

**ENRON  
Oil Canada Ltd.**

(403) 298-2600

19 December 1991

Manitoba Energy and Mines  
#555, 330 Graham Avenue  
Winnipeg, Manitoba  
R3C 4E3

Attention: Mr. John Fox,  
Chief Petroleum Engineer

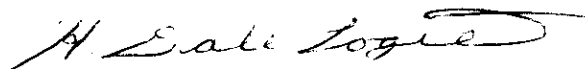
Dear Mr. Fox:

Subject: Pressure Surveys  
Waskada Unit No. 17 and No. 18

In reply to your letter of November 27, 1991, Enron Oil Canada Ltd. supplies the following information. Static bottom hole pressure surveys were run on the wells converted to water injection service on October 22, 1991 for Unit No. 17 and October 25, 1991 for Unit No. 18. The shut-in period between pressure survey measurement and service rig release date varied from approximately 5 to 20 days as presented in Table 1 attached. These pressure measurements were conducted to meet your requirements under Section 3 of the pressure maintenance approval. No detailed interpretation can be conducted on these single point static gradient pressure tests. Workover operations to change over to coated tubing made pressure build-up tests inappropriate. A more representative pressure regime within the Waskada Unit No. 17 and No. 18 waterflood project areas will be evident when pressure fall-off tests are conducted on these injection wells next summer. Average water injection rates from October 25 to December 9, 1991 are also presented in Table 1. All wells were able to meet target water injection rates at reasonable injection pressures and Enron is therefore pleased with initial waterflood operations.

Yours very truly,

ENRON OIL CANADA LTD.



H. Dale Logie, P.Eng.  
Chief Reservoir Engineer

HDL:pdh

**TABLE 1**

**WASKADA UNIT NO. 16 AND NO. 17  
INITIAL INJECTOR DATA**

	<b>*Shut-in Pressure (kPag)</b>	<b>Shut-in Time (Days)</b>	<b>+ Water Injection (m<sup>3</sup>)</b>	<b>Injection Rate (m<sup>3</sup>/d)</b>	<b>Last Surface Injection Pressure (kPag)</b>
11-16-1-25	2 053	19.71	851.4	20.2	4 000
15-16-1-25	1 051	6.04	416.0	9.6	2 220
6-21-1-25	1 327	4.79	606.1	14.0	5 200
10-21-1-25	1 371	8.50	693.9	16.1	4 600
14-3-2-25	2 367	14.77	667.6	15.1	5 800
8-10-2-25	1 545	11.87	662.0	15.3	5 200
11-10-2-25	1 593	6.71	643.1	14.6	4 800
1-15-2-25	1 441	10.63	858.8	19.4	2 650
4-15-2-25	3 378	12.92	549.6	12.4	6 000
6-15-2-25	1 255	8.75	535.6	12.1	3 900
<p>* Shut-in pressure calculated @ MPP.</p> <p>+ Water injected from October 25 to December 9, 1991.</p>					

November 27, 1991

Mr. Dale Logie  
Enron Oil Canada Ltd.  
1300, 700-9th Avenue S.W.  
Calgary, Alberta  
T2P 3V4

Dear Sir:

**RE: Pressure Surveys - Waskada Unit No.'s 17 and 18**

The Petroleum Branch is in receipt of the results of the pressure surveys for Waskada Unit No.'s 17 and 18. The static gradients show very low reservoir pressures in both Units; 1250-3400 kPa in Unit No. 17 and 1050-2050 kPa in Unit No. 18.

It is impossible for the Branch to determine how representative the pressure survey results are without some indication of the shut-in period.

Please provide the Branch with your interpretation of the pressure surveys results and their impact on Enron's planned waterflood operations.

Yours truly,

ORIGINAL SIGNED BY  
JOHN N. FOX

John N. Fox, P. Eng.  
Chief Petroleum Engineer

**ENRON  
Oil Canada Ltd.**

**TRANSMITTAL**

November 7, 1991

Date:

**Attn.: Mr. John Curley**  
CHAUVCO RESOURCES LTD.  
#2900, 255 - 5 Avenue S.W.  
Calgary, Alberta T2P 3G6

**Attn.: Mr. Glen Volk**  
VOYAGER ENERGY INC.  
#2700 Bow Valley Square 2  
205 - 5 Avenue S.W.  
Calgary, Alberta T2P 2V7

**Attn.: Mr. R.T. Vanderham**  
HIGHRIDGE EXPLORATION LTD.  
#1500, 630 - 6 Avenue S.W.  
Calgary, Alberta T2P OS8

**Attn.: Mr. William Tobman**  
PALLISER ENERGY INC.  
#410, 815 - 8 Avenue S.W.  
Calgary, Alberta T2P 3P2

**Attn.: Mr. John Fox**  
~~MANITOBA ENERGY SERVICES~~  
#555, 330 Graham Avenue  
Winnipeg, Manitoba R3C 4E3

FILE: WASKADA UNIT

NO. 17

PRESSURE

SURVEYS

**WASKADA UNIT NO. 17**

**LSD'S:      14-03-02-25 WPM**  
                 08-10-02-25 WPM  
                 11-10-02-25 WPM  
                 01-15-02-25 WPM  
                 A4-15-02-25 WPM  
                 06-15-02-25 WPM

Enclosed please find the following data:

- Static Gradient Tests  
Waskada/Spearfish Survey - Oct. 22/91

C. Squires,  
Drilling Secretary

:cs  
Encl.(s)

## WASKADA/SPEARFISH

kPa-Meter

MOOSE MOUNTAIN  
WELL SERVICES LTD.

