



KOLA BAKKEN 'A' POOL

32 HECTARE SPACING

APPLICATION

JULY, 1994

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July 15, 1994

Manitoba Energy and Mines
Petroleum Branch
555 - 330 Graham Avenue
Winnipeg, Manitoba

Attention: **Mr. L.R. Dubreuil**
Director, Petroleum Branch

Dear Mr. Dubreuil,

RE: Kola Area TWP. 10-11, RGE. 29 W1M
32 Hectare Special Spacing Application
Bakken Development

INTRODUCTION

Tundra Oil and Gas Ltd., and Corvair Oils Ltd. jointly submit the referenced application to ammend the current 16 hectare spacing to 32 hectare spacing for Bakken oil development in Townships 10 and 11, Range 29 W1M. The 32 hectare Bakken development plan has been initiated due to high historical finding costs and unpredictable low oil prices which has made Bakken development on 16 hectare spacing economically unattractive. From a technical perspective, the special spacing application is also in response to observed production performance in the Kola Bakken 'A' Pool. Recent development drilling during 1993 in the Kola Bakken 'A' Pool indicates significant pressure depletion in newly developed drilling spacing units. This suggests that the existing vertical wells are draining oil reserves beyond their current 16 hectare spacing units. As a result, interwell interference is occurring, and 16 hectare spacing is not necessary to exploit the Bakken oil reserves.

In order to determine the most attractive exploitation strategy for Bakken development in the Kola area, Tundra Oil and Gas Ltd. initiated a numerical reservoir simulation study. The objectives of the reservoir simulation study were three fold: (1) to determine the optimum economic spacing for primary recovery; (2) to assess the incremental oil recovery by waterflooding the Bakken formation on both 16 and 32 hectare spacing; and (3) to evaluate the technical feasibility and economic impact of horizontal drilling in the Bakken reservoir. A Calgary petroleum engineering consulting firm (Scientific Software Intercomp) with Bakken simulation experience was retained to undertake the study. In support of our 32 hectare special spacing application for

Bakken development, a copy of the reservoir simulation study is attached. A discussion of the production performance of the new 1993 Bakken development wells, and the highlights of the reservoir simulation study are presented hereafter.

NEW WELL PRODUCTION PERFORMANCE

A review of the production performance of the new 1993 Bakken development wells was undertaken to establish in conjunction with DST's pressures whether interwell production interference is occurring. The production performance of all six 1993 North Kola Bakken 'A' Pool development wells were reviewed to address this drainage consideration. Appendix A outlines the ultimate recovery predictions of new wells 13-28, 16-29, 1-32, 2-32, 8-32, and 7-33-10-29. Wells 16-29 and 13-28 are declining at a high rate due to historical depletion from wells 9-29 and 12-28-10-29. This is supported by the 1993 DST pressure at well 16-29 which had a static extrapolated reservoir pressure of 6920 kPa. This is 1950 kPa below the original Bakken 'A' Pool reservoir pressure of 8874 kPa. A review of wells 1-32, 2-32, and 8-32 indicates that well 1-32 has declined in oil productivity by 50% during the last six months. There are no mechanical problems evident at this location, and formation damage is not considered to be contributing to the decline. A 1993 DST static extrapolated reservoir pressure of 7420 kPa was measured at the 1-32 location. Again depletion is evident at 1-32 due to established production to the south. Similarly, depletion at new well 7-33 was also evident from the DST pressure. A static extrapolated reservoir pressure of 7915 kPa was measured at 7-33. The 7-33 well is almost 1 mile from established Bakken 'A' Pool production to the south and appreciable depletion was also evident at this location. The rapid decline in oil productivity (50% during the last 4 months) also supports that depletion has occurred in LSD 7-33 prior to drilling. The ultimate recovery predictions outlined for the North Kola wells in Appendix A indicates that only one well (8-32) at this time is likely to recover in excess of 4000 m3. Under this recovery scenario (below 4000 m3), it is not economic to pursue Bakken 'A' Pool development. In summary, over time, a typical Kola Bakken 'A' Pool well will drain oil reserves beyond its current 16 hectare spacing. On this basis, due to previous historical depletion, and current interwell production interference, 16 hectare spacing is not considered by Tundra to be the most effective exploitation plan to continue Bakken 'A' Pool development in North Kola.

LANDS

Exhibit No.1 (refer to Appendix B) outlines the lands for which 32 hectare spacing is made application herein. The surface and mineral rights owners within the 32 hectare application area and the immediate quarter section adjoining the special spacing area are also listed in Appendix B. The intent of the special spacing application is to remove 16 hectare offset drilling obligations during the 32 hectare development of the Bakken formation in the application area. Tundra is also of the understanding that with the approval of the 32 hectare special spacing application in the aforementioned target lands, we will be subject to 32 hectare offset obligations in the application area. The total area for which 32 hectare spacing is requested represents 10,036 hectares (24,800 acres).

GEOLOGY

The Bakken 'A' Pool formation has been interpreted by Tundra to extend to the North of the Kola Unit No.1 over the special application area. The productive member of the Bakken reservoir complex in the 32 hectare special application area is considered to be similar to the producing interval in the Kola Unit No.1. The Bakken 'A' Pool in the Kola Unit No.1 produces from a 1 to 3 metre thick, fine to medium grained dolomitic sandstone developed at the base of the middle Bakken member. Potential reservoir exists within a 1 metre thick sandstone developed at the top of the middle Bakken member. The production capability of the upper zone is uncertain, as no independent production testing has been done to date. The top seal for the reservoir is provided by the overlying black shale of the Upper Bakken Member. Seat seal is the red and green dolomitic shales of the Devonian Lyleton formation. The Middle Bakken reservoir has a gentle regional dip to the southwest. Local structural closure is developed to the north and west and is attributed to differential salt solution. The wells and pore volume included in the Kola simulation model area are outlined in Appendix C.

PRESSURE HISTORY

A comprehensive listing of the Kola Bakken 'A' Pool pressure history (based on drill stem tests and acoustic well sounder measurements) is outlined on Table No.7 (refer to reservoir simulation study). Discovery pool pressure (Well 13-21-10-29) for the Kola Bakken 'A' Pool was 8874 kPa (adjusted to datum). As previously mentioned, recent development drilling during 1993 in the Kola Bakken 'A' Pool

indicates that there has been significant pressure depletion and drainage of previously undrilled DSU's. Development well 15-21-10-29 indicated static pool pressure of 6195 kPa from the DST. Wells 16-29 and 1-32-10-29, north of the model simulation area, also indicated pressure depletion from wells producing in the model area. Wells 16-29 and 1-32 had static pool pressures of 6920 kPa and 7420 kPa (from DST measurements). Appendix D outlines the DST pressure measurements for wells 15-21, 16-29, and 1-32-10-29. Similarly, a 1 mile stepout also indicated depletion at new well 7-33-10-29 based on the DST static pool pressure of 7915 kPa at this location. The pressure history data for the Kola Bakken 'A' Pool suggests that the drainage area for an average well is greater than 16 hectares. The conclusions that follow under the reservoir simulation study section of this application support this observation.

RESERVOIR SIMULATION STUDY

A summary is provided hereafter of the highlights and conclusions derived from the Kola Bakken 'A' Pool reservoir simulation study.

1. Geological Model

The geological model used in the simulation study consisted of five layers. The layers have been categorized from top to bottom in the reservoir column as follows:

- * **Layer 1:** Top layer in model representing the Lodgepole formation. This layer was built into the model to represent water influx and potential pressure support after hydraulic fracturing. A Carter-Tracy infinite acting aquifer was attached to Layer 1 to provide a continuous source of water. The Upper Bakken Shale was also included in Layer 1.

- * **Layer 2:** Below Layer 1 representing the potentially productive upper zone of the Middle Bakken Member.

- * **Layer 3:** Below Layer 2 representing the tight or unproductive section separating the upper and lower Middle Bakken productive zones.

- * **Layers 4 and 5:** Bottom two layers in the geological model to represent the productive lower zone of the Middle Bakken Member.

2. Reserves

The oil-in-place estimates were determined from pore volume mapping that was recently generated by Tundra. The

pore volume mapping was based on all available petrophysical data (logs, core, seismic, and previous mapping) in the model area, and recent development drilling. Based on the aforementioned process, the total volumetric oil-in-place in the model area was determined to be 461,000 m³ (2,899,690 STB).

3. Model Design and Calibration

This represents the most important phase of the reservoir simulation project since a history match must first be achieved between model generated and actual field production history. After a reliable history match has been achieved, predictive cases can be generated to evaluate various depletion scenarios. The model calibration phase of the reservoir simulation project also provided a test of the current geological interpretation of the Kola Bakken 'A' Pool.

The reservoir drive mechanism for the Kola Bakken 'A' Pool was initially interpreted as a fluid expansion system (oil displacing oil) with no aquifer support. This concept proved to be incorrect, since oil-in-place estimates in the model area had to be increased by a factor of 10 before a history match could be achieved. Similar pore volume increases were added to the north of the model area (north of the Kola Unit No.1) with substantial permeability increases before the model would run. This suggests that oil expansion is not the primary drive mechanism in the Kola Bakken 'A' Pool.

Since an infinite acting aquifer was built into the model (Layer 1: Lodgepole formation), this approach was next tested to determine if a reliable history match could be achieved without changing the oil-in-place estimates. This approach indicated that water went preferentially to the perforations in wells that were fractured out of zone, and did not provide any areal reservoir pressure support in the Kola Bakken 'A' Pool. Since the hydraulic fractures only provide water production at the immediate well, this approach was also not considered as a reliable method to achieve a history match for the Kola Bakken 'A' Pool.

After testing larger increases in oil-in-place and pressure support from the Lodgepole formation as methods to calibrate the model to actual field production performance, an alternative approach was considered for testing. An oil-aquifer system with the aquifer being limited acting was added to the lower sand of the Middle Bakken Member (Layers 4 and 5). This suggests that the oil leg in the Kola Bakken 'A' Pool connects regionally to an aquifer with oil being driven by the water. Based on Tundra's internal geological

assessment, the oil / water contact is coincident with the salt collapse. The recent flattening of the field decline in the Kola Bakken 'A' Pool suggests that pressure support is being provided to the Kola Bakken 'A' Pool apart from the current waterflood. The model was rerun with the oil-acquifer concept and a reliable history match was achieved without changing oil-in-place estimates and without making large changes to permeability profiles in the Kola Bakken 'A' Pool. On this basis, Tundra is comfortable that the model has been appropriately constructed and calibrated to actual field producing conditions.

At this point, several predictive cases were generated to address the aforementioned objectives.

4. Optimum Spacing for Primary Recovery

The first predictive cases run after model calibration were to compare primary recovery on 16 and 32 hectare spacing. **Primary recovery under this item refers to technical oil recovery prior to economic screening.** Two cases of 32 hectare well spacing were generated. The first case of 32 hectare spacing only considered the lands available within the model area without technical screening in terms of reservoir development information acquired during the course of drilling (refer to Appendix E). The second case of 32 hectare spacing (refer to Appendix E) recognized that new locations would be selected on a technical basis as new information became available during the course of drilling (referred to as the 32-H hectare highgraded scenario). The reservoir pressure during the forecast period remained above the bubble point in both the 16 and 32 hectare cases. The single well technical recoveries (**before economics**) for 16 and 32 hectare spacing are outlined as follows:

Spacing (hectares)	Recovery/well with D&A's (STB)		Recovery/well excluding D&A's (STB)	
16	34,470	861,750	43,090	861,300
32	45,600	547,100	54,720	547,200
32-H	55,040	660,480	66,045	660,450

Note: For recovery/well with D&A's on 16 hectare spacing represents a total of 25 wells.

For recovery/well with D&A's on 32 hectare spacing represents a total of 12 wells.

Note: (continued)

For recovery/well excluding D&A's on 16 hectare spacing represents 20 producing wells.

For recovery/well excluding D&A's on 32 hectare spacing represents 10 producing wells.

The above single well recoveries represent a chance factor of success of 80%, which is considered high based on recent development drilling. A chance factor of 70% is considered more appropriate for further Bakken exploration and development.

Both 32 hectare spacing cases have exceeded the 16 hectare spacing scenario in terms of ultimate primary recovery per single well. Both the 16 and 32 hectare spacing cases include a mix of wells with good and marginal reservoir quality, in order not to bias the recovery estimates. On this basis, there is definitely interwell interference occurring in the Kola Bakken 'A' Pool, and the majority of wells on 16 hectare spacing are draining more than one spacing unit. Therefore, the 32 hectare spacing scenario appears to be more attractive on an economic basis and will provide better return on investment and lower finding costs. A subsequent section in this application addresses the economic indicators for the 16 and 32 hectare spacing scenarios.

5. Waterflood Recovery and Horizontal Drilling

Optimum well spacing was also investigated in the simulation model for secondary recovery. The predictive results from the simulation model indicate that waterflooding may not be a viable depletion strategy for the Bakken 'A' Pool.

Tundra is of the opinion that waterflooding does provide pressure maintenance, and through this process should extend the economic producing life of the Bakken 'A' Pool. Recent production results from the initial area of waterflooding in the Kola Unit No.1 are encouraging, and further monitoring is required before the impact of waterflooding can be reliably evaluated for the Kola Bakken 'A' Pool. Tundra will advise the Crown as to the economic viability and appropriate spacing for waterflooding once sufficient production history is available to proceed with an expanded depletion plan.

The impact of horizontal drilling was also investigated during the course of the simulation study. The predictive cases indicate that horizontal drilling in the Bakken 'A' Pool is very attractive and would increase pool recovery while lowering finding costs. The best place to implement this technology at this time would be in North Kola where higher reservoir pressures are expected. The application of horizontal drilling would also be more attractive on 32 hectare spacing since a larger land area could be more effectively developed and depleted with fewer wells, and less surface disruption for land owners.

ECONOMICS FOR PRIMARY RECOVERY

An economic evaluation was undertaken to determine what would have been the most attractive depletion and development scenario for primary recovery from the Kola Bakken 'A' Pool. Single well economics were run for both 16 and 32 hectare well spacing. The following information was common to the two spacing scenarios:

- * Production period commenced in January, 1994 and lasted 15 to 19 years as forecasted from the simulation study.

- * Capital cost to drill, case, complete, equip, tie-in and fracture stimulate of \$220,000/well.

- * An initial oil price of \$18.00 CDN/barrel inflated at 5%/year.

- * An initial operating cost of \$3000/well/month with a variable component of \$0.25/barrel, all inflated at 5%/year. This converted to \$3.40/barrel to \$4.70/barrel which matches current operating costs. The variance is attributable to lower initial production rates from a well on 16 hectare spacing.

- * New Crown royalties were used.

The technical reserve recoveries for the two spacing scenarios were taken from the simulation study predictions, which have been previously outlined in this application.

The single well economics for primary oil recovery on 16 and 32 hectare spacing are outlined as follows:

SINGLE WELL ECONOMICS
(Before Tax)

Well Spacing (ha)	Cap. Inv. (M\$)	Reserve Recovery (STB)	Finding Costs (\$/STB)	NPV (M\$)	Payout (years)
16	220	27,760	7.93	-30	5.0
32	220	37,440	5.88	86	2.1
32-H	220	46,880	4.69	142	2.0

Note:

- * Cap Inv.: refers to capital investment.
- * Reserve recovery represents economic reserves
- * NPV: discounted cash flow at discount factor = 12%
- * All economic indicators based on a discount factor of 12%.

The economic analysis indicates that primary oil recovery on 16 hectare spacing is not economic. The economic screening of both 16 and 32 hectare spacing scenarios also indicates that there has been erosion in all the technical primary recovery predictions. This suggests that Bakken 'A' Pool oil development is also price sensitive even under higher primary oil recoveries. The two 32 hectare spacing scenarios provide economic indicators that would allow Tundra to continue with Kola Bakken 'A' Pool development in the future. Finding costs of \$7.90/barrel (refer to Table No.1) under oil prices of \$18/barrel are unacceptable for Tundra to continue with Bakken 'A' Pool development. Finding costs of \$5/barrel are more acceptable economic indicators which can be attained with 32 hectare development. Table No.1 provides a comprehensive summary of the single well primary recovery economic indicators for 16 and 32 hectare spacing. The single well economic evaluations for the 16 and 32 hectare spacing scenarios are outlined in Appendix F.

SUMMARY

Tundra is prepared to commence development of the Kola Bakken 'A' Pool on 32 hectare spacing during the third quarter of 1994. The 32 hectare spacing application is essentially intended for primary oil recovery. This application does not, however, preclude 16 hectare development in the future, depending on our future experience with 32 hectare development. Our expectations (based on actual field performance and the recent simulation study supporting current field performance) are that the 32 hectare spacing depletion plan will meet the business objectives of investors, royalty owners, and the Crown.

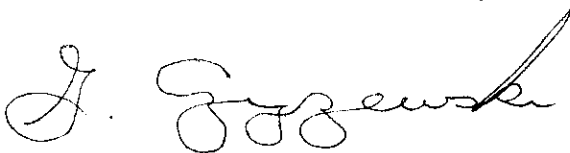
The approval of the 32 hectare special spacing application is required in order for Tundra to continue with further Kola Bakken 'A' Pool development. The prevailing average oil price of \$18/barrel during the first quarter of 1994, has resulted in Tundra adopting a survival strategy that will provide acceptable economic returns for all participating parties in a continuing volatile oil price environment. Based on our assessment, continued Kola Bakken 'A' Pool development can be best accomplished on 32 hectare spacing.

Tundra is currently planning to drill 4 wells in Section 33-10-29 on 32 hectare spacing during the third quarter of 1994. To this end, our office is prepared to provide the Crown with further assistance to expedite approval of this application by late August, 1994.

If you should have any questions, please contact George Czyzewski at 934-5853.

Respectfully submitted,

TUNDRA OIL AND GAS LTD.



George Czyzewski, P.Eng.
Senior Reservoir Engineer

Tundra
oil and gas ltd.

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Corvair Oils Ltd., as a participating party in the development of the Kola Bakken 'A' Pool, supports the 32 hectare special spacing application for the lands outlined in this document. As testimony of our support of the Kola 32 hectare special spacing application, Corvair Oils Ltd has also signed this document by a duly appointed officer of the company.

Rogers Delbaere
Corvair Oils Ltd.

July 14 / 94
Date

cc: R. Puchniak
J. Mitchell, Corvair Oils Ltd.
R. Delbaere, Corvair Oils Ltd.

KOLA BAKKEN 'A' POOL

COMPARISON OF ECONOMICS FOR 16 AND 32 HECTARE SPACING PRIMARY RECOVERY SCENARIOS

	16 Hectare Spacing	32 Hectare Spacing	32 Hectare Highgraded
Unrisked Reserves Pre-Economics	43,090 STB	54,720 STB	66,045 STB
Risked Reserves Pre-Economics	34,470 STB	45,600 STB	55,040 STB
Reserves after Economics	27,760 STB	37,440 STB	46,880 STB
Capital Inv.	220M\$	220M\$	220M\$
1994 Oil Price	18 \$/barrel	18 \$/barrel	18 \$/barrel
Avg. Royalty	18%	20%	20%
Op. Cst	\$4.73/barrel	\$3.47/barrel	\$3.40/barrel
ROR (B.T.)	0%	44%	54%
Payout (B.T.)	5.0 years	2.1 years	2.0 years
B.T. Cashflow	- 30 M\$	86 M\$	142 M\$
@ 12% D.F.			
Finding Cost	\$7.93/barrel	\$5.88/barrel	\$4.69/barrel

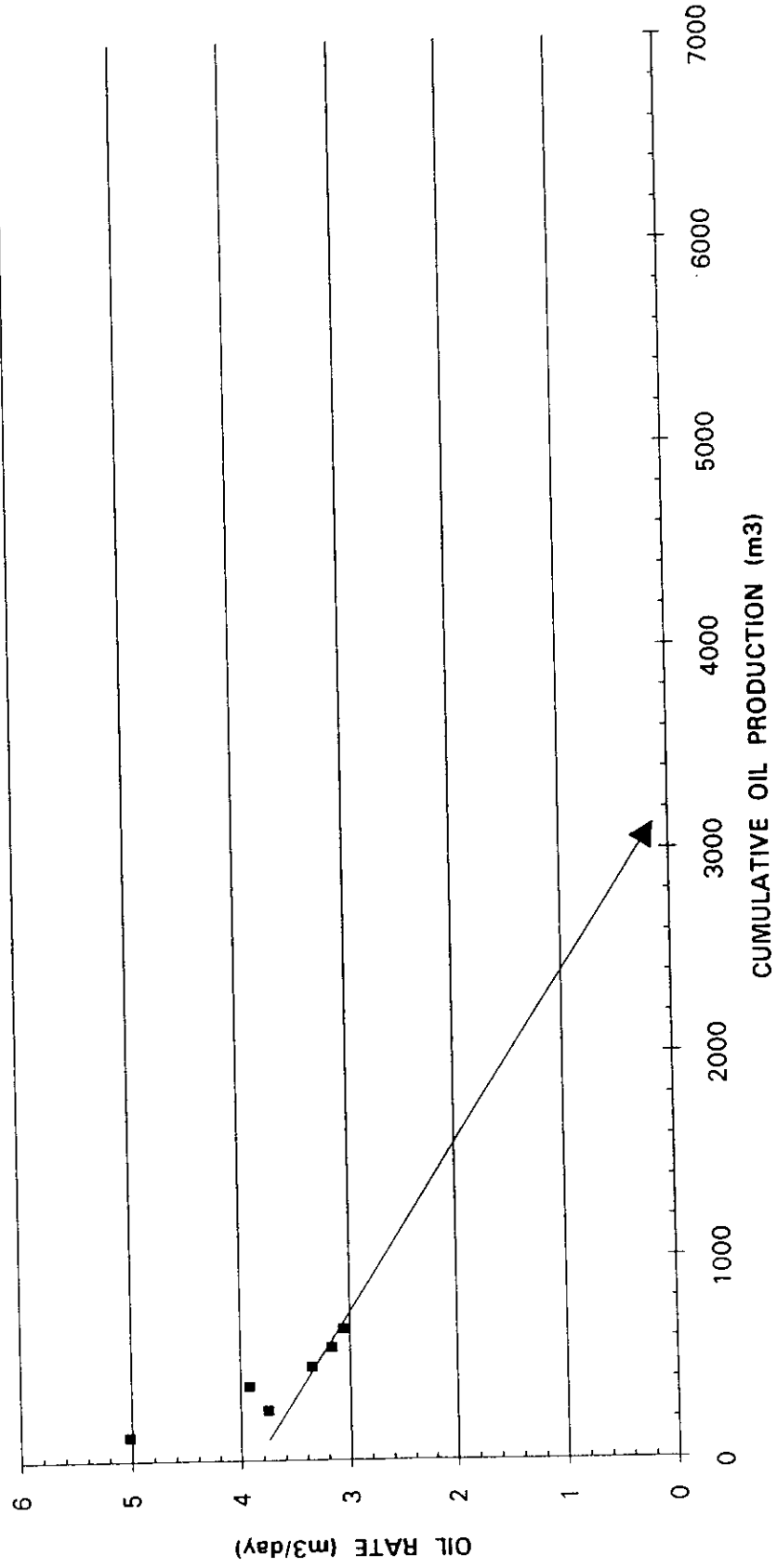
RESERVES AND ECONOMICS STATED ARE FOR A SINGLE WELL
ECONOMIC INDICATORS ARE BEFORE TAX

APPENDIX A

1993 BAKKEN 'A' POOL NEW WELL PRODUCTION PERFORMANCE

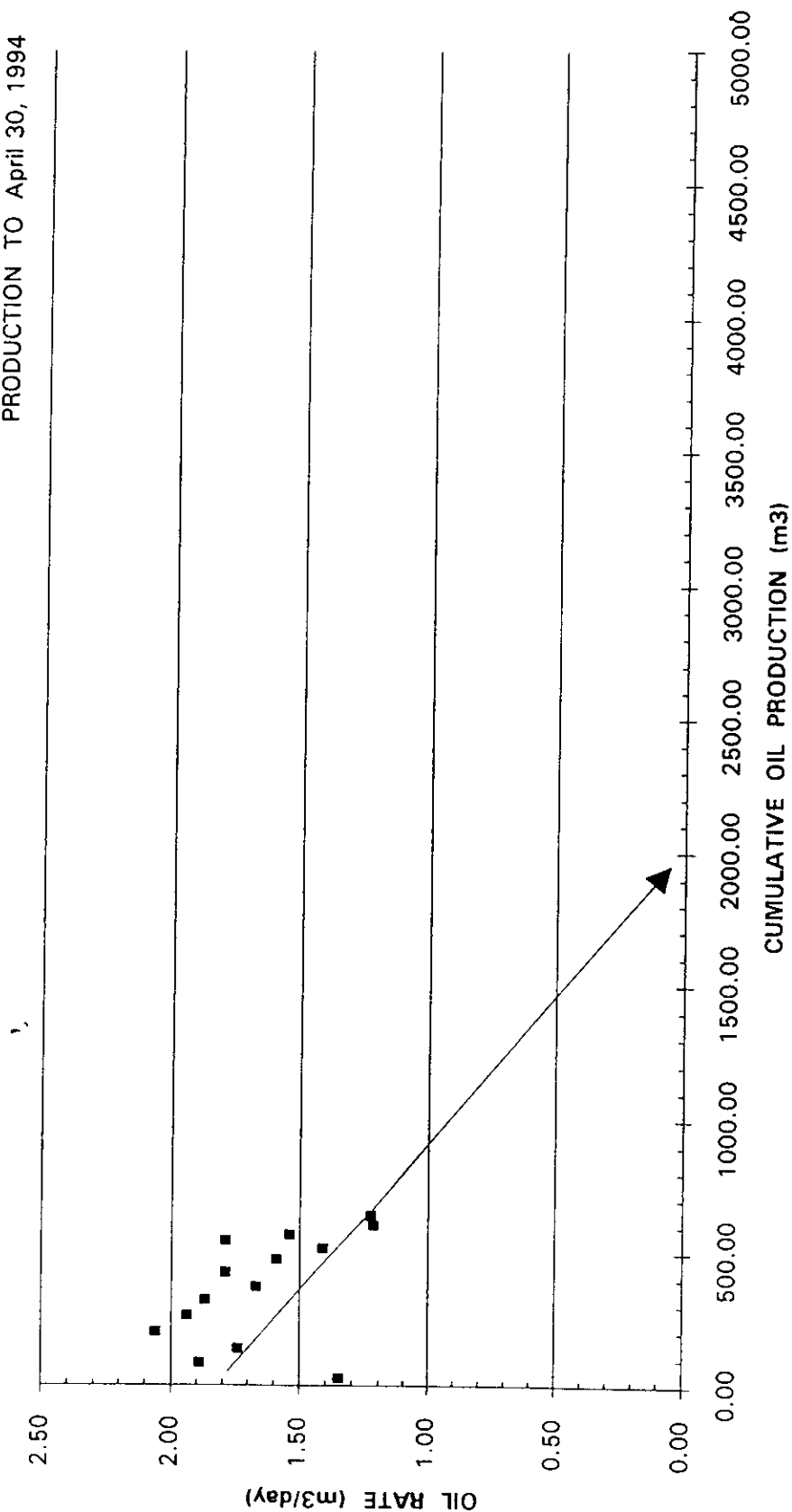
KOLA BAKKEN 'A' POOL WELL 13-28-10-29 ULTIMATE RECOVERY PREDICTION

PRODUCTION TO April 30, 1994



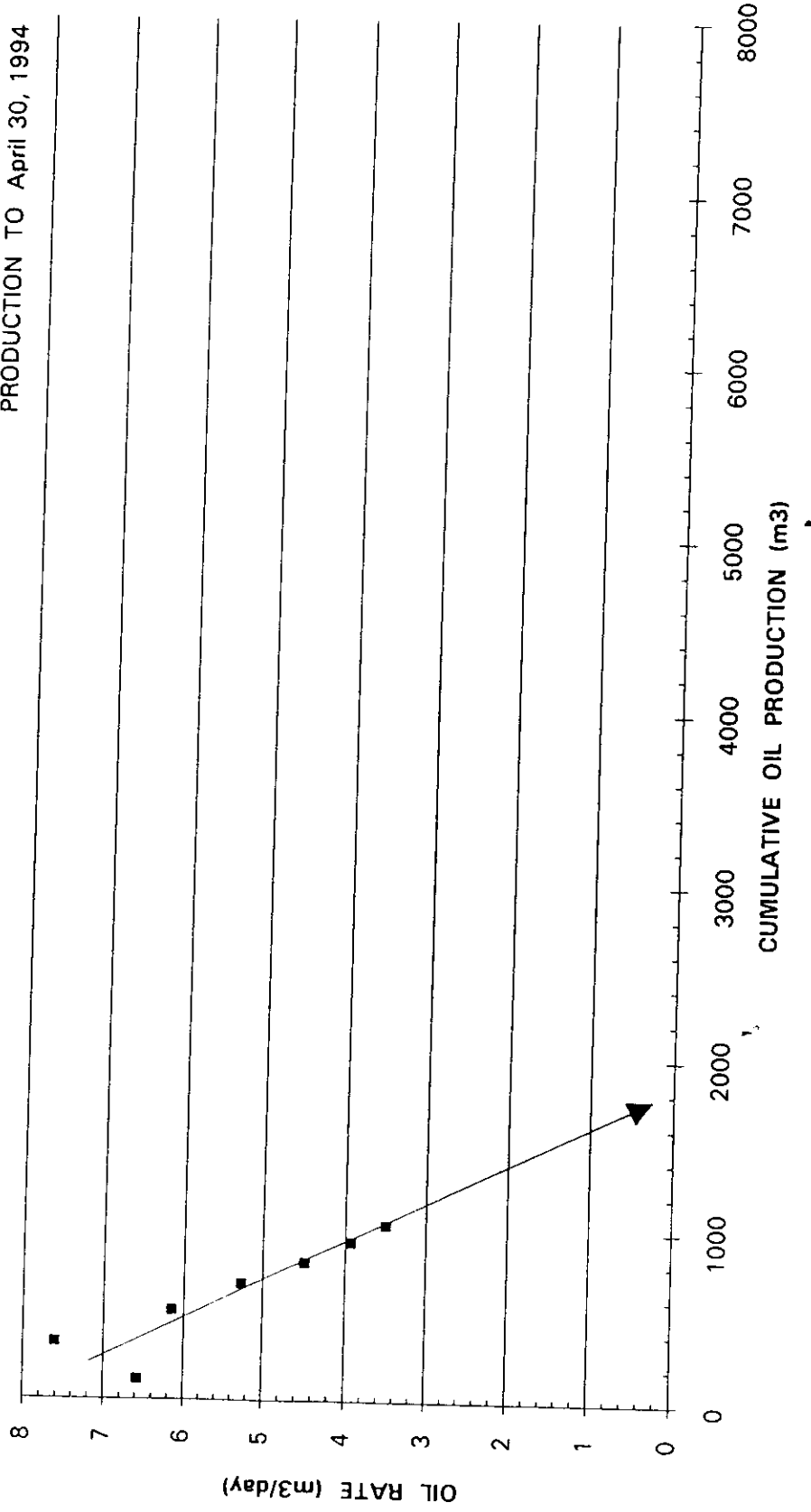
KOLA BAKKEN 'A' POOL WELL 16-29-10-29 ULTIMATE RECOVERY PREDICTION

PRODUCTION TO April 30, 1994



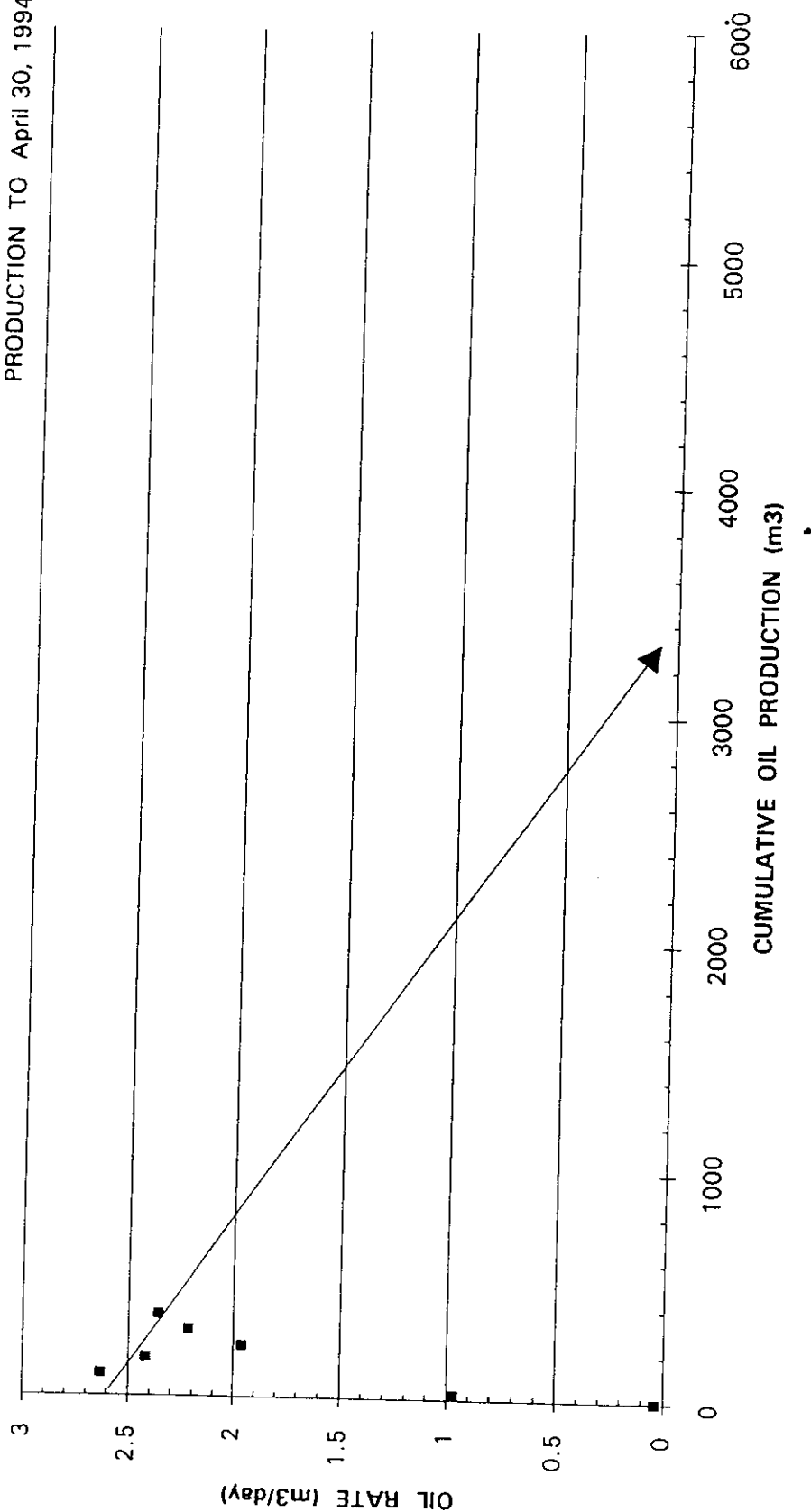
KOLA BAKKEN 'A' POOL WELL 1-32-10-29 ULTIMATE RECOVERY PREDICTION

