

APPENDIX D

EAST MEREENIE NO 4

FRACTURING & TESTING RESULTS

Summary and Conclusions

The stimulation of various porous zones within the Pacoota oil column at East Mereenie No 4 was carried out during July and August, 1967. As a result of this stimulation a production rate of 380 barrels/day was achieved using gas lift valves installed in the tubing string. Although this rate shows a marked improvement over that achieved during drill stem testing of the mud-damaged zones a plot of the pressure versus dimensionless time (shown in Figure II and IV) indicates a damage ratio of 1.53 remained after the acidisation and fracturing had been carried out.

Flow testing without the assistance of gas lift showed that on a 12/64" bean the well produced at a rate of 140 barrels/day. However during this flow test the bottom hole flowing pressure was decreasing slightly and the flow rate determined could be optimistic. During tests on larger bean sizes (22/64" and 32/64") the well was flowing by heads and the bottom hole pressures were decreasing. Consequently no reasonably accurate production data were obtained.

Some water was produced during the testing but an analysis has not yet been received. However 'taste' indicates that this water results from either mud filtrate or more likely the treated water used to control the well during stimulation operations. A Static Gradient measured in the well indicates that no water column is present in the tubing above 4544 feet RTKB (Figure V).

The results of the testing are summarised in Table 1.

It appears that the acidisation and fracturing did no more than reduce the formation damage resulting from the use of heavy drilling mud when drilling and coring through the oil column. Consequently it is considered



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that the use of an oil base or invert emulsion mud without the use of fracturing should result in a completion at least as good as that achieved at East Mereenie No 4.

The injection rate achieved during the frac jobs was lower than that recommended by Halliburton. This was due in part of the pressure restriction placed on the operations by the use of a Series 900 (3,000 psi working pressure) wellhead. Should it prove desirable to carry out further stimulation work on wells at Mereenie a Series 1500 (5,000 psi working pressure) wellhead should be used. It is also considered that an additional pumping unit be used to increase the available capacity.

East Mereenie No 4 will now be produced on gas lift for a period of approximately three weeks to determine if:-

- (a) The water production rate decreases
- (b) The damage ratio is decreased and,
- (c) The rate measured on test will stand up during prolonged flow.



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FRACTURING AND TESTING EAST MEREENIE NO 4

Diary of Events

26th July, 1967

Ran $8\frac{5}{8}$ " RTTS packer on drill pipe to 4570 feet RTKB. Pressure tested packer to 1150 psi. Waiting on hydrochloric Acid.

27th July, 1967

Pressure tested wellhead fittings and Halliburton lines to 3500 psi.

28th July, 1967

Perforated following intervals with 2 shots per foot:-

4601 - 4606

4614 - 4617

4620 - 4634

Acidised with 1500 gallons of 15% Mud Cleanout Acid. Maximum pump pressure 2300 psi. Final pump pressure 1700 psi. After 3 hours opened circulating valve above packer, displaced diesel from drill pipe with gas. Closed circulating valve. Opened up drill pipe at surface to allow acid to re-enter drill pipe.

29th July, 1967

Opened circulating valve. Back scuttled acid out of hole. Carried out frac job with 15,600 gallons gelled diesel (Vis-O-Frac) carrying 13,400 lbs 20-40 sand and 3,400 lbs 12-20 UCAR glass beads. Displaced frac fluid from drill pipe with 3,000 gallons diesel oil. maximum frac pressure 3,350 psi. Maximum displacement pressure 3,850 psi. Average injection rate 8 barrels per minute.

30th July, 1967

Opened up well to flow. Well came in after approximately 9 hours. Flowed to clean on 32/64" bean. Reduced bean size to 12/64" to reduce 'slugging'.



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31st July, 1967

Flowed well to clean. Ran production test. Flow rate 130 barrels/day. Ran in with Amerada pressure recorder for overnight build up.

1st August, 1967

Pulled Amerada. Opened circulating valve and killed well with water treated with 2½ gallons per barrel Morflo II.

Unseated packer and ran down to 4800 feet to check fill not covering interval to be perforated. Pulled back and set packer at 4660 feet. Perforated following intervals with 2 shots per foot.

