcf of gas and 8,451 barrels of water. The current open interval is 3,382' to 4,804'.

Bradenhead pressure measured in June 2012 reported a pressure of 150 psig between the production casing and surface casing, with 42 psig on the tubing and 100 psig on the tubing-casing annulus. The bradenhead bled to 0 psig in 2 hours, and no water was recovered during a 15-day flow test. The bradenhead pressure built to 54 psig after 7 days shut-in. Gas samples were taken and analyzed, and results of these analyses, shown also in Appendix B, were:

Pavillion Unit 12-11			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.3545	0.7963	124.6
Carbon Dioxide	0.3991	0	-100.0
Methane	95.1965	93.8511	-1.4
Ethane	3.0569	3.7449	22.5
Propane	0.3532	0.8768	148.2
iso-Butane	0.178	0.2674	50.2
n-Butane	0.0498	0.1839	269.3
iso-Pentane	0.0784	0.0988	26.0
n-Pentane	0.0258	0.0524	103.1
Hexanes +	0.2841	0.1214	-57.3
Benzene	0.0192	0.0066	-65.6
Toluene	0.0005	0.0001	-80.0
Ethyl-benzene	0.0006	0.0002	-66.7
Specific Gravity	0.593	0.5981	0.9
BTU (Saturated)	1040	1050	1

Surface distance from the Pavillion Unit 12-11 to domestic water well PGDW49 is 1,299'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 3,317', and the direct distance from the top producing perforation to the bottom of PGDW49 is 3,562'. The 8-5/8" surface casing is set 562' deeper than the reported bottom of PGDW49.

Pavillion Fee 12-11B (API #49-013-22272) was completed in January 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 3,860' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 1,457' FNL and 656' FWL (SWNW) and is shown on Figure 3. 7" surface casing was set at 551' and cemented to surface with 280 sacks of Class G cement. 4-1/2" production casing was set at 3,854' and cemented with 255 sacks of CemCrete cement (2.4 cubic feet/sack, 9.25 pounds per gallon). Four barrels of slurry were circulated to surface. Mud weight prior to cementing was 9.0 pounds per gallon. A cement bond log ran in December 2004 from 3,802' to 700' measured cement top behind the 4-1/2" casing at 970' from surface. The casing was perforated at 930' and squeeze cemented with 24 barrels (117 sacks) of cement. Cement was circulated to surface. A cement bond log ran after this squeeze job in January 2005 from 1,300' to 100' measured cement top behind the 4-1/2" casing at 226' from surface.

Fort Union Sands were perforated between 3,444' and 3,466' and fracture treated with an estimated 100 barrels of CO_2 assisted gelled water and 24,956 pounds of sand. Wind River Sands were selectively perforated between 1,406' and 2,674' and fracture treated with an estimated total of 610 barrels of CO_2 assisted gelled water and 98,341 pounds of sand. The shallowest perforations are 1,406'-1,473' and this interval was fracture treated with 110 barrels of CO_2 assisted gelled water and 29,519 pounds of sand.

The well is an active producer, with cumulative production through April 2014 of 354,281 mcf of gas and 731 barrels of water. The current open interval is 1,406' to 3,466'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 40 psig on the tubing and 42 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 12-11B to domestic water well PGDW49 is 590'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 1,347', and the direct distance from the top producing perforation to the bottom of PGDW49 is 1,471'. The 7" surface casing is set 491' deeper than the reported bottom of PGDW49.

Pavillion Fee 12-11W (API #49-013-22102) was completed in May 2001 by Tom Brown, Inc. at a total depth of 3,250' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 2,292' FNL and 1,014' FWL (SWNW) and is shown on Figure 3. 8-5/8" surface casing was set at 430' and cemented to surface with 160 sacks of Type III cement. 5-1/2" production casing was set at 3,250' and cemented with 660 sacks of 50/50 pozmix cement (1.48 cubic feet per sack, 13.3 pounds per gallon). Circulation was lost during displacement, with no cement returns to surface. Mud weight prior to cementing was 8.7 pounds per gallon. A cement bond log ran in April 2001 from 3,182' to 1,200' measured the cement top behind the 5-1/2" casing at 1,930' below surface.