PRODUCTION TO April 30, 1994



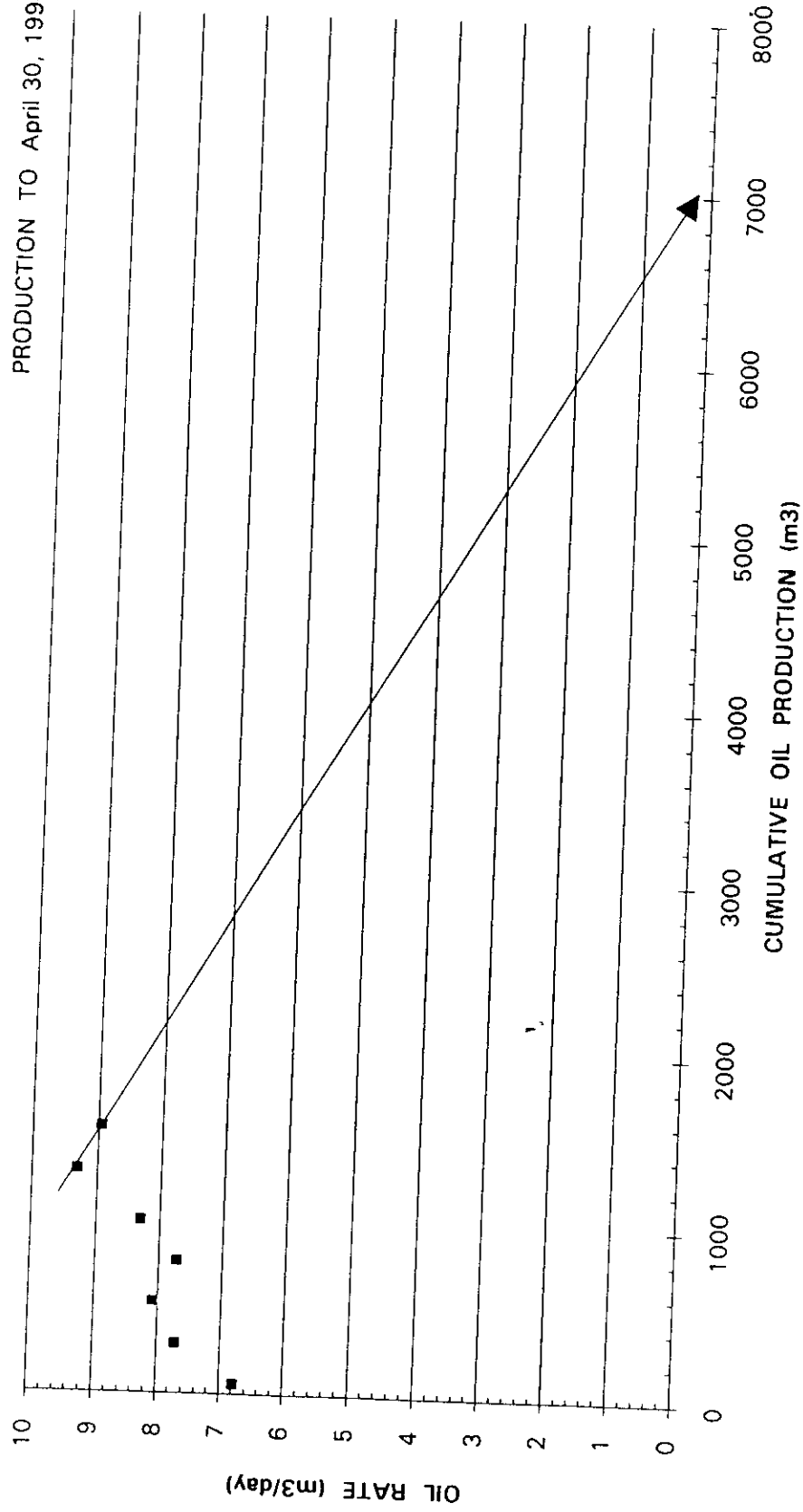
KOLA BAKKEN 'A' POOL WELL 2-32-10-29 ULTIMATE RECOVERY PREDICTION

PRODUCTION TO April 30, 1994



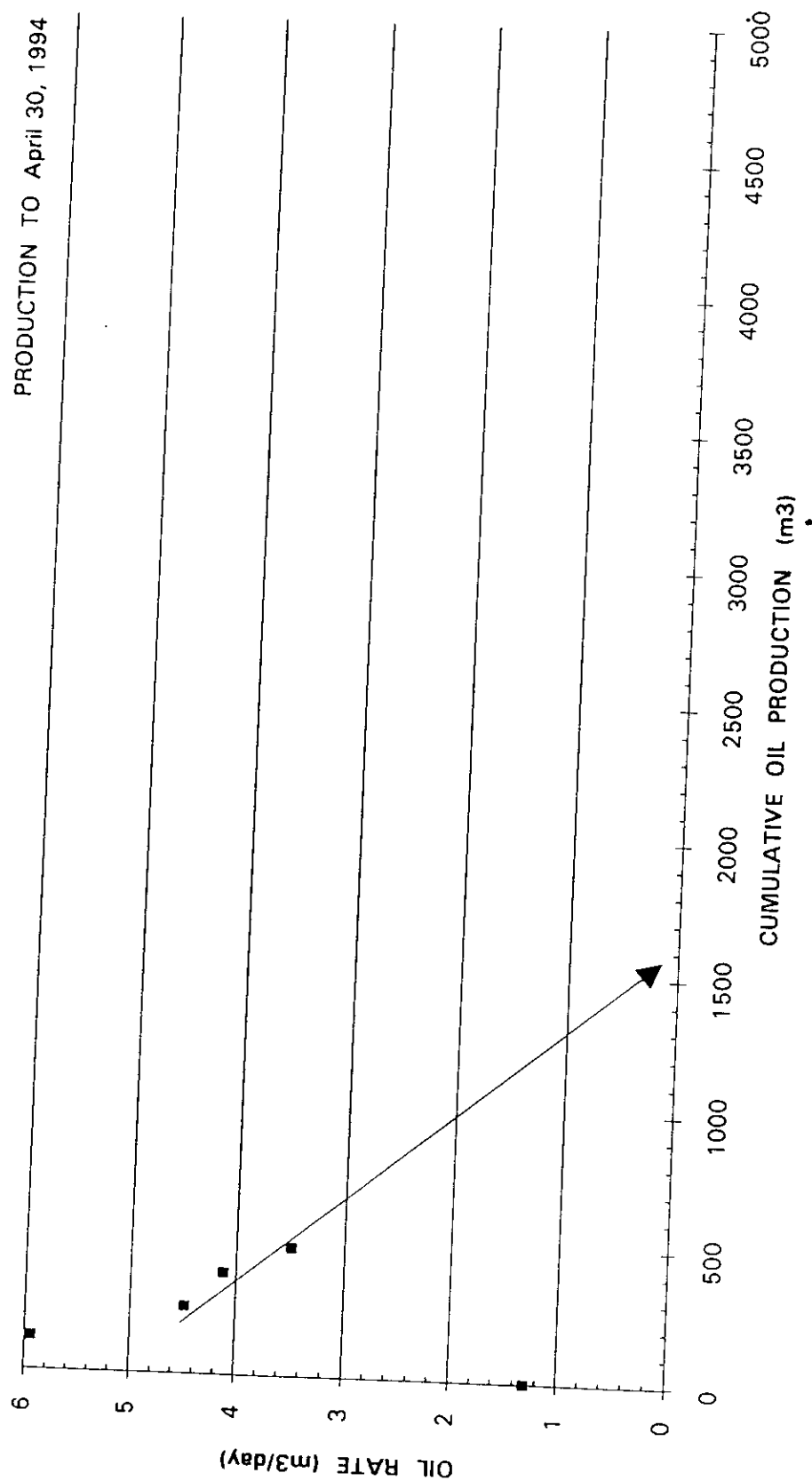
KOLA BAKKEN 'A' POOL WELL 8-32-10-29 ULTIMATE RECOVERY PREDICTION

PRODUCTION TO April 30, 1994



KOLA BAKKEN 'A' POOL WELL 7-33-10-29 ULTIMATE RECOVERY PREDICTION

PRODUCTION TO April 30, 1994



APPENDIX B

LANDS TO BE INCLUDED IN 32 HECTARE SPACING AREA

ANRO	Angus, Robert Lyle P.O. Box 400 Elkhorn, MB 845-2149	ROM ONO	CAMI	Canart, Mildred May P.O. Box 154 Elkhorn, MB 845-2455	ROM ONO	DIBE	Dibben, Beth 8531 - 77th Avenue Edmonton, AB	T6C 0L5
ANZA	Anderson, Zarett Marie 26, 9520 - 174th Street Edmonton, AB	T5T 5Z3	CARO	Canart, Robert George 3047 Victoria Heights Crescent Ottawa, ON (613) 738-7555	K1T 3M8	DIXO	Dixon, Sharon, Dava & Douglas P.O. Box 56 Maryfield, SK	
ARCH	Archambault, Marcel & Elizabeth 1115 - 22nd Street Brandon, MB 727-8780	R7B 2P6	CNEL	Canada Northwest Energy Limited 2700, 300 Fifth Avenue S.W. Calgary, AB	T2P 3C4	DRRA	Drinnan, Jim G. 408 Silver Hill Way N.W. Calgary, AB (403) 286-6613	T3B 4L5
BABE	Baughen, Bernice (formerly Northcutt)		COCI	Collinge, Cindy Lee P.O. Box 564 Didsbury, AB	TOM OWO	DULL	Duncan, Lloyd Alexander P.O. Box 1502 Taber, AB	TOK 2G0
BIVI	Bird, Vivian Mary 32 Bridge Villa Estates Lethbridge, AB (403) 320-0088	T1K 4Z8	COCL	Collins, Cindy Lorraine 601 - 7275 Salisbury Avenue Burnaby, BC	V5E 4E1	ELAR	Ellingson, Arnold Emil 36 McNabb Park Street Brooks, AB	TOJ OJO
BOEA	Boomhauer, Earl General Delivery Elkhorn, MB 845-2577	ROM ONO	COIS	Cotton, Isabel 2015 Richmond Avenue Brandon, MB 728-1890	R7B OT4	EXJE	Exley, Jean 65 Acheson Road West Hill, ON	
BOJE	c/o P.O. Box 63 St. Paul, AB	TOA 3A0	COMI	Collins, Michael Dwayne P.O. Box 1024 Westbank, BC	VOH 2A0	FOCI	Fordyce, Cindy Christine 18 Glenacres Crescent Winnipeg, MB	R3T 5P9
BUMA	Bukaluk, Marlene Fay 1613 - 20th Street Brandon, MB 728-3860	R7B 2P2	COOL	Corvair Oils Ltd. P.O. Box 3827, Station "D" Edmonton, AB	T5L 4J8	GAOC	Gauer Oil Company 202 Riverside Drive Toronto, ON	M6S 4A9
CAJO	Canart, John Lucien (Estate) c/o 3047 Victoria Heights Crescent Ottawa, ON (613) 738-7555	K1T 3M8	DEMU	Desv, Muriel Charlotte 3834 Sixth Avenue North Port Alberni, BC	V9Y 4M2	GATI	Gardiner, Timothy Lawrence P.O. Box 634 Didsbury, AB (403) 337-2866	TOM OWO
CAMA	Cantlon, Marlene Elaine P.O. Box 113 Oak Lake, MB 855-2259	ROM 1P0	DEPT	Department of Energy & Mines 555 - 330 Graham Avenue Winnipeg, MB	R3C 4E3	GIER	Giesbrecht, Ernest A. General Delivery Kola, MB	ROM 1B0

GODO	Gow, Dorothy Arlene General Delivery Minnesota, MB	ROM 1MO	KOBA	Koop, Barry Alan P.O. Box 35 Kola, MB 556-2223	ROM 1B0	LUKE	Lund, Kenneth Lloyd P.O. Box 263 Elkhorn, MB 845-2188	ROM ONO
GOHE	Goethe, Helen Rachel General Delivery Elkhorn, MB 845-2074	ROM ONO	KUSI	Kucharavv, Sidney John 23 Leeds Avenue Winnipeg, MB 261-0404	R3T 3X1	LUKM	Lund, Kenneth & Marion P.O. Box 263 Elkhorn, MB 845-2188	ROM ONO
GRAN	Grant, Andrew & Betty P.O. Box 1922 Virden, MB 748-1156	ROM 2C0	LAER	Lamont, Eretta Ilene P.O. Box 23 Manson, MB 722-2324	ROM 1J0	LULY	Lund, Lyle George Berry 105 - 5635 Paterson Avenue Burnaby, BC (604) 435-4227	V5H 2M6
GREV	Green, Eva General Delivery Crystal City, MB 873-2507 (disconnected)	ROK ONO	LEBL	Leis, Blanche Noreen P.O. Box 231 Elkhorn, MB 845-2032	ROM ONO	MACG	MacNeil, Genevieve 9631 Diamond Road Richmond, BC (604) 271-0679	V7E 1P5
HAEL	Hamilton, Elsie General Delivery Elkhorn, MB	ROM ONO	LERL	Leonard Resources Ltd. P.O. Box 245 Elkhorn, MB	ROM ONO	MAMA	Magnon, May P.O. Box 63 St. Paul, AB	TOA 3A0
HUED	Hudzik, Edward R.R. #4 Brandon, MB	R7A 5Y4	LESM	Lennon, Samuel & Myrna 619 - 22nd Street Brandon, MB 728-5482	R7A 1S5	MCMM	McEachen, Mavis Maxine P.O. Box 117 Onanole, MB	ROJ 1N0
HUKE	Hutchison, Kenneth General Delivery Elkhorn, MB 845-2008	ROM ONO	LLCM	Longman, Lloyd & Christmas, Margaret General Delivery Maryfield, SK		MCWI	McMichael, Winthrop Leigh 718 Dukeshire Avenue Kalamazoo, Michigan	U.S.A.
KC&C	Kola Church & Cemetery General Delivery Kola, MB 556-2604	ROM 1B0	LUDA	Lund, Harold Dale 3501 Rosser Avenue Brandon, MB 727-7862	R7B 2Z3	MOHI	Moore, Hillis Gordon P.O. Box 535 Virden, MB 748-1530	ROM 2C0
KIHO	Kitzler, Hope Justine 125 Cedar Avenue Snow Lake, MB 358-2550	ROB 1MO	LUGE	Lund, Gerald Laverne P.O. Box 12 Elkhorn, MB 845-2196	ROM ONO	MOMY	Mooney, Myrtle Revia 2312 Bradford Avenue Sidney, BC	V8L 2B6
KLER	Klassen, Erna 14728 Deer Ridge Drive S.E. Calgary, AB	T2J 6B5	LUGG	Lund, Glen James & Garth Walker P.O. Box 41 Kola, MB 556-2355	ROM 1B0	MOSA	Montgomery, Sarah Bessie General Delivery Virden, MB 748-1703	ROM 2C0

MOTC	Montreal Trust Company 411 Eighth Avenue S. W. Calgary, AB (403) 267-6887 (<i>Kathy J. Smith</i>)	T2P 1E7	OGDO	Ogilvie, Donald C12 Wellbury Drive, R.R. #3 Ganges, BC	VOS 1E0	PEED	Penner, Edgar General Delivery Elkhorn, MB	ROM ONO
MOTR	Montreal Trust Company P.O. Box 369 Winnipeg, MB 943-0451	R3C 2J1	OGEL	Ogilvie Enterprises Ltd. P.O. Box 417 Maryfield, SK	SOG 3K0	PEHE	Pettapiece, Helen Clarinda 119 Bruce Avenue Winnipeg, MB 832-4469	
MURO	Strata Resources Ltd. 1298 Williams Road E. Courtenay, BC	V9N 7J9	OGGE	Ogilvie, Gerald George General Delivery Elkhorn, MB 845-2015	ROM ONO	PENF	Penner Farms Ltd. P.O. Box 42 Kola, MB	ROM 1B0
NAEA	Naylen, Edward Anthony P.O. Box 174 Maryfield, SK 556-2366	SOG 3K0	OGHA	Ogilvie, Harold P.O. Box 65 Elkhorn, MB 845-2071	ROM ONO	PERM	Canada Trust c/o Montreal Trust 411 Eighth Avenue S.W. Calgary, AB (403) 267-6887 (<i>Kathy J. Smith</i>)	T2P 1E7
NARU NAOC	Naylen, Ruth J. (Est)/Naylen Oil Corp. 40 Everett Crescent Regina, SK	S4S 2M7	OVLJ	Overand, Lewis & Jean P.O. Box 313 Elkhorn, MB 845-2324	ROM ONO	POCO	Poco Petroleum Ltd. P.O. Box 4365, Station "C" Calgary, AB	T2T 5N2
NEAR	Neufeld, Arthur Peter P.O. Box 34 Kola, MB 556-2334	ROM 1B0	OVWE	Overand, Wesley & Ellen General Delivery Elkhorn, MB 845-2636	ROM ONO	REFR	Rex, Franz Leo General Delivery Butler, MB	
NEDC	Neufeld, Donald Craig General Delivery Kola, MB 556-2228	ROM 1B0	PAED	Pauli, Edward James P.O. Box 189 Elkhorn, MB 845-2418	ROM ONO	REJD	Reddekop, James & Doreen General Delivery Kola, MB	ROM 1B0
NEED	Neufeld, Eric Deane P.O. Box 396 Maryfield, SK (306) 646-4430	SOG 3K0	PAUW	Pauli, William Ian Apt. 32, 750 South Edward Street Thunder Bay, ON (807) 577-3693		ROKW	Rowan, Kenneth William John P.O. Box 402 Elkhorn, MB 845-2061	ROM ONO
NTCL	Northern Trusts Company c/o 411 Eighth Avenue S.W. Calgary, AB (403) 267-6887 (<i>Kathy J. Smith</i>)	T2P 1E7	PAWI	Pauli, William John P.O. Box 128 Elkhorn, MB 845-2127	ROM ONO	ROMA	Rowan, Mary Katherine P.O. Box 402 Elkhorn, MB 845-2061	ROM ONO
OGDA	O'Greysik, Dale Andrew General Delivery Elkhorn, MB 845-2573	ROM ONO	PEAE	Penner, Archie & Elvira P.O. Box 71 Kola, MB	ROM 1B0	ROTU	Rowan, Thelma Minnie General Delivery Elkhorn, MB	ROM ONO

RMWA	R.M. of Wallace P.O. Box 310 Virden, MB 748-1239	ROM 2C0	SHRM	Shepherd, Rosella Mary P.O. Box 411 Virden, MB 748-2607	ROM 2C0	TOGL	Tundra Oil and Gas Ltd. 1111 One Lombard Place Winnipeg, MB 934-5850	R3B 0X4
RODA	Rowan, Darwin Lorne General Delivery Elkhorn, MB 845-2389	ROM ONO	SHRO	Shepherd, Rodney Stuart P.O. Box 126 Elkhorn, MB 845-2069	ROM ONO	TWDD	Twigg, Darryl & Donald P.O. Box 248 Elkhorn, MB 845-2306	ROM ONO
ROED	Rowand, Edith Sharon General Delivery Kola, MB 556-2644	ROM 1B0	SOFL	Southern, Florence Mabel Kelowna, BC		TWDL	Twigg, Darryl Lloyd P.O. Box 248 Elkhorn, MB 845-2306	ROM ONO
ROKE	Rowan, Kenneth Lyle General Delivery Elkhorn, MB 845-2345	ROM ONO	SSBC	Soldier Settlement Board of Canada - - -		UOFM	University of Manitoba Room 202, Administration Building Winnipeg, MB	R3T 2N2
ROLA	Rouse, Lawrence Garth 5023 - 198B Street Langley, BC (604) 530-6580	V3A 7L9	STDR	Stephen, Doris Ruth 360 Evergreen Street Sherwood Park, AB	T8A 1J8	WAIL	Wasy Investments Ltd. 1598 Sixth Avenue Prince George, BC	V2L 5G7
ROWI	Rowan, William Ralph P.O. Box 223 Elkhorn, MB 845-2323	ROM ONO	STNO	Stewart, William Norman P.O. Box 307 Maryfield, SK	SOG 3K0	WAJO	Watson, John Edwin 158 Leslie Street Sault Ste. Marie, ON (705) 256-5835	P6B 5C7
SHCL	Shepherd, Clifford Dale 101 Prairie Crescent Brandon, MB 729-8884	R7B 3S9	STRC	Streeter, Rose Catherine 14923 NE Graham Portland, OREGON	U.S.A	WARO	Watson, Robin P.O. Box 245 Roblin, MB 937-2426	ROL 1P0
SHFR	Shepherd, Francis Malcolm P.O. Box 58 Elkhorn, MB 845-2051	ROM ONO	TAJA	Taylor, James Austin 7 Forest Boulevard Brandon, MB 728-6872	R7B 2N4	WATE	Watson, Thomas & Evelyn P.O. Box 1405 Virden, MB 748-3012	ROM 2C0
SHJM	Shepherd, Joyce Marlene c/o 101 Prairie Crescent Brandon, MB N/A	R7B 3S9	TAMU	Taylor, Murray Archibald P.O. Box 262 Maryfield, SK (306) 646-2201	SOG 3K0	WATH	Watson, Thomas Reginald P.O. Box 1405 Virden, MB 748-3012	ROM 2C0
SHMU	Shepherd, Murray Dwight P.O. Box 693 Virden, MB 748-1028	ROM 2C0	THKA	Thomson, Kathleen Mary P.O. Box 218 Elkhorn, MB 845-2147	ROM ONO	WIBA	Widger, Barbara J. P.O. Box 68 Elkhorn, MB 845-2311	ROM ONO

WIDO	Widger, Donald C. P.O. Box 68 Elkhorn, MB 845-2311	ROM ONO
WODJ	Wood, David John P.O. Box 87 Crossfield, AB	TOM OSO
WODO	Wood, Douglas Harold P.O. Box 99 Kelwood, MB 967-2384	ROJ OYO
WOHL	Woodbrand Holdings Ltd. General Delivery Hargrave, MB	ROM OWO

APPENDIX C

PORE VOLUME AND WELLS INCLUDED IN SIMULATION AREA

1

2

3

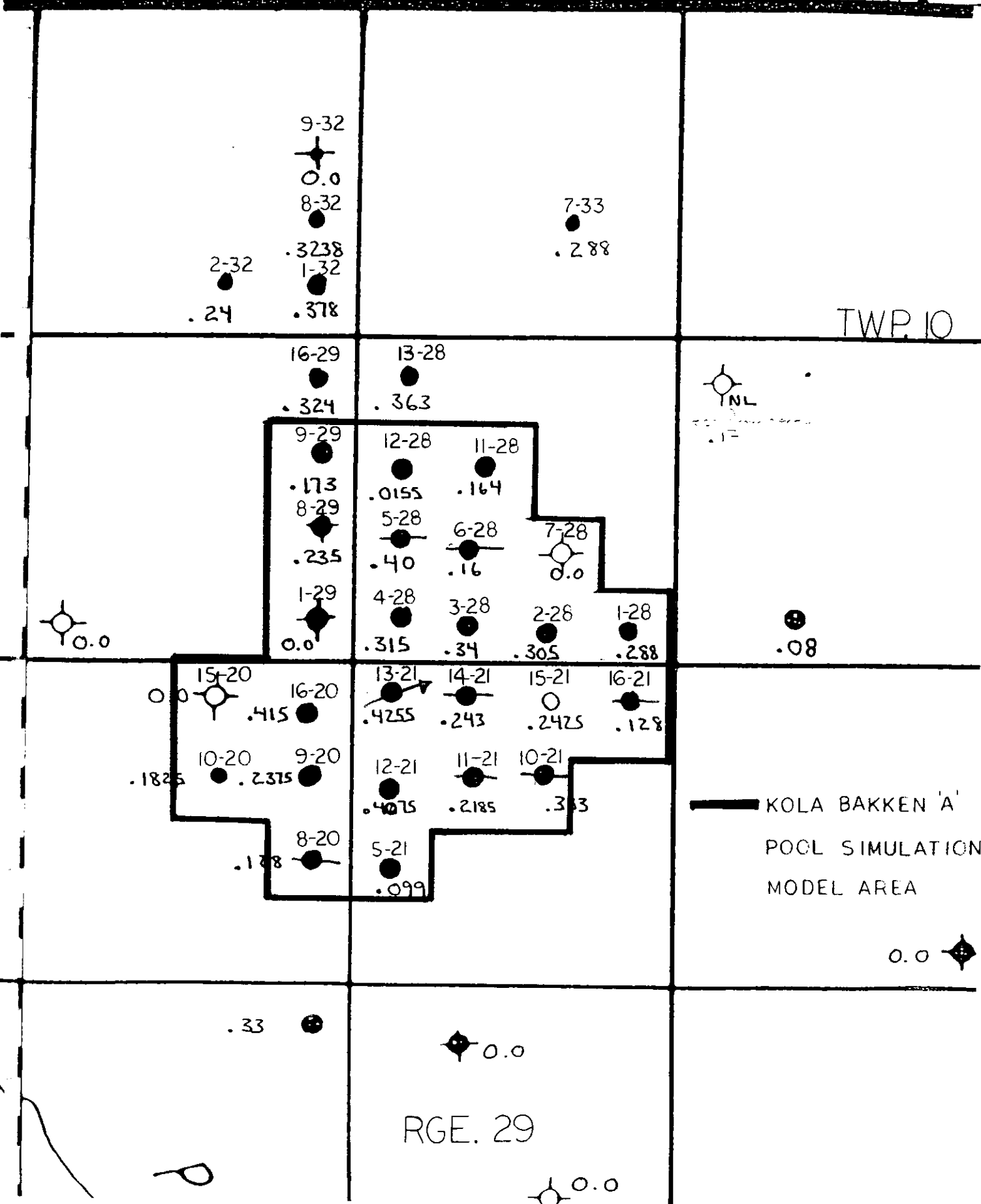
7/4
Duras cutoff 15%
(porosity - metres)
10 h cutoff

KOLA BAKKEN 'A' POOL

WELLS IN MODEL

SIMULATION AREA

TWP. 11



APPENDIX D

BAKKEN 'A' POOL 1993 DST'S

TUNDRA et al DALY 15-21-10-29 w1

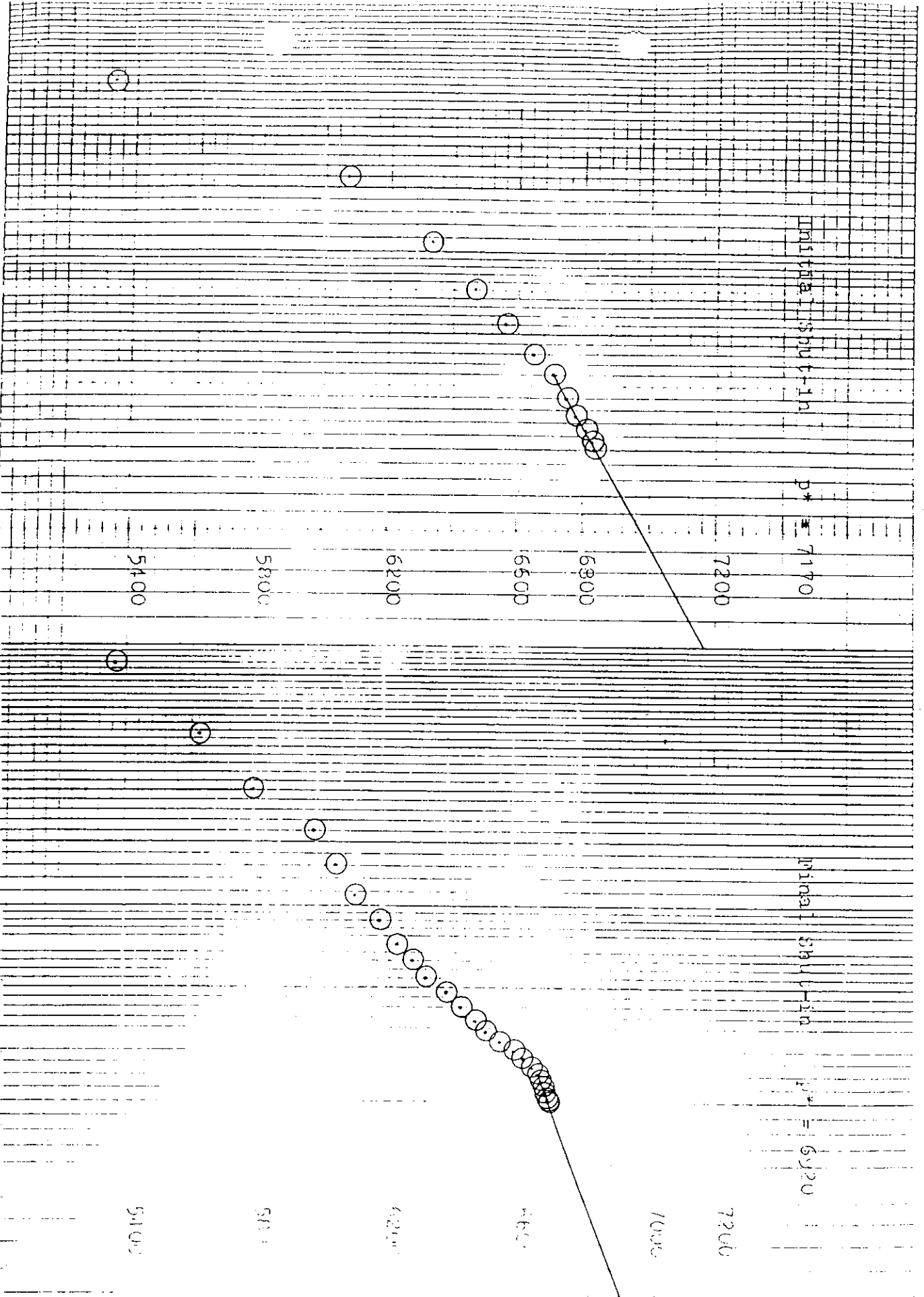
D.S.T.# 1

Feb. 13/93

Initial Shut-in $p^* = 6310$

Final Shut-in $p^* = 6195$





TUNDRA ET AL DAILY

1-32-10-29 w1

D.S.T. # 1

Oct. 3/93

INITIAL SHUT-IN

$p^* = 7615$ kPa

slope = 439

points used - 6

FINAL SHUT-IN

$p^* = 7420$ kPa

slope = 363

points used - 8

6600

6800

7000

7200

7400

7600

6600

6800

7000

7200

7400

7600

Pressure - kPa

PUNDRA DALY 7-33-10-29 w1

D.S.T. # 2

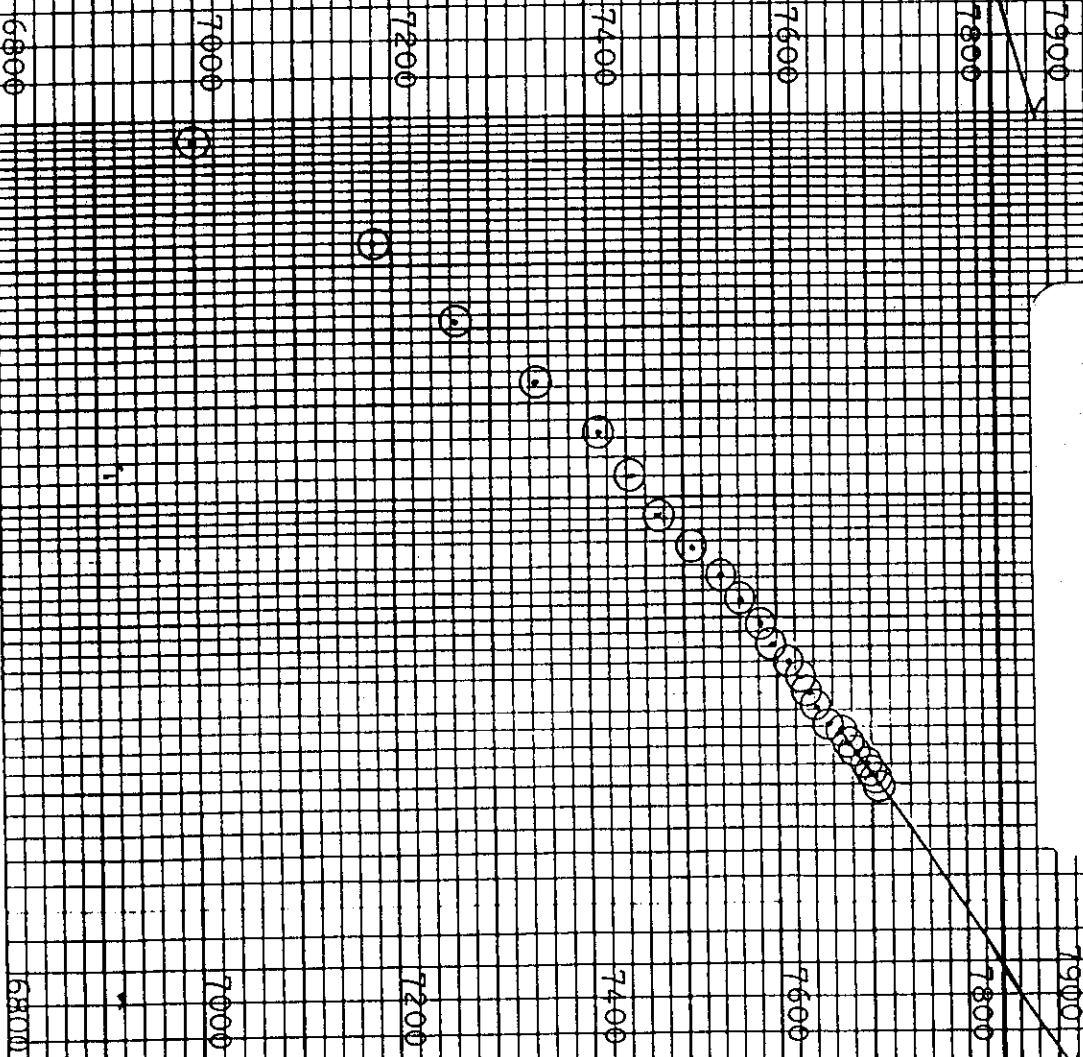
Dec. 18/93

INITIAL SHUT-IN

$p^* = 7885$ kPa
slope = 307 kPa/cycle

FINAL SHUT-IN

$p^* = 7915$ kPa
slope = 690 kPa/cycle

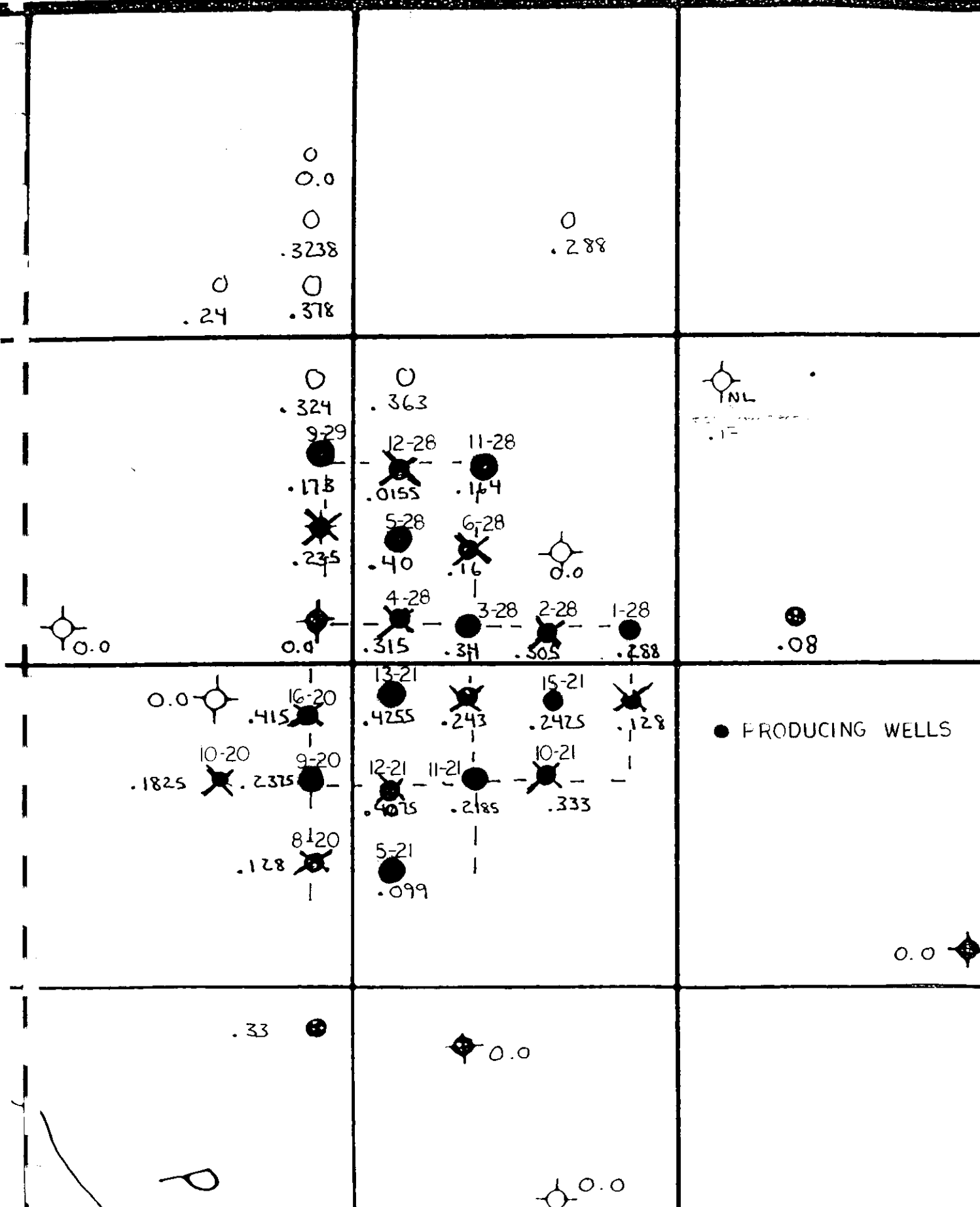


APPENDIX E

WELLS INCLUDED IN 32 HECTARE SPACING EVALUATION CASES

CASE: 32 ha SPACING

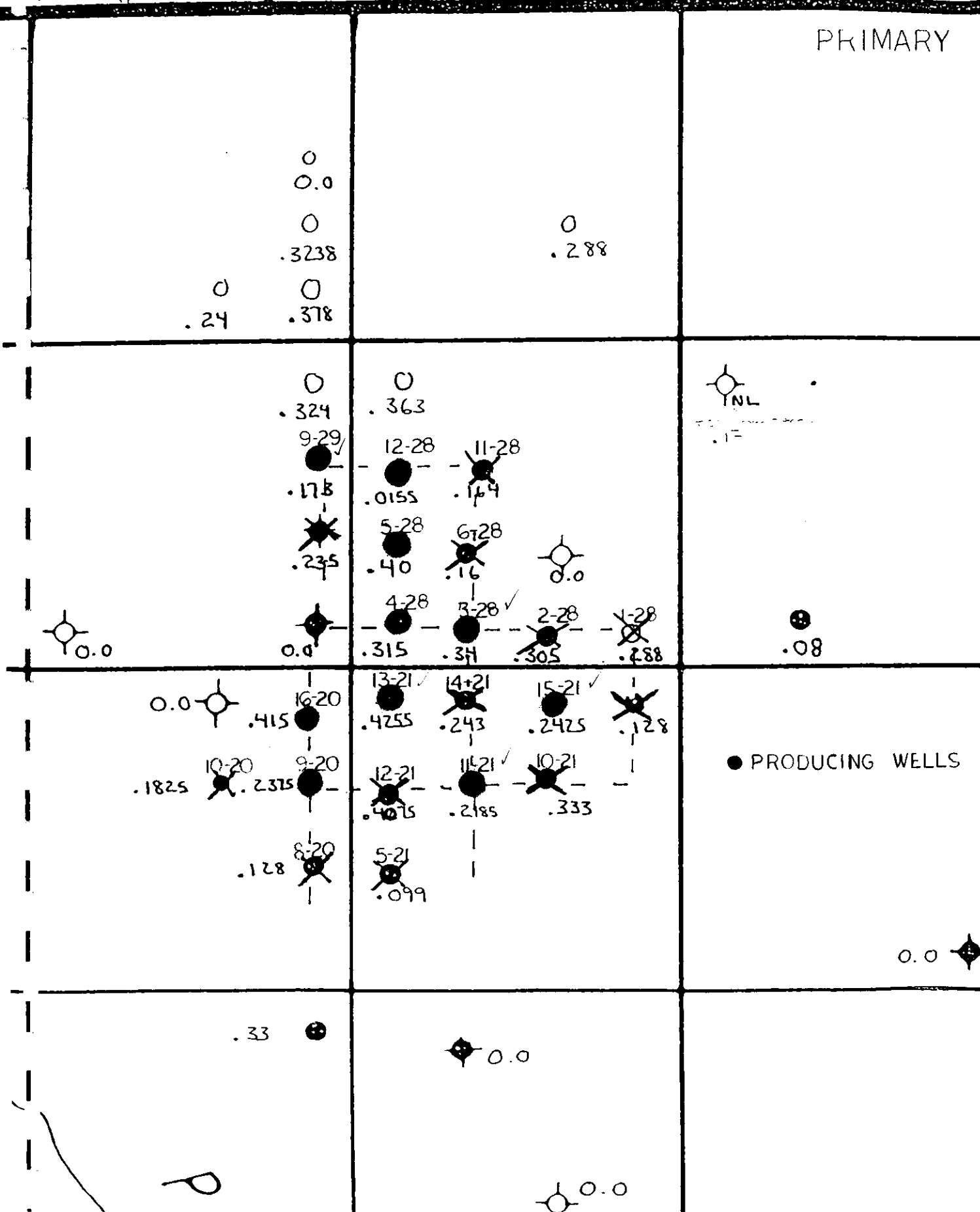
80 ACRE PRIMARY



CASE: 32-H

HIGHGRADED 80 ACRES

PRIMARY



APPENDIX F

KOLA BAKKEN 'A' POOL SINGLE WELL ECONOMICS 16 AND 32 HECTARE SPACING

----- CASE DESCRIPTION -----
KOLA BAKKEN 'A' POOL MODEL AREA
ECONOMICS FOR TYPICAL WELL ON 16 HECTARE SPACING
PRIMARY RECOVERY