4694 - 4700

4702 - 4712

4726 - 4731

4737 - 4747

2nd August, 1967

Acidised well with 2000 gallons of 15% Mud Cleanout Acid. Maximum pump pressure 3000 psi. Final pump pressure 1650 psi. After 3 hours opened circulating valve. Displaced drill pipe with gas, closed circulating valve and allowed acid to re-enter drill pipe. Opened circulating valve and back scuttled out spent acid. While opening circulating valve to backscuttle acid unseated packer. Unable to reset. Pulled out packer. Failure due to piece of rubber under one of slips. Serviced packer, replaced drag springs which were slightly worn. Re-ran packer and set at 4660 feet. New circulating valve installed in spring. Ports washed out on old one.

3rd August, 1967

Opened circulating valve, displaced water from drill pipe with diesel. Carried out second frac job using 13,600 gallons gelled diesel (Vis-0-Frac) carrying 9600 lbs of 20-40 Ottawa sand and 2600 lbs 12-20 UCAR glass beads. Displaced frac fluid with 3000 gallons diesel. Maximum frac pressure 3600, maximum displacement pressure 4450 psi. Final displacement pressure 3800 psi. Average injection rate 9 barrels/per minute.


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4th August, 1967

Opened up well to flow. Well came in after 5 hours. Flowed to clean. Flow rate visually estimated after 3 hours flow at around 500 barrels per day.

5th August, 1967

Well slugging. Reduced bean size from 32/64" to 12/64". Measured flow rate at 60 barrels per day. Ran in Amerada recorder, closed in for build up.

6th August, 1967

Pulled out Amerada, killed well with Morflo treated water. Pulled packer, ran in open ended. Tagged bottom at 4750 feet.

7th August, 1967

Layed down drill pipe. Tore out BOP's ran in to 4590 feet with tubing containing gas lift valves at 4500, 4200, 3750, 3000 and 2000 feet. Landed tubing and installed lower valves of Christmas tree.

8th August, 1967

Finished installation of Christmas tree. Tied in gas line to annulus. Installed separator in flow line. Displaced water from hole with gas. Flowed well to clean.

9th August, 1967

Repositioned low pressure separator. Tested well on gas lift. Rate 390 barrels per day including approximately 30% water. Released rig.

10th - 19th August, 1967

During this period the well was flowed to clean intermittently. A 72 hour build-up from 16th - 19th August did not record on the Amerada pressure chart.



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The following gross fluid production data were reported:-

9th August, 1967	94½ barrels
10th August, 1967	177½ barrels
11th August, 1967	222 barrels
12th August, 1967	254 barrels
13th August, 1967	192 barrels
14th-15th August, 1967	304 barrels
15th-16th August, 1967	161 barrels.

19th August, 1967

Pulled out Amerada recorder. Chart blank. Re-ran to 4544 feet RTKB. Recorded Static Gradient (see attached plot) and Bottom Hole Closed-in Pressure (BHCIP).

Opened up to flow on 12/64" tubing bean at 13-42 hours. During the subsequent testing the results obtained are tabulated in Table 1. Bottom hole pressures measured concurrently with the flow testing are:-

1. Flowing on 12/64" bean 1399 psig and decreasing slowly
2. Flowing on 22/64" bean 625* and decreasing
3. Flowing on 32/64" bean 610* and decreasing
4. During Gas Lift 332 and steady

* Measurement prior to gas lift valve opening.

A plot of the build up data obtained after testing shows a Kh factor for the treated zones of 284.3 md feet and a Damage Ratio of 1.53. Copies of the build up plots before and after fracturing are attached.