Wind River Sands were selectively perforated between 2,529' and 3,096' and fracture treated with a total of 658 barrels of CO_2 assisted gelled water and 109,866 pounds of sand. The shallowest perforations are 2,529'-2,541' and this interval was treated with 144 barrels of CO_2 assisted gelled water and 31,791 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 851,732 mcf of gas and 460 barrels of water. The current producing interval is 2,529' to 3,096'.

Bradenhead pressure measured in June 2012 reported a pressure of 150 psig between the production casing and surface casing, with 45 psig on the tubing and 45 psig on the tubing-casing annulus. The bradenhead flowed gas and water during a 15-day flow test, and 4,303 barrels of water were recovered. Gas and water samples were taken, and results of these analyses, shown also in Appendix B, were:

Pavillion Fee 12-11W			
	Mole %		Variance
Component	Tubing	Bradenhead	%
Nitrogen	0.4691	0.9415	100.7
Carbon Dioxide	0.0575	0	-100.0
Methane	94.1256	92.7397	-1.5
Ethane	3.3829	4.2221	24.8
Propane	0.8745	1.1349	29.8
iso-Butane	0.2632	0.3341	26.9
n-Butane	0.2075	0.2626	26.6
iso-Pentane	0.1173	0.1281	9.2
n-Pentane	0.0695	0.0743	6.9
Hexanes +	0.3841	0.1546	-59.8
Benzene	0.0194	0.0074	-61.9
Toluene	0.0163	0	-100.0
Ethyl-benzene	0.0009	0.0003	-66.7
Specific Gravity	0.6059	0.6076	0.3
BTU (Saturated)	1066	1062	0

Mechanical Integrity test of the casing above 2,507' was performed in October 2012, and the casing tested to 500 psig with no bleed-off. In May 2013 Encana Oil &

Gas (USA) Inc. squeeze cemented perforations in the 5-1/2" casing at 1,450' with 300 sacks of Class G cement, and pumped an additional 180 sacks of Class G cement through perforations at 480', circulating cement to the surface. A cement bond log ran in May 2013 after these cement jobs from 2,000' to surface showed cement behind the 5-1/2" casing at the surface.

Surface distance from the Pavillion Fee 12-11W to domestic water well PGDW49 is 1,369'. The vertical distance from the top producing perforation to the bottom of PGDW49 is 2,467', and the direct distance from the top producing perforation to the bottom of PGDW49 is 2,821'. The 8-5/8" surface casing is set 368' deeper than the reported bottom of PGDW49.

Tribal Pavillion 21-11B (API #49-013-22586) was completed in April 2005 by Encana Oil & Gas (USA) Inc. at a total depth of 3,875' using a closed LSND mud system. The well is located on Tribal minerals (Lease 14-20-0258-6301), at a surface location of 481' FNL and 2,000' FWL (NENW) and is shown on Figure 3. 7" surface casing was set at 642' and cemented to surface with 240 sacks of Class G cement. 4-1/2" production casing was set at 3,868' and cemented with 230 sacks of CemCrete cement (2.35 cubic feet/sack, 9.5 pounds per gallon). Mud weight prior to cementing was 8.9 pounds per gallon. A cement bond log ran in April 2005 from 3,805' to surface measured cement top behind the 4-1/2" casing at less than 30' from surface.

Fort Union Sands were perforated between 3,368' and 3,624' and fracture treated with a total of 250 barrels of CO_2 assisted gelled water and 52,136 pounds of sand. Wind River Sands were selectively perforated between 1,444' and 3,025' and fracture treated with a total of 307 barrels of CO_2 assisted gelled water and 85,664 pounds of sand. The shallowest perforations are 1,444'-1,474' and this interval was fracture treated with 54 barrels of CO_2 assisted gelled water and 15,015 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 625,953 mcf of gas and 1,560 barrels of water. The current open interval is 1,444' to 3,624'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 40 psig on the tubing and 40 psig on the tubing-casing annulus.