----- NET PRESENT VALUES (M\$) -----						
DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	221	190	184	178	174	168
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	1	-30	-36	-42	-46	-52

Royalty Regime: MANITOBA Gas Holiday: NO
Reserve type: PDP Oil Holiday: NO
Royalty Type: Crwn Eval/Prod Start: 94- 1/94- 1
Reversion Pt: Proj/Bcon Life: 15.1/ 6.0 yrs

A.T. OPER INC	194	166	160	155	151	145
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	-26	-54	-60	-65	-69	-75

----- ECONOMIC INDICATORS -----				----- PRODUCTS RECOVERY -----				----- COMPANY W.I. -----		
		B.TAX	A.TAX			GROSS	WI	ROY	NET	
ROR	- PCNT	0.3	0.0	OIL	STB	27757	27757	3810	23946	REVENUE
PAYOUT PERIOD	- EVAL	5.0	0.0	GAS-RAW	MSCF	0	0			FIELD CAP
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP
UNDISC PIR	- \$/\$	0.00	-0.12	ETHANE	STB	0	0	0	0	GATH CAP
12.0 PCT PIR	- \$/\$	-0.13	-0.25	PROPANE	STB	0	0	0	0	
15.0 PCT PIR	- \$/\$	-0.16	-0.27	BUTANE	STB	0	0	0	0	ORR-GAS
NPV @ 12.0	- \$/Bbl	-1.07	-1.95	CONDENS.	STB	0	0	0	0	ORR-OIL
NPV @ 15.0	- \$/Bbl	-1.30	-2.16	SULPHUR	LT	0	0	0	0	
				OTHER	STB	0	0	0	0	ROYALTY
										18.0
										0.0

----- WI CASH FLOW SUMMARY -----														
YEAR	-----OIL PRODUCTION--			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	-----AFTER TAX-----
	RATE	VOL.	PRICE	REV.	AMINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0% CUM
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000 -220000 -220000
1994	22	8037	18.00	144673	26040	18	38009	4.73	80624	10.03	0	80624	13508	67116 66452 -153548
1995	17	6201	18.90	117195	18751	16	39428	6.36	59016	9.52	0	59016	7138	51879 45584 -107965
1996	13	4784	19.84	94936	12729	13	41009	8.57	41198	8.61	0	41198	4539	36659 28585 -79379
1997	10	3691	20.84	76904	7805	10	42743	11.58	26357	7.14	0	26357	1733	24625 17040 -62339
1998	8	2847	21.88	62298	4878	8	44623	15.67	12797	4.49	0	12797	0	12797 7859 -54480
1999	6	2197	22.97	50465	3048	6	46647	21.23	770	0.35	0	770	0	770 420 -54061
SUBT		27757		546472	73252		252459		220761		220000	761	26917	-26155 -54061
REM.		0		0	0		0		-0		0	0	0	-0
TOTL		27757		546472	73252		252459		220761		220000	761	26917	-26155 -54061
12.0% DISC				439224	62242		186659		190323		220000	-29677	24384	-54061
% OF REV.				100	14		42		43		50	-7	6	-12

nt: KOLA BAKKEN 'A' POOL MODEL AREA

***** WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES *****

----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

[illegible]

----- CASE DESCRIPTION -----
KOLA BAKKEN 'A' POOL MODEL AREA
ECONOMICS FOR TYPICAL WELL ON 32 HECTARE SPACING
PRIMARY RECOVERY

----- NET PRESENT VALUES (M\$) -----						
DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	363	306	295	284	278	265
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	143	86	75	64	58	45

Royalty Regime: MANITOBA Gas Holiday: NO
Reserve type: PDP Oil Holiday: NO
Royalty Type: Crwn Eval/Prod Start: 94- 1/94- 1
Reversion Pt: Proj/Econ Life: 15.4/ 6.0 yrs

A.T. OPER INC	277	232	223	215	210	200
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	57	12	3	-5	-10	-20

----- ECONOMIC INDICATORS -----				----- PRODUCTS RECOVERY -----				----- COMPANY W.I. -----		
		B.TAX	A.TAX			GROSS	WI	ROY	NET	
ROR	- PCNT	43.5	16.1	OIL	STB	37438	37438	6078	31359	REVENUE
PAYOUT PERIOD	- EVAL	2.1	3.3	GAS-RAW	MSCF	0	0			FIELD CAP
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP
UNDISC PIR	- \$/\$	0.65	0.26	ETHANE	STB	0	0	0	0	GATH CAP
12.0 PCT PIR	- \$/\$	0.39	0.06	PROPANE	STB	0	0	0	0	
15.0 PCT PIR	- \$/\$	0.34	0.01	BUTANE	STB	0	0	0	0	ORR-GAS
NPV @ 12.0	- \$/Bbl	2.31	0.33	CONDENS.	STB	0	0	0	0	ORR-OIL
NPV @ 15.0	- \$/Bbl	2.00	0.09	SULPHUR	LT	0	0	0	0	
				OTHER	STB	0	0	0	0	ROYALTY
										19.9
										0.0

[----- WI CASH FLOW SUMMARY -----]																
YEAR	[----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[----AFTER TAX-----]		
	RATE	VOL.	PRICE	REV.	4MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM	
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$	
ZERO											220000	-220000	0	-220000	-220000	
1994	31	11163	18.00	200931	39964	20	38791	3.47	122176	10.94	0	122176	32580	89596	88709	
1995	23	8469	18.90	160068	29362	18	40023	4.73	90683	10.71	0	90683	21673	69010	60637	
1996	18	6426	19.84	127516	20793	16	41461	6.45	65262	10.16	0	65262	15584	49677	38737	
1997	13	4875	20.84	101583	13836	14	43085	8.84	44662	9.16	0	44662	10099	34562	23917	
1998	10	3699	21.88	80925	8231	10	44882	12.13	27812	7.52	0	27812	5224	22588	13872	
1999	8	2806	22.97	64467	4975	8	46842	16.69	12651	4.51	0	12651	924	11727	6391	
SUBT		37438		735490	117161		255084		363245		220000	143245	86084	57161	12263	
REM.		0		0	0		0		0		0	0	0	0	0	
TOTL		37438		735490	117161		255084		363245		220000	143245	86084	57161	12263	
12.0% DISC				594148	98922		188810		306416		220000	86416	74153	12263		
% OF REV.				100	17		32		52		37	15	12	2		

Report: peeprov

CROWN ROYALTIES AND MINERAL TAX

[----- OTHER ROYALTIES -----]

[illegible]

[----- CASE DESCRIPTION -----]
 KOLA BAKKEN 'A' POOL MODEL AREA
 ECONOMICS FOR TYPICAL WELL ON HIGH GRADED 32 HECTARE SPACING
 PRIMARY RECOVERY

[----- NET PRESENT VALUES (M\$) -----]							
DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0	
B.T. OPER INC	448	362	345	330	320	303	
B.T. CAP INV.	220	220	220	220	220	220	
B.T. CASH FLOW	228	142	125	110	100	83	
A.T. OPER INC	329	265	252	241	234	222	
A.T. CAP INV.	220	220	220	220	220	220	
A.T. CASH FLOW	109	45	32	21	14	2	

Royalty Regime: MANITOBA Gas Holiday: NO
 Reserve type: PDP Oil Holiday: NO
 Royalty Type: Crwm Eval/Prod Start: 94- 1/94- 1
 Reversion Pt: Proj/Bcon Life: 18.6/ 8.0 yrs

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]				[----- COMPANY W.I. -----]			
		B.TAX	A.TAX			GROSS	WI	ROY	NET		
OR	- PCNT	54.4	24.6	OIL	STB	46883	46883	7444	39439	REVENUE	100.0
AYOUT PERIOD	- EVAL	2.0	3.0	GAS-RAW	MSCP	0	0			FIELD CAP	100.0
				GAS-SALES	MSCP	0	0	0	0	PLANT CAP	
NDISC PIR	- \$/\$	1.04	0.49	ETHANE	STB	0	0	0	0	GATH CAP	
2.0 PCT PIR	- \$/\$	0.64	0.20	PROPANE	STB	0	0	0	0		
15.0 PCT PIR	- \$/\$	0.57	0.15	BUTANE	STB	0	0	0	0	ORR-GAS	
NPV @ 12.0	- \$/Bbl	3.02	0.95	CONDENS.	STB	0	0	0	0	ORR-OIL	
PV @ 15.0	- \$/Bbl	2.66	0.69	SULPHUR	LT	0	0	0	0		
				OTHER	STB	0	0	0	0	ROYALTY	20.0
											0.0

[----- WI CASH FLOW SUMMARY -----]														
YEAR	[-----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[-----AFTER TAX-----]
	RATE	VOL.	PRICE	REV.	AMINTAX	EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM
	Bbl/D	STB	\$/Bbl	\$	\$	\$	\$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$
ZERO										220000	-220000	0	-220000	-220000
1994	31	11419	18.00	205541	41105	20	38855	3.40	125581	11.00	0	125581	34143	91438
1995	25	9084	18.90	171683	32237	19	40184	4.42	99262	10.93	0	99262	25610	73651
1996	20	7226	19.84	143402	24725	17	41682	5.77	76996	10.66	0	76996	20970	56025
1997	16	5748	20.84	119780	18340	15	43338	7.54	58102	10.11	0	58102	16268	41833
1998	13	4573	21.88	100049	12891	13	45148	9.87	42010	9.19	0	42010	11708	30302
1999	10	3638	22.97	83568	8359	10	47107	12.95	28102	7.73	0	28102	7399	20703
2000	8	2894	24.12	69802	5554	8	49213	17.01	15035	5.20	0	15035	3394	11641
2001	6	2302	25.33	58304	3691	6	51465	22.36	3148	1.37	0	3148	0	3148
SUBT		46883		952128	146902		356992		448234		220000	228234	119493	108741
M.		0		0	0		0		-0		0	0	0	-0
TL		46883		952128	146902		356992		448234		220000	228234	119493	108741
12.0% DISC				714838	117737		235563		361538		220000	141538	96782	44756
OP REV.				100	16		33		51		31	20	14	6

Report: peeprory

CROWN ROYALTIES AND MINERAL TAX

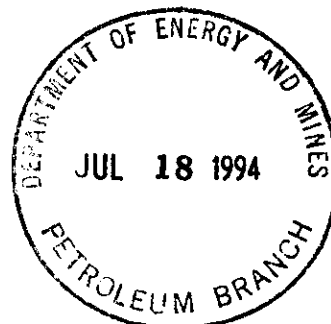
[----- OTHER ROYALTIES -----]

[illegible]

July 15, 1994

Manitoba Energy and Mines
Petroleum Branch
555 - 330 Graham Avenue
Winnipeg, Manitoba

Attention: **Mr. L.R. Dubreuil**
Director, Petroleum Branch



Dear Mr. Dubreuil,

RE: Kola Area TWP. 10-11, RGE. 29 W1M
32 Hectare Special Spacing Application
Bakken Oil Development

Please find attached two copies of the referenced 32 hectare special spacing application. A copy of the Kola Bakken 'A' Pool reservoir simulation study was previously submitted to the Petroleum Branch on July 12, 1994. The reservoir simulation study is a proprietary document, and as stated in our letter of 94.07.12, Tundra and our partner Corvair Oils Ltd. would appreciate that this study be returned to our offices after your review.

In discussions with your Mr. John Fox, P.Eng., Tundra has added the following information to the Kola 32 hectare special spacing application, in order for the Petroleum Branch to begin processing the application:

1. Signed copies of the application by both co-applicants.
2. Names and addresses of mines and mineral owners (refer to Appendix B).
3. Map outlining land area for which 32 hectare spacing is requested for Bakken oil development (refer to Appendix B).
4. Tundra's acceptance of the Petroleum Branch's request to exclude the current 16 hectare Kola Bakken oil development lands from the 32 hectare spacing development area (refer to Appendix B).
5. Tundra Oil and Gas Ltd., and Corvair Oils Ltd. will be the only two working interest owners currently involved in Bakken oil development in the 32 hectare special spacing application area. Corvair Oils Ltd. address is: 11030 - 127 Street, Edmonton, Alberta, T5M 3K7.

6. Tundra requests stand-up 32 hectare spacing, with the target area in the odd-numbered LSD's. This configuration has been selected, since this provides the best fit with the

1111 - One Lombard Place, Winnipeg, Manitoba R3B 0X4 Telephone: (204) 934-5850 Fax: (204) 934-5820

Tundra

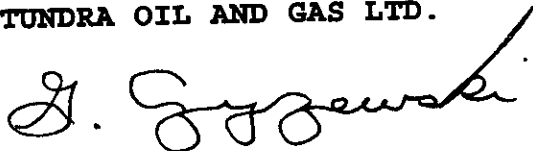
oil and gas ltd.

existing 16 hectare Bakken oil development in the application area. On this basis, the spacing unit for each well drilled, or to be drilled, for the purpose of obtaining oil from the Bakken formation, within the area outlined in Appendix B, is two legal subdivisions comprising the east half or the west half of a quarter section. The target area of each drilling spacing unit will be a square area in the odd numbered legal subdivision having sides one hundred metres from the sides of the legal subdivision and parallel to them. However, if new pool(s) are discovered in the 32 hectare spacing application, and the Geology dictates a different arrangement, Tundra would like the option of changing the target within the 32 hectare development area, without incurring production allowable penalties.

Should you have any questions during your review of the referenced application, please call me at 934-5853.

Yours truly,

TUNDRA OIL AND GAS LTD.



George Czyzewski, P.Eng.
Senior Reservoir Engineer

cc: R. Puchniak
R. Delbaere (Corvair Oils Ltd.)



June 4, 1997

Mr. George Czyzewski, P.Eng.
General Manager
Tundra Oil and Gas Ltd.
1111-One Lombard Place.
Winnipeg MB R3B 0X4

FILE: DALY
BAKKEN A POOL
32 ha SPACING

Dear George:

**Re: Spacing Order No. 11A - 32 ha
in the Daly Field and South Ki**

Spacing Order No. 11 was issued on Janu for the
Bakken Formation in a 9000 ha area in the g
area"). One of the primary purposes of the upon discovery of a
new Bakken pool, orderly development w and the place without the drilling of unnecessary
wells on 16 ha spacing. If reservoir performance indicated recovery could be increased on 16
ha spacing, the operator could apply for amendment of the order.

At the time the order was made Tundra and Corvair were the sole lessees in the spacing area.
Licences recently issued to Northrock Resources at 15-29-10-29 and 14-8-11-29 indicate this
is no longer the case. In order to permit all companies to optimize their exploration targets the
Branch has amended the order to allow new field wildcats (drilled more than 1.6 km from the
nearest well cased for production in the Bakken) to be completed without penalty in either the
even- or odd-numbered legal subdivision within the 32 ha spacing unit. The discovery well
for a Bakken pool in the spacing area will set the target area for future drilling in the pool.
Attached is amended Spacing Order No. 11A reflecting this change in target areas for new
field wildcat wells.

If you have any questions please contact the undersigned an 945-6574.

Yours truly,

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

cc. Corvair Oils - Rick Korol



June 4, 1997

Mr. Jeff R. Shaw
Northrock Resources Ltd.
Suite 3500, 700 Second Street SW
Calgary AB T2P 2W2

Dear Mr. Shaw:

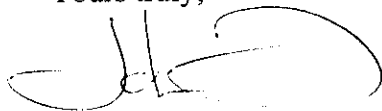
**Re: Spacing Order No. 11A - 32 ha Spacing for the Bakken Formation
in the Daly Field and South Kirkella Area**

Spacing Order No. 11 was issued on January 30, 1995 establishing 32 ha spacing units for the Bakken Formation in a 9000 ha area in the Daly Field and S. Kirkella area ("the spacing area"). One of the primary purposes of the spacing order was to ensure upon discovery of a new Bakken pool, orderly development would take place without the drilling of unnecessary wells on 16 ha spacing. If reservoir performance indicated recovery could be increased on 16 ha spacing, the operator could apply for amendment of the order.

At the time the order was made Tundra Oil and Gas Ltd. and Corvair Oils Ltd. were the sole lessees in the spacing area. Licences recently issued to Northrock at 15-29-10-29 and 14-8-11-29 indicate this is no longer the case. In order to permit all companies to optimize their exploration targets the Branch has amended the order to allow new field wildcats (drilled more than 1.6 km from the nearest well cased for production in the Bakken) to be completed without penalty in either the even- or odd-numbered legal subdivision within the 32 ha spacing unit. The discovery well for a Bakken pool in the spacing area will set the target area for future drilling in the pool. Attached is amended Spacing Order No. 11A reflecting this change in target areas for new field wildcat wells.

If you have any questions please contact the undersigned at 945-6574.

Yours truly,

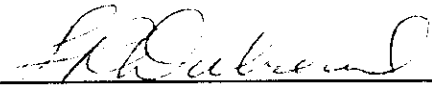


John N. Fox, P.Eng.
Chief Petroleum Engineer

**MINISTERIAL ORDER
SPACING ORDER NO. 11A**

1. The spacing unit for each well drilled, or to be drilled, for the purpose of obtaining oil for the Bakken formation within the area of application outlined on Schedule A is two legal subdivisions comprising the east half or west half of a quarter section.
2. Except as provided in Clause 4, the target area of each spacing unit shall be a square in the odd-numbered legal subdivision with sides 100 m from, and parallel to, the sides of the legal subdivision.
3. Subject to Section 16 of the Drilling and Production Regulation, where a well is completed outside the target area, the maximum production rate of the well will be reduced by application of an off-target penalty determined as shown on Schedule B.
4. The target area for an exploratory well drilled more than 1.6 km from the nearest well that has been cased for production in the Bakken Formation, shall be a square in either the even- or odd-numbered legal subdivision with sides 100 m from, and parallel to, the sides of the legal subdivision and shall set the target area for other wells drilled in the pool with Schedule B being modified accordingly.
5. The area outlined in Schedule A may be modified by the Director of Petroleum from time to time to meet changing conditions.
6. This order expires February 1, 2000 unless rescinded or extended prior to this date.

JUNE 4, 1997
Date



Director of Petroleum for
Minister of Energy and Mines

SPACING ORDER NO.11A SCHEDULE A

DALY FIELD AND SOUTH KIRKELLA AREA
32 ha Spacing Units

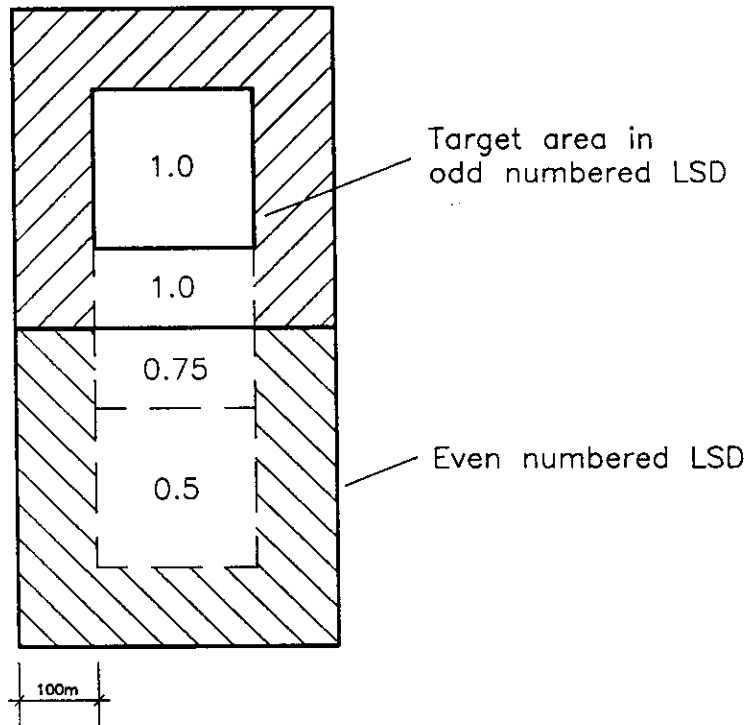
Rge 29 WPM					Rge 28 WPM	
Twp 11	18				13	18
	6				1	6
Twp 10	31				36	
	19				24	

SPACING ORDER NO. 11A

SCHEDULE B

OFF-TARGET PENALTY FACTOR (PF_{OT}) 32 ha SPACING

32 ha Spacing Unit

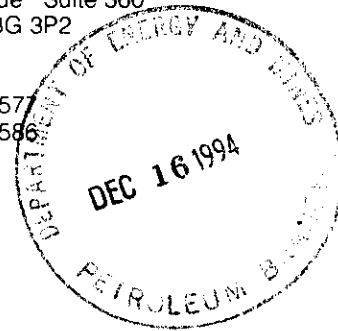


$\left[\begin{matrix} 0.5 \\ 0.5 \end{matrix} \right]$ Off-target
penalty factor PF_{OT}

$$\left[\begin{matrix} 0.5 \\ 0.5 \end{matrix} \right] PF_{OT} = 0.5 \frac{AB}{10000}$$

$$\left[\begin{matrix} 0.5 \\ 0.5 \end{matrix} \right] PF_{OT} = 0.25 \frac{AB}{10000}$$

A and B are the minimum distances in metres within the pool to the nearest boundaries of the legal subdivision



December 5, 1994

Mr. and Mrs. Watson
Box 1405
Virden MB R0M 2C0

Dear Mr. and Mrs. Watson:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

If you are satisfied with the information received from the Branch and the proposed temporary approval of the application, please indicate your agreement by signing in the space provided below and returning the duplicate copy of this letter to the undersigned. If you have any additional questions in respect of this matter please contact the undersigned or John Fox, Chief Petroleum Engineer at (204) 945-6573 and 945-6574, respectively.

Yours truly,

L.R. Dubreuil
Director of Petroleum

Thomas Evelyn Watson hereby withdraw my objection to the application.

Thomas R. Watson Evelyn C. Watson
Thomas Watson & Evelyn Watson

Dec 15/94
Date

cc: Tundra Oil and Gas Ltd.

ENVOYÉ
PAR
TELETYPE

L.R. Dubreuil

Director of Petroleum

Manitoba Energy & Mines

FROM
DE

Hope J. Kitzler

P.O. Box 55

Snow Lake, Manitoba

SUBJECT
SUJET

Letter of Dec.5/94 re: Tundra Oil & Gas

REF.
RÉF.

DATE

December 9/94

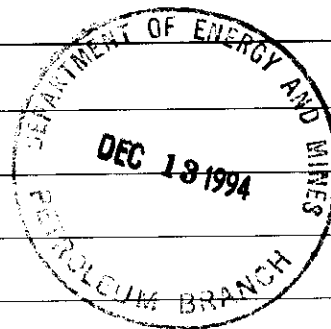
MESSAGE

I have signed the duplicate copy of the letter you forwarded but you will notice that I have corrected the spelling of my last name and initialled. Should you require another document without corrections it can be faxed to 204-358-2320.

Hope J. Kitzler

REPLY FROM
RÉPONSE DE

DATE



FORM NO. 234-0057



December 5, 1994

Ms. Hope J. ^{KITZLER}~~Kittler~~ ^{HJK}
Box 55
Snow Lake MB R0B 1M0

Dear Ms. Kittler:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

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Yours truly,

L.R. Dubreuil
Director of Petroleum

I, Hope J. Kitzler hereby withdraw my objection to the application.

Hope J. Kitzler
Hope J. Kittler
^{KITZLER HJK}

Dec. 9/94
Date

cc: Tundra Oil and Gas Ltd.



December 5, 1994

Mr. Sid Kucheravy
23 Leeds Avenue
Winnipeg, MB R3T 3X1

Dear Mr. Kucheravy:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

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Yours truly,

L.R. Dubreuil
Director of Petroleum

I, _____ hereby withdraw my objection to the application.

Sid Kucheravy

Date

cc: Tundra Oil and Gas Ltd.



December 5, 1994

Ms. Cindy C. Fordyce
18 Glenacres Cr.
Winnipeg MB R3T 5P9

Dear Ms. Fordyce:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

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Yours truly,

L.R. Dubreuil
Director of Petroleum

I, _____ hereby withdraw my objection to the application.

Cindy C. Fordyce

Date

cc: Tundra Oil and Gas Ltd.



December 5, 1994

Ms. Hope J. Kittler
Box 55
Snow Lake MB R0B 1M0

Dear Ms. Kittler:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

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Yours truly,

L.R. Dubreuil
Director of Petroleum

I, _____ hereby withdraw my objection to the application.

Hope J. Kittler

Date

cc: Tundra Oil and Gas Ltd.



Energy and Mines

Petroleum

1395 Ellice Avenue Suite 360
Winnipeg MB R3G 3P2
CANADA

PH: (204) 945-6577
Fax: (204) 945-0586

December 5, 1994

Mr. and Mrs. Watson
Box 1405
Virden MB R0M 2C0

Dear Mr. and Mrs. Watson:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

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Yours truly,

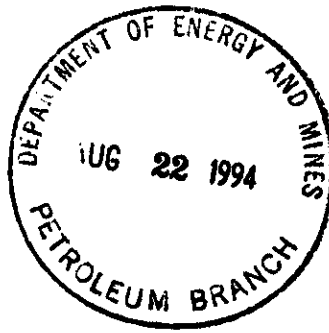
L.R. Dubreuil
Director of Petroleum

I, _____ hereby withdraw my objection to the application.

Thomas Watson & Evelyn Watson

Date

cc: Tundra Oil and Gas Ltd.



Box 1405
Virden, Man
R0M2C0
August 17, 1994

Manitoba Energy & Mines Pet
555-330 Graham Avenue
Winnipeg, Manitoba
R3C 4E3

ATT: L. R. Dubreuil

Dear Sir:

Re: Oil & Gas Act.

I am replying to your letter as of
July 27, 1994 that I am opposed to the
oil and gas company increasing the size
from 16 hectares to 32 hectares.

- Homestead

SW 14 of Sec 22-10-29
mineral & surface
rights.

Thank you
Sincerely
Thomas Watson
Evelyn Watson.
(POWER OF ATTORNEY)

748-3012

FAX 945-0586

TO: MANITOBA ENERGY & MINES
555-330 GRAHAM AVE.
WINNIPEG, MB.

ATT: L.R. DUBREUIL
PETROLEUM.

FROM: SID KUCHERAVY
WINNIPEG, MB.

NUMBER OF PAGES 4 (INCLUDING THIS PAGE)

I FORWARD CORRESPONDENCE FROM MYSELF,
CINDY FORDYCE AND HOPE KETZLER
RELATING TO TUNDRA OILS APPLICATION
TO INCREASE DRILLING SPACE TO
80 ACRES.

IF YOU DO NOT RECEIVE ALL FOUR
PAGES, CALL ME AT 261-0404
A.S.A.P.

Sid Kuchera

August 17, 1994

Manitoba Energy Mines
Petroleum
S.S. - 330 Graham Avenue
Winnipeg, Man
R3C 4E3

Attention: L.R. Dubreuil
Director of Petroleum

With reference to Tundra Oil & Gas Ltd application
under section 103 of the Oil and Gas Act, I
object to the increase in drilling space to 32
hectares (80 acres) from the present 16 hectares
(40 acres) due to personal interests in TWP 10,
Range 29 WPM, SW 1/4, Sec 34.

Cindy C. Fordyce
18 Glenacres Cres.
Winnipeg, Man.
R3T 5G9
261-4990.

similar concerns

Aug 17, 1994

Manitoba Energy & Mines

Petroleum

555-330 Graham Ave.

Winnipeg, Man.

R3C-4E3

Attn: L. R. Dubreuil

Director of Petroleum

In reference to Tundra Oil & Gas Ltd.
application under section 102 of the
Oil & Gas Act, I object to the
increase in drill spacing size
to 32 hectares (80 acres) due to
personal concerns & interests
in TWP 10, Range 29WPM; 5W14 Sec 34

Hope J. Kitzler

Hope J. KITZLER

Box 55

SNOW LAKE, MAN.

R0B-1M10

204-358-2550

* ATTENDED TUNDRA'S PRESENTATION

② CONVENTION

- concern loss of revenue

FAX #(204) 945-0586

AUGUST 17, 1994

MANITOBA ENERGY & MINES
555- 330 GRAHAM AVENUE
WINNIPEG, MANITOBA
R3C 4E3

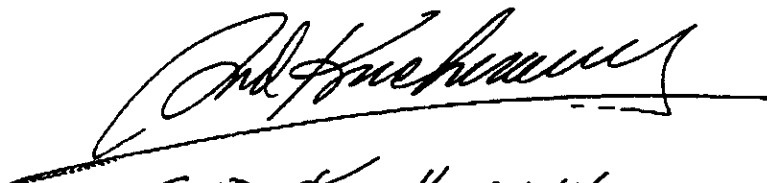
ATT: L.R. DUBREUIL
DIRECTOR OF PETROLEUM

RE: NOTICE DATED JULY 27TH, 1994 UNDER THE OIL AND GAS
ACT DALY FIELD AND SOUTH KIRKELLA AREA.

I REFER TO TUNDRA OIL & GAS LTD APPLICATION
UNDER SECTION 102 OF THE OIL AND GAS ACT,

I OBJECT TO THE INCREASE IN DRILLING
SPACE SIZE TO 32 HECTARES (80 ACRES)

FROM THE PRESENT 16 HECTARES (40 ACRES) DUE
TO PERSONAL INTERESTS IN TWP 10, RANGE 29 WPM,
SW $\frac{1}{4}$, SEC. 34.



SID KUCHERA
23 LEEDS AVENUE,
WINNIPEG, MB.
R3T 3X1
HOME PHONE 261-0404
BUS. PHONE 453-9622

- immediate area
16 ha spacing
- potential for drainage
- no receive fair share
of revenue
- income delayed

JOHN SEC. 20-10-29
- NO LONGER
RECEIVING REVENUE
CALL MRS. COTTON
IN BRANDON @
728-1890

SHE WOULD LIKE AN
EXPLANATION ON THE
NOTICE UNDER THE OIL &
GAS ACT DALY OIL FIELD
& SOUTH KIRKELLA
AREA.

John

Gerald

556-2672

Re: Notice.

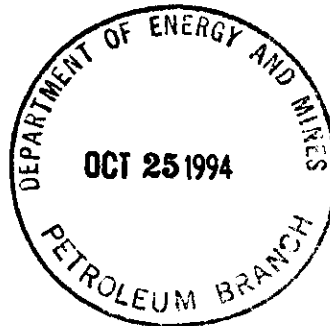
has a few questions

SEC 6-11-28

~~2~~ SEC 1-11-29

October 25, 1994

Manitoba Energy and Mines
Petroleum Branch
1395 Ellice Avenue Suite 360
Winnipeg, Manitoba
R3G 0G3



Attention: **Mr. L.R. Dubreuil**
Director of Petroleum

Dear Mr. Dubreuil,

RE: North Kola 32 Hectare Spacing Application

In reply to your letter dated 94.09.22, Tundra Oil and Gas Ltd. and Corvair Oils Ltd. have reviewed the technical and economic questions raised by the Petroleum Branch pertaining to the referenced matter. Both Tundra and Corvair are fully committed in pursuing 32 hectare development of the Bakken oil formation in the North Kola area. To that end, we offer our position on the outstanding information that is required to complete processing and approval of the application. The technical and economic questions are addressed as follows.

A. Technical Questions (Reservoir Simulation Study and Development Strategy)

Question No.1:

In order to achieve a history-match a regional aquifer was added to the model to provide additional pressure support, is there any evidence of an oil-water contact in the Bakken in wells located downdip of the A Pool?

Tundra/Corvair Position

At this time there is no conclusive evidence that there is an oil/water contact downdip based on the existing wells. However, it is Tundra's geological opinion as stated in the application that in the structural low to the north in the pool, an oil/water interface quite likely exists. Further delineation drilling will be required in the 32 hectare spacing area to confirm this. The fluid expansion pressure support system used in the model was augmented with a limited acting aquifer system. As stated in the application, a fluid expansion drive system (oil pushing oil) resulted in

not being able to calibrate the model without substantially altering the reservoir parameters. Although the selection of a limited acting aquifer as supplementing the reservoir drive system is not rigorous, there is no evidence at this time that this situation does not exist.

To further support our position, the Kola Bakken "A" Pool production profile indicates that there is more than one reservoir drive mechanism impacting on oil recovery. From the period 1986 to early 1989, the Kola Bakken "A" Pool indicated fluid expansion behaviour (rapid exponential decline after initial production). During the period from 1989 to 1992, there was a flattening of the production decline (not attributable to workovers), which suggests a supplementary reservoir drive mechanism is supporting fluid expansion. Based on our interpretation, the flattening of the Kola Bakken "A" Pool production decline during the period 1989 to 1992 is primarily attributable to partial aquifer support. If production performance in the Kola Bakken "A" Pool was solely impacted by fluid expansion, there would not have been any arresting of the production decline.

Question No.2:

What is Tundra's explanation for the apparent contradiction between the waterflood performance predicted by the simulation and the actual waterflood performance in the "A" and "D" Pools?

Tundra/Corvair Postion

First of all, although there has been waterflood response in the "A" Pool, at this time it is difficult to evaluate whether this response is incremental oil recovery or rate acceleration. More production history will be required to confirm the actual benefit of the existing waterflood in the Kola Unit No.1. To-date, only a response in wells 16-20, 3-28, and 4-28 has been observed. The simulation model predicted that the Kola "A" Pool will respond to waterflooding, but the end result will be rate acceleration. As stated earlier, more production history will be required to evaluate which scenario is correct. A previous analysis by Intera Technologies for Newscope Resources suggested that the Kola Bakken "A" Pool could not be economically waterflooded due to the high number of injectors that would be required, as a result of high injection pressures. Based on the current high injection pressures at injection well 13-21-10-29, the Intera assessment may be correct. The high injection pressures are attributable to a combination of low mobility ratios in the Bakken formation, and possible fines migration.