COMPANY: ENRON OIL CANADA LIMITED  
ADDRESS: CALGARY ALBERTA  
FIELD-POOL: WASKADA/SPEARFISH  
TYPE OF TEST: STATIC GRADIENT  
PERF/OH INTERVAL: 881-891 KB  
ELEVATIONS: (GL) 473.08 (KB) 477.33  
POOL DATUM:

WELL NAME: WASKADA  
LOCATION: 14-3-2-25-WPM  
WELL STATUS: OIL  
DATE OF TEST: 91OCT22  
PRODUCING THROUGH: TUBING  
MP PROD. INTER: 881.75 GL  
DATUM DEPTH: (CF)

SHUT IN:  
DWG PRESS: (KPA) T=350 C=200

RUN DEPTH TEMP: (C) 44  
ON/OFF BTM: 1423-1438

	TOP RECORDER	BOTTOM RECORDER
ELEMENT SERIAL NO:	45299	45301
RUN DEPTH: (MCF)	880.2	882
RUN DEPTH PRESS: (KPA)	2347	2378
GRADIENT-RUN DEPTH: (KPA/M)	7.728	7.799
PRESSURE AT MMP: (KPA)	2359	2376
DATUM DEPTH PRESS: (KPA)		

REMARKS:

Company: ENRON OIL CANADA LIMITED

Location: 14-3-2-25-WFM

Element #: 45299      Range(kPa): 13790      IHH: 15282      3 hr Clock #: 2440  
 Run Date: 91OCT22      Calib. Equation: 276.03 -30.76      Calib. Date: 91OCT11

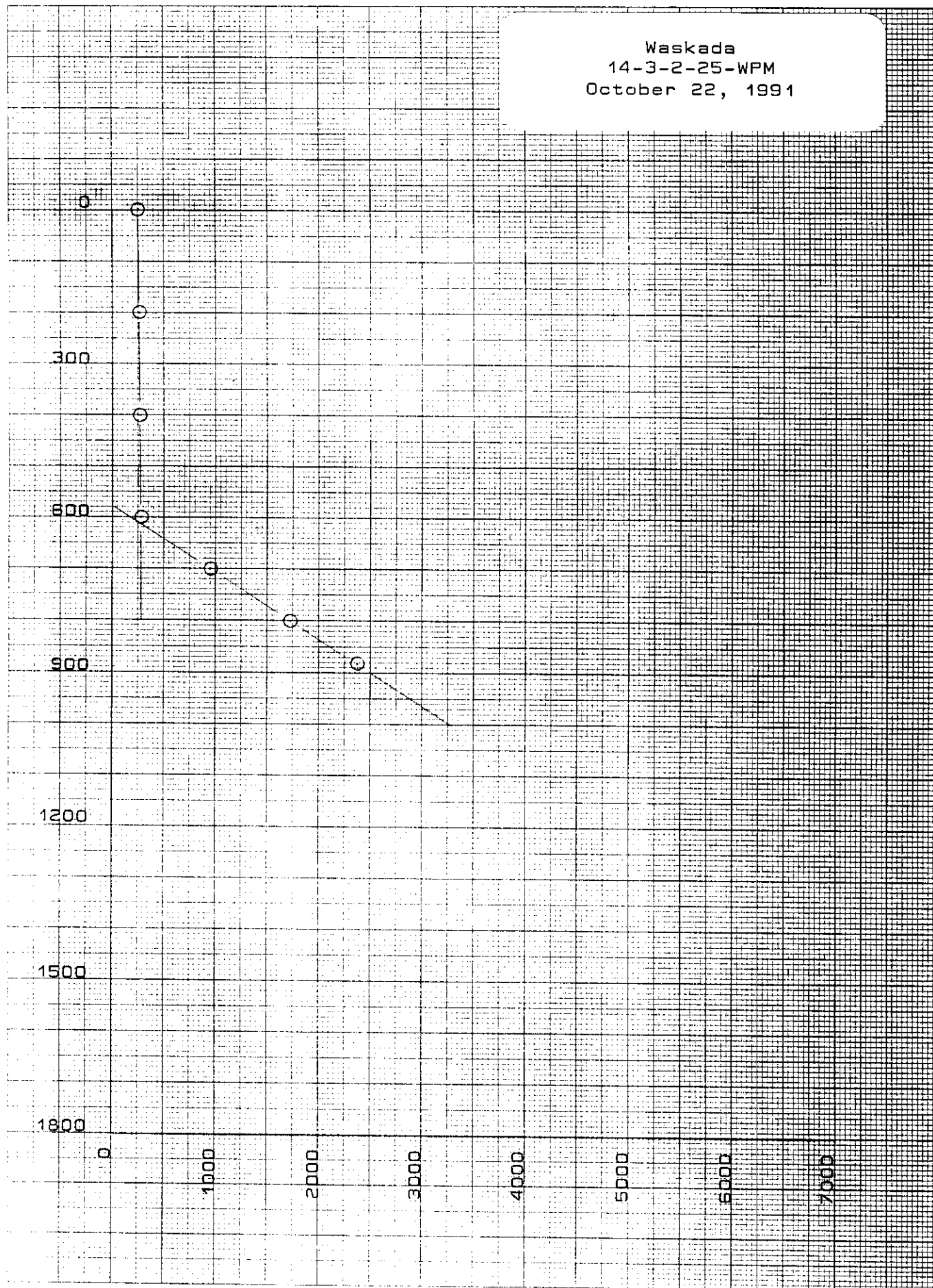
Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
-1.80	1351-1356	0.945	+27	258	0.000
198.20	1357-1402	0.975	+27	266	0.041
398.20	1402-1407	1.010	+27	275	0.048
598.20	1408-1413	1.040	+27	283	0.041
698.20	1413-1418	3.390	+19	924	6.405
798.20	1418-1423	6.285	+9	1713	7.891
880.20	1423-1438	8.610	+1	2347	7.728