Surface distance from the Tribal Pavillion 21-11B to domestic water well PGDW05 is 833'. The vertical distance from the top producing perforation to the bottom of PGDW05 is 1,224', and the direct distance from the top producing perforation to the bottom of PGDW05 is 1,481'. The 7" surface casing is set 422' deeper than the reported bottom of PGDW05.

Surface distance from the Tribal Pavillion 21-11B to domestic water well PGDW45 is 900'. The vertical distance from the top producing perforation to the bottom of PGDW45 is 1,334', and the direct distance from the top producing perforation to the bottom of PGDW45 is 1,609'. The 7" surface casing is set 532' deeper than the reported bottom of PGDW45.

Section 12, T3N, R2E

The **Pavillion Fee 13-12** (API #49-013-22060) was completed in June 2001 by Tom Brown, Inc. at a total depth of 3,275' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 2,459' FSL and 1,301' FWL (NWSW) and is shown on Figure 5. 7" surface casing was set at 327' and cemented to surface with 85 sacks of Type III cement. 4-1/2" production casing was set at 3,725' and cemented with 215 sacks of HLC cement (1.9 cubic feet per sack). Mud weight prior to cementing was 9.1 pounds per gallon. A cement bond log ran in January 2001 from 3,140' to 323' measured the cement top behind the 4-1/2" casing at 915' below surface.

Wind River Sands were selectively perforated between 2,170' and 3,125' and fracture treated with a total of 672 barrels of CO_2 assisted gelled water and 141,608 pounds of sand. The shallowest perforations are 2,170'-2,180' and this interval was fracture treated with 88 barrels of CO_2 assisted gelled water and 18,748 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 658,223 mcf of gas and 221 barrels of water. The current producing interval is 2,170' to 3,125'.

Bradenhead pressure measured in October 2011 reported a pressure of 30 psig between the production casing and surface casing, with 41 psig on the tubing and 45 psig on the tubing-casing annulus. The bradenhead bled off to 0 psig with no recovery, and did not build any pressure in 7 days shut-in.

Surface distance from the Pavillion Fee 13-12 to domestic water well PGDW20 is 563'. The vertical distance from the top producing perforation to the bottom of PGDW20 is 1,698', and the direct distance from the top producing perforation to the bottom of PGDW20 is 1,789'. The 7" surface casing is set 145' shallower than the reported bottom of PGDW20.

Surface distance from the Pavillion Fee 13-12 to domestic water well PGDW21 is 563'. The vertical distance from the top producing perforation to the bottom of PGDW21 is 1,698', and the direct distance from the top producing perforation to the bottom of PGDW21 is 1,789'. The 7" surface casing is set 145' shallower than the reported bottom of PGDW21.

Surface distance from the Pavillion Fee 13-12 to domestic water well LD02 is 563'. The vertical distance from the top producing perforation to the bottom of LD02 is 1,548', and the direct distance from the top producing perforation to the bottom of LD02 is 1,647'. The 7" surface casing is set 295' shallower than the reported bottom of LD02.

Unit 22-12 (API #49-013-20878) was completed in January 1980 by Shell Oil Company at a total depth of 5,200' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-0258-1310), at a surface location of 1,906' FNL and 1,393' FWL (SENW) and is shown on Figure 5. 8-5/8" surface casing was set at 586' and cemented to surface with 450 sacks of Class G cement. 4-1/2" production casing was set at 5,200' and cemented with 825 sacks of Class G cement. Mud weight prior to cementing was 9.2 pounds per gallon. A cement bond log was referenced on the completion report as having been run, however was not located in WOGCC files, BLM files, or Encana records.

In December 1979, Fort Union Sands were selectively perforated between 3,510' and 4,998', and not fracture treated. Wind River Sands were selectively perforated between 3,218' and 3,327', and fracture treated with 1,190 barrels of gelled water and 61,000 pounds of sand. In April 1993, additional Wind River Sands were selectively perforated between 1,701' and 2,388', and were not fracture treated. The shallowest

perforations are 1,701'-1,713' and this interval was not fracture treated. The well is an active producer, with cumulative production through April 2014 of 3,639,997 mcf of gas and 288 barrels of water. The current producing interval is 1,701' to 3,327'.