In our opinion, a direct comparison between the Bakken "D" Pool and the Bakken "A" Pool cannot be made, since there are lithology differences, which would also result in performance differences. On a broader scale, there are lithology differences between all four (Bakken "A", "B", "D", and "I" Pools) Bakken Pools in Manitoba. This suggests that each Bakken Pool will quite likely have a different permeability - porosity crossplot with different porosity cutoffs in estimating effective reservoir pay. All of these factors will impact on waterflood recovery.

The Bakken "D" Pool currently has 3 to 4 years of production history, which allows for an assessment of incremental recovery with waterflooding. The Bakken "A" formation in the Kola Unit No.1 has been on waterflood for 1 year with one injector, and on this basis, no reliable correlations can be made between the two Bakken Pools. Although there has been incremental oil recovery with waterflooding in the Bakken "D" Pool, it is difficult to assess this based on a review of the total pool production. Individual well analysis is required to establish which wells have indicated incremental oil recovery with waterflooding. There have been workovers, development drilling, and fracture/acid stimulations concurrent with waterflooding in both North Ebor Units No.1 and No.2., which makes the assessment of the waterflood contribution difficult. In our opinion, incremental oil recovery from waterflooding the Bakken "D" Pool is estimated at 8 - 10% of the oil-in-place (best case). On the other hand, a third party assessment (Coles Gilbert) of the Bakken "D" Pools in 1993 suggested that there was minimal waterflood response in the Bakken "D" Pool.

Question No.3:

Does Tundra anticipate implementing a waterflood in the area of application, if a pool similar to the "A" Pool is discovered? Are there any potential geological, technical, or economic barriers to waterflooding the Bakken in the area of application?

Tundra/Corvair Position

Based on our geological assessment, the 32 hectare application area contains an extension of the Kola Bakken 'A' Pool which has not yet been fully delineated. The application lands have exploratory potential for similar pools. Yes, Tundra as the operator does expect to implement a waterflood in the 32 hectare spacing area at a later date after production and reservoir pressure declines. We envision an inverted 5-spot waterflood pattern in the 32

hectare spacing area. At this time, based on the 32 hectare drilling already implemented in Section 33-10-29, we do not envision any potential geological or technical barriers that would impact waterflooding the Bakken formation in the North Kola 32 hectare spacing area.

WF on
16 ha?

Question No.4

The simulation indicates horizontal drilling will significantly increase recovery in the Bakken "A" Pool. Does Tundra plan to drill a horizontal well in the "A" Pool? If Tundra plans on drilling horizontal wells in the area of application, how will the horizontal wells be oriented under 32 hectare spacing?

Tundra/Corvair Position

Tundra investigated horizontal drilling in the simulation study to determine what the potential recovery would be with the application of this type of technology. Although the potential recovery predicted by the model is attractive with horizontal drilling, virgin reservoir pressure conditions would be required to achieve the high recoveries predicted by the simulation model. Similarly, the simulation model does not address the mechanical feasibility of drilling a horizontal section in a reservoir with an average thickness of 1 metre. Based on our internal technical assessment, it would be very difficult to maintain the horizontal section in effective reservoir pay in this type of application. On this basis, our immediate plans do not call for any horizontal drilling in delineating the Bakken formation, unless reservoir pressures are encountered that indicate no depletion.

Question No.5

Provide an overview of Tundra's development strategy for the North Kola area. This should include the proposed use of 32 hectare spacing, horizontal drilling, waterflooding and infill drilling on 16 hectares.

Tundra/Corvair Position

Tundra's proposed 32 hectare spacing development is illustrated on Attachment No.1 and No.2 for primary recovery and waterflooding, respectively. The development outlined for Section 33 would be representative of the 32 hectare program proposed in the application area for both primary and secondary recovery. Since we do not plan to do any horizontal drilling in the immediate future, this case is

not included. Infill drilling on 16 hectare spacing has not been addressed since the historical production performance on 32 hectare spacing would have to be evaluated, before potential infill locations could be identified. In this type of scenario, horizontal drilling may be more attractive, and would be addressed as conditions dictate.

General Comments Pertaining to Reservoir Simulation Study

Tundra has reviewed the Crown's general observations and conclusions pertaining to the simulation study and offers the following commentary. The purpose of the reservoir simulation study was to investigate various reservoir management depletion strategies before actual implementation. Through this process, the objective was to identify the reservoir exploitation program that would maximize economic oil recovery, and provide the best return on investment. As with all state of the art computer generated predictions, the conclusions represent a "best guess" of what may ultimately occur. The accuracy of the predictions is primarily based on the quality of the reservoir data available to the operator. In the current case, there was a lack of pressure history between 1987 to 1992 (previous operators did not conduct annual pressure surveys). After investigating several alternatives to calibrate the model, the best fit in our opinion was to introduce a partial aquifer support to support historical reservoir performance. On the basis of the information available to Tundra, this approach was not considered to be unreasonable.

In terms of blanket 32 hectare development, Tundra recognizes that this approach may have to be augmented in the future with some selective 16 hectare locations within the 32 hectare spacing project area. However, at this time, the reservoir has to be delineated and primary production performance evaluated before any definitive 16 hectare locations are identified to maximize oil recovery.

As a clarification, two 32 hectare scenarios were evaluated with the simulation model. Case 3 represented the blanket 32 hectare development plan with a total of 10 wells. Case 4 represented a high graded 32 hectare development also with a total of 10 wells. Case 4 is considered by Tundra as a skewed 32 hectare development plan, and was designed to evaluate whether well location in the pool impacted on recovery. The simulation model indicated that the 32 hectare highgraded case provided an incremental 4% recovery of oil-in-place over blanket 32 hectare development. Our intent is to start off with blanket 32 hectare development. However, as stated earlier, if

future production performance warrants, there may be a limited number of infill locations drilled to maximize economic recovery.

B. Economic Questions

Question No.1

Tundra used an oil price of \$18/barrel escalated at 5%/year to run the economics. This price is representative of oil prices in the first quarter of 1994. During 1994 Bakken crude has averaged \$21.90/barrel and over the last 5 years has averaged \$23.65/barrel.

Tundra/Corvair Position

The arena of oil pricing is very volatile and dominated by foreign interests with Canadian producers having no control over the pricing of domestic crude oil. As a result, we have evaluated the 32 hectare spacing project under an oil pricing scenario that will allow Tundra and its partners to have the confidence that this is a viable project in a low oil price environment. This is especially important, since if 50 wells are drilled during the next 3 years at a projected total cost of 10 million dollars (not including facilities), acceptable project economics are required at lower oil prices. On this basis, our choice to use an \$18 CDN/barrel oil price (escalated at 5%/year) is appropriate to justify continuing with Bakken development in Manitoba.

Question No.2

The holiday volume provided by the Manitoba Drilling Incentive Program has not been included in the economics.

Tundra/Corvair Position

Tundra will include the following holiday oil volumes (HOV) for 16 and 32 hectare spacing based on oil prices of \$18 and \$22/barrel in the revised economics:

	<u>\$18/barrel</u>	<u>\$22/barrel</u>
a. 16 ha spacing	1759 m3	1433 m3
b. 32 ha spacing	1968 m3	1664 m3

Question No.3

The economic limit in the 16 ha drilling case is 0.95 m3/day in 1999. The Branch believes an economic limit of 0.5 m3/day is more representative of current operating conditions in Manitoba. Comment on the reason for the high economic limit.

Tundra/Corvair Position

The 16 hectare case reached its economic limit at the end of 1999. In the year 2000, revenues were less than operating costs, and as a result the PEEP case was terminated. The oil rate averaged 0.95 m3/day during 1999, and the economic limit of this case was determined by the expected fiscal parameters in 1999, rather than Tundra arbitrarily setting the limiting economic rate.

Revised Economic Cases

The following revisions have been made to the economics presented in our application as requested in your letter dated 94.09.22:

- a. Included holiday oil volumes for both 16 and 32 hectare evaluation cases.
- b. Oil price forecasts of \$18/barrel escalated at 5%/year, and a \$22/barrel price constant over the life of the well for each of the two spacing scenarios.
- c. The operating costs presented in our application are appropriate and no adjustments have been made to this fiscal parameter in the revised economics.
- d. Both Crown and freehold mineral cases have been evaluated.
- e. The economics cases are based on before and after tax scenarios. The after tax scenario is based on the condition that Tundra and Corvair are fully taxable.

The single well economic evaluation cases requested by the Petroleum Branch have been summarized as follows:

- a. **Table No.1:** Crown Royalties, Oil Price = \$18/STB, B.Tax
- b. **Table No.2:** Freehold Roy., Oil Price = \$18/STB, B.Tax
- c. **Table No.3:** Crown Roy., Oil Price = Flat \$22/STB, B.Tax

d. **Table No.4:** Freehold Roy., Oil Price = Flat \$22/STB, B. Tax.

e. **Table No.5:** Crown and Freehold Roy., Oil Price = \$18/STB, A.Tax.

f. **Table No.6:** Crown and Freehold Roy., Oil Price = Flat \$22/STB, A.Tax.

The PEEP economic evaluation scenarios are included in the following Appendices for your review:

- a. **Appendix A:** 16 hectare evaluation cases
- b. **Appendix B:** 32 hectare evaluation cases
- c. **Appendix C:** 32 hectare highgraded evaluation cases

Tundra/Corvair Commentary on Economics

The economic evaluation scenarios clearly indicate that 32 hectare Bakken development is very attractive from an economic standpoint, whereas, 16 hectare Bakken development is marginally economic. Even with the inclusion of oil holiday volumes, and improved oil pricing suggested by the Petroleum Branch, 32 hectare development is by far a better development scenario than 16 hectare spacing. In none of the eight 16 hectare development cases evaluated were the economic indicators acceptable to Tundra and Corvair. Crown lands only represent less than 14% of the total application area, and would not result in a material impact on the overall economics in the 32 hectare application area. From an operators standpoint, economics have to be viewed after tax. Likewise, all of the 16 hectare after tax cases are unattractive for industry to develop when compared to 32 hectare spacing after tax (refer to Tables No.5 and No.6). This additional assessment requested by your office supports our earlier position that industry can only economically develop the Bakken formation at this time in the application area under 32 hectare spacing.

Summary

As stated in your letter of 94.09.22, blanket Bakken development on 16 hectare spacing has resulted in poor project economics. In order for both Tundra and Corvair to continue Bakken development in the North Kola area at this time, 32 hectare spacing will be required to justify further

Tundra

oil and gas ltd.

capital investment. In the event that 32 hectare spacing does not meet future production performance and recovery requirements, we will review the merits of Bakken development using 16 hectare spacing at a later date.

We trust that the information contained in this letter will aid your department in continuing to process the North Kola 32 hectare spacing application, and recommending approval to the Minister. Should you have any further questions or find a meeting on this matter to be beneficial, please contact me at 934-5853.

Respectfully Submitted,

TUNDRA OIL AND GAS LTD.

G. Czyzewski
George Czyzewski, P.Eng.
Senior Reservoir Engineer

CORVAIR OILS LTD.

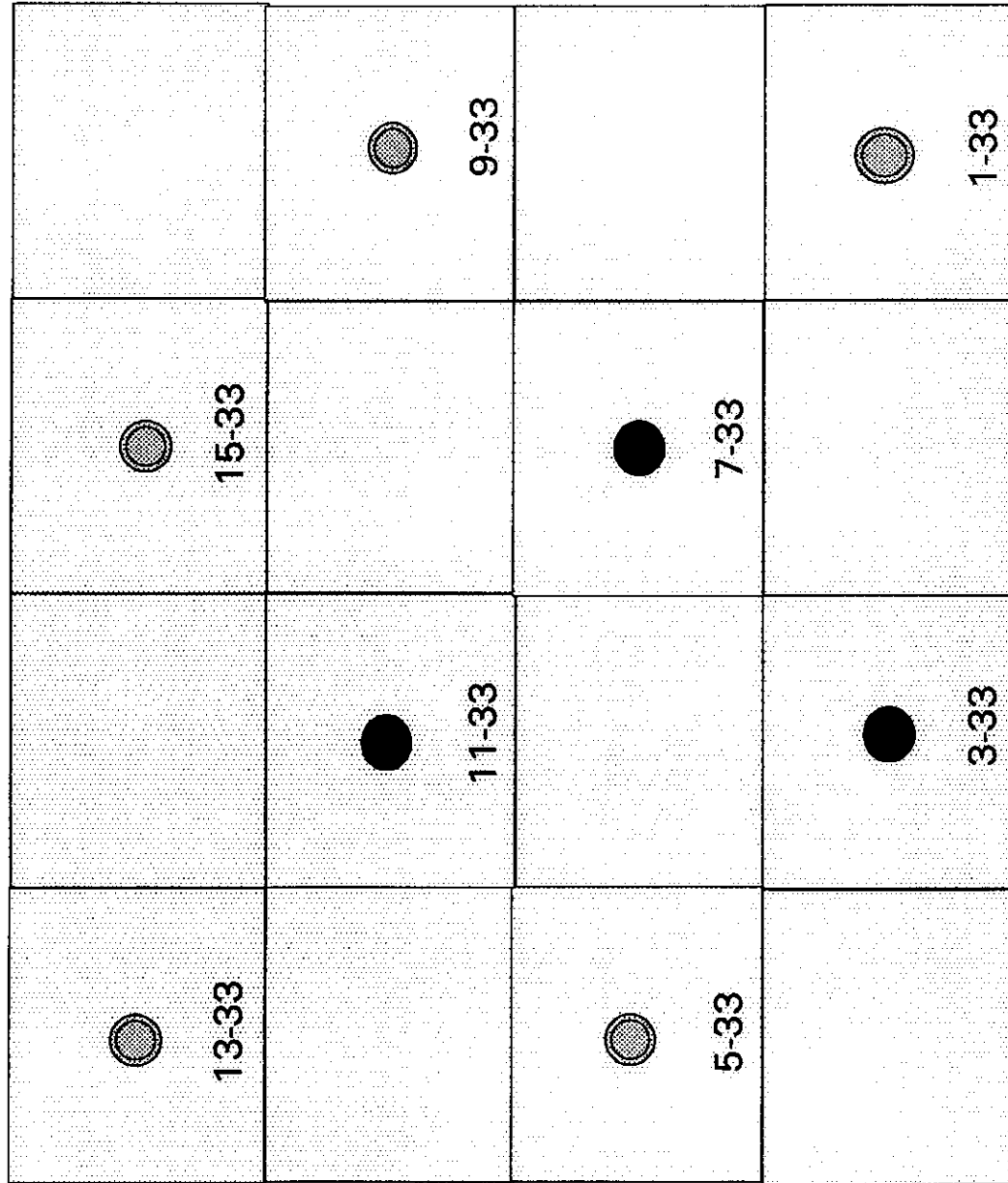
Roger Delbaere
R.A. Delbaere, P.Eng.
V.P. Engineering

cc: R. Puchniak
D. Barchyn

ATTACHMENT NO.1

SECTION 33-10-29

32 HECTARE DEVELOPMENT PLAN



● DRILLED DSU

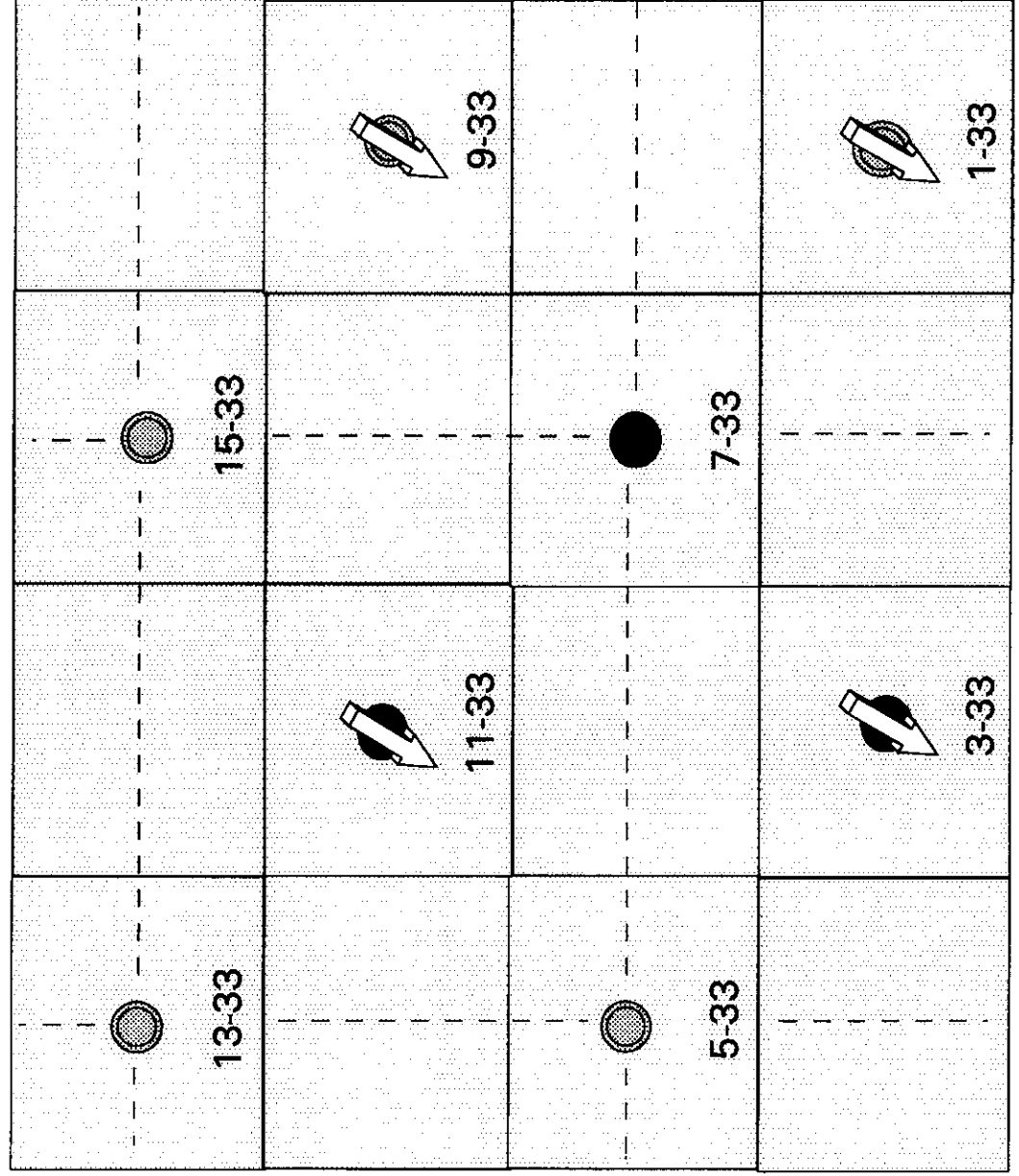
⊗ PROPOSED
LOCATION

PRIMARY RECOVERY WELL SPACING

ATTACHMENT NO.2

SECTION 33-10-29

32 HECTARE DEVELOPMENT PLAN



● DRILLED DSU

● PROPOSED
LOCATION

OR FUTURE INJECTOR



PROPOSED 5-SPOT WATERFLOOD PATTERN

TABLE NO.1
SINGLE WELL ECONOMICS (BEFORE TAX)
CROWN ROYALTIES / OIL PRICE = \$18/STB

Well Spacing (ha)	Cap. Inv. (M\$)	Reserve Recovery (STB)	Finding Costs (\$/STB)	NPV (B.Tax) (M\$)	Payout (B.Tax) (years)
16 ha	220 M\$	27,760 STB	7.92 (\$/STB)	4 M\$	3.2 years
32 ha	220 M\$	37,440 STB	5.88 (\$/STB)	130 M\$	1.6 years
32-H ha	220 M\$	46,880 STB	4.69 (\$/STB)	185 M\$	1.5 years

OIL PRICE = \$18/BARREL, ESCALATED AT 5%/YEAR
HOLIDAY OIL VOLUME INCLUDED
NPV BASED ON DISCOUNT FACTOR = 12%

TABLE NO.2
SINGLE WELL ECONOMICS (BEFORE TAX)
FREEHOLD ROYALTIES / OIL PRICE = \$18/STB

Well Spacing (ha)	Cap. Inv. (M\$)	Reserve Recovery (STB)	Finding Costs (\$/STB)	NPV (B.Tax) (M\$)	Payout (B.Tax) (years)
16 ha	220 M\$	25,560 STB	8.61 (\$/STB)	-43 M\$	-
32 ha	220 M\$	37,440 STB	5.88 (\$/STB)	70 M\$	2.1 years
32-H ha	220 M\$	44,560 STB	4.94 (\$/STB)	117 M\$	1.9 years

OIL PRICE = \$18/BARREL, ESCALATED AT 5%/YEAR
HOLIDAY OIL VOLUME INCLUDED
NPV BASED ON DISCOUNT FACTOR = 12%

TABLE NO.3
SINGLE WELL ECONOMICS (BEFORE TAX)
CROWN ROYALTIES / OIL PRICE = FLAT \$22/STB

Well Spacing (ha)	Cap. Inv. (M\$)	Reserve Recovery (STB)	Finding Costs (\$/STB)	NPV (B.Tax) (M\$)	Payout (B.Tax) (years)
16 ha	220 M\$	25,560 STB	8.61 (\$/STB)	55 M\$	2.1 years
32 ha	220 M\$	37,440 STB	5.88 (\$/STB)	197 M\$	1.1 years
32-H ha	220 M\$	44,580 STB	4.93 (\$/STB)	252 M\$	1.1 years

HOLIDAY OIL VOLUME INCLUDED
NPV BASED ON DISCOUNT FACTOR = 12%

TABLE NO.4
SINGLE WELL ECONOMICS (BEFORE TAX)
FREEHOLD ROYALTIES / OIL PRICE = FLAT \$22/STB

Well Spacing (ha)	Cap. Inv. (M\$)	Reserve Recovery (STB)	Finding Costs (\$/STB)	NPV (B.Tax) (M\$)	Payout (B.Tax) (years)
16 ha	220 M\$	25,560 STB	8.61 (\$/STB)	3 M\$	3.0 years
32 ha	220 M\$	37,440 STB	5.88 (\$/STB)	131 M\$	1.5 years
32-H ha	220 M\$	44,580 STB	4.93 (\$/STB)	179 M\$	1.4 years

HOLIDAY OIL VOLUME INCLUDED
 NPV BASED ON DISCOUNT FACTOR = 12%

TABLE NO.5
SINGLE WELL ECONOMICS (AFTER TAX)
CROWN AND FREEHOLD ROYALTIES / OIL PRICE = \$18/STB

Well Spacing (ha)	NPV (M\$) CROWN ROY.	PAYOUT (years) CROWN ROY.	NPV (M\$) FREEHOLD ROY.	PAYOUT (years) FREEHOLD ROY.
16 ha	-20 M\$	4.4 years	-47 M\$	-
32 ha	56 M\$	2.3 years	25 M\$	2.9 years
32-H ha	88 M\$	2.2 years	56 M\$	2.7 years

OIL PRICE = \$18/BARREL, ESCALATED AT 5%/YEAR
HOLIDAY OIL VOLUME INCLUDED
NPV BASED ON DISCOUNT FACTOR = 12%

TABLE NO.6
SINGLE WELL ECONOMICS (AFTER TAX)
CROWN AND FREEHOLD ROYALTIES / OIL PRICE = FLAT \$22/STB

Well Spacing (ha)	NPV (M\$) CROWN ROY.	PAYOUT (years) CROWN ROY.	NPV (M\$) FREEHOLD ROY.	PAYOUT (years) FREEHOLD ROY.
16 ha	10 M\$	3.0 years	-14 M\$	3.0 years
32 ha	95 M\$	1.8 years	62 M\$	2.2 years
32-H ha	127 M\$	1.7 years	92 M\$	2.0 years

HOLIDAY VOLUME INCLUDED
NPV BASED ON DISCOUNT FACTOR = 12%

APPENDIX A

16 HECTARE EVALUATION CASES

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:11:1

File: K1618crw

[----- CASE DESCRIPTION -----]				[----- NET PRESENT VALUES (M\$) -----]						
				DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
KOLA BAKKEN 'A' POOL MODEL AREA										
ECONOMICS FOR TYPICAL WELL ON 16 HECTARE SPACING										
PRIMARY RECOVERY				B.T. OPER INC	256	224	218	211	207	200
CROWN ROYALTIES; HOV = 1759 m3				B.T. CAP INV.	220	220	220	220	220	220
				B.T. CASH FLOW	36	4	-2	-9	-13	-20
Royalty Regime: MANITOBA	Gas Holiday: NO									
Reserve type: PDP	Oil Holiday: YES			A.T. OPER INC	229	200	194	188	184	178
Royalty Type: Crwn	Eval/Prod Start: 94- 1/94- 1			A.T. CAP INV.	220	220	220	220	220	220
Reversion Pt:	Proj/Econ Life: 15.1/ 6.0 yrs			A.T. CASH FLOW	9	-20	-26	-32	-36	-42

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]				[----- COMPANY W.I. -----]			
		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%
ROR	- PCNT	13.9	3.3	OIL	STB	27757	27757	1879	25877	REVENUE	100.0
PAYOUT PERIOD	- EVAL	3.2	4.4	GAS-RAW	MSCF	0	0			FIELD CAP	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP	
UNDISC PIR	- \$/\$	0.16	0.04	ETHANE	STB	0	0	0	0	GATH CAP	
12.0 PCT PIR	- \$/\$	0.02	-0.09	PROPANE	STB	0	0	0	0		
15.0 PCT PIR	- \$/\$	-0.01	-0.12	BUTANE	STB	0	0	0	0	ORR-GAS	
NPV @ 12.0	- \$/Bbl	0.15	-0.73	CONDENS.	STB	0	0	0	0	ORR-OIL	
NPV @ 15.0	- \$/Bbl	-0.09	-0.95	SULPHUR	LT	0	0	0	0		
				OTHER	STB	0	0	0	0	ROYALTY	0.0

[----- WI CASH FLOW SUMMARY -----]														
YEAR	[----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[----AFTER TAX-----]
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000
1994	22	8037	18.00	144673	0	0	38009	4.73	106664	13.27	0	106664	13508	93156
1995	17	6201	18.90	117195	9599	8	39428	6.36	68169	10.99	0	68169	7138	61031
1996	13	4784	19.84	94936	12729	13	41009	8.57	41198	8.61	0	41198	4539	36659
1997	10	3691	20.84	76904	7805	10	42743	11.58	26357	7.14	0	26357	1733	24625
1998	8	2847	21.88	62298	4878	8	44623	15.67	12797	4.49	0	12797	0	12797
1999	6	2197	22.97	50465	3048	6	46647	21.23	770	0.35	0	770	0	770
SUBT		27757		546472	38059		252459		255954		220000	35954	26917	9037
REM.		0		0	0		0		-0		0	0	0	0
TOTL		27757		546472	38059		252459		255954		220000	35954	26917	9037
12.0% DISC				439224	28418		186659		224147		220000	4147	24384	-20236
% OF REV.				100	6		42		51		50	1	6	-5

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

Report: peepry

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

	Oil	Gas	Cond	Propane	Butane	Ethane	Sulphur	Other	Manual	Crn or	Frhld		Oil	Gas	
	Crown	Crown	Crown	Crown	Crown	Crown	Crown	Prod.		Indian	Mineral	Frhld	Over-	Over-	Net
	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty		Royalty	Tax	Royalty	Riding	Riding	Profit
Year	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$		M\$	M\$	M\$	M\$	M\$	M\$

1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
1995	9.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
1996	12.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
1997	7.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
1998	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
1999	3.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0

6.0	38.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0

6.0	38.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0		0.0	0.0	0.0	0.0	0.0	0.0
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TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:19:2

File: K1618FRR

[----- CASE DESCRIPTION -----]		[----- NET PRESENT VALUES (M\$) -----]						
		DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
KOLA BAKKEN 'A' POOL MODEL AREA								
ECONOMICS FOR TYPICAL WELL ON 16 HECTARE SPACING								
PRIMARY RECOVERY		B.T. OPER INC	201	177	172	167	164	159
FREEHOLD ROYALTIES, MINERAL TAX HOLIDAY = 1759 m3 (11069 bbl)		B.T. CAP INV.	220	220	220	220	220	220
		B.T. CASH FLOW	-19	-43	-48	-53	-56	-61
Royalty Regime:	MANITOBA Gas Holiday: NO							
Reserve type:	PDP Oil Holiday: YES	A.T. OPER INC	198	173	168	164	161	155
Royalty Type:	Frhd Eval/Prod Start: 94- 1/94- 1	A.T. CAP INV.	220	220	220	220	220	220
Reversion Pt:	Proj/Econ Life: 15.1/ 5.0 yrs	A.T. CASH FLOW	-22	-47	-52	-56	-59	-65

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]						[----- COMPANY W.I. -----]		
		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	0.0	0.0	OIL	STB	25560	25560	3834	21726	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	0.0	0.0	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	-0.09	-0.10	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	-0.20	-0.21	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	-0.22	-0.23	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	-1.68	-1.82	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	-1.88	-2.02	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	15.0	0.0

WI CASH FLOW SUMMARY															
YEAR	[---OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[---AFTER TAX-----]	
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.		B.TAX	INVT.	CASH	TAX	CASH	12.0%
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000	-220000
1994	22	8037	18.00	144673	21701	15	38009	4.73	84963	10.57	0	84963	3560	81403	80597
1995	17	6201	18.90	117195	23344	20	39428	6.36	54424	8.78	0	54424	0	54424	47820
1996	13	4784	19.84	94936	20381	21	41009	8.57	33547	7.01	0	33547	0	33547	26159
1997	10	3691	20.84	76904	13948	18	42743	11.58	20214	5.48	0	20214	0	20214	13988
1998	8	2847	21.88	62298	9698	16	44623	15.67	7977	2.80	0	7977	0	7977	4899
SUBT		25560		496006	89071		205812		201124		220000	-18876	3560	-22436	-46537
REM.		0		0	-0		0		-0		0	0	0	0	-0
TOTL		25560		496006	89071		205812		201124		220000	-18876	3560	-22436	-46537
12.0% DISC				411720	73497		161236		176987		220000	-43013	3525	-46537	
% OF REV.				100	18		39		43		53	-10	1	-11	

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

Report: peeprroy

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

	Oil	Gas	Cond	Propane	Butane	Ethane	Sulphur	Other	Manual	Frhld		Oil	Gas	
	Crown	Crown	Crown	Crown	Crown	Crown	Crown	Prod.	Crn or	Mineral	Frhld	Over-	Over-	Net
	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Tax	Royalty	Riding	Riding	Profit
Year	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	17.6	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	14.2	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.4	11.5	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	9.3	0.0	0.0	0.0

5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.7	74.4	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.7	74.4	0.0	0.0	0.0

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:27:3

File: K1622CRW

[----- CASE DESCRIPTION -----]				[----- NET PRESENT VALUES (M\$) -----]						
				DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
KOLA BAKKEN 'A' POOL MODEL AREA										
ECONOMICS FOR TYPICAL WELL ON 16 HECTARE SPACING										
PRIMARY RECOVERY				B.T. OPER INC	311	275	267	260	255	247
CROWN ROYALTIES; HOV = 1433 m3				B.T. CAP INV.	220	220	220	220	220	220
				B.T. CASH FLOW	91	55	47	40	35	27
Royalty Regime: MANITOBA	Gas Holiday: NO									
Reserve type: PDP	Oil Holiday: YES			A.T. OPER INC	261	230	223	217	213	206
Royalty Type: Crwn	Eval/Prod Start: 94- 1/94- 1			A.T. CAP INV.	220	220	220	220	220	220
Reversion Pt:	Proj/Econ Life: 15.1/ 5.0 yrs			A.T. CASH FLOW	41	10	3	-3	-7	-14

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]					[----- COMPANY W.I. -----]		
				B.TAX	A.TAX	GROSS	WI	ROY	NET	Init%	Finl%
ROR	- PCNT	39.6	16.5	OIL	STB	25560	25560	2075	23485	REVENUE	100.0
PAYOUT PERIOD	- EVAL	2.1	3.0	GAS-RAW	MSCF	0	0			FIELD CAP	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP	
UNDISC PIR	- \$/\$	0.41	0.19	ETHANE	STB	0	0	0	0	GATH CAP	
12.0 PCT PIR	- \$/\$	0.25	0.04	PROPANE	STB	0	0	0	0		
15.0 PCT PIR	- \$/\$	0.21	0.01	BUTANE	STB	0	0	0	0	ORR-GAS	
NPV @ 12.0	- \$/Bbl	2.13	0.38	CONDENS.	STB	0	0	0	0	ORR-OIL	
NPV @ 15.0	- \$/Bbl	1.84	0.12	SULPHUR	LT	0	0	0	0		
				OTHER	STB	0	0	0	0	ROYALTY	0.0

[----- WI CASH FLOW SUMMARY -----]														
YEAR	[----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[----AFTER TAX-----]
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$
ZERO										220000	-220000		0	-220000
1994	22	8037	22.00	176823	0	0	38009	4.73	138814	17.27	0	138814	24561	114253
1995	17	6201	22.00	136418	18389	13	39428	6.36	78601	12.68	0	78601	13746	64854
1996	13	4784	22.00	105245	14112	13	41009	8.57	50125	10.48	0	50125	8083	42042
1997	10	3691	22.00	81196	8240	10	42743	11.58	30213	8.19	0	30213	3208	27005
1998	8	2847	22.00	62642	4905	8	44623	15.67	13114	4.61	0	13114	0	13114
SUBT		25560		562323	45646		205812		310866		220000	90866	49598	41268
REM.		0		0	0		0		0		0	0	0	0
TOTL		25560		562323	45646		205812		310866		220000	90866	49598	41268
12.0% DISC				471661	35876		161236		274549		220000	54549	44919	9631
% OF REV.				100	8		34		58		47	12	10	2

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

[illegible][illegible][illegible]

[----- CASE DESCRIPTION -----]

KOLA BAKKEN 'A' POOL MODEL AREA
ECONOMICS FOR TYPICAL WELL ON 16 HECTARE SPACING
PRIMARY RECOVERY
FREEHOLD ROYALTIES, MINERAL TAX HOLIDAY = 1433 m3

Royalty Regime: MANITOBA Gas Holiday: NO
Reserve type: PDP Oil Holiday: YES
Royalty Type: Frhd Eval/Prod Start: 94- 1/94- 1
Reversion Pt: Proj/Econ Life: 15.1/ 5.0 yrs

[----- NET PRESENT VALUES (M\$) -----]

DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	251	223	217	211	207	201
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	31	3	-3	-9	-13	-19
A.T. OPER INC	234	206	200	195	191	185
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	14	-14	-20	-25	-29	-35

[----- ECONOMIC INDICATORS -----]

		B.TAX	A.TAX
ROR	- PCNT	13.3	5.5
PAYOUT PERIOD	- EVAL	3.0	3.8
UNDISC PIR	- \$/\$	0.14	0.06
12.0 PCT PIR	- \$/\$	0.01	-0.06
15.0 PCT PIR	- \$/\$	-0.02	-0.09
NPV @ 12.0	- \$/Bbl	0.11	-0.55
NPV @ 15.0	- \$/Bbl	-0.13	-0.78

[----- PRODUCTS RECOVERY -----]

		GROSS	WI	ROY	NET
OIL	STB	25560	25560	3834	21726
GAS-RAW	MSCF	0	0		
GAS-SALES	MSCF	0	0	0	0
ETHANE	STB	0	0	0	0
PROPANE	STB	0	0	0	0
BUTANE	STB	0	0	0	0
CONDENS.	STB	0	0	0	0
SULPHUR	LT	0	0	0	0
OTHER	STB	0	0	0	0

[----- COMPANY W.I. -----]

		Init%	Finl%
REVENUE		100.0	100.0
FIELD CAP		100.0	100.0
PLANT CAP			
GATH CAP			
ORR-GAS			
ORR-OIL			
ROYALTY		15.0	0.0

[----- WI CASH FLOW SUMMARY -----]

YEAR	[---OIL PRODUCTION---]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[---AFTER TAX---]		
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM	
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000	-220000	-220000
1994	22	8037	22.00	176823	26523	15	38009	4.73	112290	13.97	0	112290	12402	99888	98899	-121101
1995	17	6201	22.00	136418	31506	23	39428	6.36	65484	10.56	0	65484	4366	61117	53702	-67400
1996	13	4784	22.00	105245	22594	21	41009	8.57	41643	8.70	0	41643	847	40796	31812	-35588
1997	10	3691	22.00	81196	14726	18	42743	11.58	23727	6.43	0	23727	0	23727	16419	-19169
1998	8	2847	22.00	62642	9751	16	44623	15.67	8267	2.90	0	8267	0	8267	5077	-14092
SUBT		25560		562323	105101		205812		251411		220000	31411	17615	13796	-14092	
REM.		0		0	0		0		0		0	0	0	0	0	
TOTL		25560		562323	105101		205812		251411		220000	31411	17615	13796	-14092	
12.0% DISC				471661	87741		161236		222684		220000	2684	16776	-14092		
% OF REV.				100	19		34		47		47	1	4	-3		

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====
[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