Element #: 45301      Range(kPa): 13790      IHH: 36585      3 hr Clock #: 2492  
 Run Date: 91OCT22      Calib. Equation: 279.84 -23.59      Calib. Date: 91OCT11

Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
0.00	1351-1356	0.900	+21	250	0.000
200.00	1357-1402	0.930	+21	258	0.042
400.00	1402-1407	0.970	+21	269	0.055
600.00	1408-1413	1.030	+21	286	0.083
700.00	1413-1418	3.430	+15	952	6.659
800.00	1418-1423	6.265	+9	1738	7.866
882.00	1423-1438	8.570	+3	2378	7.799

46 1510

WASKADA  
14-3-2-25-WPM  
October 22, 1991





**MOOSE MOUNTAIN  
WELL SERVICES LTD.**

COMPANY: ENRON OIL CANADA LIMITED  
 ADDRESS: CALGARY ALBERTA  
 FIELD-POOL: WASKADA/SPEARFISH  
 TYPE OF TEST: STATIC GRADIENT  
 PERF/OH INTERVAL: 862-883.5 KB  
 ELEVATIONS: (GL) 472.7 (KB) 476.9  
 POOL DATUM:

WELL NAME: WASKADA  
 LOCATION: 8-10-2-25-WPM  
 WELL STATUS: OIL  
 DATE OF TEST: 91OCT22  
 PRODUCING THROUGH: TUBING  
 MP PROD. INTER: 868.55 GL  
 DATUM DEPTH: (CF)

SHUT IN:  
 DWG PRESS: (KPA) T=125 C=\VAC

RUN DEPTH TEMP: (C) 43  
 ON/OFF BTM: 1158-1213

	TOP RECORDER	BOTTOM RECORDER
ELEMENT SERIAL NO:	45299	45301
RUN DEPTH: (MCF)	859.2	861
RUN DEPTH PRESS: (KPA)	1465	1494
GRADIENT-RUN DEPTH: (KPA/M)	7.775	7.846
PRESSURE AT MMP: (KPA)	1538	1553
DATUM DEPTH PRESS: (KPA)		

REMARKS:

Company: ENRON OIL CANADA LIMITED

Location: B-10-2-25-WPM

Element #: 45299      Range(kPa): 13790      IHH: 15282      3      hr Clock #: 2440  
 Run Date: 91OCT22      Calib. Equation: 276.03 -30.76      Calib. Date: 91OCT11

Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
-1.80	1127-1132	0.090	+30	25	0.000
198.20	1133-1138	0.100	+30	27	0.014
398.20	1138-1143	0.110	+30	30	0.014
598.20	1143-1148	0.120	+30	33	0.014
698.20	1148-1153	0.700	+28	191	1.581
798.20	1153-1158	3.635	+18	991	8.000
859.20	1158-1213	5.375	+12	1465	7.775