Bradenhead pressure measured in April 2012 reported a pressure of 150 psig between the production casing and surface casing, with 38 psig on the tubing and 38 psig on the tubing-casing annulus. The bradenhead pressure bled off with no recovery, and did not build any pressure in 7 days shut-in.

Surface distance from the Unit 22-12 to domestic water well PGDW20 is 631'. The vertical distance from the top producing perforation to the bottom of PGDW20 is 1,227', and the direct distance from the top producing perforation to the bottom of PGDW20 is 1,380'. The 8-5/8" surface casing is set 112' deeper than the reported bottom of PGDW20.

Surface distance from the Unit 22-12 to domestic water well PGDW21 is 630'. The vertical distance from the top producing perforation to the bottom of PGDW21 is 1,227', and the direct distance from the top producing perforation to the bottom of PGDW21 is 1,379'. The 8-5/8" surface casing is set 112' deeper than the reported bottom of PGDW21.

Surface distance from the Unit 22-12 to domestic water well LD02 is 630'. The vertical distance from the top producing perforation to the bottom of LD02 is 1,077, and the direct distance from the top producing perforation to the bottom of LD02 is 1,248'. The 8-5/8" surface casing is set 38' shallower than the reported bottom of LD02.

The **Pavillion Fee 23-12** (API #49-013-22060) was completed in September 2001 by Tom Brown, Inc. at a total depth of 3,260' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 2,494' FSL and 2,502' FWL (NESW) and is shown on Figure 5. 7" surface casing was set at 534' and cemented to surface with 210 sacks of Type III cement (1.39 cubic feet per sack). 4-1/2" production casing was set at 3,260' and cemented with 300 sacks of 50/50 pozmix cement (1.59 cubic feet per sack, 13.0 pounds per gallon). 15 barrels of cement circulated to surface. Mud weight prior to cementing was 9.1 pounds per gallon. A cement bond log ran in July 2001 from 3,173' to surface measured the cement top behind the 4-1/2" casing at less than 29' below surface.

Wind River Sands were selectively perforated between 1,730' and 3,118' and were fracture treated with a total of 525 barrels of CO_2 assisted gelled water and 135,879 pounds of sand. The shallowest perforations are 1,730'-1,758', and this interval was fracture treated with 112 barrels of CO_2 assisted gelled water and 37,560 pounds of sand. The well is an active producer, with cumulative production through April 2014 of 422,041 mcf of gas and 138 barrels of water. The current producing interval is 1,730' to 3,118'.

Bradenhead pressure measured in March 2012 reported no pressure between the production casing and surface casing, with 36 psig on the tubing and 36 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 23-12 to domestic water well PGDW20 is 685'. The vertical distance from the top producing perforation to the bottom of PGDW20 is 1,260', and the direct distance from the top producing perforation to the bottom of PGDW20 is 1,434'. The 7" surface casing is set 64' deeper than the reported bottom of PGDW20.

Surface distance from the Pavillion Fee 23-12 to domestic water well PGDW21 is 659'. The vertical distance from the top producing perforation to the bottom of PGDW21

is 1,260', and the direct distance from the top producing perforation to the bottom of PGDW21 is 1,422'. The 7" surface casing is set 64' deeper than the reported bottom of PGDW21.

Surface distance from the Pavillion Fee 23-12 to domestic water well LD02 is 659'. The vertical distance from the top producing perforation to the bottom of LD02 is 1,110', and the direct distance from the top producing perforation to the bottom of LD02 is 1,291'. The 7" surface casing is set 86' shallower than the reported bottom of LD02.