Year	Oil	Gas	Cond	Propane	Butane	Ethane	Sulphur	Other	Manual	Frhld	Frhld	Oil	Gas	Net
	Crown	Crown	Crown	Crown	Crown	Crown	Crown	Prod.	Crn or	Mineral	Mineral	Over-	Over-	Profit
	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Tax	Royalty	Riding	Riding	Inter.
	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	26.5	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	20.5	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.8	15.8	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	12.2	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	9.4	0.0	0.0	0.0
5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	84.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	20.8	84.3	0.0	0.0	0.0

APPENDIX B

32 HECTARE EVALUATION CASES

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:34:0

File: K3218CRW

[----- CASE DESCRIPTION -----]

KOLA BAKKEN 'A' POOL MODEL AREA
 ECONOMICS FOR TYPICAL WELL ON 32 HECTARE SPACING
 PRIMARY RECOVERY
 CROWN ROYALTIES; HOV = 1968 m3

[----- NET PRESENT VALUES (M\$) -----]

DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	407	350	338	327	320	308
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	187	130	118	107	100	88
A.T. OPER INC	321	276	266	258	252	243
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	101	56	46	38	32	23

Royalty Regime: MANITOBA Gas Holiday: NO
 Reserve type: PDP Oil Holiday: YES
 Royalty Type: Crwn Eval/Prod Start: 94- 1/94- 1
 Reversion Pt: Proj/Econ Life: 15.4/ 6.0 yrs

[----- ECONOMIC INDICATORS -----]

[----- PRODUCTS RECOVERY -----]

[----- COMPANY W.I. -----]

		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	71.8	35.0	OIL	STB	37438	37438	3635	33803	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.6	2.3	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	0.85	0.46	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.59	0.25	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.54	0.21	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	3.46	1.48	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	3.15	1.24	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	0.0	0.0

[----- WI CASH FLOW SUMMARY -----]

YEAR	[---OIL PRODUCTION---]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[---AFTER TAX---]		
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%		CUM
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000	-220000	-220000
1994	31	11163	18.00	200931	0	0	38791	3.47	162140	14.53	0	162140	32580	129560	128277	-91723
1995	23	8469	18.90	160068	25146	16	40023	4.73	94899	11.21	0	94899	21673	73226	64341	-27381
1996	18	6426	19.84	127516	20793	16	41461	6.45	65262	10.16	0	65262	15584	49677	38737	11355
1997	13	4875	20.84	101583	13836	14	43085	8.84	44662	9.16	0	44662	10099	34562	23917	35273
1998	10	3699	21.88	80925	8231	10	44882	12.13	27812	7.52	0	27812	5224	22588	13872	49144
1999	8	2806	22.97	64467	4975	8	46842	16.69	12651	4.51	0	12651	924	11727	6391	55536
SUBT		37438		735490	72980		255084		407426		220000	187426	86084	101341	55536	
REM.		0		0	0		0		0		0	0	0	0	-0	
TOTL		37438		735490	72980		255084		407426		220000	187426	86084	101341	55536	
12.0% DISC				594148	55649		188810		349689		220000	129689	74153	55536		
% OF REV.				100	9		32		59		37	22	12	9		

Report: peeproy

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

[illegible]

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:37:3

File: K3218FRR

[----- CASE DESCRIPTION -----]				[----- NET PRESENT VALUES (M\$) -----]						
				DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
KOLA BAKKEN 'A' POOL MODEL AREA										
ECONOMICS FOR TYPICAL WELL ON 32 HECTARE SPACING										
PRIMARY RECOVERY				B.T. OPER INC	337	290	280	271	266	255
FREEHOLD ROYALTIES, MINERAL TAX HOLIDAY = 1968 m3				B.T. CAP INV.	220	220	220	220	220	220
				B.T. CASH FLOW	117	70	60	51	46	35
Royalty Regime: MANITOBA	Gas Holiday: NO									
Reserve type: PDP	Oil Holiday: YES			A.T. OPER INC	286	245	237	229	224	215
Royalty Type: Frhd	Eval/Prod Start: 94- 1/94- 1			A.T. CAP INV.	220	220	220	220	220	220
Reversion Pt:	Proj/Econ Life: 15.4/ 6.0 yrs			A.T. CASH FLOW	66	25	17	9	4	-5

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]						[----- COMPANY W.I. -----]		
		B.TAX	A.TAX			GROSS	WI	ROY	NET	Init%		Finl%
ROR	- PCNT	41.4	21.7	OIL	STB	37438	37438	5616	31822	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	2.1	2.9	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	0.53	0.30	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.32	0.11	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.27	0.08	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	1.86	0.67	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	1.61	0.44	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	15.0	0.0

[----- WI CASH FLOW SUMMARY -----]													
YEAR	[----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL [----AFTER TAX-----]
	RATE	VOL.	PRICE	REV.	&MINTAX	EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0% CUM
	Bbl/D	STB	\$/Bbl	\$	\$	\$	\$/Bbl	\$	\$/Bbl	\$	\$	\$	\$
ZERO										220000	-220000	0	-220000 -220000 -220000
1994	31	11163	18.00	200931	30140	15	38791	3.47	132001	11.83	0	132001	22218 109782 108695 -111305
1995	23	8469	18.90	160068	38321	24	40023	4.73	81724	9.65	0	81724	13418 68306 60018 -51287
1996	18	6426	19.84	127516	29921	23	41461	6.45	56134	8.74	0	56134	9008 47126 36747 -14540
1997	13	4875	20.84	101583	21062	21	43085	8.84	37436	7.68	0	37436	4861 32575 22542 8002
1998	10	3699	21.88	80925	14313	18	44882	12.13	21729	5.87	0	21729	1051 20679 12699 20701
1999	8	2806	22.97	64467	9912	15	46842	16.69	7714	2.75	0	7714	0 7714 4204 24905
SUBT		37438		735490	143669		255084		336737		220000	116737	50556 66181 24905
REM.		0		0	-0		0		0		0	0	0 0 0
TOTL		37438		735490	143669		255084		336737		220000	116737	50556 66181 24905
12.0% DISC				594148	115611		188810		289727		220000	69727	44822 24905
% OF REV.				100	19		32		49		37	12	8 4

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

	Oil Crown Royalty M\$	Gas Crown Royalty M\$	Cond Crown Royalty M\$	Propane Crown Royalty M\$	Butane Crown Royalty M\$	Ethane Crown Royalty M\$	Sulphur Crown Royalty M\$	Other Prod. Crown Royalty M\$	Manual Crn or Indian Royalty M\$	Frhld Mineral Tax M\$	Frhld Royalty M\$	Oil Over- Riding Royalty M\$	Gas Over- Riding Royalty M\$	Net Profit Inter. M\$
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1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.1	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.3	24.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	10.8	19.1	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.8	15.2	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	12.1	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	9.7	0.0	0.0	0.0

6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	110.3	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	33.3	110.3	0.0	0.0	0.0

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:51:5

File: K3222CRW

[----- CASE DESCRIPTION -----]				[----- NET PRESENT VALUES (M\$) -----]						
				DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
KOLA BAKKEN 'A' POOL MODEL AREA										
ECONOMICS FOR TYPICAL WELL ON 32 HECTARE SPACING										
PRIMARY RECOVERY				B.T. OPER INC	481	417	404	392	385	371
CROWN ROYALTIES; HOV = 1664 m3				B.T. CAP INV.	220	220	220	220	220	220
				B.T. CASH FLOW	261	197	184	172	165	151
Royalty Regime: MANITOBA	Gas Holiday: NO									
Reserve type: PDP	Oil Holiday: YES			A.T. OPER INC	364	315	305	296	291	280
Royalty Type: Crwn	Eval/Prod Start: 94- 1/94- 1			A.T. CAP INV.	220	220	220	220	220	220
Reversion Pt:	Proj/Econ Life: 15.4/ 6.0 yrs			A.T. CASH FLOW	144	95	85	76	71	60

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]						[----- COMPANY W.I. -----]		
		B.TAX	A.TAX			GROSS	WI	ROY	NET	Init%		Finl%
ROR	- PCNT	130.8	57.5	OIL	STB	37438	37438	3996	33441	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.1	1.8	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	1.18	0.66	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.90	0.43	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.84	0.39	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	5.27	2.55	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	4.92	2.28	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	1.2	0.0

[----- WI CASH FLOW SUMMARY -----]															
YEAR	[---OIL PRODUCTION---]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[---AFTER TAX---	
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000	-220000
1994	31	11163	22.00	245582	3045	1	38791	3.47	203747	18.25	0	203747	47931	155815	-65727
1995	23	8469	22.00	186323	34178	18	40023	4.73	112121	13.24	0	112121	30699	81422	5815
1996	18	6426	22.00	141363	23051	16	41461	6.45	76851	11.96	0	76851	20345	56506	49877
1997	13	4875	22.00	107252	14608	14	43085	8.84	49558	10.17	0	49558	12048	37510	75834
1998	10	3699	22.00	81372	8276	10	44882	12.13	28213	7.63	0	28213	5378	22836	89858
1999	8	2806	22.00	61737	4764	8	46842	16.69	10131	3.61	0	10131	0	10131	95379
SUBT		37438		823628	87922		255084		480622		220000	260622	116401	144220	95379
REM.		0		0	0		0		-0		0	0	0	0	0
TOTL		37438		823628	87922		255084		480622		220000	260622	116401	144220	95379
12.0% DISC				674933	68808		188810		417315		220000	197315	101935	95379	
% OF REV.				100	10		28		62		33	29	15	14	

***** WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES *****

	Other	Manual	Oil	Gas
1950	100	100	100	100
1951	100	100	100	100
1952	100	100	100	100
1953	100	100	100	100
1954	100	100	100	100
1955	100	100	100	100
1956	100	100	100	100
1957	100	100	100	100
1958	100	100	100	100
1959	100	100	100	100
1960	100	100	100	100
1961	100	100	100	100
1962	100	100	100	100
1963	100	100	100	100
1964	100	100	100	100
1965	100	100	100	100
1966	100	100	100	100
1967	100	100	100	100
1968	100	100	100	100
1969	100	100	100	100
1970	100	100	100	100
1971	100	100	100	100
1972	100	100	100	100
1973	100	100	100	100
1974	100	100	100	100
1975	100	100	100	100
1976	100	100	100	100
1977	100	100	100	100
1978	100	100	100	100
1979	100	100	100	100
1980	100	100	100	100
1981	100	100	100	100
1982	100	100	100	100
1983	100	100	100	100
1984	100	100	100	100
1985	100	100	100	100
1986	100	100	100	100
1987	100	100	100	100
1988	100	100	100	100
1989	100	100	100	100
1990	100	100	100	100
1991	100	100	100	100
1992	100	100	100	100
1993	100	100	100	100
1994	100	100	100	100
1995	100	100	100	100
1996	100	100	100	100
1997	100	100	100	100
1998	100	100	100	100
1999	100	100	100	100
2000	100	100	100	100
2001	100	100	100	100
2002	100	100	100	100
2003	100	100	100	100
2004	100	100	100	100
2005	100	100	100	100
2006	100	100	100	100
2007	100	100	100	100
2008	100	100	100	100
2009	100	100	100	100
2010	100	100	100	100
2011	100	100	100	100
2012	100	100	100	100
2013	100	100	100	100
2014	100	100	100	100
2015	100	100	100	100
2016	100	100	100	100
2017	100	100	100	100
2018	100	100	100	100
2019	100	100	100	100
2020	100	100	100	100
2021	100	100	100	100
2022	100	100	100	100
2023	100	100	100	100
2024	100	100	100	100
2025	100	100	100	100
2026				

[illegible]

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:40:5

File: K3222PRR

[----- CASE DESCRIPTION -----]				[----- NET PRESENT VALUES (M\$) -----]						
				DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
KOLA BAKKEN 'A' POOL MODEL AREA										
ECONOMICS FOR TYPICAL WELL ON 32 HECTARE SPACING										
PRIMARY RECOVERY				B.T. OPER INC	403	351	340	330	324	312
FREEHOLD ROYALTIES, MINERAL TAX HOLIDAY = 1664 m3				B.T. CAP INV.	220	220	220	220	220	220
				B.T. CASH FLOW	183	131	120	110	104	92
Royalty Regime: MANITOBA Gas Holiday: NO										
Reserve type: PDP Oil Holiday: YES				A.T. OPER INC	326	282	273	265	259	250
Royalty Type: Frhd Eval/Prod Start: 94- 1/94- 1				A.T. CAP INV.	220	220	220	220	220	220
Reversion Pt: Proj/Econ Life: 15.4/ 6.0 yrs				A.T. CASH FLOW	106	62	53	45	39	30

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]						[----- COMPANY W.I. -----]		
		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	78.5	39.1	OIL	STB	37438	37438	5616	31822	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.5	2.2	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	0.83	0.48	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.60	0.28	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.55	0.24	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	3.50	1.66	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	3.21	1.42	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	15.7	0.0

[----- WI CASH FLOW SUMMARY -----]																
YEAR	[---OIL PRODUCTION---]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[---AFTER TAX-----]		
	RATE	VOL.	PRICE	REV.	&MINTAX	%	EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM	
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$	
ZERO											220000	-220000	0	-220000	-220000	
1994	31	11163	22.00	245582	38665	16	38791	3.47	168127	15.06	0	168127	35267	132860	131544	
1995	23	8469	22.00	186323	47400	25	40023	4.73	98899	11.68	0	98899	21090	77809	68368	
1996	18	6426	22.00	141363	33170	23	41461	6.45	66732	10.39	0	66732	13055	53677	41856	
1997	13	4875	22.00	107252	22237	21	43085	8.84	41929	8.60	0	41929	6517	35412	24505	
1998	10	3699	22.00	81372	14392	18	44882	12.13	22097	5.97	0	22097	1181	20916	12845	
1999	8	2806	22.00	61737	9492	15	46842	16.69	5403	1.93	0	5403	0	5403	2945	
SUBT		37438		823628	165356		255084		403188		220000	183188	77111	106077	62063	
REM.		0		0	0		0		-0		0	0	0	0	0	
TOTL		37438		823628	165356		255084		403187		220000	183188	77111	106077	62063	
12.0% DISC				674933	135196		188810		350927		220000	130927	68864	62063		
% OF REV.				100	20		28		52		33	19	10	9		

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====
[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

	Oil	Gas	Cond	Propane	Butane	Ethane	Sulphur	Other	Manual	Frhld		Oil	Gas	Net
	Crown	Crown	Crown	Crown	Crown	Crown	Crown	Prod.	Crn or	Mineral	Frhld	Over-	Over-	Profit
	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Tax	Royalty	Riding	Riding	Inter.
Year	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.8	36.8	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	19.5	27.9	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	12.0	21.2	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	6.1	16.1	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.2	12.2	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	9.3	0.0	0.0	0.0
6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.8	123.5	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.8	123.5	0.0	0.0	0.0

APPENDIX C

32-H HECTARE EVALUATION CASES

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 16:56:3

File: K3218CRH

[----- CASE DESCRIPTION -----]
KOLA BAKKEN 'A' POOL MODEL AREA
ECONOMICS FOR TYPICAL WELL ON HIGH GRADED 32 HECTARE SPACING
PRIMARY RECOVERY
CROWN ROYALTIES; HOV = 1968 m3

[----- NET PRESENT VALUES (M\$) -----]						
DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	493	405	388	373	363	346
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	273	185	168	153	143	126
A.T. OPER INC	373	308	296	285	278	265
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	153	88	76	65	58	45

Royalty Regime: MANITOBA Gas Holiday: NO
Reserve type: PDP Oil Holiday: YES
Royalty Type: Crwn Eval/Prod Start: 94- 1/94- 1
Reversion Pt: Proj/Econ Life: 18.6/ 8.0 yrs

[----- ECONOMIC INDICATORS -----]				[----- PRODUCTS RECOVERY -----]						[----- COMPANY W.I. -----]		
		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	83.5	43.1	OIL	STB	46883	46883	4980	41903	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.5	2.2	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	1.24	0.70	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.84	0.40	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.77	0.35	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	3.95	1.89	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	3.59	1.62	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	0.0	0.0

[----- WI CASH FLOW SUMMARY -----]														
YEAR	[---OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[---AFTER TAX---
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ /Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000 -220000 -220000
1994	31	11419	18.00	205541	0	0	38855	3.40	166687	14.60	0	166687	34143	132543 131231 -88769
1995	25	9084	18.90	171683	28830	17	40184	4.42	102669	11.30	0	102669	25610	77058 67708 -21061
1996	20	7226	19.84	143402	24725	17	41682	5.77	76996	10.66	0	76996	20970	56025 43687 22626
1997	16	5748	20.84	119780	18340	15	43338	7.54	58102	10.11	0	58102	16268	41833 28949 51575
1998	13	4573	21.88	100049	12891	13	45148	9.87	42010	9.19	0	42010	11708	30302 18609 70184
1999	10	3638	22.97	83568	8359	10	47107	12.95	28102	7.73	0	28102	7399	20703 11283 81467
2000	8	2894	24.12	69802	5554	8	49213	17.01	15035	5.20	0	15035	3394	11641 5630 87097
2001	6	2302	25.33	58304	3691	6	51465	22.36	3148	1.37	0	3148	0	3148 1351 88448
SUBT		46883		952128	102389		356992		492747		220000	272747	119493	153253 88448
REM.		0		0	0		0		-0		0	0	0	0 0
TOTL		46883		952128	102389		356992		492747		220000	272747	119493	153253 88448
12.0% DISC				714838	74045		235563		405230		220000	185230	96782	88448
% OF REV.				100	10		33		57		31	26	14	12

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Version: Rel. 7.1
Time: 94/10/04 16:56:3
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Report: peeproy

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

[illegible]

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 17:07:3

File: K3218PRH

[----- CASE DESCRIPTION -----]
 KOLA BAKKEN 'A' POOL MODEL AREA
 ECONOMICS FOR TYPICAL WELL ON HIGH GRADED 32 HECTARE SPACING
 PRIMARY RECOVERY
 FREEHOLD ROYALTIES; HOV = 1968 m3

[----- NET PRESENT VALUES (M\$) -----]
 DISC RATE (%) 0.0 12.0 15.0 18.0 20.0 24.0

B.T. OPER INC 408 337 323 311 303 289
 B.T. CAP INV. 220 220 220 220 220 220
 B.T. CASH FLOW 188 117 103 91 83 69

A.T. OPER INC 334 276 264 254 248 236
 A.T. CAP INV. 220 220 220 220 220 220
 A.T. CASH FLOW 114 56 44 34 28 16

Royalty Regime: MANITOBA Gas Holiday: NO
 Reserve type: PDP Oil Holiday: YES
 Royalty Type: Frhd Eval/Prod Start: 94- 1/94- 1
 Reversion Pt: Proj/Econ Life: 18.6/ 7.0 yrs

[----- ECONOMIC INDICATORS -----]

[----- PRODUCTS RECOVERY -----]

[----- COMPANY W.I. -----]

		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	52.8	30.3	OIL	STB	44581	44581	6687	37894	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.9	2.7	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	0.85	0.52	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.53	0.25	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.47	0.20	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	2.63	1.25	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	2.32	1.00	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	15.0	0.0

[----- WI CASH FLOW SUMMARY -----]

YEAR	[----OIL PRODUCTION--]		TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[----AFTER TAX-----]		
	RATE	VOL.	PRICE	REV.	&MINTAX	EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM	
	Bbl/D	STB	\$/Bbl	\$	\$	\$	\$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	
ZERO										220000	-220000	0	-220000	-220000	
1994	31	11419	18.00	205541	30831	15	38855	3.40	135856	11.90	0	135856	23544	112312	
1995	25	9084	18.90	171683	42427	25	40184	4.42	89072	9.81	0	89072	16757	72315	
1996	20	7226	19.84	143402	34949	24	41682	5.77	66771	9.24	0	66771	13575	53196	
1997	16	5748	20.84	119780	26950	22	43338	7.54	49492	8.61	0	49492	10091	39400	
1998	13	4573	21.88	100049	19961	20	45148	9.87	34940	7.64	0	34940	6548	28392	
1999	10	3638	22.97	83568	14648	18	47107	12.95	21813	6.00	0	21813	3090	18723	
2000	8	2894	24.12	69802	10890	16	49213	17.01	9699	3.35	0	9699	0	9699	
SUBT		44581		893824	180656		305527		407642		220000	187642	73604	114037	
REM.		0		0	0		0		0		0	0	0	0	
TOTL		44581		893824	180656		305527		407642		220000	187642	73604	114037	
12.0% DISC				689813	139215		213472		337125		220000	117125	61308	55818	
% OF REV.				100	20		31		49		32	17	9	8	

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====
[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

	Oil	Gas	Cond	Propane	Butane	Ethane	Sulphur	Other	Manual	Frhld		Oil	Gas	Net
	Crown	Crown	Crown	Crown	Crown	Crown	Crown	Prod.	Crn or	Mineral	Frhld	Over-	Over-	Profit
	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Tax	Royalty	Riding	Riding	Inter.
Year	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	30.8	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	16.7	25.8	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	13.4	21.5	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.0	18.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	15.0	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.1	12.5	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	10.5	0.0	0.0	0.0
7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.6	134.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	46.6	134.1	0.0	0.0	0.0

TUNDRA OIL AND GAS LTD.

Time: 94/10/04 17:11:1

File: K3222CRH

[----- CASE DESCRIPTION -----]

KOLA BAKKEN 'A' POOL MODEL AREA
 ECONOMICS FOR TYPICAL WELL ON HIGH GRADED 32 HECTARE SPACING
 PRIMARY RECOVERY
 CROWN ROYALTIES; HOV = 1664 m3

[----- NET PRESENT VALUES (M\$) -----]

DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	561	472	454	438	428	410
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	341	252	234	218	208	190
A.T. OPER INC	411	347	334	322	315	302
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	191	127	114	102	95	82

Royalty Regime: MANITOBA Gas Holiday: NO
 Reserve type: PDP Oil Holiday: YES
 Royalty Type: Crwn Eval/Prod Start: 94- 1/94- 1
 Reversion Pt: Proj/Econ Life: 18.6/ 7.0 yrs

[----- ECONOMIC INDICATORS -----]

[----- PRODUCTS RECOVERY -----]

[----- COMPANY W.I. -----]

		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	144.6	65.5	OIL	STB	44581	44581	5205	39376	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.1	1.7	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	1.55	0.87	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	1.14	0.58	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	1.06	0.52	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	5.65	2.84	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	5.25	2.56	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	1.7	0.0

[----- WI CASH FLOW SUMMARY -----]

YEAR	[----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[----AFTER TAX-----]		
	RATE	VOL.	PRICE	REV.	&MINTAX	EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM		
	Bbl/D	STB	\$/Bbl	\$	\$	\$	\$	\$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$
ZERO													220000	-220000	0	-220000 -220000 -220000
1994	31	11419	22.00	251217	4188	2 38855	3.40	208174	18.23	0	208174	49847	158328	156760	-63240	
1995	25	9084	22.00	199843	37524	19 40184	4.42	122134	13.45	0	122134	35292	86842	76305	13065	
1996	20	7226	22.00	158974	27410	17 41682	5.77	89883	12.44	0	89883	26324	63559	49561	62626	
1997	16	5748	22.00	126464	19363	15 43338	7.54	63762	11.09	0	63762	18566	45196	31276	93902	
1998	13	4573	22.00	100601	12962	13 45148	9.87	42491	9.29	0	42491	11898	30594	18788	112690	
1999	10	3638	22.00	80028	8005	10 47107	12.95	24916	6.85	0	24916	6182	18734	10210	122900	
2000	8	2894	22.00	63662	5066	8 49213	17.01	9383	3.24	0	9383	1283	8100	3918	126818	
SUBT				44581	980789	114519		305527	560744		220000	340744	149392	191353	126818	
REM.				0	0	0		0	-0		0	0	0	0	0	
TOTL				44581	980789	114519		305527	560744		220000	340744	149392	191353	126818	
12.0% DISC					771988	86664		213472	471852		220000	251852	125034	126818		
% OF REV.					100	11		28	61		28	33	16	16		

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

[illegible][illegible]

[----- CASE DESCRIPTION -----]

KOLA BAKKEN 'A' POOL MODEL AREA
 ECONOMICS FOR TYPICAL WELL ON HIGH GRADED 32 HECTARE SPACING
 PRIMARY RECOVERY
 FREEHOLD ROYALTY MINERAL TAX HOLIDAY = 1664 m3

[----- NET PRESENT VALUES (M\$) -----]

DISC RATE (%)	0.0	12.0	15.0	18.0	20.0	24.0
B.T. OPER INC	472	399	384	370	362	347
B.T. CAP INV.	220	220	220	220	220	220
B.T. CASH FLOW	252	179	164	150	142	127
A.T. OPER INC	371	312	301	290	283	271
A.T. CAP INV.	220	220	220	220	220	220
A.T. CASH FLOW	151	92	81	70	63	51

Royalty Regime: MANITOBA Gas Holiday: NO
 Reserve type: PDP Oil Holiday: YES
 Royalty Type: Frhd Eval/Prod Start: 94- 1/94- 1
 Reversion Pt: Proj/Econ Life: 18.6/ 7.0 yrs

[----- ECONOMIC INDICATORS -----]

[----- PRODUCTS RECOVERY -----]

[----- COMPANY W.I. -----]

		B.TAX	A.TAX			GROSS	WI	ROY	NET		Init%	Finl%
ROR	- PCNT	90.2	47.1	OIL	STB	44581	44581	6687	37894	REVENUE	100.0	100.0
PAYOUT PERIOD	- EVAL	1.4	2.0	GAS-RAW	MSCF	0	0			FIELD CAP	100.0	100.0
				GAS-SALES	MSCF	0	0	0	0	PLANT CAP		
UNDISC PIR	- \$/\$	1.15	0.69	ETHANE	STB	0	0	0	0	GATH CAP		
12.0 PCT PIR	- \$/\$	0.81	0.42	PROPANE	STB	0	0	0	0			
15.0 PCT PIR	- \$/\$	0.75	0.37	BUTANE	STB	0	0	0	0	ORR-GAS		
NPV @ 12.0	- \$/Bbl	4.01	2.07	CONDENS.	STB	0	0	0	0	ORR-OIL		
NPV @ 15.0	- \$/Bbl	3.68	1.81	SULPHUR	LT	0	0	0	0			
				OTHER	STB	0	0	0	0	ROYALTY	16.0	0.0

[----- WI CASH FLOW SUMMARY -----]

YEAR	[----OIL PRODUCTION--]			TOTAL	--ROYALTY--		--OPERATING--		OPER	NETBACK	CAPTL	B.TAX	TOTAL	[----AFTER TAX-----]		
	RATE	VOL.	PRICE	REV.	&MINTAX		EXPENSE	INC.	B.TAX	INV.	CASH	TAX	CASH	12.0%	CUM	
	Bbl/D	STB	\$/Bbl	\$	\$	%	\$ \$/Bbl	\$	\$/Bbl	\$	\$	\$	\$	\$	\$	\$
ZERO											220000	-220000	0	-220000	-220000	-220000
1994	31	11419	22.00	251217	40205	16	38855	3.40	172157	15.08	0	172157	36891	135266	133927	-86073
1995	25	9084	22.00	199843	51679	26	40184	4.42	107979	11.89	0	107979	24986	82993	72923	-13150
1996	20	7226	22.00	158974	38744	24	41682	5.77	78549	10.87	0	78549	18126	60423	47116	33965
1997	16	5748	22.00	126464	28454	22	43338	7.54	54672	9.51	0	54672	12044	42627	29498	63463
1998	13	4573	22.00	100601	20071	20	45148	9.87	35383	7.74	0	35383	6710	28673	17609	81072
1999	10	3638	22.00	80028	14028	18	47107	12.95	18893	5.19	0	18893	2055	16838	9177	90249
2000	8	2894	22.00	63662	9932	16	49213	17.01	4517	1.56	0	4517	0	4517	2185	92434
SUBT		44581		980789	203113		305527		472149		220000	252149	100812	151337	92434	
REM.		0		0	0		0		-0		0	0	0	0	-0	
TOTL		44581		980789	203113		305527		472149		220000	252149	100812	151337	92434	
12.0% DISC				771988	159892		213472		398623		220000	178623	86190	92434		
% OF REV.				100	21		28		52		28	23	11	12		

Comment: KOLA BAKKEN 'A' POOL MODEL AREA

===== WORKING INTEREST CROWN ROYALTIES, MINERAL TAX AND OTHER ROYALTIES =====

[----- CROWN ROYALTIES AND MINERAL TAX -----] [----- OTHER ROYALTIES -----]

Year	Oil	Gas	Cond	Propane	Butane	Ethane	Sulphur	Other	Manual	Frhld	Frhld	Oil	Gas	Net
	Crown	Crown	Crown	Crown	Crown	Crown	Crown	Prod.	Crn or			Over-	Over-	
	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Royalty	Indian	Mineral	Royalty	Riding	Riding	Profit
	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$	M\$
1994	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.5	37.7	0.0	0.0	0.0
1995	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21.7	30.0	0.0	0.0	0.0
1996	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	14.9	23.8	0.0	0.0	0.0
1997	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	9.5	19.0	0.0	0.0	0.0
1998	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	15.1	0.0	0.0	0.0
1999	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	12.0	0.0	0.0	0.0
2000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	9.5	0.0	0.0	0.0
7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	147.1	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	56.0	147.1	0.0	0.0	0.0



Date January 30, 1995

Memorandum

To L.R. Dubreuil
Director of Petroleum

From John N. Fox
Chief Petroleum Engineer

Subject **Tundra Oil and Gas**
32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area

Tundra's application for 32 ha spacing in the Daly Field and South Kirkella area was advertised in the Virden Empire Advance and the Westman Gazette. Notice of the application was also sent to royalty interest owners in the area of application. Objections to the application were received from 4 royalty owners in the area of application. A letter was sent to the royalty owners who objected to the application, requesting they formally withdraw their objections. All the objections have been withdrawn (see attached letters).

Recommendations

It is recommended that the Director of Petroleum on behalf of the Minister approve temporary 32 ha spacing in the area of application by issuing Ministerial Spacing Order No. 11 (attached). Spacing Order No. 11 provides for 32 ha spacing to be reviewed in 5 years and the order rescinded or extended at that time. The spacing order also provides for the 32 ha spacing area to be amended from time to time to meet changing conditions.

Discussion

Tundra's application for increased 32 ha spacing for the Bakken Formation in the Daly Field and South Kirkella area (Fig. 1) includes both technical and economic issues. This review attempts to balance the issues of maximum technical vs maximum economic recovery.

Technical Data - 16 ha vs 32 ha Spacing

There are two sources of technical data to support the application. The observed performance of wells in the Daly Bakken A Pool and a reservoir simulation study of the A pool. The simulation study reviewed A Pool performance on 16 ha, 32 ha, and combined 16 ha and 32 ha spacing. The simulation also included cases with waterflooding and horizontal drilling.

First | Fold

The results of the simulation indicate recovery from the A Pool can be maximized by drilling on 16 ha spacing. Drilling on 16 ha spacing results in a recovery of 137 100 m³ or 30 % OOIP (Table 1 and Fig.2) Drilling on 32 ha spacing results in a recovery of 87 400 m³ or 19% OOIP (Table 1 and Fig.3). A mixture of 16 ha and 32 ha spacing, where good producers on 32 ha spacing are offset by wells on 16 ha spacing results in a recovery of 104 900 m³ or 23% OOIP (Table 1 and Fig.4).

In all cases a significant portion of the recoverable reserves are produced by a few wells. Under 16 ha spacing, 5 of the 20 wells account for 65% of the recoverable reserves. Under 32 ha spacing, 3 of the 10 wells account for 75% of the recoverable reserves. Under a combination of 16 ha and 32 ha spacing, 4 of the 10 wells account for 77% of the recoverable reserves. Conversely, recovery from the poor producers in the A Pool is independent of spacing. The 7 poor producers in the 32 ha spacing case recover 21 400 m³. The same 7 producers recover 21 100 m³ on 16 ha spacing.

Field observations confirm the simulation results that wells in the better parts of the A Pool are capable of adequately draining more than 16 ha. Newly drilled wells at 13-28, 16-29, and in Sections 32 and 33 have shown pressure depletion on DST. DST pressures (Fig.5) are 6 195 to 7 915 kPa, substantially lower than the original reservoir pressure of 8 874 kPa. Tundra also believes the high decline rates and low individual well recoveries on 16 ha spacing indicate interference between producing wells.

The simulation results suggest that without consideration of economic data, recovery from the A Pool can be maximized by drilling on 16 ha spacing. The simulation also indicates the majority of reserves can be recovered by drilling a limited number of wells in the better parts of the pool.

Economic Data - 16 ha vs 32 ha Single Well Economics

The definition of "waste" in the Act requires both sound engineering and economic principles be used to determine the spacing of wells. Tundra in its application indicated Bakken development on 16 ha spacing has resulted in high finding costs and marginal economics that do not meet corporate hurdle rates.

Tundra has provided the Branch with a number of economic runs comparing single well drilling economics on 16 ha and 32 ha spacing for both Crown and freehold land and for different price forecasts. Table 2 summarizes the economic runs. Under 16 ha spacing only one of the 4 runs is economic - Crown land with an oil price of \$22/bbl flat over the life of the project. Crown land represents only 14% of the area of application. Under 32 ha spacing all runs were economic with rates of return ranging from 22% to 57% and pay-outs from 1.8 to 2.9 years.

The Branch believes a number of Tundra's economic assumptions combine to yield conservative economic results, particularly their low oil price forecast and high operating costs. A review of Tundra's economics indicates with a slight increase in the price forecast to \$22/bbl (1994) escalated at 3%/yr and a 10% reduction in operating costs (Tundra's high operating costs result in an economic limit of 0.95 m³/d in 1999), all 16 ha drilling cases would yield a rate of return in excess of 20%. However, the economics are based on recoverable reserves of 4061 m³/well on 16 ha spacing. Figure 6 is a graph showing the distribution of individual well recoverable reserves for well in the A Pool and other Bakken pools in the Daly Field. The graph shows that 64% of current Bakken producers in the Daly Field and 50% of producers in the A Pool will not recover 4000 m³ and therefore will not yield a satisfactory return on investment. It is apparent from the graph and Tundra's economic analysis that poor overall project economics have resulted from blanket Bakken development on 16 ha spacing.


Bakken Depletion Strategy

Tundra's planned depletion strategy is to continue development of the A Pool to the north on 32 ha spacing. If injection in the A Pool at 13-21-10-29 continues to have a positive response on production, Tundra plans to expand the waterflood into Section 33-10-29 as shown on Figure 7. Tundra did not elaborate on its exploration strategy for the remainder of the area of application.

Within the area of application (39 sections), using the Daly Field as an analogy, another 3-5 new Bakken pools may be discovered. Each new pool could be delineated with the drilling of 5-15 wells on 32 ha spacing. The Branch believes a suitable depletion strategy is to permit the extension of the A Pool and Bakken exploration in the area of application to be conducted on 32 ha spacing. This will eliminate 16 ha offset drilling obligations and reduce the number of poor producers and dry holes drilled. However to realize the maximum economic recovery from the Bakken, the Branch believes that selective infill drilling on 16 ha spacing is required after a pool has been delineated. This position is supported by the simulation results. Therefore it is recommended that temporary 32 ha spacing be approved in the area of application. A 5 year approval of 32 ha spacing should provide adequate time to complete delineation of the A Pool and conduct an extensive exploration program within the remainder of the area of application. The proposed spacing order also provides for modification of the area of approval from time to time to meet changing conditions.

Objections to the Application

A total of four objections to the application were received from royalty owners in the SW/4 of Section 22-10-29 and the SW/4 of Section 34-10-29 (3 owners). Discussions with the owners indicated their concerns were two-fold; (1) a lack of understanding of the purpose of the application, and (2) the potential loss of royalty revenues. The royalty owners concerns have been satisfied and they have formally withdrawn their objections. As there are no remaining objections to the application, the Director has the delegated authority to approve the proposed spacing order.

A handwritten signature in black ink, consisting of a stylized 'J' followed by a large, loopy 'F' and a horizontal line extending to the right.

John N. Fox

Attached.

TABLE 1
DALY BAKKEN A POOL - SIMULATION RESULTS

Case	No. of Wells	Recoverable Reserves		Recoverable Reserves	
		(10³m³)	(% OOIP)	Per Well	(10³m³)
16 ha Spacing*	20	137.1	30		6855
32 ha Spacing	10	87.4	19		8740
Combination 16 & 32 ha Spacing	10	104.9	23		10490

* Assumes no Injection at 13-21-10-29

Table 2

**COMPARISON OF BAKKEN DRILLING ECONOMICS
ON 16 ha AND 32 ha SPACING**

Spacing	Initial Production (m/d)	Recoverable Reserves (m ³)	Oil Price (\$/bbl)	Royalties	NPV (ATT) DCF=12%	ROR (%)	Pay-out (YRS)	Finding Cost (\$/bbl)
16 ha	3.5	4411	18*	Crown	-20	3.3	4.4	7.92
16 ha	3.5	4061	18*	Freehold	-47	0	0	8.61
16 ha	3.5	4061	22**	Crown	10	16.5	3.0	8.61
16 ha	3.5	4061	22**	Freehold	-14	5.5	3.8	8.61
32 ha	5.0	5949	18*	Crown	56	35.0	2.3	5.88
32 ha	5.0	5949	18*	Freehold	25	21.7	2.9	5.88
32 ha	5.0	5949	22**	Crown	95	57.5	1.8	5.88
32 ha	5.0	5949	22**	Freehold	62	39.1	2.2	5.88

* Escalated @ 5%/yr

** Oil price constant over evaluation period



December 5, 1994

Ms. Cindy C. Fordyce
18 Glenacres Cr.
Winnipeg MB R3T 5P9

Dear Ms. Fordyce:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

If you are satisfied with the information received from the Branch and the proposed temporary approval of the application, please indicate your agreement by signing in the space provided below and returning the duplicate copy of this letter to the undersigned. If you have any additional questions in respect of this matter please contact the undersigned or John Fox, Chief Petroleum Engineer at (204) 945-6573 and 945-6574, respectively.