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TABLE 1

FLOW TEST RESULTS - EAST MEREENIE NO 4

<u>Bean Size</u>	<u>Date</u>	<u>Time</u>	<u>Tubing Pressure</u> (psig)	<u>Annulus Pressure</u> (psig)	<u>Separator Pressure</u> (psig)	<u>Critical Flow Prover Pressure</u> (psig)	<u>Production</u> (bbls)	<u>Water Cut</u> (bbls)	<u>Remarks</u>
12" 64	19.8.67	13-42	700	800	-	-	-	-	Closed in Pressures
		14-42	525	800	30	-	5.7	-	-
		15-42	480	800	25	-	6.9	-	-
		16-42	480	775	23	-	6.3	-	-
		17-42	480	775	-	Gas rate 155,000 cubic ft/day by Pitot Tube		7.0	GOR 962
	20.8.67	18-12	505	775	-	-	6.7	-	-
		19-45	490	750	-	-	13.4	-	-
		21-45	540	735	23	-	14.3	-	-
		22-45	425	715	26	-	6.0	-	-
		07-00	400	688	15	Gas Rate 124,000 cubic ft/day by Pitot Tube		48.3	GOR 886 Oil Rate 140.4 barrels/day
		08-15	395	625	-	-	6.4	-	Changed bean size to 22" 64
		Total Production on 12" 64 bean						121.0	Nil
22" 64	15-20	09-15	300	595	16-18	-	22.0+	-	Tank overflowed
		10-15	130	490	8-11	-	34.6	-	-
		10-55	110	470	2-10	-	18.0	-	-
		11-15	120	475	2-10	-	12.3	-	-
		12-15	110-120	475	5-10	-	21.1	-	Tubing Pressure Fluctuating
		13-15	110-120	475	6-9	-	17.7	-	-
		14-15	110-120	475	6-9	-	18.3	-	-
		15-15	110-120	477	8-10	-	17.1	3	Rate 425 bbls/day based on 3 hr test
		15-20				1/2" Orifice, 4" Line 25 psig 100°F Rate 200,000 cu ft/day			Passed trough CF Prover and increased back pressure on well
	16-15	125	480	-		27 psig Rate 211,000 cu ft/day		14.3	GOR 618

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<u>Bean Size</u>	<u>Date</u>	<u>Time</u>	<u>Tubing Pressure (psig)</u>	<u>Annulus Pressure (psig)</u>	<u>Separator Pressure (psig)</u>	<u>Critical Flow Prover Pressure (psig)</u>	<u>Production (bbls)</u>	<u>Water Cut (bbls)</u>	<u>Remarks</u>
$\frac{32}{64}$ "	21.8.67	17-15	125	490	-	32 psig	15.7	-	-
		17-20	265-280	470	-	11-5	-	-	Instantaneous increase in flow rate due to gas lift valve opening
		18-15	140-160	295	14-16	-	20.0	-	Flow decreased after initial surge
		19-15	100	300	Nil	-	3.7	-	Flow died
		20-15	100	330	Nil	-	Nil	3	-
		Total Production on $\frac{22}{64}$ " bean					214.8	6	Switched to $\frac{32}{64}$ " bean
		21-15	100	350	Nil	-	Nil	-	
		07-15	115	430	0-5	-	85.1+	-	Tank overflowed
		07-45	115	430	0-5	-	10.6	-	-
		07-50							Flow rate increase due to opening gas lift valve
		08-15					18.6		
		09-00	-	-	-	-	-	-	Flow died
		1000	-	-	-	-	-	-	No flow
		Total Production $\frac{32}{64}$ " bean					114.3+		
		11-15							Opened to gas lift. No bean
<u>No Bean</u>		11-35		<u>Injection Pressure</u>		1" orifice in 4" line			Flow recommenced
		14-10	75*	275	35	31	6.6	-	*Changed gauge. Previous gauge reading 100 psig high
		14-15				Gas Rate 630,000 cu ft/day			Gas Injection Rate 298,000 cubic ft/day
		15-10	75	275	35	31	24.3	-	-
		15-40							Gas Injection Rate 355,000 cubic ft/day
		16-10	80	290	35	31	16.3	4	-
		17-10	75	280	30	28	14.0	-	-
		18-10	60	270	25	20	13.1	-	Increased Gas Rate
		19-10	60	290	25	21	17.1	-	-
	21.8.67	20-10	60	280	-	21	17.1	-	Switched from CFP to Riser

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<u>Bean</u> <u>Size</u>	<u>Date</u>	<u>Time</u>	<u>Tubing</u> <u>Pressure</u> <u>(psig)</u>	<u>Annulus</u> <u>Pressure</u> <u>(psig)</u>	<u>Separator</u> <u>Pressure</u> <u>(psig)</u>	<u>Critical Flow</u> <u>Prover Pressure</u> <u>(psig)</u>	<u>Production</u> <u>(bbls)</u>	<u>Water</u> <u>Cut</u> <u>(bbls)</u>	<u>Remarks</u>
		21-10	55	275	15	-	17.1	-	-
		22-10	55	280	15	-	17.4	-	-
		22-13							Switched Tanks
		23-13	60	280	15	-	13.7	-	-
		23-15							Opened to both tanks
		24-15	55	280	15	-	19.1	-	-
22.8.67		01-15	55	280	16	-	14.9	-	-
		05-15	55	280	18	-	60.0	4.6	-
		08-15	55	270	31	26	46.9	7	Switched to CFP
							Total Production on Gas Lift	297.6	14.6
		08-45							Closed in to recover Amerada Recorder
		09-00							Amerada out of hole
		09-15							Opened up to gas lift
		12-50							Closed in. Ran Magellan Amerada Recorder.