Section 13, T3N, R2E

Tribal Pavillion 12-13 (API #49-013-20855) was completed in May 1979 by Shell Oil Company at a total depth of 5,400' using an oil-based mud system with reserve pits. The well is located on Tribal minerals (Lease 14-20-0258-1325), at a surface location of 1,530' FNL and 660' FWL (SWNW) and is shown on Figure 5. 8-5/8" surface casing was set at 576' and cemented to surface with 430 sacks of Class G cement. 5-1/2" production casing was set at 5,399' and cemented with 1,010 sacks of Class G cement (1.15 cubic feet per sack). Mud weight prior to cementing was 9.6 pounds per gallon. A cement bond log reportedly ran in January 1979 from 5,200' to 500' measured the cement top behind the 5-1/2" casing at 544' below surface. This log was not located in WOGCC files, BLM files, or Encana records. A second cement bond log ran in July 2000 from 3,340' to 576' measured the cement top behind the 5-1/2" casing at 950' below surface.

In 1979, Fort Union Sands were selectively perforated between 3,721' and 4,580', and not fracture treated. Wind River Sands were selectively perforated between 3,388' and 3,462', and fracture treated with 952 barrels of nitrogen assisted gelled water and 81,618 pounds of sand. In July 2000, additional Wind River Sands were selectively perforated between 1,898' and 2,744', and the interval 2,726'-2,744' was fracture treated with 177 barrels of CO_2 assisted gelled water and 22,618 pounds of sand. The shallowest perforations were 1,898' – 2,432' and these were not fracture treated. The well was plugged and abandoned in July 2001 with cumulative production of 1,043,834 mcf of gas and 18 barrels of water. The plugging and abandonment consisted of a 10 sack cement plug at 3,360' and 195 sack cement plug 2,851'-1,720'. The 5-1/2" casing was perforated at 625' and 200 sacks of cement were squeezed with cement circulated to surface.

Because this well has been plugged and abandoned, no bradenhead testing could be performed due to the inability to access the 8-5/8" x 5-1/2" annulus.

Surface distance from the Tribal Pavillion 12-13 to domestic water well PGDW32 is 565'. The vertical distance from the top producing perforation to the bottom of PGDW32 is 1,214', and the direct distance from the top producing perforation to the bottom of PGDW32 is 1,339'. The 8-5/8" surface casing is set 108' shallower than the reported bottom of PGDW32.

Surface distance from the Tribal Pavillion 12-13 to domestic water well PGDW33 is 440'. The vertical distance from the top producing perforation to the bottom of PGDW33 is 1,858', and the direct distance from the top producing perforation to the bottom of PGDW33 is 1,909'. The 8-5/8" surface casing is set 536' deeper than the reported bottom of PGDW33.

The **Pavillion Fee 21-13** (API #49-013-22057) was completed in February 2001 by Tom Brown, Inc. at a total depth of 3,500' using a closed LSND mud system. The well is located on fee minerals, at a surface location of 660' FNL and 1,980' FWL (NENW) and is shown on Figure 5. 7" surface casing was set at 442' and cemented to surface with 110 sacks of Type III cement. 4-1/2" production casing was set at 3,500' and cemented with 255 sacks of 50/50 pozmix cement (1.59 cubic feet per sack, 13.0 pounds per gallon). Mud weight prior to cementing was 9.2 pounds per gallon. A cement bond log ran in February 2001 from 3,386' to 450' measured the cement top behind the 4-1/2" casing at 1,190' below surface.

Wind River Sands were selectively perforated between 1,654' and 2,654' and were fracture treated with a total of 442 barrels of CO_2 assisted gelled water and 109,000 pounds of sand. The shallowest perforations are 1,654'-1,664' and this interval was fracture treated with 98 barrels of CO_2 assisted gelled water and 24,000 pounds of sand.

The well is an active producer, with cumulative production through April 2014 of 160,665 mcf of gas and 1,422 barrels of water. The current producing interval is 1,654' to 2,654'.

Bradenhead pressure measured in October 2011 reported no pressure between the production casing and surface casing, with 50 psig on the tubing and 50 psig on the tubing-casing annulus.

Surface distance from the Pavillion Fee 21-13 to domestic water well PGDW32 is 514'. The vertical distance from the top producing perforation to the bottom of PGDW32 is 968', and the direct distance from the top producing perforation to the bottom of PGDW32 is 1,096'. The 7" surface casing is set 244' shallower than the reported bottom of PGDW32.