Yours truly,

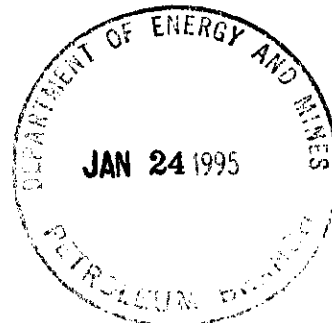
L.R. Dubreuil
Director of Petroleum

I, Cindy C. Fordyce hereby withdraw my objection to the application.

Cindy C. Fordyce
Cindy C. Fordyce

January 4, 1995
Date

cc: Tundra Oil and Gas Ltd.



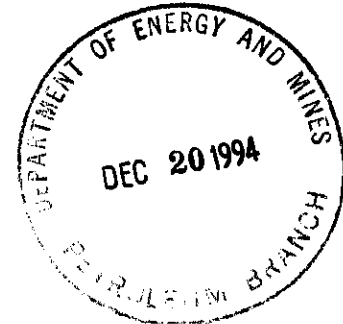


December 5, 1994

Mr. Sid Kucheravy
23 Leeds Avenue
Winnipeg, MB R3T 3X1

Dear Mr. Kucheravy:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**



The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

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Yours truly,

L.R. Dubreuil
Director of Petroleum

I, Sid Kucheravy hereby withdraw my objection to the application.

Sid Kucheravy

Dec. 18, 1994
Date

cc: Tundra Oil and Gas Ltd.



December 5, 1994

Ms. Hope J. ~~Kittler~~ **KITZLER** *HR*
Box 55
Snow Lake MB R0B 1M0

Dear Ms. Kittler:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

If you are satisfied with the information received from the Branch and the proposed temporary approval of the application, please indicate your agreement by signing in the space provided below and returning the duplicate copy of this letter to the undersigned. If you have any additional questions in respect of this matter please contact the undersigned or John Fox, Chief Petroleum Engineer at (204) 945-6573 and 945-6574, respectively.

Yours truly,

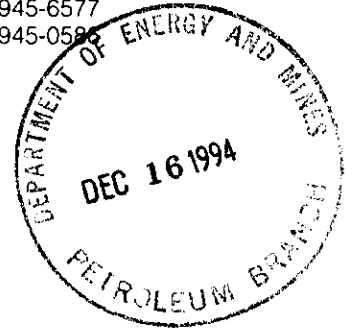
L.R. Dubreuil
Director of Petroleum

I, Hope J. Kittler **KITZLER** *HR* hereby withdraw my objection to the application.

Hope J. Kittler
Hope J. ~~Kittler~~ **KITZLER** *HR*

Dec 9/94
Date

cc: Tundra Oil and Gas Ltd.



December 5, 1994

Mr. and Mrs. Watson
Box 1405
Virden MB R0M 2C0

Dear Mr. and Mrs. Watson:

**Re: Tundra Oil and Gas
Application for 32 ha Spacing for the Bakken Formation
Daly Field and South Kirkella Area**

The Petroleum Branch is in receipt of your objection to the subject application. Based on your recent conversation with John Fox, I understand your questions regarding the application have been addressed.

The Branch is preparing to recommend temporary five (5) year approval of Tundra's application for 32 ha spacing. Approval of 32 ha spacing is consistent with one of the primary objectives of the Oil and Gas Act - the spacing of wells in accordance with sound engineering and economic principles to ensure the maximum economic recovery of oil. Tundra will be required to provide technical and economic information to the Branch on a regular basis to ensure drilling on 32 ha spacing remains appropriate.

If you are satisfied with the information received from the Branch and the proposed temporary approval of the application, please indicate your agreement by signing in the space provided below and returning the duplicate copy of this letter to the undersigned. If you have any additional questions in respect of this matter please contact the undersigned or John Fox, Chief Petroleum Engineer at (204) 945-6573 and 945-6574, respectively.

Yours truly,

L.R. Dubreuil
Director of Petroleum

I, Thomas & Evelyn Watson hereby withdraw my objection to the application.

Thomas Watson Evelyn Watson
Thomas Watson & Evelyn Watson

Dec 15/94.
Date

cc: Tundra Oil and Gas Ltd.

FIGURE 1

32 ha SPACING AREA

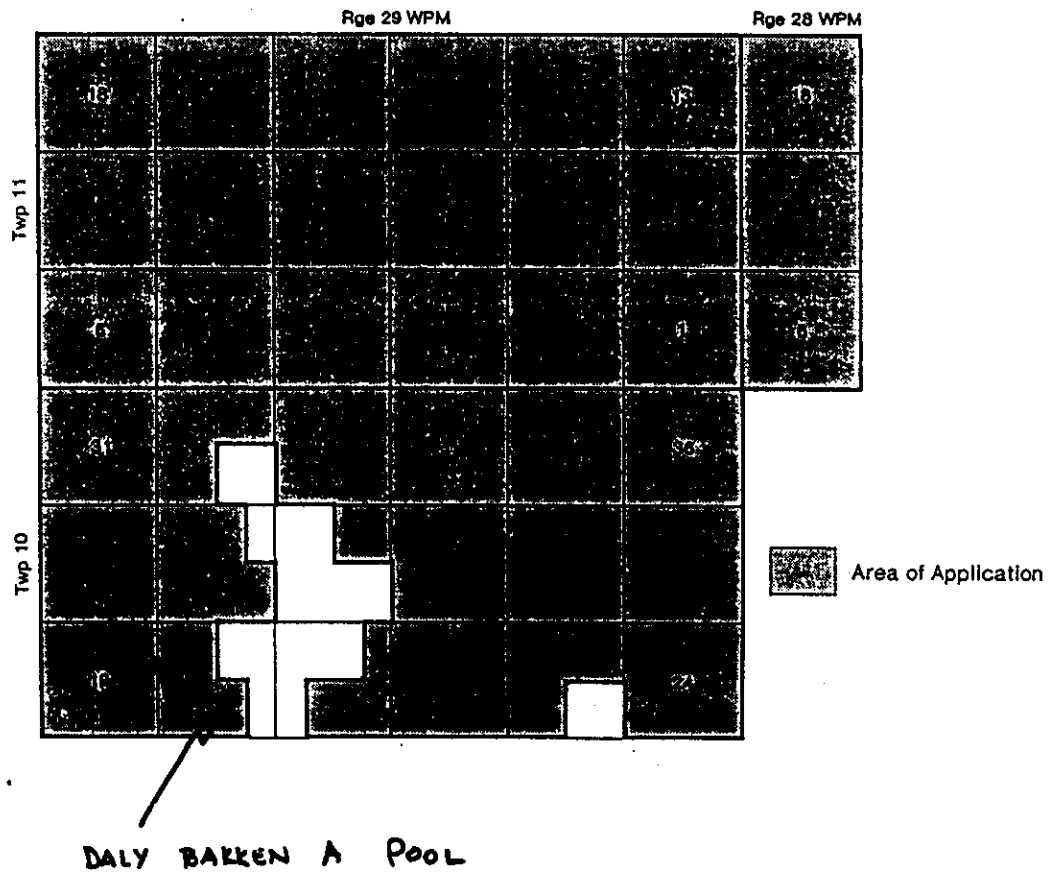


FIGURE 2 - 16 ha SPACING - SIMULATION RUN

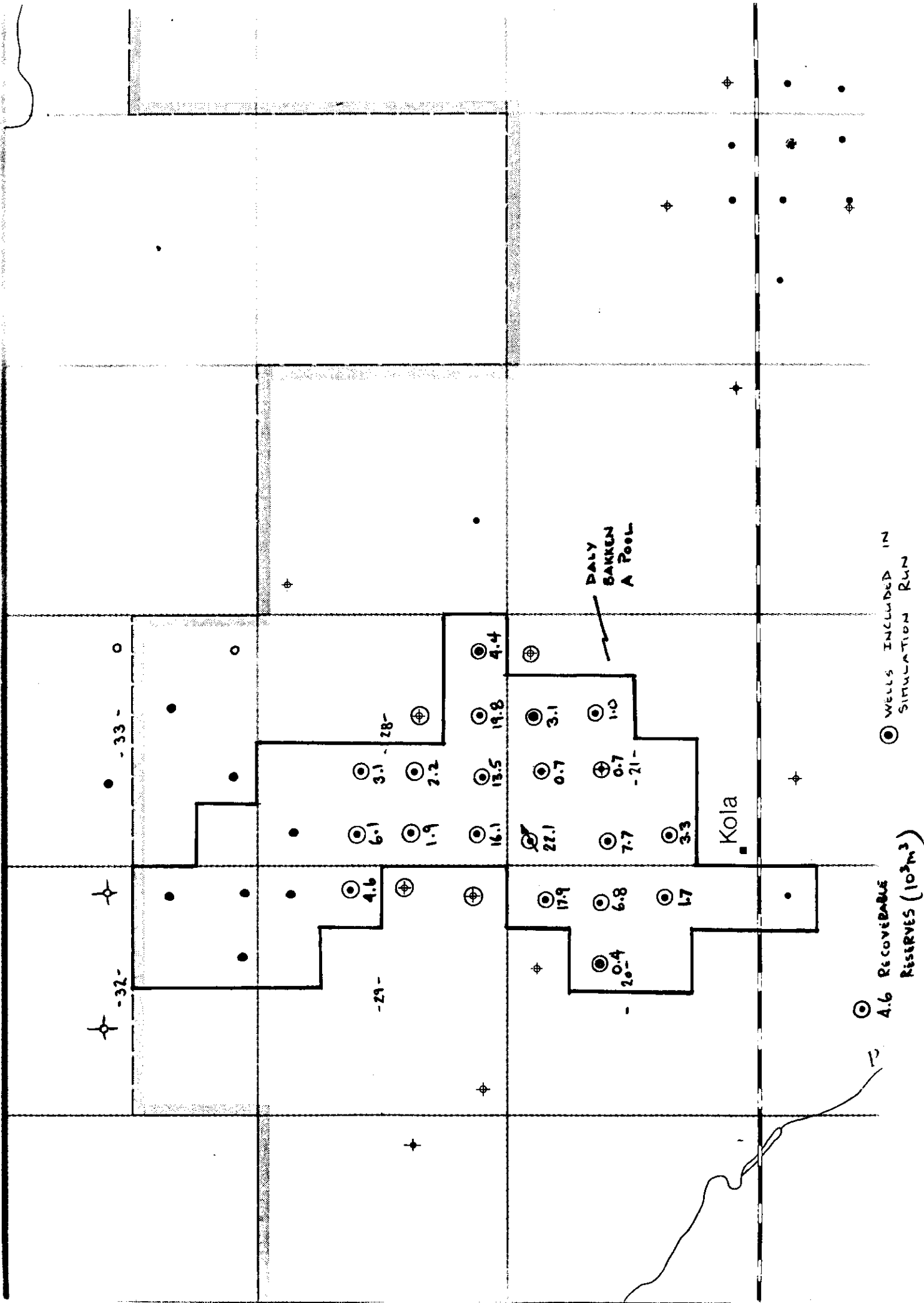


FIGURE 3-32 ha SPACING - SIMULATION RUN

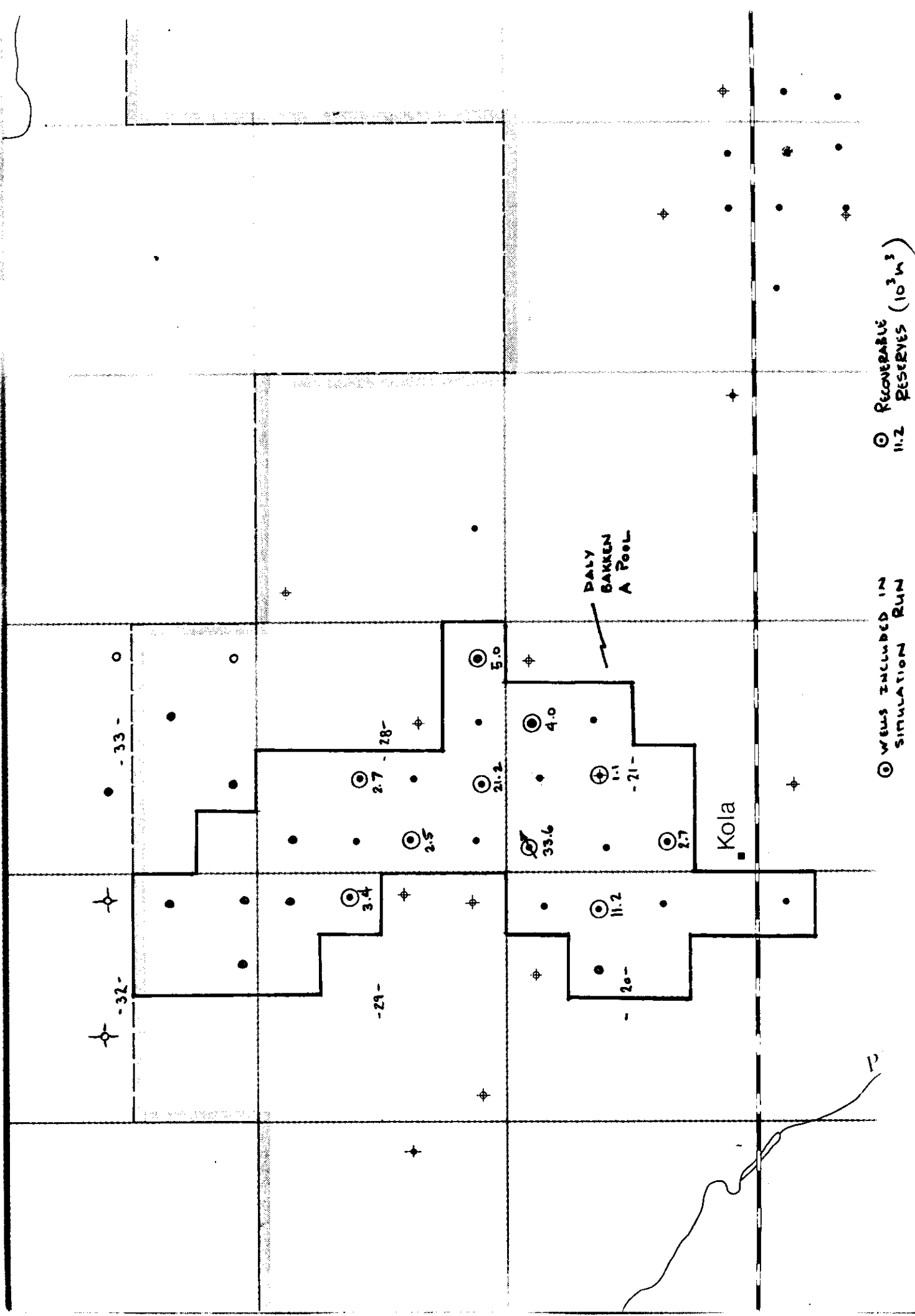


FIGURE 5 - DST PRESSURE MEASUREMENTS

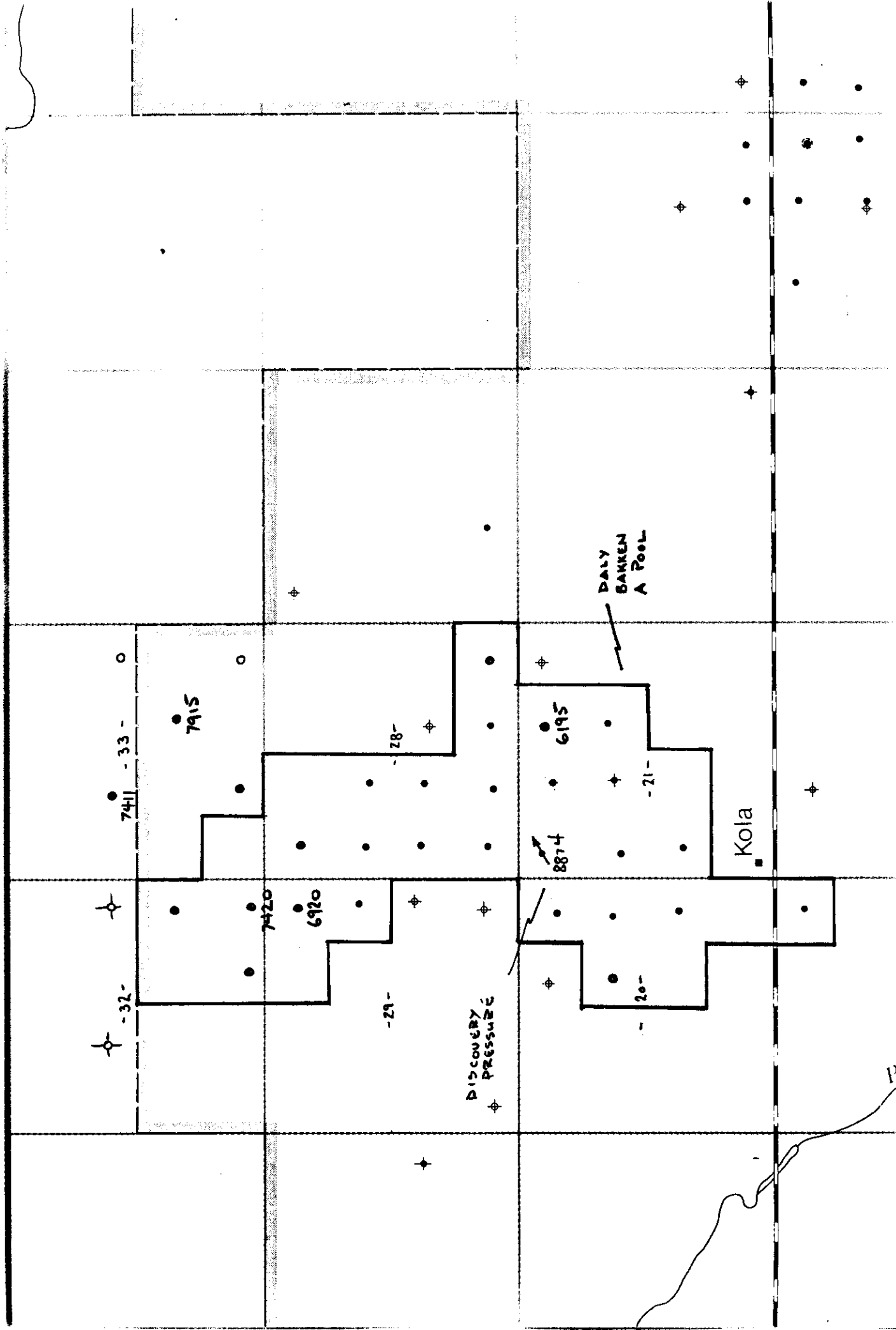


FIG. 6 - GRAPH SHOWING THE DISTRIBUTION
OF INDIVIDUAL WELL REC. RESERVES

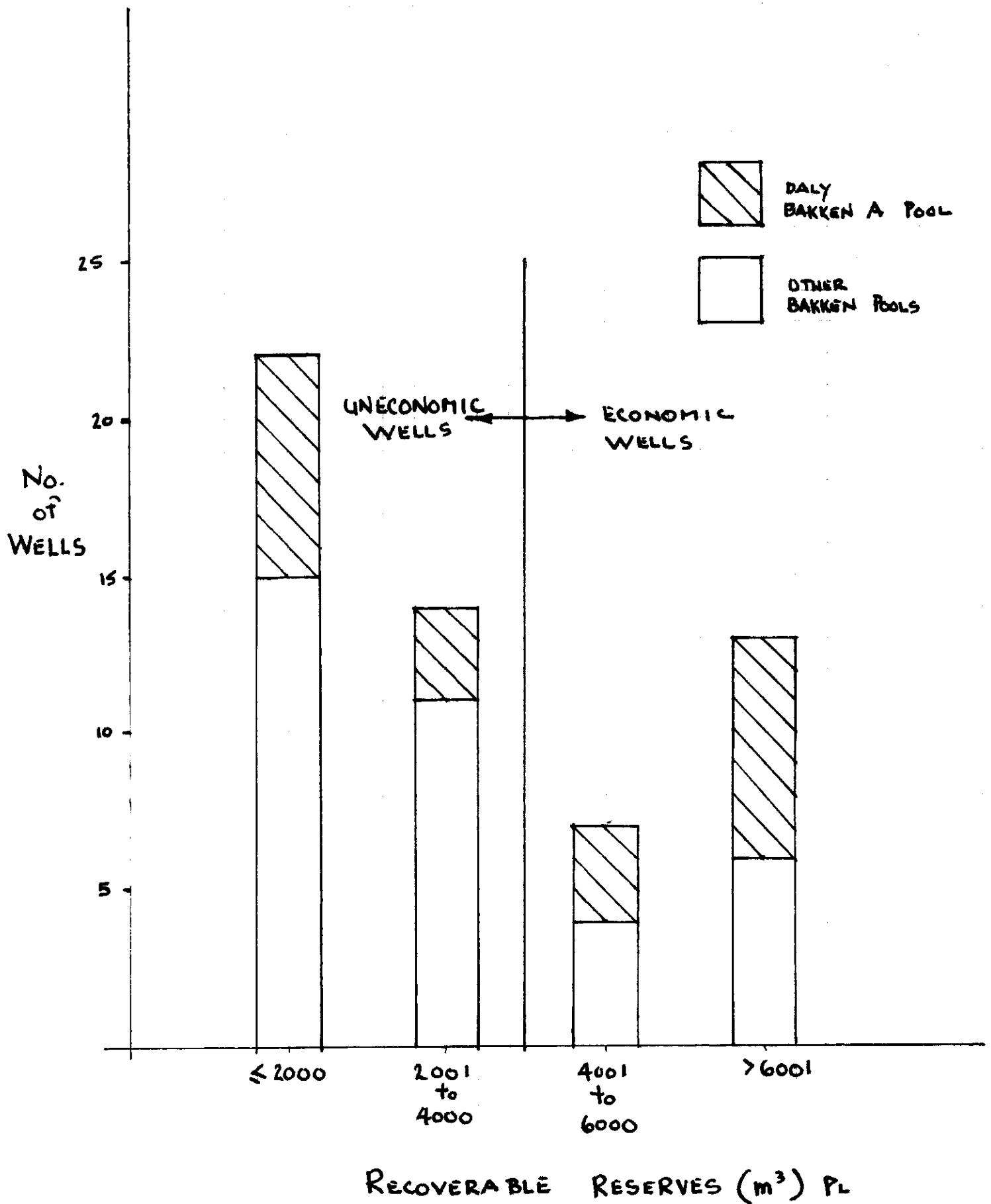
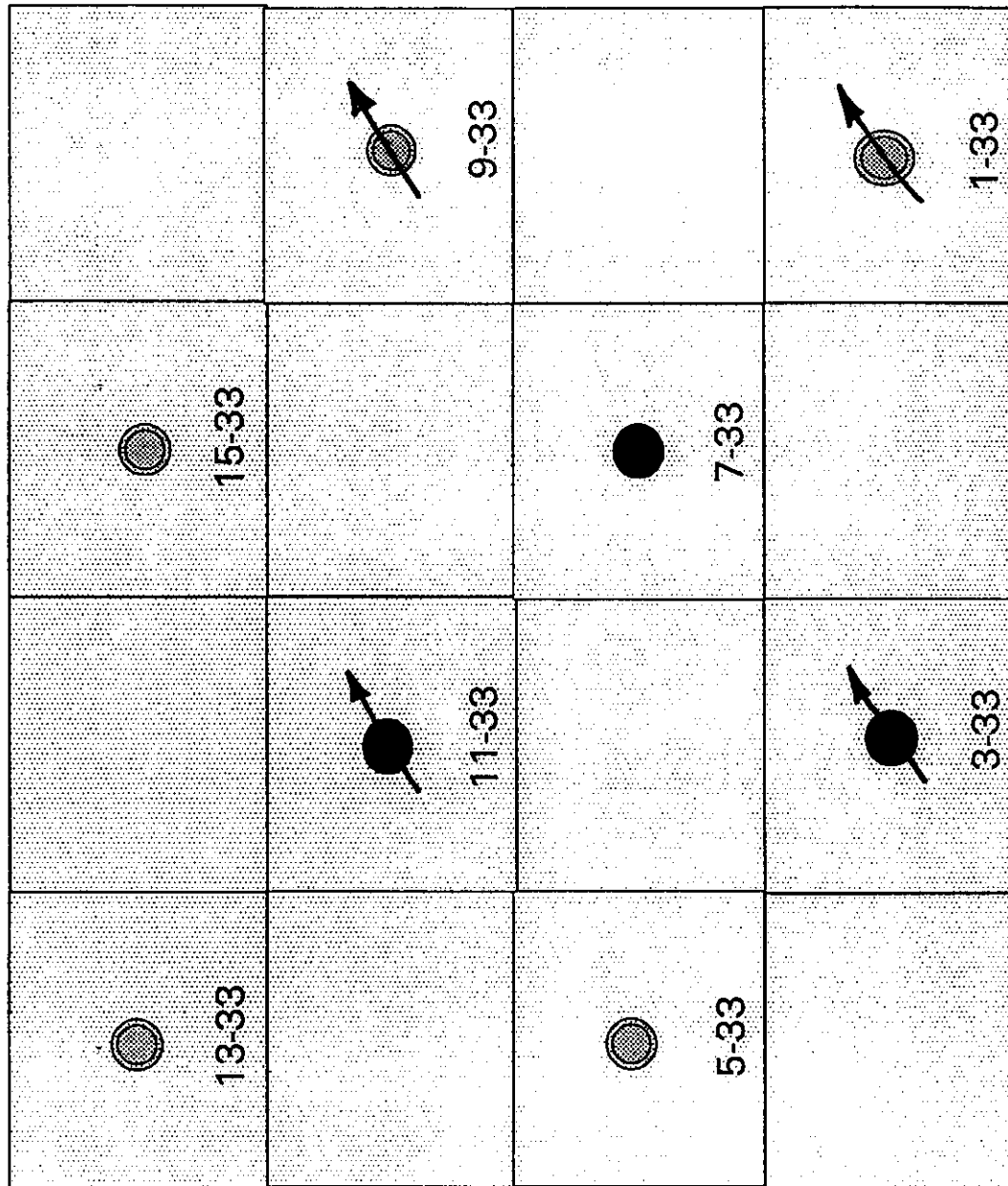


FIGURE 7

SECTION 33-10-29

32 HECTARE DEVELOPMENT PLAN



DRILLED DSU

PROPOSED LOCATION

POTENTIAL FUTURE INJECTORS

PRIMARY RECOVERY WELL SPACING

January 31, 1995

Mr. George Czyzewski
Tundra Oil and Gas Ltd.
1111- One Lombard Place
Winnipeg MB R3B 0X4

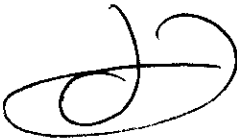
Dear Mr. Czyzewski:

**Re: Spacing Order No. 11
32 ha Spacing Bakken Formation**

Attached is Ministerial Spacing Order No. 11 approving 32 ha spacing for the Bakken Formation in a portion of the Daly Field and South Kirkella Area. The spacing order is for a five-year period ending February 1, 2000. If Tundra wishes to extend the order beyond this date, a technically supported application for an extension is to be submitted to the Branch before December 1, 1999. The order also provides for modification of the 32 ha spacing area from time to time to meet changing conditions. A request to modify the spacing area must include a discussion of Tundra's development plans and the impact the spacing change will have on recovery from the pool and on correlative rights.

If you have any questions in respect of this approval, please contact the undersigned at 945-6574.

Yours truly,



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


cc. Thomas and Evelyn Watson
Hope J. Kitzler
Sid Kucheravy
Cindy C. Fordyce

**MINISTERIAL ORDER
SPACING ORDER NO. 11**

**Pertaining to Spacing Units for the
Bakken Formation in the Daly Field and South Kirkella Area**

1. The spacing unit for each well drilled, or to be drilled, for the purpose of obtaining oil from the Bakken Formation within the area of application outlined on Schedule A is two legal subdivisions comprising the east half or west half of a quarter section.
2. The target area of each spacing unit shall be a square in the odd-numbered legal subdivision with sides 100 m from, and parallel to, the sides of the legal subdivision.
3. Subject to Section 16 of the Drilling and Production Regulation, where a well is completed outside its target area, the maximum production rate of the well will be reduced by application of an off-target penalty determined as shown on Schedule B.
4. The area outlined on Schedule A may be modified by the Director of Petroleum from time to time to meet changing conditions.
5. This order expires February 1, 2000 unless rescinded or extended prior to this date.

JAN. 30, 1995
Date



Director of Petroleum for
Minister of Energy and Mines

SPACING ORDER NO.11 SCHEDULE A

DALY FIELD AND SOUTH KIRKELLA AREA
32 ha Spacing Units

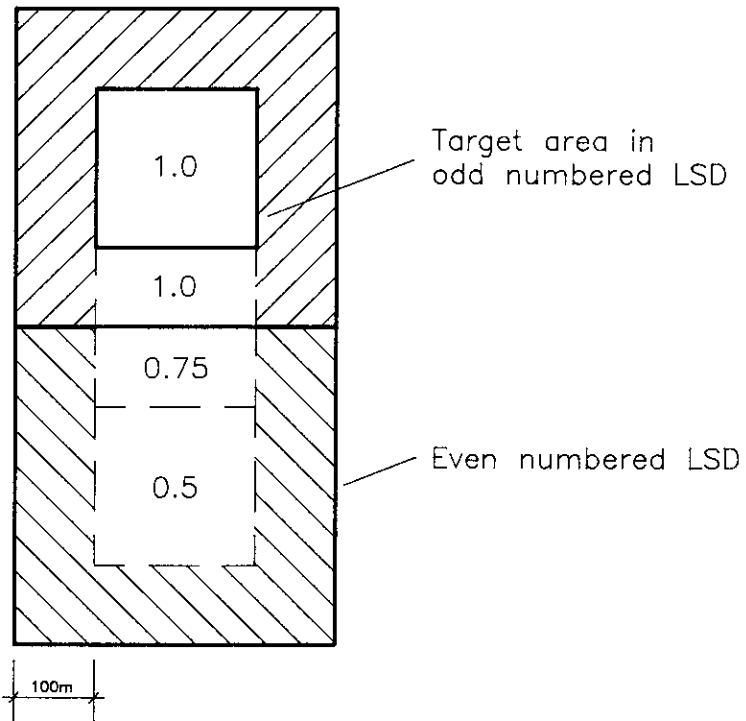
Rge 29 WPM					Rge 28 WPM	
Twp 11	18				13	18
	6				1	6
Twp 10	31				36	
	19				24	

SPACING ORDER NO. 11

SCHEDULE B

OFF-TARGET PENALTY FACTOR (PF_{OT}) 32 ha SPACING

32 ha Spacing Unit



$\left[\begin{matrix} 0.5 \\ 0.5 \end{matrix} \right]$ Off-target
penalty factor PF_{OT}

$$PF_{OT} = 0.5 \frac{AB}{10000}$$

$$PF_{OT} = 0.25 \frac{AB}{10000}$$

A and B are the minimum distances in metres within the pool to the nearest boundaries of the legal subdivision

NORTH KOLA 32 ha SPACING - TUNDRA EFFICIENCY LETTER

- Tundra believes lithological differences between Bakken pools makes each unique
- waterflooding in A&D pools not an unqualified economic success
- waterflooding in area of applⁿ - inverted 5-spot pattern on 32 ha spacing
- Tundra feels technical difficulties in keeping a horizontal well in pay would be encountered in the Bakken - horizontal drilling still an option
- depletion strategy develop See 33 on odd-numbered LSP's - additional wells 1, 5, 9, 13 & 15 of 33-10-29, convert 3-33 & 11-33 to injection
- * if prod. performance warrants, a limited no. of infill locations may be drilled to max. rec.

ECONOMICS.

- HOV value \$34,000 (16 ha) to \$43,000 (32 L)
- Freehold economics 16 ha @ \$18/bbl & \$22/bbl. even with HOV is uneconomic freehold royalty = 15%.

more optimistic price forecast \$22/bbl

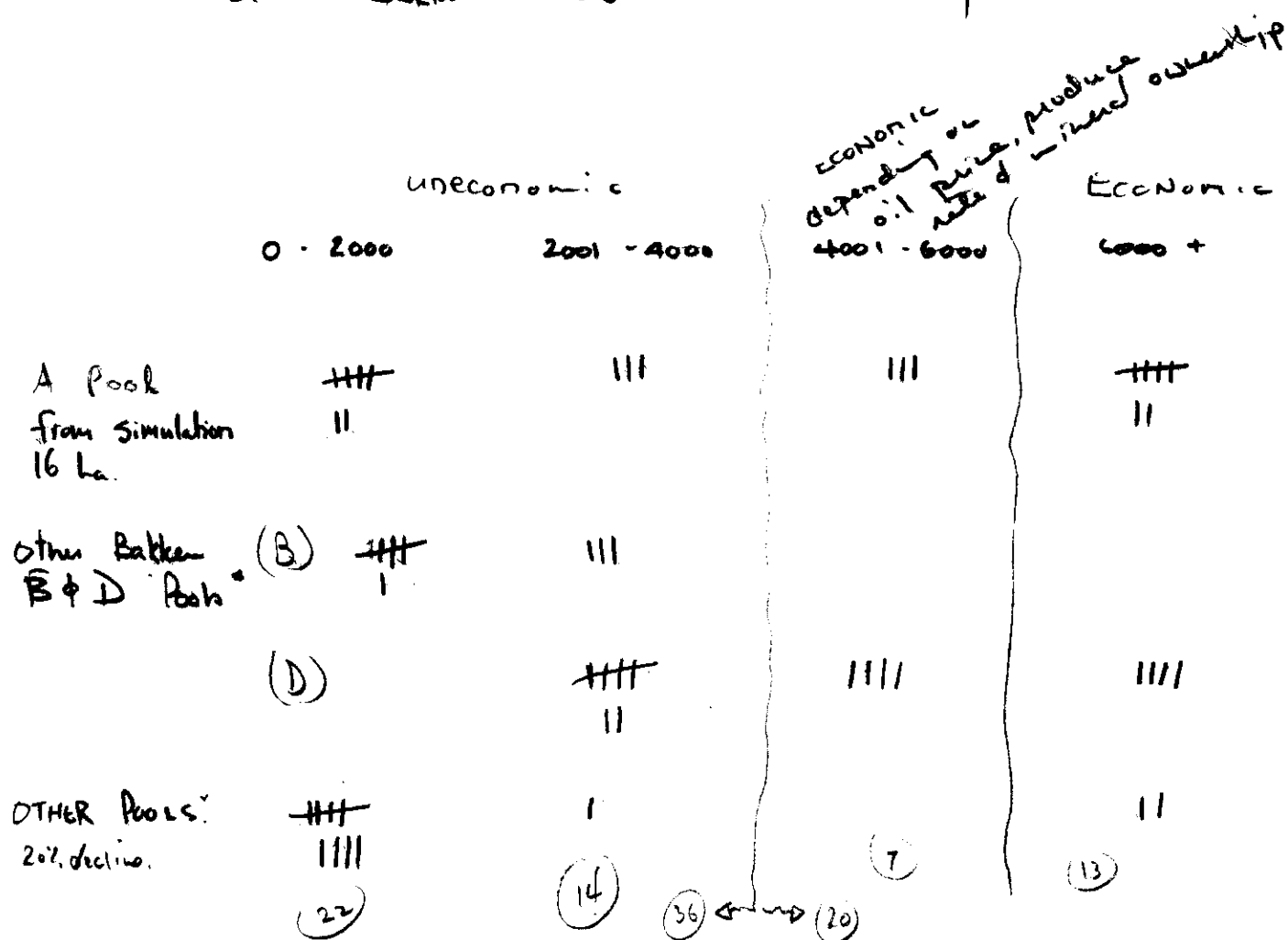
econ. parameters NPV (AIT) \$10000

ROR 16.5%

PO 3 yrs

RIP = 4062 m³

- Table — shows a bar graph of estimated recoverable reserves for wells in the A Pool and other Bakken Pools in the Dely Field



- if an economic cut-off of 4001 m³ recoverable reserves is used, A - 50% of the completed wells are not economic; overall 64% of completed Bakken wells are not economic or will not yield a satisfactory rate of return on investment

Economic limit = 0.2 - 3000

* B Pool Decline 21.7%

D Pool Decline



September 22, 1994

Mr. George Czyzewski, P.Eng.
Sr. Reservoir Engineer
Tundra Oil and Gas Ltd.
1111-One Lombard Place
Winnipeg, MB R3B 0X4

Dear George:

Re: North Kola Area - 32 ha Spacing Application

The Petroleum Branch has completed its preliminary review of your application for 32 ha spacing in the North Kola area. We have reached the following conclusions based on the technical and economic evidence.