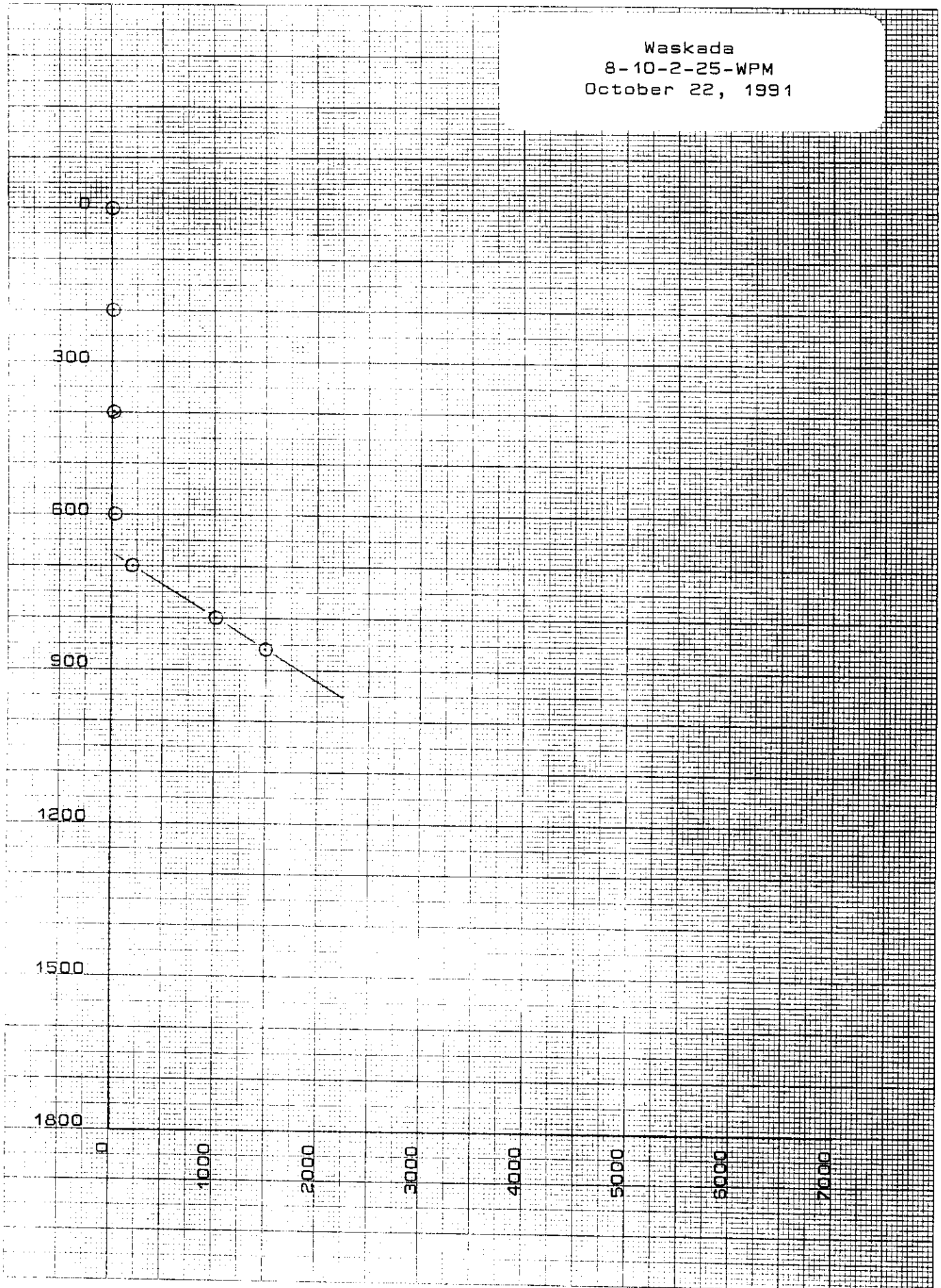
Element #: 45301      Range(kPa): 13790      IHH: 36585      3      hr Clock #: 2492  
 Run Date: 91OCT22      Calib. Equation: 279.84 -23.59      Calib. Date: 91OCT11

Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
0.00	1127-1132	0.060	+23	17	0.000
200.00	1133-1138	0.070	+23	19	0.014
400.00	1138-1143	0.090	+23	25	0.028
600.00	1143-1148	0.110	+23	31	0.028
700.00	1148-1153	0.750	+22	208	1.776
800.00	1153-1158	3.660	+15	1016	8.074
861.00	1158-1213	5.385	+11	1494	7.846

Waskada  
8-10-2-25-WPM  
October 22, 1991

461510

WASKADA  
8-10-2-25-WPM  
OCTOBER 22, 1991



**MOOSE MOUNTAIN  
WELL SERVICES LTD.**

COMPANY: ENRON OIL CANADA LIMITED  
 ADDRESS: CALGARY ALBERTA  
 FIELD-POOL: WASKADA/SPEARFISH  
 TYPE OF TEST: STATIC GRADIENT  
 PERF/OH INTERVAL: 876-885 KB  
 ELEVATIONS: (GL) 472.76 (KB) 476.46  
 POOL DATUM:

WELL NAME: WASKADA  
 LOCATION: 11-10-2-25-WPM  
 WELL STATUS: OIL  
 DATE OF TEST: 91OCT22  
 PRODUCING THROUGH: TUBING  
 MP PROD. INTER: 876.8 GL  
 DATUM DEPTH: (CF)

SHUT IN:  
 DWG PRESS: (KPA) T=100 C=2390

RUN DEPTH TEMP: (C) 42  
 ON/OFF BTM: 1309-1324

	TOP RECORDER	BOTTOM RECORDER
ELEMENT SERIAL NO:	45299	45301
RUN DEPTH: (MCF)	874.2	876
RUN DEPTH PRESS: (KPA)	1566	1593
GRADIENT-RUN DEPTH: (KPA/M)	7.782	7.813
PRESSURE AT MMP: (KPA)	1586	1599
DATUM DEPTH PRESS: (KPA)		

REMARKS:

Company: ENROM OIL CANADA LIMITED

Location: 11-10-2-25-WPM

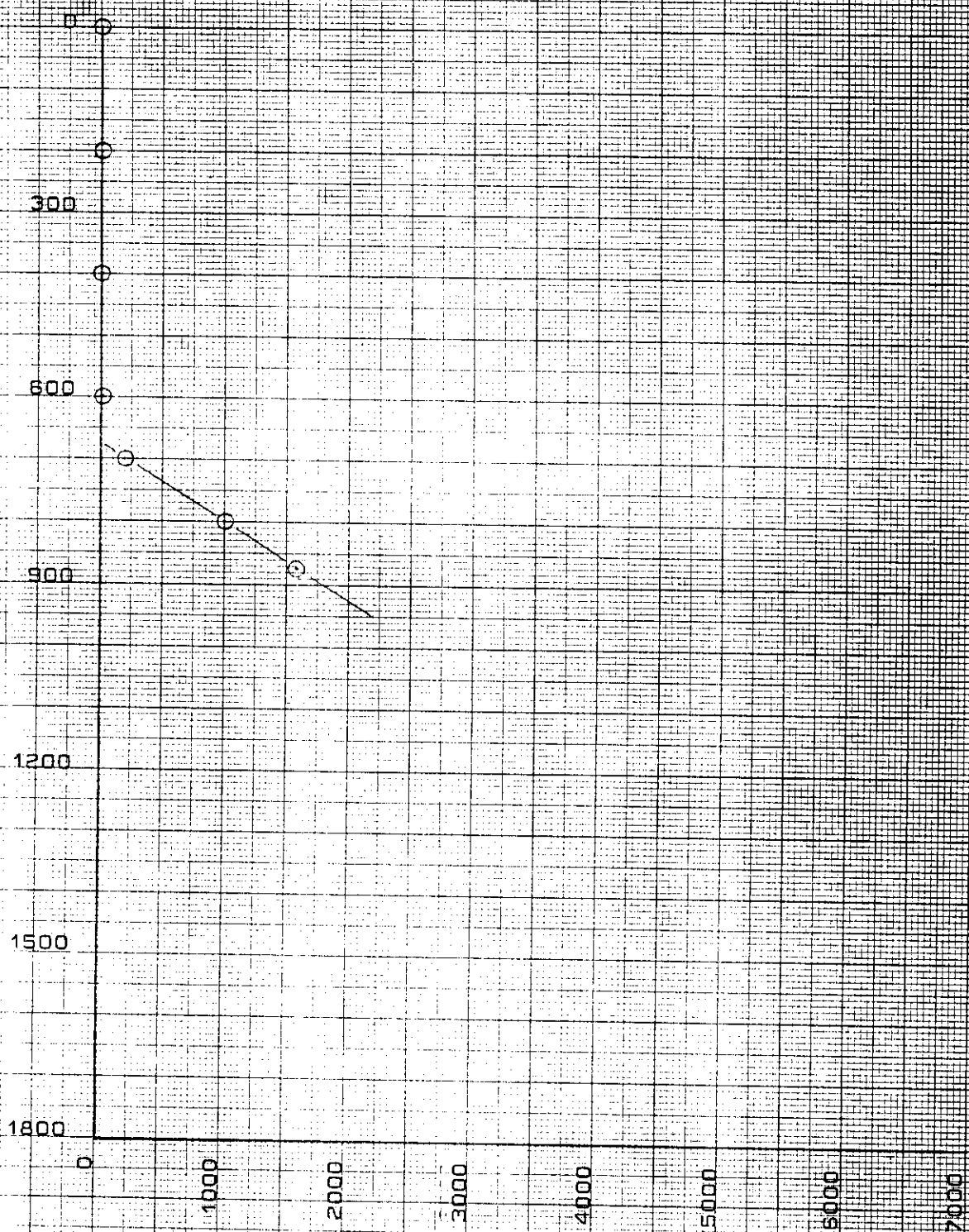
Element #: 45299      Range(kPa): 13790      IHH: 15282      3      hr Clock #: 2440  
 Run Date: 91OCT22      Calib. Equation: 276.03 -30.76      Calib. Date: 91OCT11

Depth Below cfs	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
-1.80	1237-1242	0.030	+31	8	0.000
198.20	1243-1248	0.040	+31	11	0.014
398.20	1248-1253	0.045	+31	12	0.007
598.20	1254-1259	0.060	+31	16	0.020
698.20	1259-1304	0.640	+29	174	1.581
798.20	1304-1309	3.575	+18	974	8.000
874.20	1309-1324	5.745	+11	1566	7.782

Element #: 45301      Range(kPa): 13790      IHH: 36585      3      hr Clock #: 2492  
 Run Date: 91OCT22      Calib. Equation: 279.84 -23.59      Calib. Date: 91OCT11

Depth Below cfs	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
0.00	1237-1242	0.010	+24	3	0.000
200.00	1243-1248	0.010	+24	3	0.000
400.00	1248-1253	0.025	+24	7	0.021
600.00	1254-1259	0.050	+23	14	0.035
700.00	1259-1304	0.700	+22	194	1.804
800.00	1304-1309	3.600	+15	999	8.046
876.00	1309-1324	5.740	+10	1593	7.813

Waskada  
11-10-2-25-WPM  
October 22, 1991



46 1510

10 X 10 TO THE CENTIMETER 15 X 25 CM.  
10 X 10 TO THE CENTIMETER 15 X 25 CM.

**MOOSE MOUNTAIN  
WELL SERVICES LTD.**

COMPANY:ENRON OIL CANADA LIMITED	WELL NAME: WASKADA
ADDRESS: CALGARY ALBERTA	LOCATION: 1-15-2-25-WPM
FIELD-POOL: WASKADA/SPEARFISH	WELL STATUS: OIL
TYPE OF TEST: STATIC GRADIENT	DATE OF TEST: 91OCT22
PERF/OH INTERVAL: 869.0-879.0 KB	PRODUCING THROUGH: TUBING
ELEVATIONS: (GL)473.7 (KB) 477.6	MP PROD. INTER: 870.1 GL
POOL DATUM:	DATUM DEPTH: (CF)