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Image **A**

See image file
Attached.

Image B

See image file
Attached.

Image C

**See image file
Attached.**

Image **D**

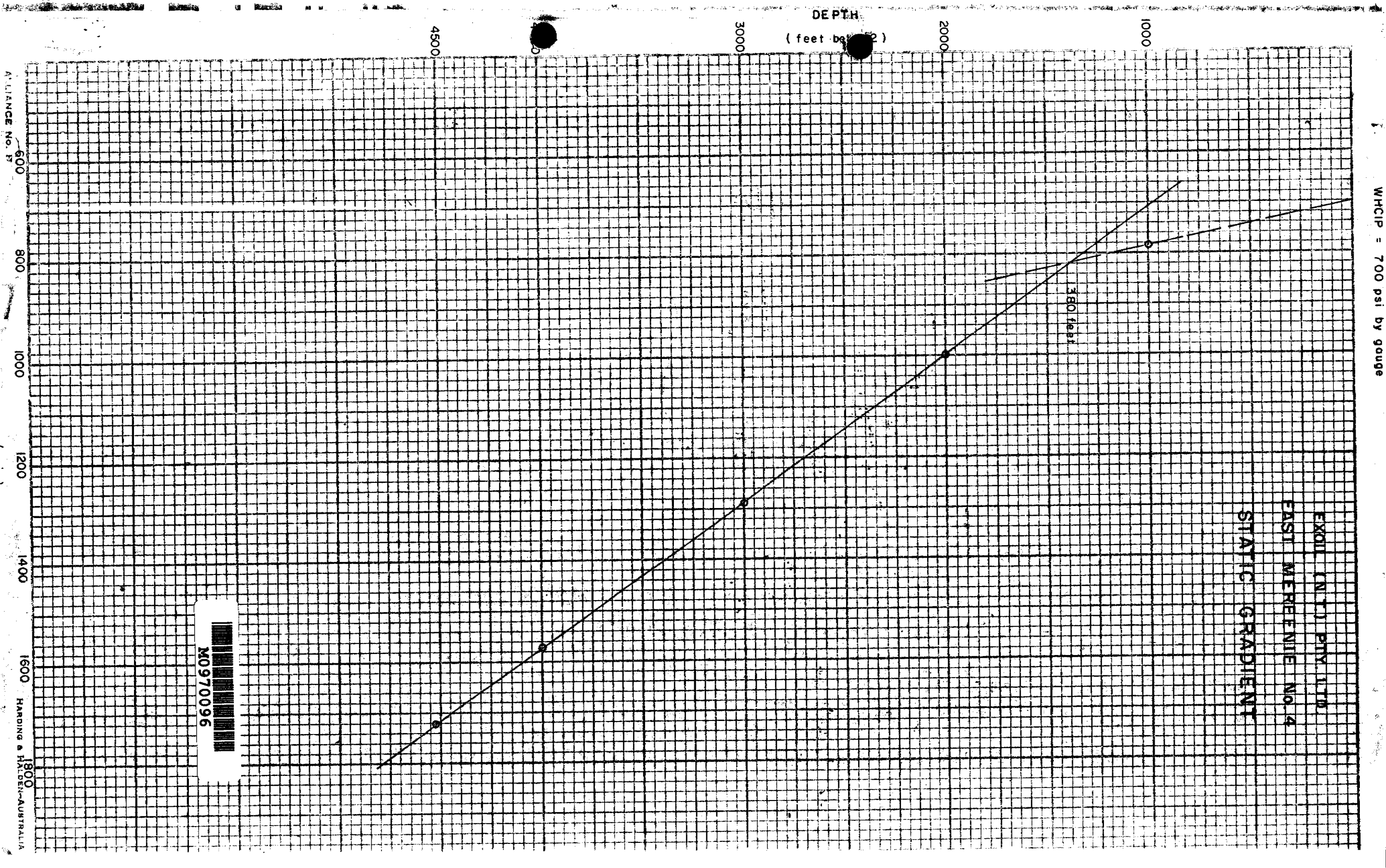
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WHCIP = 700 psi by gauge

EXOLL (N.T.) PVT. LTD.

EAST MERLENE NO. 4

STATIC GRADIENT



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