- Recovery from the A Pool increases with increasing well density
- High productivity wells located in the better parts of the pool drain more than 16 ha, while poor producers don't adequately drain 16 ha
- Maximum economic recovery is realized by developing the better parts of the pool on 16 ha spacing
- Poor overall project economics have resulted from blanket Bakken development on 16 ha spacing

These conclusions are based on the following observations from the simulation study.

(1) Recovery under 16 ha spacing is 30% OOIP; recovery on 32 ha spacing - odd numbered LSD's is 19% OOIP; recovery on 32 ha spacing - even numbered LSD's is 16% OOIP; recovery from the 8 best producers, 9-20, 16-20, 12-21, 13-21, 2-28, 3-28, 4-28 and 12-28 is 24% OOIP.

(2) Simulation Case 4 has more wells in the better parts of the reservoir. The case includes 2 LSD's developed on 16 ha spacing plus an off-target well. This type of development which is a mix of 16 and 32 ha spacing would not be permitted under a 32 ha spacing approval.

(3) Simulation Cases 1,3 & 4 indicate maximum economic recovery is achieved by offsetting good producers on 32 ha spacing with a limited number of wells on 16 ha spacing in the better parts of the reservoir.

(4) To optimize recovery, flexibility to locate wells in the better parts of the reservoir is needed and 16 ha spacing is required to provide this flexibility, especially after the pool has been delineated.

Development on 32 ha spacing may reduce the number of poor producers and dry holes drilled and reduce offset drilling obligations. However, the Branch is not convinced that blanket 32 ha spacing will result in the maximum economic recovery. Prior to making a recommendation to the Minister, the Branch has a number of questions regarding the simulation results, Tundra's development strategy and drilling economics.

RESERVOIR SIMULATION STUDY AND DEVELOPMENT STRATEGY

(1) In order to achieve a history-match a regional aquifer was added to the model to provide additional pressure support, is there any evidence of an oil-water contact in the Bakken in wells located downdip of the A Pool?

(2) What is Tundra's explanation for the apparent contradiction between the waterflood performance predicted by the simulation and the actual waterflood performance in the A and D pools?

(3) Does Tundra anticipate implementing a waterflood in the area of application, if a pool similar to the A pool is discovered? Are there any potential geological, technical or economic barriers to waterflooding the Bakken in the area of application?

(5) The simulation indicates horizontal drilling will significantly increase recovery in the A pool. Does Tundra plan to drill a horizontal well in the A Pool? If Tundra plans on drilling horizontal wells in the area of application, how will the horizontal wells be oriented under 32 ha spacing?

(6) Provide an overview of Tundra's development strategy for the North Kola area. This should include the proposed use of 32 ha spacing, horizontal drilling, waterflooding and infill drilling on 16 ha.

Tundra may also wish to comment on the Branch's observations and conclusions from the simulation study.

ECONOMICS

(1) Tundra used an oil price of \$18/bbl escalated at 5%/year to run the economics. This price is representative of oil prices in the 1st Qu. 1994. During 1994 Bakken crude has averaged \$21.90/bbl and over the last 5 years has averaged \$23.65/bbl.

(2) The holiday oil volume (HOV) provided by the Manitoba Drilling Incentive Program has not been included in the economics. At \$18/bbl the HOV for a 16 ha development well is 1759 m³ and at \$22/bbl the HOV is 1433 m³.

(3) The economic limit in the 16 ha drilling case is 0.95 m³/d in 1999. The Branch's believes an economic limit of 0.5 m³/d is more representative of current operating conditions in Manitoba. Comment on the reason for the high economic limit.

In order to review the sensitivity of 16 ha drilling economics to these factors, the following cases should be run using two price forecasts; \$18/bbl escalated at 5%/year and \$22/bbl constant over the life of the well plus; (a) HOV; (b) reduced operating costs, if appropriate; (c) both Crown and freehold mineral ownership; and (d) both before and after tax (assuming Tundra is fully taxable).

If you have any question please contact the undersigned at 945-6573 or John N. Fox, Chief Petroleum Engineer at 945-6574.

Yours truly,



L.R. Dubreuil
Director of Petroleum

cc. Virden



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L.R. Dubreuil
Director of Petroleum

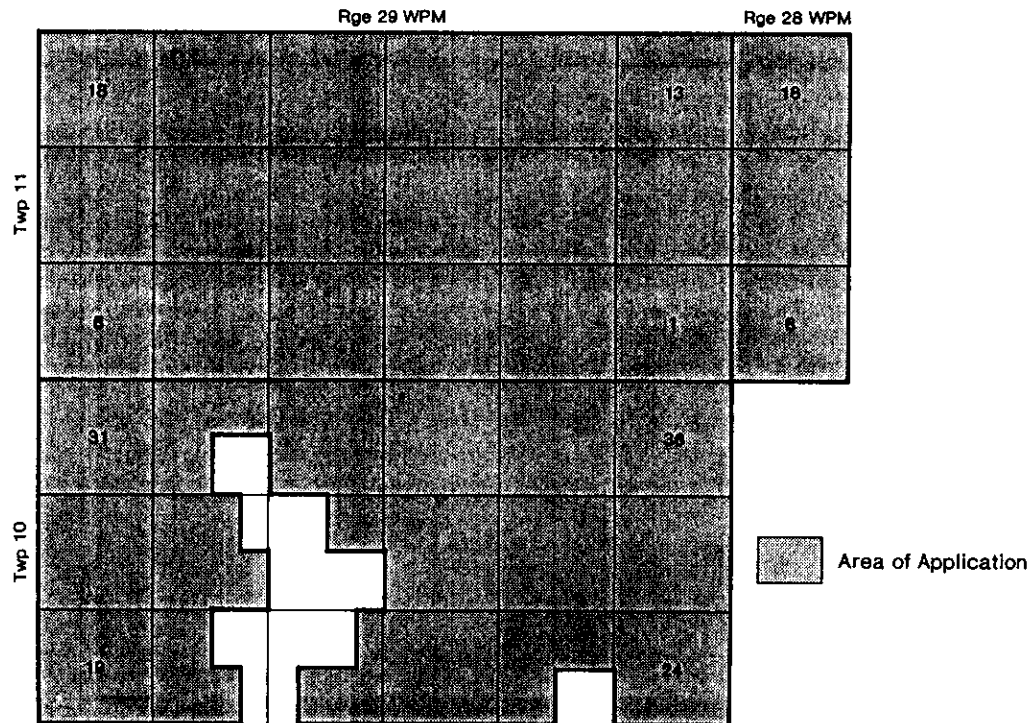
cc. Virden



NOTICE

UNDER THE OIL AND GAS ACT DALY OIL FIELD AND SOUTH KIRKELLA AREA

Tundra Oil and Gas Ltd. and Corvair Oils Ltd. have made application jointly under section 102 of The Oil and Gas Act for approval of special drilling spacing units in a portion of the Daly Oil Field and surrounding area. The area of application is outlined below.



It is proposed that drilling spacing units be increased in size from 16 hectares (40 acre) to 32 hectares (80 acres) for production from the Bakken Formation in the area of application. Individual drilling spacing units would consist of north-south pairs of Legal Subdivisions (eg. Lsd's 1 and 8, Lsd's 2 and 7, etc.). Proposed target area for the 32 hectare drilling spacing units would be located in the odd numbered legal subdivisions and would be of the same size and location as if that legal subdivision was a 16 hectare drilling spacing unit.

If no valid intervention or objection in writing is received by the Director of Petroleum at 555-330 Graham Avenue, Winnipeg, Manitoba, R3C 4E3 prior to August 19, 1994, the application may be approved.

Copies of the application can be obtained from:

Tundra Oil and Gas Ltd.
1111 One Lombard Place
Winnipeg MB R3B 0X4

Attention: Mr. George Czyzewski
Phone: (204) 934-5853

The application can be viewed at the offices of the Petroleum Branch:

555-330 Graham Avenue
Winnipeg MB R3C 4E3

Phone: (204) 945-6577

227 King Street West
Virden MB R0M 2C0

Phone: (204) 748-1557

Dated at Winnipeg, this 27th day of July, 1994.


L. R. Dubreuil
Director of Petroleum

Robert Lyle Angus
P.O. Box 400
Elkhorn MB R0M 0N0 ✓

Zarett Marie Anderson
26, 9520 - 174th Street
Edmonton AB T5T 5Z3 ✓

Marcel and Elizabeth Archambault
1115 - 22nd Street
Brandon MB R7B 2P6 ✓

Bernice Baughen (Estate)
c/o P.O. Box 357
Souris MB R0K 2C0 ✓

BRIDGE
Vivian Mary Bird
32 Birdege Villa Estates
Lethbridge AB T1K 4Z8

Earl Boomhauer
General Delivery
Elkhorn MB R0M 0N0 ✓

Jeanette Boyanowski
c/o P.O. Box 63
St. Paul AB T0A 3A0 ✓

Marlene Fay Bukaluk
1613 - 20th Street
Brandon MB R7B 2P2 ✓

John Lucien Canart (Estate)
c/o 3047 Victoria Heights Crescent ✓
Ottawa ON K1T 3M8

Marlene Elaine Cantlon
P.O. Box 113
Oak Lake MB R0M 1P0 ✓

Mildred May Canart
P.O. Box 154
Elkhorn MB R0M 0N0 ✓

Robert George Canart
3047 Victoria Heights Crescent ✓
Ottawa ON K1T 3M8

Canada Northwest Energy Limited
2700, 300 Fifth Avenue SW ✓
Calgary AB T2P 3C4

Cindy Lee Collinge
P.O. Box 564 ✓
Didsbury AB T0M 0W0

Cindy Lorraine Collins
601 - 7275 Salisbury Avenue
Burnaby BC V5E 4E1 ✓

Isabel Cotton
2015 Richmond Avenue ✓
Brandon MB R7B 0T4

Michael Dwayne Collins
P.O. Box 1024
Westbank BC V0H 2A0 ✓

Corvair Oils Ltd.
P.O. Box 3827, Station "D" ✓
Edmonton AB T5L 4J8

Muriel Charlotte Desy ✓
3834 Sixth Avenue North
Port Alberni BC V9Y 4M2

Beth Dibben
8531 - 77th Avenue ✓
Edmonton AB T6C 0L5

Sharon, Dava and Douglas Dixon
P.O. Box 56
Maryfield SK S0G 3K0 ✓

Jim G. Drinnan
408 Silver Hill Way NW ✓
Calgary AB T3B 4L5

Lloyd Alexander Duncan
P.O. Box 1502 ✓
Taber AB T0K 2G0

Arnold Emil Ellingson
36 McNabb Park Street ✓
Brooks AB T0J 0J0

Jean Exley
65 Acheson Road ✓
West Hill ON M1C 3C4

Cindy Christine Fordyce
18 Glenacres Crescent ✓
Winnipeg MB R3T 5P9

Gauer Oil Company
202 Riverside Drive ✓
Toronto ON M6S 4A9

Timothy Lawrence Gardiner
P.O. Box 634 ✓
Didsbury AB T0M 0W0

Ernest A. Giesbrecht
General Delivery ✓
Kola MB R0M 1B0

Dorothy Arlene Gow
Box 221 ✓
Miniota MB R0M 1M0

Helen Rachel Goethe
General Delivery
Elkhorn MB R0M 0N0 ✓

Andrew and Betty Grant
P.O. Box 1922
Virden MB R0M 2C0 ✓

Eva Green
General Delivery
Crystal City MB R0K 0N0 ✓

Elsie Hamilton
General Delivery
Elkhorn MB R0M 0N0 ✓

Edward Hudzik
R.R. #4
Brandon MB R7A 5Y4 ✓

Kenneth Hutchison
General Delivery
Elkhorn MB R0M 0N0 ✓

Kola Church and Cemetery
General Delivery
Kola MB R0M 1B0

Hope Justine Kitzler
125 Cedar Avenue
Snow Lake MB R0B 1M0 ✓

Erna Klassen
14728 Deer Ridge Drive SE ✓
Calgary AB T2J 6B5

Barry Alan Koop
P.O. Box 35
Kola MB R0M 1B0 ✓

Sidney John Kucharavy
23 Leeds Avenue
Winnipeg MB R3T 3X1 ✓

Eretta Ilene Lamont
P.O. Box 23
Manson MB R0M 1J0 ✓

Blanche Noreen Leis
P.O. Box 231
Elkhorn MB R0M 0N0 ✓

Leonard Resources Ltd.
P.O. Box 245
Elkhorn MB R0M 0N0 ✓

Samuel and Myrna Lennon
619 - 22nd Street
Brandon MB R7A 1S5 ✓

Lloyd Longman &
Margaret Christmas
General Delivery
Maryfield SK S0G 3K0 ✓

Harold Dale Lund
3501 Rosser Avenue
Brandon MB R7B 2Z3 ✓

Gerald Laverne Lund
P.O. Box 12
Elkhorn MB R0M 0N0 ✓

Glen James & Garth Walker Lund
P.O. Box 41
Kola MB R0M 1B0 ✓

Kenneth & Marion Lund
P.O. Box 263
Elkhorn MB R0M 0N0 ✓

Lyle George Berry Lund
105 - 5635 Paterson Avenue ✓
Burnaby BC V5H 2M6

Genevieve MacNeil
9631 Diamond Road ✓
Richmond BC V7E 1P5

May Magnan
P.O. Box 63
St. Paul AB T0A 3A0 ✓

Mavis Maxine McEachen
P.O. Box 117 ✓
Onanole MB R0J 1N0

Winthrop Leigh McMichael
718 Dukeshire Avenue
Kalamazoo, Michigan ✓
U.S.A.

Hillis Gordon Moore
P.O. Box 535
Virden MB R0M 2C0 ✓

Myrtle Revia Mooney
2312 Bradford Avenue ✓
Sidney BC V8L 2B6

Sarah Bessie Montgomery
General Delivery ✓
Virden MB R0M 2C0

Montreal Trust Company/
Northern Trusts Company/
Canada Trust ✓
411 Eighth Avenue SW
Calgary AB T2P 1E7

Montreal Trust Company ✓
P.O. Box 369
Winnipeg MB R3C 2J1

Strata Resources Ltd.
1298 Williams Road
E. Courtenay BC V9N 7J9 ✓

Edward Anthony Naylen
P.O. Box 174
Maryfield SK S0G 3K0 ✓

Ruth J. Naylen (Estate)
Naylen Oil Corp.
40 Everett Crescent
Regina SK S4S 2M7 ✓

Arthur Peter Neufeld
P.O. Box 34
Kola MB R0M 1B0 ✓

Donald Craig Neufeld
General Delivery
Kola MB R0M 1B0 ✓

Eric Deane Neufled
P.O. Box 396
Maryfield SK S0G 3K0 ✓

Dale Andrew O'Greysik
General Delivery
Elkhorn MB R0M 0N0 ✓

Donald Ogilvie
C12 Wellbury Drive, R.R. #3
Ganges BC V0S 1E0 ✓

Ogilvie Enterprises Ltd.
P.O. Box 417
Maryfield SK S0G 3K0 ✓

Gerald George Olgilvie
General Delivery
Elkhorn MB R0M 0N0 ✓

Harold Olgilvie
P.O. Box 65
Elkhorn MB R0M 0N0 ✓

Lewis and Jean Overand
P.O. Box 313
Elkhorn MB R0M 0N0 ✓

Wesley and Ellen Overand
General Delivery
Elkhorn MB R0M 0N0 ✓

Edward James Paull
P.O. Box 189
Elkhorn MB R0M 0N0 ✓

William Ian Paull
Apt. 32, 750 South Edward Street ✓
Thunder Bay ON P7E 2H4

William John Paull
P.O. Box 128 ✓
Elkhorn MB R0M 0N0

Archie and Elvira Penner ✓
P.O. Box 71
Kola MB R0M 1B0

Edgar Penner ✓
General Delivery
Elkhorn MB R0M 0N0

Helen Clarinda Pettapiece
119 Bruce Avenue
Winnipeg MB R3J 0T9 ✓

Penner Farms Ltd. ✓
P.O. Box 42
Kola MB R0M 1B0

Poco Petroleums Ltd.
P.O. Box 4365, Station "C"
Calgary AB T2T 5N2

Franz Leo Rex
General Delivery
Butler MB R0M 0J0

James and Doreen Reddekop
General Delivery
Kola MB R0M 1B0

M. K. and K. W. Rowan
P.O. Box 402
Elkhorn MB R0M 0N0

Thelma Minnie Rowan
General Delivery
Elkhorn MB R0M 0N0

R.M. of Wallace
P.O. Box 310
Virden MB R0M 2C0

Darwin Lorne Rowan
General Delivery
Elkhorn MB R0M 0N0

Edith Sharon Rowan
General Delivery
Kola MB R0M 1B0

Kenneth Lyle Rowan
General Delivery
Elkhorn MB R0M 0N0

Lawrence Garth Rouse
5023 - 198B Street
Langley BC V3A 7L9

William Ralph Rowan
P.O. Box 223
Elkhorn MB R0M 0N0 ✓

Clifford Dale Shepherd
101 Prairie Crescent
Brandon MB R7B 3S9 ✓

Francis Malcolm Shepherd
P.O. Box 58
Elkhorn MB R0M 0N0 ✓

Joyce Marlene Shepherd
c/o 101 Prairie Crescent
Brandon MB R7B 3S9 ✓

Murray Dwight Shepherd
P.O. Box 693
Virden MB R0M 2C0 ✓

Rosella Mary Shepherd
P.O. Box 411
Virden MB R0M 2C0 ✓

Rodney Stuart Shepherd
P.O. Box 126
Elkhorn MB R0M 0N0 ✓

Soldier Settlement Board of
Canada
Property Management Directorate
Western Canada
501, 101 - 22nd Street E.
Saskatoon SK S7K 0E4 ✓

Doris Ruth Stephen
360 Evergreen Street
Sherwood Park AB T8A 1J8 ✓

William Norman Stewart
P.O. Box 307
Maryfield SK S0G 3K0 ✓

Rose Catherine Streeter
14923 NE Graham
Portland, Oregon ✓
U.S.A.

James Austin Taylor
7 Forest Boulevard ✓
Brandon MB R7B 2N4

Murray Archibald Taylor
P.O. Box 262
Maryfield SK S0G 3K0 ✓

Kathleen Mary Thomson
P.O. Box 218
Elkhorn MB R0M 0N0 ✓

Tundra Oil and Gas Ltd.
1111 One Lombard Place ✓
Winnipeg MB R3B 0X4

Darryl and Donald Twigg
P.O. Box 248
Elkhorn MB R0M 0N0 ✓

University of Manitoba
Room 202,
Adminstration Building ✓
Winnipeg MB R3T 2N2

Wasy Investments Ltd.
1598 Sixth Avenue
Prince George BC V2L 5G7 ✓

John Edwin Watson
158 Leslie Street
Sault Ste. Marie ON P6B 5C7 ✓

Robin Watson
P.O. Box 245
Roblin MB R0L 1P0 ✓

Thomas and Evelyn Watson
P.O. Box 1405
Viriden MB ROM 2C0 ✓

Donald C. & Barbara J. Widger
P.O. Box 68
Elkhorn MB ROM 0N0 ✓

David John Wood
P.O. Box 87
Crossfield AB TOM 0S0 ✓

Douglas Harold Wood
P.O. Box 99
Kelwood MB ROJ 0Y0 ✓

Woodbrand Holdings Ltd.
General Delivery
Hargrave MB ROM 0W0 ✓

ANRO	Angus, Robert Lyle P.O. Box 400 Elkhorn, MB 845-2149	ROM ONO	
ANZA	Anderson, Zarett Marie 26, 9520 - 174th Street Edmonton, AB	T5T 5Z3	
ARCH	Archambault, Marcel & Elizabeth 1115 - 22nd Street Brandon, MB 727-8780	R7B 2P6	
BABE	Baughen, Bernice (formerly Northcott) - c/o P.O. Box 357 - Souris MB	ESTATE ROM 2CO	
BIVI	Bird, Vivian Mary 32 Bridge Villa Estates Lethbridge, AB (403) 320-0088	T1K 4Z8	
BOEA	Boonhauer, Earl General Delivery Elkhorn, MB 845-2577	ROM ONO	
BOUE	BOYANOWSKI, JEANETTE c/o P.O. Box 63 St. Paul, AB	TOA 3A0	
BUMA	Bukaluk, Marlene Fay 1613 - 20th Street Brandon, MB 728-3860	R7B 2P2	
CAJO	Canart, John Lucien (Estate) c/o 3047 Victoria Heights Crescent Ottawa, ON (613) 738-7555	K1T 3M8	
CAMA	Cannton, Marlene Elaine P.O. Box 113 Oak Lake, MB 855-2259	ROM 1PO	
CAMI	Canart, Mildred May P.O. Box 154 Elkhorn, MB 845-2455	ROM ONO	
CARO	Canart, Robert George 3047 Victoria Heights Crescent Ottawa, ON (613) 738-7555	K1T 3M8	
CNEL	Canada Northwest Energy Limited 2700, 300 Fifth Avenue S.W. Calgary, AB	T2P 3C4	
COCI	Collinge, Cindy Lee P.O. Box 564 Didsbury, AB	TOM OWO	
COCL	Collins, Cindy Lorraine 601 - 7275 Salisbury Avenue Burnaby, BC	V5E 4E1	
COIS	Cotton, Isabel 2015 Richmond Avenue Brandon, MB 728-1890	R7B OT4	
COMI	Collins, Michael Dwayne P.O. Box 1024 Westbank, BC	V0H 2A0	
COOL	Corvair Oils Ltd. P.O. Box 3827, Station "D" Edmonton, AB	T5L 4J8	
DEMU	Desy, Muriel Charlotte 3834 Sixth Avenue North Port Alberni, BC	V9Y 4M2	
DEPT	Department of Energy & Mines 555 - 320 Graham Avenue Winnipeg, MB	R3C 4E3	
DIBE	Dibben, Beth 8531 - 77th Avenue Edmonton, AB	T6C 0L5	
DIXO	Dixon, Sharon, Dava & Douglas P.O. Box 56 Marryfield, SK	S0G 3K0	
DRRA	Drimman, Jim G. 408 Silver Hill Way N.W. Calgary, AB (403) 286-6613	T3B 4L5	
DULL	Duncan, Lloyd Alexander P.O. Box 1502 Taber, AB	TOK 2G0	
ELAR	Ellingson, Arnold Emil 36 McNabb Park Street Brooks, AB	TOJ 0J0	
EXJE	Exley, Jean 65 Acheson Road West Hill, ON	MC 3C4	
FOCI	Fordyce, Cindy Christine 18 Glenacres Crescent Winnipeg, MB	R3T 5P9	
GAOC	Gauer Oil Company 202 Riverside Drive Toronto, ON	M6S 4A9	
GATTI	Gardiner, Timothy Lawrence P.O. Box 634 Didsbury, AB (403) 337-2866	TOM OWO	
GIER	Giesbrecht, Ernest A. General Delivery Kola, MB	ROM 1B0	

GODO	Gow, Dorothy Arlene General Delivery Box 221 Miniota, MB	ROM 1MO	KOBA	Koop, Barry Alan P.O. Box 35 Kola, MB 556-2223	ROM 1BO	LUKE	Lund, Kenneth Lloyd P.O. Box 263 Elkhorn, MB 845-2188	ROM ONO
GOHE	Goethe, Helen Rachel General Delivery Elkhorn, MB 845-2074	ROM ONO	KUSI	Kucharav, Sidney John 23 Leeds Avenue Winnipeg, MB 261-0404	R3T 3X1	LUKM	Lund, Kenneth & Marion P.O. Box 263 Elkhorn, MB 845-2188	ROM ONO
GRAN	Grant, Andrew & Betty P.O. Box 1922 Virden, MB 748-1156	ROM 2CO	LAER	Lamont, Eietta Ilene P.O. Box 23 Manson, MB 722-2324	ROM 1JO	LULY	Lund, Lyle George Berry 105 - 5635 Paterson Avenue Burnaby, BC (604) 435-4227	V5H 2M6
GREV	Green, Eva General Delivery Crystal City, MB 873-2507 (<i>disconnected</i>)	ROK ONO	LEBL	Leis, Blanche Noreen P.O. Box 231 Elkhorn, MB 845-2032	ROM ONO	MACG	MacNeil, Genevieve 9631 Diamond Road Richmond, BC (604) 271-0679	V7E 1P5
HAEL	Hamilton, Elsie General Delivery Elkhorn, MB	ROM ONO	LERL	Leonard Resources Ltd. P.O. Box 245 Elkhorn, MB	ROM ONO	MAMA	^A Magnan, May P.O. Box 63 St. Paul, AB	TOA 3AO
HUED	Hudzik, Edward R.R. #4 Brandon, MB	R7A 5Y4	LESM	Lennon, Samuel & Myrna 619 - 22nd Street Brandon, MB 728-5482	R7A 1S5	MCMM	McEachen, Mavis Maxine P.O. Box 117 Onanole, MB	ROJ 1NO
HUKE	Hutchison, Kenneth General Delivery Elkhorn, MB 845-2008	ROM ONO	LLCM	Longman, Lloyd & Christmas, Margaret General Delivery Maryfield, SK	SOG 3KO	MCWI	McMichael, Winthrop Leigh 718 Dukeshire Avenue Kalamazoo, Michigan	U.S.A.
KC&C	Kola Church & Cemetary General Delivery Kola, MB 556-2604	ROM 1BO	LUDA	Lund, Harold Dale 3501 Rosser Avenue Brandon, MB 727-7862	R7B 2Z3	MOHI	Moore, Hillis Gordon P.O. Box 535 Virden, MB 748-1530	ROM 2CO
KIHO	Kitzler, Hope Justine 125 Cedar Avenue Snow Lake, MB 358-2550	ROB 1MO	LUGE	Lund, Gerald Laverne P.O. Box 12 Elkhorn, MB 845-2196	ROM ONO	MOMY	Mooney, Myrtle Revia 2312 Bradford Avenue Sidney, BC	V8L 2B6
KLER	Klassen, Erna 14728 Deer Ridge Drive S.E. Calgary, AB	T2J 6B5	LUGG	Lund, Glen James & Garth Walker P.O. Box 41 Kola, MB 556-2355	ROM 1BO	MOSA	Montgomery, Sarah Bessie General Delivery Virden, MB 748-1703	ROM 2CO

MOTC Montreal Trust Company
411 Eighth Avenue S. W.
Calgary, AB
(403) 267-6887 (Kathy J. Smith) T2P 1E7

MOTR Montreal Trust Company
P.O. Box 369
Winnipeg, MB
943-0451 R3C 2J1

MURO Strata Resources Ltd.
1298 Williams Road
E. Courtenay, BC V9N 7J9

NAEA Naylen, Edward Anthony
P.O. Box 174
Maryfield, SK
556-2366 SOG 3K0

NARU Naylen, Ruth J. (Est)/Naylen Oil Corp.
40 Everett Crescent
Regina, SK S4S 2M7

NEAR Neufeld, Arthur Peter
P.O. Box 34
Kola, MB
556-2334 ROM 1B0

NEDC Neufeld, Donald Craig
General Delivery
Kola, MB
556-2228 ROM 1B0

NEED Neufeld, Eric Deane
P.O. Box 396
Maryfield, SK
(306) 646-4430 SOG 3K0

NTCL Northern Trusts Company
c/o 411 Eighth Avenue S.W.
Calgary, AB T2P 1E7
(403) 267-6887 (Kathy J. Smith)

OGDA O'Greysik, Dale Andrew
General Delivery
Elkhorn, MB
845-2573 ROM ONO

OGDO Ogilvie, Donald
C12 Wellbury Drive, R.R. #3
Ganges, BC V0S 1E0

OGEL Ogilvie Enterprises Ltd.
P.O. Box 417
Maryfield, SK SOG 3K0

OGGE Ogilvie, Gerald George
General Delivery
Elkhorn, MB
845-2015 ROM ONO

OGHA Ogilvie, Harold
P.O. Box 65
Elkhorn, MB
845-2071 ROM ONO

OVLJ Overand, Lewis & Jean
P.O. Box 313
Elkhorn, MB
845-2324 ROM ONO

OVWE Overand, Wesley & Ellen
General Delivery
Elkhorn, MB
845-2636 ROM ONO

PAED Paul, Edward James
P.O. Box 189
Elkhorn, MB
845-2418 ROM ONO

PAUV Paul, William Ian
Apt. 32, 750 South Edward Street
Thunder Bay, ON P7E 2H4
(807) 577-3693

PAWI Paul, William John
P.O. Box 128
Elkhorn, MB
845-2127 ROM ONO

PEAE Penner, Archie & Elvira
P.O. Box 71
Kola, MB ROM 1B0

PEED Penner, Edgar
General Delivery
Elkhorn, MB ROM ONO

PEHE Pettapiece, Helen Clarinda
119 Bruce Avenue
Winnipeg, MB
832-4469 R3S 0T9

PENF Penner Farms Ltd.
P.O. Box 42
Kola, MB ROM 1B0

PERM Canada Trust c/o Montreal Trust
411 Eighth Avenue S.W.
Calgary, AB T2P 1E7
(403) 267-6887 (Kathy J. Smith)

POCO Poco Petroleum Ltd.
P.O. Box 4365, Station "C"
Calgary, AB T2T 5N2

REFR Rex, Franz Leo
General Delivery
Butler, MB ROM 050

REJD Reddekop, James & Doreen
General Delivery
Kola, MB ROM 1B0

ROKW Rowan, Kenneth William John
P.O. Box 402
Elkhorn, MB ROM ONO
845-2061

ROMA Rowan, Mary Katherine & Kenneth William
P.O. Box 402
Elkhorn, MB ROM ONO
845-2061

ROTU Rowan, Thelma Minnie
General Delivery
Elkhorn, MB ROM ONO

RMWA	R.M. of Wallace P.O. Box 310 Virden, MB 748-1239	ROM 2C0	SHRM	Shepherd, Rosella Mary P.O. Box 411 Virden, MB 748-2607	ROM 2C0	TOGL	Tundra Oil and Gas Ltd. 1111 One Lombard Place Winnipeg, MB 934-5850	R3B 0X4
RODA	Rowan, Darwin Lorne General Delivery Elkhorn, MB 845-2389	ROM ONO	SHRO	Shepherd, Rodney Stuart P.O. Box 126 Elkhorn, MB 845-2069	ROM ONO	TWDD	Twigg, Darryl & Donald P.O. Box 248 Elkhorn, MB 845-2306	ROM ONO
ROED	Rowand, Edith Sharon General Delivery Kola, MB 556-2644	ROM 1B0	SOFL	Southern, Florence Mabel Kelowna, BC		TWDL	Twigg, Darryl Lloyd P.O. Box 248 Elkhorn, MB 845-2306	ROM ONO
ROKE	Rowan, Kenneth Lyle General Delivery Elkhorn, MB 845-2345	ROM ONO	SSBC	Soldier Settlement Board of Canada 501, 101-12th St. E. West Saskatoon, SK	57K DEC	UOFM	University of Manitoba Room 202, Administration Building Winnipeg, MB	R3T 2N2
ROLA	Rouse, Lawrence Garth 5023 - 1988 Street Langley, BC (604) 530-6580	V3A 7L9	STDR	Stephen, Doris Ruth 360 Evergreen Street Sherwood Park, AB	T8A 1J8	WAIL	Wasyl Investments Ltd. 1598 Sixth Avenue Prince George, BC	V2L 5G7
ROWI	Rowan, William Ralph P.O. Box 223 Elkhorn, MB 845-2323	ROM ONO	STNO	Stewart, William Norman P.O. Box 307 Maryfield, SK	SOG 3K0	WAJO	Watson, John Edwin 158 Leslie Street Sault Ste. Marie, ON (705) 256-5835	P6B 5C7
SHCL	Shepherd, Clifford Dale 101 Prairie Crescent Brandon, MB 729-8884	R7B 3S9	STRC	Streeter, Rose Catherine 14923 NE Graham Portland, OREGON	U.S.A	WARO	Watson, Robin P.O. Box 245 Roblin, MB 937-2426	ROL 1P0
SHFR	Shepherd, Francis Malcolm P.O. Box 58 Elkhorn, MB 845-2051	ROM ONO	TAJA	Taylor, James Austin 7 Forest Boulevard Brandon, MB 728-6872	R7B 2N4	WATE	Watson, Thomas & Evelyn P.O. Box 1405 Virden, MB 748-3012	ROM 2C0
SHJM	Shepherd, Joyce Marlene c/o 101 Prairie Crescent Brandon, MB N/A	R7B 3S9	TAMU	Taylor, Murray Archibald P.O. Box 262 Maryfield, SK (306) 646-2201	SOG 3K0	WATH	Watson, Thomas Reginald P.O. Box 1405 Virden, MB 748-3012	ROM 2C0
SHMU	Shepherd, Murray Dwight P.O. Box 693 Virden, MB 748-1028	ROM 2C0	THKA	Thomson, Kathleen Mary P.O. Box 218 Elkhorn, MB 845-2147	ROM ONO	WIBA	Widger, Barbara J. P.O. Box 68 Elkhorn, MB 845-2311	ROM ONO

WIDG Widger, Donald C. ~~BARBARA J.~~
P.O. Box 68

Elkhorn, MB
845-2311

ROM ONO

WODJ Wood, David John

P.O. Box 87
Crossfield, AB

TOM OSO

WODO Wood, Douglas Harold

P.O. Box 99
Kelwood, MB
967-2384

ROJ OYO

WOHL Woodbrand Holdings Ltd.

General Delivery
Hargrave, MB

ROM OWO



FAX COVER PAGE



International Year of the Family

Friend of the Family

DATE: 94-07-30

PAGE / OF /
(Including cover page)TO: PETROLEUM BRANCH
ATTN: DAN SURZYCHYN

#

FROM: SUZANNE TOWNS
OF:

(204) 934-5820

DAN - WE GOT LUCKY. MABEL SOUTHERN CALLED ME BACK.

301-217 ELM AVENUE
PENTICTON, BC
V2A 3W1Thank
SuzannePLEASE NOTE: IF YOU DO NOT RECEIVE ALL PAGES, PLEASE CONTACT BEV
AT (204) 934-5850.



FAX COVER PAGE

DATE: 94-07-26

PAGE 1 OF 6
(including cover page)TO: PETROLEUM BRANCH
ATTN: DAN SURZYCHYN

#

FROM: SUZANNE TOEWS

#(204) 934-5820

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DAN -

ATTACHED IS A NEW ADDRESS LISTING FOR THE 80-ACRE SPACING APPLICATION. I HAVEN'T BEEN ABLE TO LOCATE FLORENCE SOUTHERN YET... BUT I LEFT A MESSAGE ON SOMEONE'S ANSWERING MACHINE. ADDRESSES I'M NOT POSITIVE ABOUT HAVE A ??

SUE.