SHUT IN:	RUN DEPTH TEMP: (C) 43
DWG PRESS: (KPA) T=350 C=0	ON/OFF BTM: 1049-1104

	TOP RECORDER	BOTTOM RECORDER
ELEMENT SERIAL NO:	45299	45301
RUN DEPTH: (MCF)	868.2	870
RUN DEPTH PRESS: (KPA)	1421	1446
GRADIENT-RUN DEPTH: (KPA/M)	7.885	7.967
PRESSURE AT MMP: (KPA)	1436	1447
DATUM DEPTH PRESS: (KPA)		

REMARKS:

Company: ENRON OIL CANADA LIMITED

Location: 1-15-2-25-WPM

Element #: 45299 Range(kPa): 13790 IHH: 15282 3 hr Clock #: 2440

Run Date: 91OCT22 Calib. Equation: 276.03 -30.76 Calib. Date: 91OCT11

Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
-1.80	1018-1023	0.945	+27	258	0.000
198.20	1023-1028	0.980	+27	267	0.048
398.20	1029-1034	1.010	+27	275	0.041
598.20	1034-1039	1.040	+27	283	0.041
698.20	1039-1044	1.065	+27	290	0.068
798.20	1044-1049	3.190	+20	869	5.792
868.20	1049-1104	5.215	+13	1421	7.885

Element #: 45301 Range(kPa): 13790 IHH: 36585 3 hr Clock #: 2492

Run Date: 91OCT22 Calib. Equation: 279.84 -23.59 Calib. Date: 91OCT11

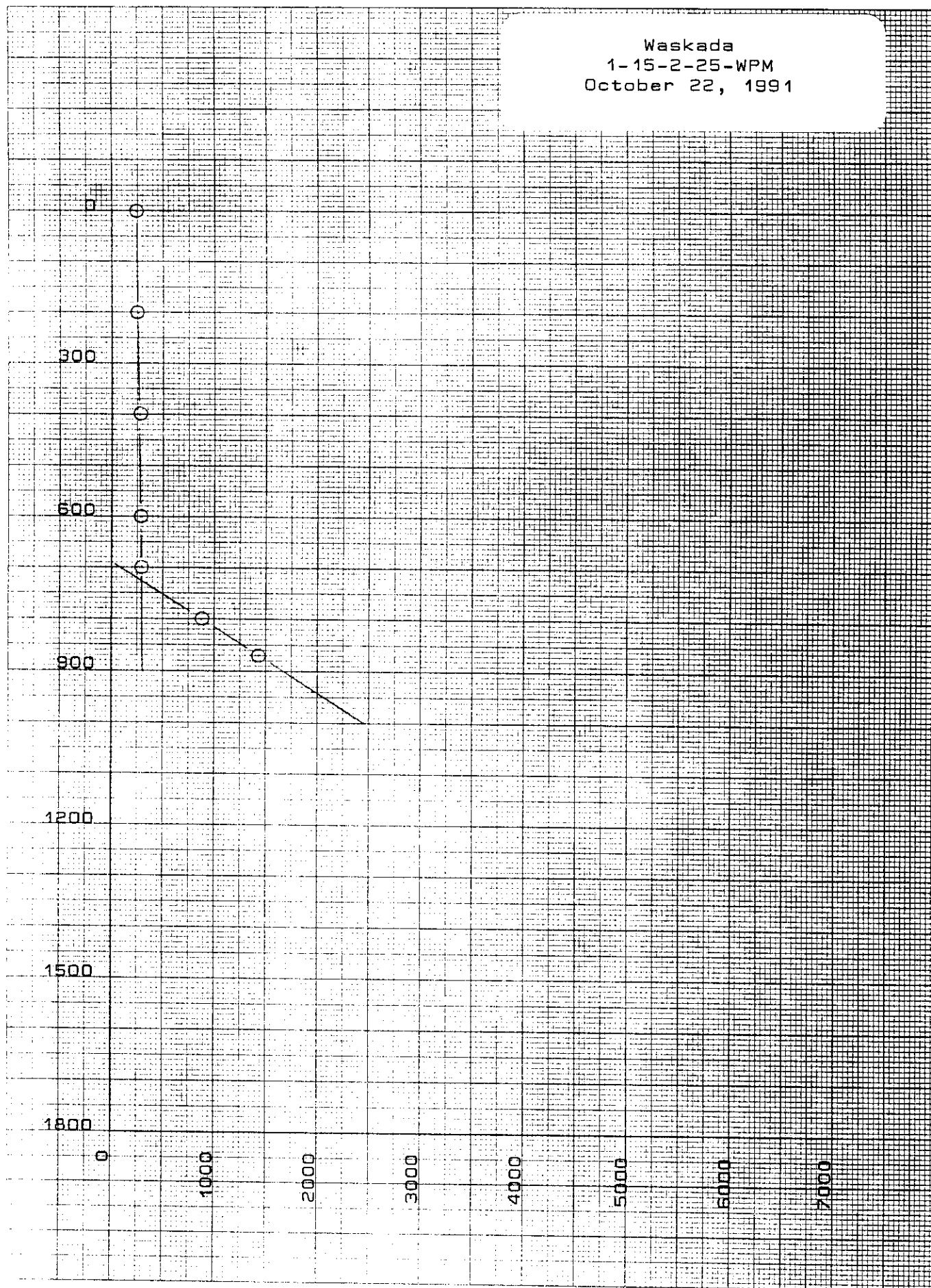
Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
0.00	1018-1023	0.885	+21	246	0.000
200.00	1023-1028	0.920	+21	255	0.049
400.00	1029-1034	0.960	+21	266	0.055
600.00	1034-1039	1.005	+21	279	0.062
700.00	1039-1044	1.040	+21	289	0.097
800.00	1044-1049	3.200	+16	888	5.993
870.00	1049-1104	5.210	+11	1446	7.967