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[illegible]

GODO	Gow, Dorothy Arlene P.O. Box 221 Minoka, MB 588-4550	ROM 1M0	KOBA	Koop, Barry Alan P.O. Box 35 Kola, MB 558-2223	ROM 1B0	LUKE	Lund, Kenneth Lloyd P.O. Box 263 Elkhorn, MB 845-2188	ROM ONO
GOHE	Goethe, Helen Rachel General Delivery Elkhorn, MB 845-2074	ROM ONO	KUSI	Kuchavy, Sidney John 23 Leeds Avenue Winnipeg, MB 261-0404	R3T 3X1	LUKM	Lund, Kenneth & Marion P.O. Box 263 Elkhorn, MB 845-2188	ROM ONO
GRAN	Grant, Andrew & Betty P.O. Box 1922 Virden, MB 748-1156	ROM 2C0	LAER	Lamont, Eretta Irene P.O. Box 23 Manson, MB 722-2324	ROM 1J0	LULY	Lund, Lyb George Berry 105 - 5635 Paterson Avenue Burnaby, BC (604) 435-4227	V5H 2M6
GREV	Green, Eva General Delivery Crystal City, MB 873-2507 (disconnected)	ROM ONO	LEBL	Leis, Blanche Noreen P.O. Box 231 Elkhorn, MB 845-2032	ROM ONO	MACG	MacNeil, Genevieve 9631 Diamond Road Richmond, BC (604) 271-0879	V7E 1P5
HAEL	Hamilton, Elsie General Delivery Elkhorn, MB	ROM ONO	LERL	Leonard Resources Ltd. P.O. Box 245 Elkhorn, MB	ROM ONO	MAMA	Magnan, May <i>note spelling</i> P.O. Box 63 St. Paul, AB (403) 645-6930	TOA 3A0
HUED	Hudzik, Edward R.R. #4 Brandon, MB 728-2537	R7A 5Y4	LESM	Lennon, Samuel & Myrna 619 - 22nd Street Brandon, MB 728-5482	R7A 1S5	MCMM	McEachen, Mavis Maxine P.O. Box 117 Oranode, MB	ROJ 1N0
HUKE	Hutchison, Kenneth General Delivery Elkhorn, MB 845-2008	ROM ONO	LLCM	Longman, Lloyd & Christmas, Margaret General Delivery Maryfield, SK		MCWI	McMichael, Winthrop Leigh 718 Dukeshire Avenue Kalamazoo, Michigan	U.S.A.
KC&C	Kola Church & Cemetary General Delivery Kola, MB 556-2604	ROM 1B0	LUDA	Lund, Harold Dale 3501 Rosser Avenue Brandon, MB 727-7862	R7B 2Z3	MOHI	Moore, Hllis Gordon P.O. Box 535 Virden, MB 748-1530	ROM 2C0
KIHO	Kitzler, Hope Justine 125 Cedar Avenue Snow Lake, MB 358-2550	ROM 1M0	LUGE	Lund, Gerald Laverne P.O. Box 12 Elkhorn, MB 845-2196	ROM ONO	MOIV	Mooney, Myrtle Revia 2312 Bradford Avenue Sidney, BC	V8L 2B6
KLER	Klassen, Erna 14728 Deer Ridge Drive S.E. Calgary, AB	T2J 6B5	LUGG	Lund, Glen James & Garth Walker P.O. Box 41 Kola, MB 556-2355	ROM 1B0	MOSA	Montgomery, Sarah Bessie General Delivery Virden, MB 748-1703	ROM 2C0

MOTC	Montreal Trust Company 411 Eighth Avenue S. W. Calgary, AB (403) 267-6887 (Kathy J. Smith)	T2P 1E7			
MOTR	Montreal Trust Company P.O. Box 369 Winnipeg, MB 943-0451	R3C 2J1			
MURO	Strata Resources Ltd. 1298 Williams Road E. Courtenay, BC	V9N 7J9			
NAEA	Naylen, Edward Anthony P.O. Box 174 Maryfield, SK 556-2366	S0G 3K0			
NARU	Naylen, Ruth J. (Est)/Naylen Oil Corp. 40 Everett Crescent Regina, SK	S4S 2M7			
NEAR	Neufeld, Arthur Peter P.O. Box 34 Kola, MB 556-2334	ROM 1B0			
VEDC	Neufeld, Donald Craig General Delivery Kola, MB 556-2228	ROM 1B0			
NEED	Neufeld, Eric Deane P.O. Box 396 Maryfield, SK (306) 646-4430	S0G 3K0			
ITCL	Northern Trusts Company c/o 411 Eighth Avenue S.W. Calgary, AB (403) 267-6887 (Kathy J. Smith)	T2P 1E7			
IGDA	O'Greysk, Dale Andrew General Delivery Elkhorn, MB 845-2573	ROM ONO			
OGDO	Ogilvie, Donald C12 Welbunry Drive, R.R. #3 Ganges, BC	V0S 1E0			
OGEL	Ogilvie Enterprises Ltd. P.O. Box 417 Maryfield, SK	S0G 3K0			
OGGE	Ogilvie, Gerald George General Delivery Elkhorn, MB 845-2015	ROM ONO			
OGHA	Ogilvie, Harold P.O. Box 65 Elkhorn, MB 845-2071	ROM ONO			
OVLI	Overand, Lewis & Jean P.O. Box 313 Elkhorn, MB 845-2324	ROM ONO			
OVWE	Overand, Wesley & Elen General Delivery Elkhorn, MB 845-2636	ROM ONO			
PAED	Paul, Edward James P.O. Box 189 Elkhorn, MB 845-2418	ROM ONO			
PAUW	Paul, William Ian Apt. 32, 750 South Edward Street Thunder Bay, ON (807) 577-3693	P7E 2H4			
PAWI	Paul, William John P.O. Box 128 Elkhorn, MB 845-2127	ROM ONO			
PEAE	Perner, Archie & Elvira P.O. Box 71 Kola, MB	ROM 1B0			
PEED	Perner, Edgar General Delivery Elkhorn, MB	ROM ONO			
PEHE	Pettapiece, Helen Clarinda 119 Bruce Avenue Winnipeg, MB 832-4469				
PENF	Penner Farms Ltd. P.O. Box 42 Kola, MB	ROM 1B0			
PERM	Canada Trust c/o Montreal Trust 411 Eighth Avenue S.W. Calgary, AB (403) 267-6887 (Kathy J. Smith)	T2P 1E7			
POCO	Poco Petroleum Ltd. P.O. Box 4365, Station "C" Calgary, AB	T2T 5N2			
REFR	Rex, Franz Leo General Delivery Butler, MB				
REJD	Reddekop, James & Doreen General Delivery Kola, MB	ROM 1B0			
ROKw	Rowan, Kenneth William John P.O. Box 402 Elkhorn, MB 845-2061	ROM ONO			
ROMA	Rowan, Mary Katharine P.O. Box 402 Elkhorn, MB 845-2061	ROM ONO			
ROTU	Rowan, Thelma Minnie General Delivery Elkhorn, MB	ROM ONO			

RMWA	R.M. of Wallace P.O. Box 310 Virden, MB 748-1239	ROM 2CO	SHRM	Shepherd, Rosella Mary P.O. Box 411 Virden, MB 748-2607	ROM 2CO	THKA	Thomson, Kathleen Mary P.O. Box 218 Elkhorn, MB 845-2147	ROM ONO
RODA	Rowan, Darwin Lorne General Delivery Elkhorn, MB 845-2389	ROM ONO	SHRO	Shepherd, Rodney Stuart P.O. Box 126 Elkhorn, MB 845-2069	ROM ONO	TOGL	Tundra Oil and Gas Ltd. 1111 One Lombard Place Winnipeg, MB 934-5850	R3B 0X4
ROED	Rowand, Edith Sharon General Delivery Kola, MB 556-2644	ROM 1B0	SOFL	Southern, Florence Mabel Kelowna, BC		TWDD	Twigg, Darryl & Donald P.O. Box 248 Elkhorn, MB 845-2308	ROM ONO
ROKE	Rowan, Kenneth Lyle General Delivery Elkhorn, MB 845-2345	ROM ONO	SSBC	Soldier Settlement Board of Canada Property Management Directorate Western Canada 501, 101 - 22nd Street Saskatoon, SK (800) 667-6991	STK 0E4	TWDL	Twigg, Darryl Lloyd P.O. Box 248 Elkhorn, MB 845-2308	ROM ONO
ROLA	Rouse, Lawrence Garth 5023 - 1988 Street Langley, BC (604) 530-6580	V3A 7L9				UOFM	University of Manitoba Room 202, Administration Building Winnipeg, MB	R3T 2N2
ROWI	Rowan, William Ralph P.O. Box 223 Elkhorn, MB 845-2323	ROM ONO	STDR	Stephen, Doris Ruth 360 Evergreen Street Sherwood Park, AB	TBA 1JB	WAIL	Wasy Investments Ltd. 1598 Sixth Avenue Prince George, BC	V2L 5G7
SHCL	Shepherd, Clifford Dale 101 Prairie Crescent Brandon, MB 729-8884	R7B 3S9	STNO	Stewart, William Norman P.O. Box 307 Maryfield, SK	SOG 3K0	WAJO	Watson, John Edwin 158 Leslie Street Sault Ste. Marie, ON (705) 256-5835	P6B 5C7
SHFR	Shepherd, Francis Malcolm P.O. Box 58 Elkhorn, MB 845-2051	ROM ONO	STRC	Streeter, Rose Catherine 14923 NE Graham Portland, OREGON	U.S.A	WARO	Watson, Robin P.O. Box 245 Roblin, MB 937-2426	ROL 1PO
SHJM	Shepherd, Joyce Marlene c/o 101 Prairie Crescent Brandon, MB N/A	R7B 3S9	TAJA	Taylor, James Austin 7 Forest Boulevard Brandon, MB 728-6872	R7B 2N4	WATE	Watson, Thomas & Evelyn P.O. Box 1405 Virden, MB 748-3012	ROM 2CO
SHMU	Shepherd, Murray Dwight P.O. Box 693 Virden, MB 748-1028	ROM 2CO	TAMU	Taylor, Murray Archibald P.O. Box 262 Maryfield, SK (306) 648-2201	SOG 3K0	WATH	Watson, Thomas Reginald P.O. Box 1405 Virden, MB 748-3012	ROM 2CO

WMBA	Widge, Barbara J. P.O. Box 68 Elkhorn, MB 845-2311	ROM ONO
WIDO	Widge, Donald C. P.O. Box 68 Elkhorn, MB 845-2311	ROM ONO
WODJ	Wood, David John P.O. Box 87 Crossfield, AB	TOM OSO
WODO	Wood, Douglas Harold P.O. Box 99 Kelwood, MB 967-2384	ROJ OYO
WOHL	Woodward Holdings Ltd. General Delivery Hargrave, MB	ROM OWO

Manitoba



Energy and Mines

Petroleum

555 — 330 Graham Avenue
Winnipeg, Manitoba, CANADA
R3C 4E3

FAX NO.: (204) 945-0586

(204) 945-6577
FAX: (204) 945-0586

DATE: July 14

TOTAL NO. OF PAGES (including this page) 4

PLEASE DELIVER THE FOLLOWING PAGES TO:

NAME: GEORGE C.

FROM: John N. Fox
Chief Petroleum Engineer

BRANCH: TUNDRA

BRANCH: Petroleum Branch

FAX NO: _____

PHONE: (204) 945-6574

COMMENTS: AS PER OUR DISCUSSION.

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July 14/94

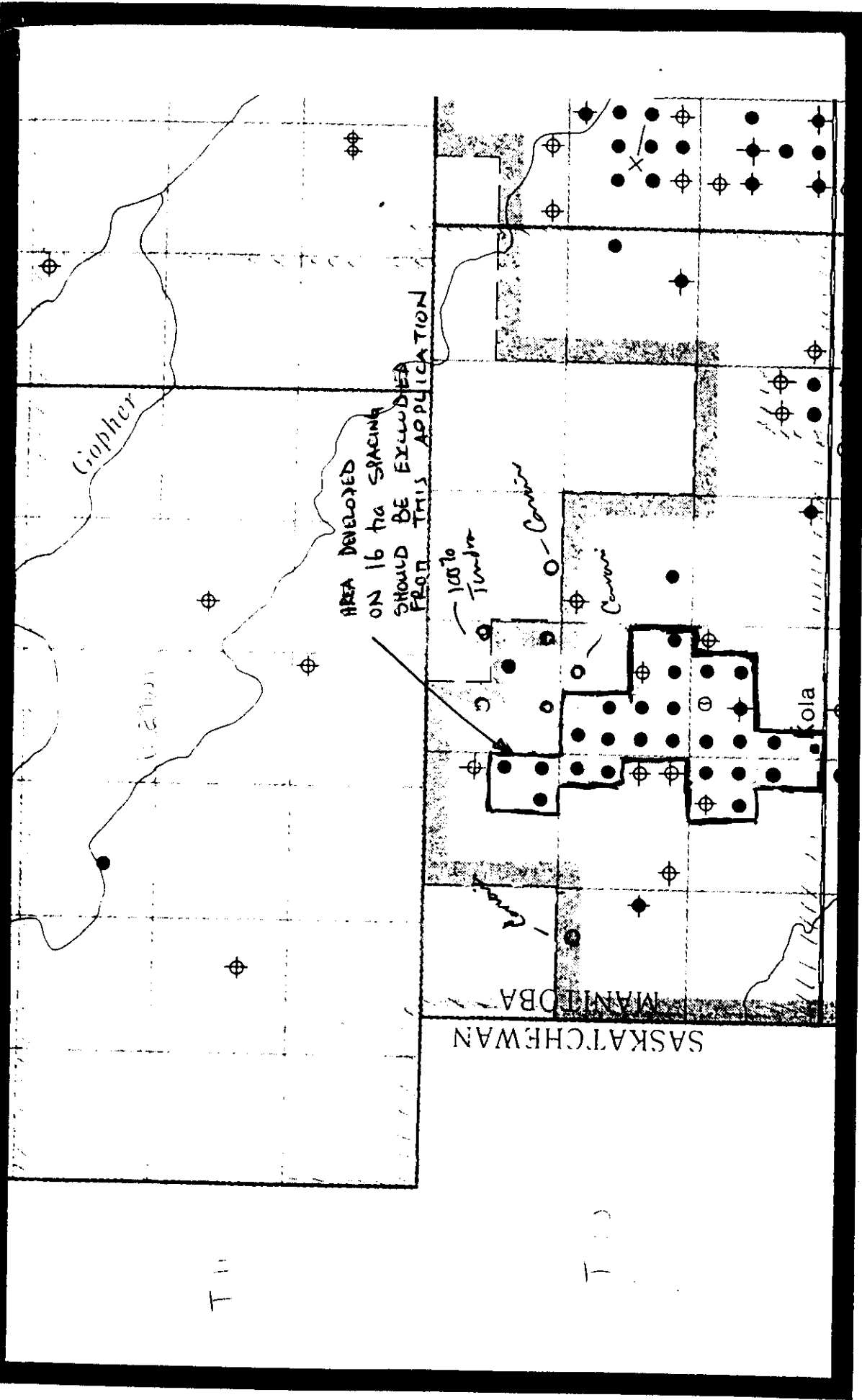
DEAR GEORGE:

As we discussed, the following are suggested changes/additions required to publish notice of the application. Submit 2 copies of the application & simulation study with following

- ① remove "DRAFT" and have Tundra & Conuan ~~co-applicants~~ sign as co-applicants
- ② request stand-up 32 ha spacing with the target area in the odd-numbered LSD's (see next page)
- ③ modify area of application to exclude portions of the 'A' pool developed on 16 ha spacing
- ④ send application Attention: L.R. Oubrevil
- ⑤ NAMES & ADDRESSES & ROYALTY & WORKING INTEREST OWNERS

PROPOSED SPACING UNIT DESCRIPTION

1. The spacing unit for each well drilled, or to be drilled, for the purpose of obtaining oil from the Mississippiian ^{the} Bakken Formation within the area outlined on Appendix B is two legal subdivisions comprising the east half or the west half of a quarter section.
2. The target area of each drilling spacing unit shall be a square area in the odd-numbered legal subdivision having sides one hundred metres from the sides of the legal subdivision and parallel to them.



Tundra oil and gas ltd.

Karl Tuck
TIN RENTAL INCORPORATED

Contour Interval: Date: By:

OUTLINE OF 20 ACRE
SPACING APPLICATION

PROPOSED SPACING
100% TUNDRA PACE

M.E.M

Reply to Tundra
Oil & Gas Increased
Spacing application

July 14/94

4-28-10-29 BATT.
0/60A #1

	EDM PAR	GROSS PRICE	AVERAGE NET PRICE	TRANS. COSTS
January '94	112.90	109.76	106.96	2.80 m ³
February	113.61	112.97	110.17	2.80 m ³
March	117.19	118.26	115.37	2.85 m ³
April	134.60	135.32	132.23	3.08 m ³
May	148.68	148.73	145.69	3.05 m ³
JUNE	159.93	159.65	156.88	2.80 m ³
JULY		164.02	161.32	2.80 m ³
AUG		152.96	150.16	2.80 m ³
SEP		142.70	139.90	2.80 m ³
	AVERAGE	PRICE - EDM PAR		
1993		137.83		
1992		149.60		
1991		147.32		
1990		172 ***		

*** estimate

11-33-10-29

KOLA 32 SPACING APPL'N

DST F51P

7411

151P 7622

- TUNDRA has requested reservoir simulation be returned as it is a "proprietary document"
- 32 ha spacing - odd LSD target
- new pools discovered, based on geology, Tundra would like to modify the target area w/o penalty

INTRODUCTION

- 32 ha spacing rationale/intent
 - high historical finding costs
 - low oil prices
 - 16 ha development uneconomic
 - prod. performance Bakken A pool (interwell interference)
 - observed pressure depletion
 - remove 16 ha drilling obligations (REVIEW LEASE CLAUSE)
- reservoir simulation conducted objectives
 - optimum spacing primary rec.
 - incremental WF recovery
 - review hor. drilling
- simulation - "in support of appl'n", highlights presented in application

NEW WELL PERFORMANCE

- (6) 1993 A Pool wells

13-28 2-32

16-29 8-32

1-32 7-33

- 7-33 $\overline{P}_{DST\ 1993} = 7915\ kPa$; 15-21 $\overline{P}_{DST\ 1993} = 6195\ kPa$
- 16-29 $\overline{P}_{DST\ 1993} = 6920\ kPa$ vs $\overline{P}_{RA\ Pool} = 8874\ kPa$
- 1-32 $\overline{P}_{DST\ 1993} = 7420\ kPa$
- wells exhibiting high decline rates \rightarrow 1-32, 7-33

- REVIEW PRESSURE DATUM

- low recovery predicted for N. Kola wells $< 4000\ m^3$
- REVIEW A POOL INDIVIDUAL PRODUCTION HISTORIES
+ DEVELOPMENT DRILLING TIMING
- pressure depletion, high decline rates indicative of production interference and drainage in excess of 16 ha

LAND

- area of applⁿ = 10036 ha
- * - probability of discovering new Bakken pool
USE DALY BAKKEN DEVELOPMENT SUCCESS

GEOLOGY

- net pay 1-3 m fine to medium grained ss

RESERVOIR SIMULATION STUDY

- 5 layers
 - ① Lodgepole (infinite acting) + Upper Bakken shale
aquifer
 - ② Upper zone of Middle Mbr. - potentially productive
 - ③ tight interval separating upper & lower productive zones in Middle Mbr.
 - ④ + ⑤ lower zone - Middle Mbr.

OOIP = $461 \times 10^3 \text{ m}^3$ volumetric

- history-match (model calibration)

① - sol^r gas drive required 10 * 001P + ^{estimated} 4k

② - dump flooding from Lodgepole - providing areal pressure support (cured into wells)

③ ^{required} aquifer added to Bakken - providing limited water drive (no contact consistent with area of salt collapse) → Carol M.

RECOVERY

PRIMARY CASES

SPACING	Recovery/well (m ³)	DRILLING SUCCESS $\left\{ \frac{\# \text{ of Productive}}{\# \text{ of wells}} \right\}$	ECONOMIC Recovery/well
16 ha	6847	80% (20/25)	4411
32 ha	8695	83.3% (10/12)	5950
32 ha (high-grade) optimal locations	10495	83.3% (10/12)	7450

Tundra believes 20% success ratio

* need production forecast
to calculate economic limit
(- % of forecast estimates)

• 16 ha development 57% more oil than 32 ha development &
30% " " " " " " high-grade dev.

DOESN'T RESULTS OF SIMULATION CONTRADICT OBSERVED
PERFORMANCE OF A+D Pool WATERFLOODS — SIMULATION
WATERFLOODING MAY NOT BE VIABLE

- Tundra makes no commitment to applicⁿ or viability of waterflooding, and appropriateness of 32 ha spacing for waterflooding, in the area of application.
- horizontal drilling in Bakken increase recovery, economically attractive, more attractive w/ 32 ha spacing

Two Questions

(a) Based on the performance of the N. Elbow Unit No. 1 and Kola Unit No. 1 waterfloods, estimated — & — % increase in recovery over primary, does Tundra anticipate implementation of a waterflood in North Kola, if a pool of similar size is discovered? Would waterflooding be conducted w/ 16 or 32 ha spacing? Why does the simulation indicate waterflooding is not a viable depletion strategy?

(b) Under what scenario does Tundra envision horizontal drilling in North Kola.

ECONOMICS

Capital Cost - 1 well, Complete rigging, tie-in \$220,000

Operating Cost - \$3000/well/mo + \$1.57/m³, inc. @ 5%/yr

1994	Oil Price	\$18/161	2000	24.12
	95	18.90	01	25.33
	96	19.85	02	26.59
	97	20.84	03	27.92
	98	21.88	04	29.32
	99	22.97	05	30.79

- recovery on 16 ha spacing 4411 m³ uneconomical

CURRENT BACKON RECOVERY JUN 1994

	<4000*	4001-6000	>6001
TUNDRA	<div> <div> </div> <div> </div> <div> </div> <div> </div> </div>	<div> <div> </div> <div> </div> </div>	<div> <div> </div> </div>
OTHER OPERATORS			

* of these wells 8 have daily production in excess of 1.5 m³/d & will recover more than 4000 m³

- new economic forecast as shown

What is the backhole royalty rate used?

- RISKED ECONOMICS 16 ha. reserves reduced 80%

- Holiday oil volume included?

- Economic summary before tax

TABLE 1 How DOES THE REDUCTION OF RESERVEs ,
UNRISKED RESERVEs VS. RISKED RESERVEs EFFECT THE
PROD. FORECAST WIND.

"A" Pool PERFORMANCE - INDIVIDUAL WELL RECOVERY

WELL	DATE ON PRODUCTION	DAILY OIL 1ST (3) MONTHS	ULT Rec Res	Sub/Ad
13-28			3200	784
16-29			2000	708
1-32			1800	1206
2-32			3400	441
8-32			7200	1972
7-33			1600	

→ Review Bakken structure map for evaluation of
O/W contact (4-29-6)

10 well-32 ha stimulation drilling on odd-numbered LSD's
10 well-32 ha highgrade stimulation includes 3 off-target
wells on even-numbered LSD's and is actually
includes 5 LSD's developed on 32 ha spacing
and 3 LSD's developed on 16 ha spacing - Does
NOT qualify as 32 ha development

REVIEW OF ECONOMICS

16 ha SPACING

- Crown

- NO HOLIDAY OIL VOLUME

$$HOV = \$113/m^3 (\$18/bbl), D = 400m$$

$$HOV = \$141.47/m^3 (\$22.40/bbl), D = 400m$$

$$HOV = \frac{1759}{2.12} m^3$$

$$HOV = \frac{1394}{1.394} m^3$$

- HOV is greater than the 1st years production
ESTIMATED ROYALTY SAVING $26040 + 9169 = 35209$

PRODUCTION FORECAST

1994	3.5	1998	1.27
1995	2.7	1999	0.95
1996	2.07	ECONOMIC LIMIT	
1997	1.59		

Calculate decline rate

$$Q_A = \frac{365 (q_i - q_f)}{D}$$

$$27757 = \frac{365 (22 - 6)}{D}$$

$$D = 21 \% / yr$$

32 HA SPACING

PRODUCTION FORECAST

1994	4.93	1998	1.59	
95	3.65	1990	1.27	ECONOMIC LIMIT
96	2.86			
97	2.07			

$$\text{Decline rate} \quad 37438 = 365 \left(\frac{31 - 8}{D} \right)$$
$$D = 22.4\% / \text{yr}$$

$$\text{Royalty savings} \left(\text{HOV} = 1759 \text{ m}^3 \right) = \$39628$$

32 HA SPACING - HIGH GRADE CASE

$$\text{IP} = 4.93 \text{ L/D} \quad \text{decline rate} = 19.46\%$$
$$\text{Economic limit} \quad 0.95 \text{ L/D}$$

RESERVOIR SIMULATION STUDY

OOIP - $461.8 \times 10^3 \text{ m}^3$

FVF - $1.14 \text{ m}^3/\text{m}^3$

- oil influx outside model area of 38000 m^3 from the extension of pool

- simulation's application limited to "A" pool - due to unique nature of model

- limited pressure data may impact accuracy of model

CASES

BASE CASE

① Primary Rec (to 2014) $137 \times 10^3 \text{ L}^3$, 30% OOIP
(as pool developed + 13-21 not converted)

② WF Rec (13-21) $152 \times 10^3 \text{ L}^3$ - includes 13-21
13-21 only provides accurate data

③ 32 ha Primary Rec $87 \times 10^3 \text{ L}^3$ 19% OOIP (13-21 not converted)

- comparison of individual well recoveries

32 ha - $8700 \text{ m}^3/\text{well}$

16 ha - $6850 \text{ m}^3/\text{well}$

④ 32 ha Primary Rec (HUNGRED) excludes marginal wells @ pool edge & includes more wells in prolific areas of pool \rightarrow recovery $10500 \text{ m}^3/\text{well}$

⑤ 32 ha WATERFLOOD 3 INJECTORS (13-21, 15-21 & 5-28) Rec $75 \times 10^3 \text{ L}^3$, not a viable alternative
CONVERT FEB 1/94

⑥ 16 ha development with 1 hor well (drilled in 1986) replacing 4 vert. producers
PRIM. Rec. $150 \times 10^3 \text{ L}^3$ (5-28, 6-28, 11-28, 12-28)

CASES

horizontal well $MC_{MC} = 39 \times 10^3 L$ S.S. * area. rec. of vert. well
 $IP = 2.5 * (5.28 + 6.28)$

④ 16 Le Prim. Rec. (as in Case ②) + horizontal drilled (as in case 6)
 $R_{ec} = 152 \times 10^3 L$; horizontal well rec $25.9 \times 10^3 L$
 $(5.28 + 6.28 \text{ rec.} = 27)$
 $13.21 \text{ L} \neq$

ECONOMIC
 OPTIMAL DEVELOPMENT APPEARS TO BE 32 ha SPACING
 VERTICAL WELLS + INFILL DRILLING USING HORIZONTAL WELLS
 - maximize individual well recovery

- history match oil influx from pool extension and any down-dip aquifer

- recommendation that water injection remain below
 frac press. (8960 ^{kPa} wellhead)

- NEED COPY OF C&G Lab Feb/94 AT analysis

- CHECK FOR HVAL 1993 K_r STUDY

MODEL
 DEVELOPMENT

- TUNDRA NET PAY CUT-OFF USED $\phi = 15 / K = 1 \text{ m d}$ TO DEVELOP ϕ vs K CORRELATION
- TUNDRA PROVIDE RESERVOIR DATA, ϕ , net pay & structure
- no anisotropy, $K_v = 0.1 K_x$
- water influx from inter-acting Ldgple aquifer
 controlled by transmissibility, barrier
- 16-17-10-29 in separate pool
- simulation indicated a current res pressure of 6300 kPa.

- lack of A pool pressure data (pressure data a key component in history-matching process) impacts on model accuracy

MODEL CALIBRATION - history match (Oct/83 to Jan/94)

- K_h increased
- Lodgepole aquifer reduced to limited-acting
- oil influx needed to be added to maintain reservoir pressure @ 6500 kPa
- upper sand contributing to production
- 7-28 LSD contributing prod. to 2-28
- 12-28 well has oil influx from 5-28, 6-28 & 8-29
- history-matching attempts include
 - 10x OOIP
 - PV increase along northern edge of model + increase K
 - Lodgepole dumpflooding only lead to rapid wetting out
- to get history-match oil influx 38000 m³ (1985-94) for this limited pool extension with support from aquifer needed (SW dip to strata)
- anomalous prod. behavior attributed to fracture stimulation which according to our records were not done

RESULTS OF SIMULATION

① BASE CASE

Rec. Res $137.1 \times 10^3 \text{ t}$

FINAL WL = 52.3%

Calculate decline Rate

$$Q_t = 365 \frac{q_i - q_t}{D} = 137.1 - 60.7 = 365 \frac{(15.7 - 7.9)}{D} = 2.3\% / \text{yr}$$

$$q_t = q_i e^{-Dt} \quad \text{on} \quad \ln \left(\frac{q_t}{q_i} \right) = -Dt = \ln \left(\frac{7.9}{15.7} \right) \times \frac{1}{20} = 3.4\% / \text{yr}$$

INDIVIDUAL
WELL RECOVERIES.

< 4000

4000 < x < 6000

> 6000

||||
||||

||

||||
|||

5 of 20 wells account for 65% of rec. res.
3 are located on even no. LSD's & two are located on odd no. LSD's

- simulation indicates LSD's with non-producing wells are being drained (see Fig 33)
- abandonment pressure: 5800 kPa. Pool average
- both wells = 2500 kPa

② BALL CASE + INJECTION IN 13-21

Rec Cos 132 000 m³

Final WC = 78.8

- effect of inj 13-21 dominate production initially but increasing watercut resulted in lower ultimate recovery (production from 13-21 inj pattern < under primary)
- oil swept from 13-21 to offsetting producers as far away as 2 LSD's, some offsetting LSD's actually recovered less oil than under primary
- swept portion of reservoir restricted to 9 spot surrounding 13-21 & limited to lower pay zone

③ 32 ha spacing odd # LSD's (No inj)

Rec Res 87000

< 4000

4000-6000

> 6000

+++

I

III

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- 38% in individual well recovery, overall 11% less rec. res.

- only good wells which recovered > 6000 m³ on 16 ha case performed significantly better on 32 ha. average 56% increase in recovery on 32 vs 16 ha spacing

- final WC 36%

- decline rate = 6.5% 1987-2014 (1994-2014) D = 2%

④ 32 ha HIGHGRADE → IS NOT A 32 ha development scenario as it includes 2 LSD's developed on 16 ha spacing at an off-target location - is what's contemplated by Tundra under this approval

16 ha, 32 ha & 32 ha upgrade show that the good wells definitely drainage more than 16 ha, while the poor wells, perform economically regardless of spacing

< 4000	4000 to 6000	> 6000
		+++

- case is hindsight only on an ^{most} optimistic 32 ha development scenario

Field water cut 40 %

decline rate	1987-2014	D=8.2%
	1994-2014	D=2.9%

Case (5) 32 ha WF on potential 2-spot

Rec. Res. $74.8 \times 10^3 \text{ m}^3$ vs $87.4 \times 10^3 \text{ m}^3$ Case (3) 32 ha 1pacing
no waterflood

with imp. into 11-21, 5-28 & 13-21

- lost production from conversions was not recovered by offsetting wells.
- little or no incremental oil recovered by poor producers with 32 ha wf, incremental oil recovered by 9-20 (5100 m^3) & 3-28 (3400 m^3)
- no one would consider this option technically feasible

final WC = 62.2%

pressure distribution map shows the majority of the reservoir depressed to or above PR

- no water contained in lower zone

CASE (6)

horizontal well 650 m from 5-28 to 6-28
replaced 5-6, 11 & 12-28 vertical wells

Rec. Res. $149.7 \times 10^3 \text{ m}^3$ 32% OOIP

Horizontal well recovered $39,100 \text{ m}^3$ vs combined vertical rec.
5-6, 11 & 12-28 = 13300 m^3
2.5 to 3.3 * vert. rates for 5-28 & 6-28 combined

find WC 16.5%

- improved drainage by horizontal well in E/2 Sec 29 & NW/4 of Sec 20

Horizontal well IP = 16.4 c/d Find WC 12.1 %
1st yr. = 70%
2nd yr. 15%
3rd yr. 9%

Case (7) 16 ha spacing + injector @ 13-21 adding
a horizontal well in 1994 from 5-28 to 6-28
IP: 20.8 c/d, 1st yr. double rate 126%
Horizontal well recovered 25900 m³ find WC = 73%
due well to inj @ 13-21 & Lodgepole
dump flooding

- recoverable res 152.1×10^3 c/d

- proof that the more streams in the pot the higher the recovery

- also indicates when compared to Case 1
that 80% oil recovered by the horizontal
well in horizontal reserves.

I

32 ha Low GRADE

- drilling exclusively on even no. LSDJ
acc. reserves 73600 L³ or 53.7% of recovery
on 32 ha spacing

DISCUSSION

Tunisia has applied for 32 ha ^{spacing} north of the
Daly Bakken A based on the following rationale

- (a) High historical finding costs in the
A Pool - drilling success ratio 20/25 \rightarrow 80%
for wells included in reservoir simulation,
NOTE: 5 years historical average
development drilling success ratio (1989-93) 91%

NOTE: of 5 dry holes within simulation area
2 were cured and upon completion
proved uneconomic

NOTE 32 ha drilling as odd number LOD's
in 1993-94 Drill of the A pool in
Sec 32 & 33 has yielded 3 wells & 2 DPA wells - 71%

D Pool 16/22 or 72.7% success ratio

(b) Low oil prices - Tundra team economics at \$18/bbl,

- Falden crude is classified as light sweet and typically receives a price equal to the Edmonton posted OIL PRICE - 1994 to Aug 31 aver. - \$137.78/m³ (\$21.50/bbl)
1990 - 1994-08 aver - \$148.91/m³ (\$23.66/bbl)
- Oil price sensitivity is an issue (out \$20/bbl, \$22/bbl & possibly \$24/bbl cases should be run)

(c) 16 ha Development Economics.

- Crown economic team did not include royalty oil volume with production royalty savings in excess of \$25000
- stock incorporated into recoverable reserves - 5472 m³ (1994) - 4411 m³ (1995) recovery 30% (1994) - A pool simulation 2747 m³ v. stock reserves for reserves 5472 m³, recoverable reserves 4411 m³
- economic limit is quite high for 16 ha case - 0.95 m³/to suggests operating cost. are quite high
IP = 15 m³/to 1st year.

• it's apparent from the simulation that the high productivity wells located in the better parts of the reservoir will obtain more than 16 ha, while the poor producers don't adequately draw 16 ha

• in the 32 ha high-grade case which includes 16 ha development along a N-S axis through the best part of the reservoir, the combined recovery from 2#16-20, 13-21 and 4, 5#12-28 wells of 77900 m³ is equivalent to 89% of the total pool recovery under 32 ha spacing (odd-numbered LUDs)

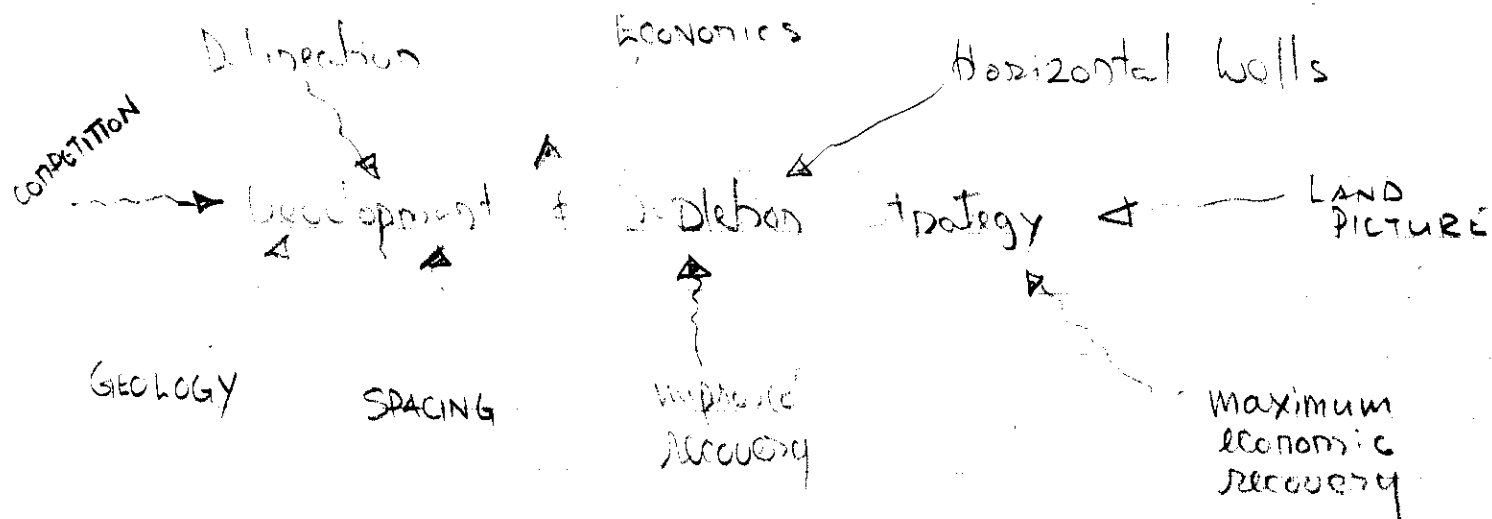
• The 32 ha highgrade case is a case of hindsight and does not represent 32 ha spacing but a mix of 16 and 32 ha spacing

• If a 32 ha downgrade case is run assuming 32 ha spacing on even-numbered LUDs, the total recoverable reserves are 75000 m³, 53% of the recovery on 16 ha spacing.

Prod Performance

in support of 32 ha spacing. Therefore, I have used the following performance parameters

- depletion observed in newly drilled well is 13.28, 13.29 and the 32 & 33 average DST's pressures between 6195 - 7915 kPa compared to the A full discovery pressure of 8874 kPa
- high decline rates and low ultimate recovery exhibited by wells on 16 ha spacing indicates interference between wells in a well drainage in excess of 16 ha
- the wells of the simulation are quite interesting
 - on 16 ha spacing, 5 of the 20 wells account for 65% of the recoverable reserves
 - on 2 ha spacing, 3 of the 10 wells account for 70% of the ^{total} recoverable reserves and the remaining wells produce
 - 21400 m³ on 2 ha spacing
 - 21100 m³ on 16 ha spacing



- decision of \leftarrow coordinated competitive

~ objectives - facilitate max. economic recovery
- to prevent waste

locating of wells that is accordance with
 \rightarrow sound engineering & economic principles results in
 might result in the maximization of recoverable
 reserves

- locating of wells is a ~~factor~~ that (Having regard to sound engineering & economic principles) is not necessary to achieve max. recovery of oil from the pool.

Max economic recovery - develop a 32 ha spacing, will drill with horizontal wells or with optimally placed 16 ha vertical wells & waterflood.