46 1510

10 X 10 TO THE CENTIMETER  
KUMPEL & ESSER

Waskada  
1-15-2-25-WPM  
October 22, 1991



**MOOSE MOUNTAIN  
WELL SERVICES LTD.**

COMPANY:ENRON OIL CANADA LIMITED	WELL NAME: WASKADA
ADDRESS: CALGARY ALBERTA	LOCATION: A4-15-2-25-WPM
FIELD-POOL: WASKADA/SPEARFISH	WELL STATUS: OIL
TYPE OF TEST: STATIC GRADIENT	DATE OF TEST: 91OCT22
PERF/OH INTERVAL: 877.0-887.0 KB	PRODUCING THROUGH: TUBING
ELEVATIONS: (GL)473.34 (KB) 477.54	MP PROD. INTER: 877.8 GL
POOL DATUM:	DATUM DEPTH: (CF)

SHUT IN:	RUN DEPTH TEMP: (C) 43
DWG PRESS: (KPA) T=225 C=150	ON/OFF BTM: 0826-0841

	TOP RECORDER	BOTTOM RECORDER
ELEMENT SERIAL NO:	45299	45301
RUN DEPTH: (MCF)	880.2	882
RUN DEPTH PRESS: (KPA)	3394	3430
GRADIENT-RUN DEPTH: (KPA/M)	10.274	10.295
PRESSURE AT MMP: (KPA)	3369	3387
DATUM DEPTH PRESS: (KPA)		

REMARKS:

Company: ENRON OIL CANADA LIMITED

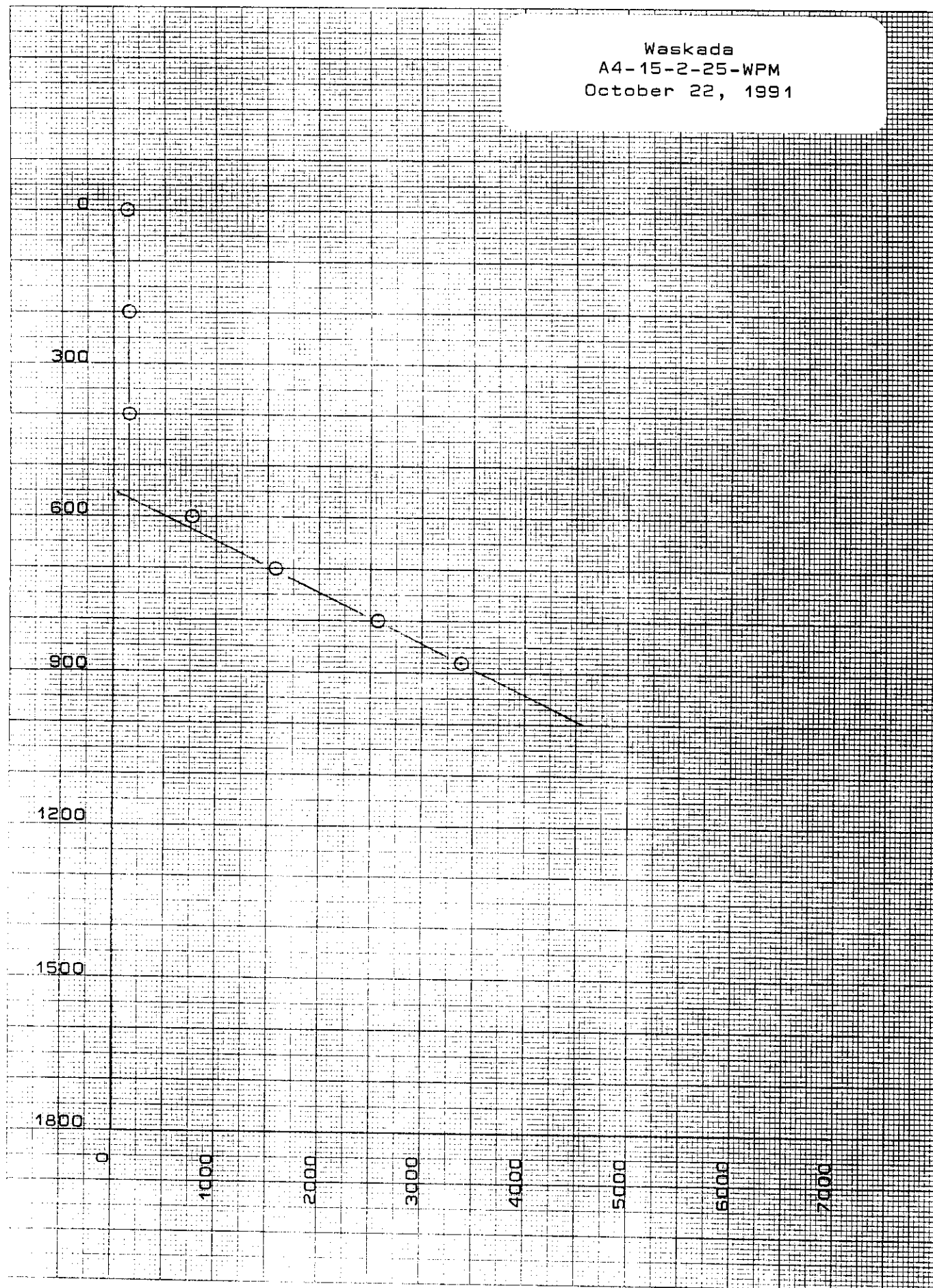
Location: A4-15-2-25-WFM

Element #: 45299      Range(kPa): 13790      IH#: 15282      3 hr Clock #: 2440  
 Run Date: 91OCT22      Calib. Equations: 276.03 -30.76      Calib. Date: 91OCT11

Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
-1.80	755- 800	0.500	+29	136	0.000
198.20	801- 806	0.525	+29	143	0.034
398.20	806- 811	0.545	+29	149	0.027
598.20	811- 816	2.720	+21	741	2.964
698.20	816- 821	5.670	+11	1545	8.040
798.20	821- 826	9.360	-2	2551	10.057
880.20	826- 841	12.440	-9	3394	10.274

Element #: 45301      Range(kPa): 13790      IH#: 36585      3 hr Clock #: 2492  
 Run Date: 91OCT22      Calib. Equation: 279.84 -23.59      Calib. Date: 91OCT11

Depth Below cfm	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
0.00	755- 800	0.490	+22	136	0.000
200.00	801- 806	0.500	+22	139	0.014
400.00	806- 811	0.535	+22	148	0.049
600.00	811- 816	2.750	+17	763	3.073
700.00	816- 821	5.675	+10	1575	8.116
800.00	821- 826	9.320	+1	2586	10.114
882.00	826- 841	12.360	-5	3430	10.295



MOOSE MOUNTAIN  
WELL SERVICES LTD.

COMPANY:ENRON OIL CANADA LIMITED	WELL NAME: WASKADA
ADDRESS: CALGARY ALBERTA	LOCATION: 6-15-2-25-WPM
FIELD-POOL: WASKADA/SPEARFISH	WELL STATUS: OIL
TYPE OF TEST: STATIC GRADIENT	DATE OF TEST: 91OCT22
PERF/DH INTERVAL: 867.0-877.0 KB	PRODUCING THROUGH: TUBING
ELEVATIONS: (GL)473.37 (KB) 477.07	MP PROD. INTER: 868.3 GL
POOL DATUM:	DATUM DEPTH:(CF)

SHUT IN:	RUN DEPTH TEMP:(C) 42
DWG PRESS:(KPA) T=1050 C=200	ON/OFF BTM: 0937-0952

	TOP RECORDER	BOTTOM RECORDER
ELEMENT SERIAL NO:	45299	45301
RUN DEPTH:(MCF)	86702	869
RUN DEPTH PRESS:(KPA)	1248	1262
GRADIENT-RUN DEPTH:(KPA/M)	2.884	3.197
PRESSURE AT MMP:(KPA)	1251	1260
DATUM DEPTH PRESS:(KPA)		

REMARKS:

Company: ENRON OIL CANADA LIMITED

Location: 6-15-2-25-WPM

Element #: 45299      Range(kPa): 13790      IH#: 15282      3 hr Clock #: 2440  
Run Date: 91OCT22      Calib. Equation: 276.03 -30.76      Calib. Date: 91OCT11

Depth Below cfs	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
-1.80	908- 913	3.495	+19	953	0.000
198.20	913- 918	3.590	+18	978	0.129
398.20	918- 923	3.665	+18	999	0.102
598.20	923- 928	3.755	+18	1023	0.123
698.20	928- 933	3.800	+18	1036	0.123
798.20	933- 937	3.850	+17	1049	0.136
867.20	937- 952	4.580	+15	1248	2.884

Element #: 45301      Range(kPa): 13790      IH#: 36585      3 hr Clock #: 2492  
Run Date: 91OCT22      Calib. Equation: 279.84 -23.59      Calib. Date: 91OCT11

Depth Below cfs	Time	Deflection mm	P-PC kPa	Pressure kPa	Gradient kPa/m
0.00	908- 913	3.370	+16	935	0.000
200.00	913- 918	3.455	+15	959	0.118
400.00	918- 923	3.540	+15	982	0.118
600.00	923- 928	3.635	+15	1009	0.132
700.00	928- 933	3.700	+15	1027	0.180
800.00	933- 937	3.755	+15	1042	0.153
869.00	937- 952	4.550	+13	1262	3.197

Waskada  
6-15-2-25-W1M  
October 22, 1991

...X 10 TO THE CENTIMETER IS X 10 CM

